Regulations and Curriculum for

Bachelor of Technology (B.Tech.) in Computer and Communication Engineering

Version 2024.02

NITTE
(Deemed to be University)

Established under Section 3 of UGC Act, 1956)
Placed under Category 'A' by MHRD, GoI | Accredited with 'A+' Grade by NAAC

Regulations and Curriculum for

Bachelor of Technology (B. Tech.)

in

Computer and Communication Engineering

Choice Based Credit System (CBCS)

Effective for the Batch admitted in

AY 2024-25

(Deemed to be University under Section 3 of UGC Act, 1956)

(Placed under Category 'A' by MHRD, Govt. of India, Accredited with 'A+' Grade by NAAC)

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VISION

To build a humane society through excellence in the education and healthcare

MISSION

To develop
Nitte (Deemed to be University)
As a center of excellence imparting quality education,
Generating competent, skilled manpower to face the scientific and social challenges with a high degree of credibility, integrity,
ethical standards and social concern

Regulations and Curriculum
B.Tech. Degree Programs
Choice based Credit System
(CBCS)

Effective for the Batch admitted in Academic Year 2024 – 2025

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

REGULATIONS: 2024

COMMON TO ALL

B.Tech. DEGREE PROGRAMME

CHOICE BASED CREDIT SYSTEM

(CBCS)

Version 2024.02

Choice Based Credit System (CBCS)

1. Choice for the selection of courses during each semester
2. Choice in planning the academic activities by selecting desired number of courses per semester.
3. Balanced curriculum with engineering, science, humanities, and management courses.
4. Project based learning (PBL) which focusses on experiential learning.
5. Opportunities to study inter-disciplinary courses.
6. Enabling slow learners by offering important courses in all semesters.
7. Optional Summer semester
8. Opportunity to get associated in research projects to acquire research experience.
9. Value addition with Honors / Minor credentials.

Curriculum for Acquiring Professional Skills (CAPS)

1. Practicing outcome-based education (OBE) where Courses made student-centric rather than teacher-centric.
2. Provisions for courses integrated with Lab/ PBL component.
3. Focus on experiential learning.
4. Ability enhancement and skill development courses as per National Education Policy (NEP) 2020
5. Focus on Industry Internship and Research Internship
6. Students to work on real world/interdisciplinary problems in major project.
7. Importance is given to creativity, innovation, and development of entrepreneurship skills.

Key Information

Program Title	Bachelor of Technology Abbreviated as B.Tech. in Computer and Communication Engineering
Short description	Four-year, eight semester Choice Based Credit System (CBCS) type of Undergraduate Engineering Degree Programme taught in English
Program Code	14ENGR05D2
Revision version	**2024.02** These regulations may be modified from time to time as mandated by the policies of the University. Revisions are to be recommended by the Board of Studies for • Computer and Communication Engineering • Humanities • Mathematics • Science and approved by the Academic Council.
Effective from	**01-08-2024**
Approvals	**Approved in the 57th Academic Council meeting of NITTE (Deemed to be University), held on 26.06.2024 and vide Notification of Registrar** • **Ref: N(DU)/REG/AC-NMAMIT/2023-24/1412 dated 09.07.2024** • **Ref: N(DU)/REG/AC-NMAMAIT/2023-24/1419 dated 09.07.2024** • **Ref: N(DU)/REG/AC-NMAMIT/2023-24/1420 dated 09.07.2024** • **Ref: N(DU)REG/AC-NMAMIT/2023-24/1421 dated 09.07.2024.** **Approved in the 60th Academic Council meeting of NITTE (Deemed to be University), held on 05.02.2025 and vide Notification of Registrar Ref: N(DU)/REG/AC-NMAMIT/2024-25/748-A dated 15.02.2025.**
Program offered at	NMAM Institute of Technology, Off -Campus Centre, Nitte, 574110, Karkala Taluk
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Executive Council. The decision of the Executive Council is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only

CONTENTS

PREAMBLE

NMAM Institute of Technology (NMAMIT) was established in 1986, is located at Nitte and off-campus of NITTE (Deemed to be University), accredited by National Assessment & Accreditation Council (NAAC) with 'A+' grade. NMAMIT is recognized by the All-India Council for Technical Education (AICTE), New Delhi.

The Bachelor of Technology (B. Tech.) Programs focus on Pursuing Excellence, Empowering people, Partnering in Community Development. Out of eleven UG Programs i.e., Artificial Intelligence & Machine Learning (AM), Artificial Intelligence & Data Science(AD), Biotechnology (BT),Computer and Communication Engineering (CC), Computer Science & Engineering(CS), Civil Engineering(CV), Electronics & Communication Engineering (EC), Electrical & Electronics Engineering (EE), Information Science & Engineering (IS),Mechanical Engineering(ME) and Robotics & Artificial Intelligence (RI), all eligible UG Programs i.e., BT, CS, CV, EC, EE, IS and ME are accredited by NBA, New Delhi under Tier - I category till 30th June 2025.

The curriculum is jointly approved by members of Board of Studies (BoS)and Academic Council drawn from academia, Industry, Alumni and working professionals fromIndustry and has been designed to integrate hands-on practical training with the concepts of theory courses to enhance the learning experience.

The Curriculum focusses students for Acquiring Professional Skills (CAPS) through rigorous theoretical training using innovations in pedagogy, experiential learning, active learning, collaborative learning, critical thinking, project planning, Project Based Learning (PBL), Ability enhancement courses for skill-building, effective communication, professional practice, creativity & innovation and developing entrepreneurial skills.

The focus of Institution is to impart Quality Education to generate competent, Skilled and Humane Manpower to face emerging Scientific, Technological, Managerial and Social Challenges with Credibility, Integrity, Ethics and Social Concern.

In the present scenario, students wish to make their own plan for bright future. However, student aspirations and the industry demands are highly diverse. Employers expect the graduates possess multi-disciplinary competency, Information and Communication Technology (ICT) and leadership skills. In this context, NMAMIT offers opportunity to the students to select the courses of their choice and helps them in grooming to have well-rounded personality and become industry ready.
The efforts have been made to make the syllabus compliant with international professional societies. As part of providing quality engineering education, at NMAMIT, Nitte has initiated the Choice Based Credit System (CBCS) into its academic curriculum. By this, the students can register courses of their choice and alter the pace of learning within the broad framework of academic course and credit requirements. CBCS allows students to plan for their academic load and alter it as they progress in learning. Students also have the option of choosing courses from a pool of courses within each classification. Ample options are given to choose interdisciplinary courses from other programs which will help the student to develop additional skills. Slow

learners will also be benefitted since important courses are offered in all semesters. This arrangement helps the students to re-register the course and clear the backlog courses in the subsequent semester. Suitable provisions are made for fast learners to associate them with research activities of faculty members and contribute to research beyond the working hours.

A faculty advisor helps the student in identifying the courses to be studied in each semester based on programme requirement, course prerequisites, student’s interest in various disciplines, past academic performance and courses offered by the departments.

Learning becomes more ‘experiential’ by carrying out labs associated with theory, mini-projects and Project Based Learning (PBL) as a part of many courses which enhances capability of students in understanding and apply the Engineering /Technology concepts to solve real life-problems. Hence students will develop the ability to apply the gained knowledge in multi-disciplinary projects and able to take up major projects based on real world problems and come up with better solutions while addressing social concerns.

REGULATIONS
COMMON TO ALL B.Tech. (CBCS) DEGREE PROGRAMMES OF
NITTE (Deemed to be University)

1. INTRODUCTION

1.1 The general regulations are common to all B.Tech.(CBCS) Degree Programmes conducted at the NMAM Institute of Technology (NMAMIT), off-campus of NITTE (Deemed to be University) and shall be called "B.Tech. Regulations".

1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting instructions of course, conduct of the examination & evaluation, certification of student performance and all amendments related to the said Degree programme(s).

1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the B. Tech Degree program of NITTE (Deemed to be University) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Choice Based Credit System) conducted at theNMAMIT, Nitte with effect from its date of approval. This set of Regulations may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.

1.4 To guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when foundnecessary.

1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of Engineering courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations orotherwise.

1.6 The program shall be called **Bachelor of Technology,** abbreviated as B.Tech. (Program Specialization).

2. ELIGIBILITY FOR ADMISSION

Sl. No	Program	Duration	Eligibility
1	B. Tech.	4 years	Passed 10+2 examination with Physics/ Mathematics / Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/Technical Vocational subject as per Table-1 Obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together.
2	B.Tech. (Lateral Entry to Second year)	3 years	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in relevant branch of Engineering and Technology. (The University will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the program)

Table-1
Academic Level and Credit Framework for admission to Bachelor of Technology (B.Tech.) degree program

Sl. No.	Academic Level	Desired Entry Qualifications at different levels.	NHEQF / NSQF Level at Exit	Unified Credit Level (UCF) at Exit
1	12th Std.	-	4	4
2	First Year B.Tech. Degree	12th Completed (NHEQF /UCF level 4 completed)	5	4.5
3	Second Year B.Tech. Degree	A candidate with a Diploma in the appropriate branch of Engineering/Equivalent Vocational or Technical Program with NHEQF level 5/UCF level 4.5 completed	6	5

2.1 Qualifications from foreign countries:

Candidates with qualifications from educational institutions outside of India, may be admitted tothe program(s) subject to establishment of equivalence by the university. The Program Committeewill evaluate and establish the eligibility of such candidates.

3. PROGRAM PATHS, EXIT OPTIONS AND DURATION OF THE B. TECH. PROGRAMME

3.1 Program paths, exit options

Sr. No	Academic Level	Entry Level Qualifications	Qualifications at Exit	NCrF Level
1	1^{st} yr. of UG Degree	A candidate completing 10+2 years with Diploma of Vocation or passed 12^{th} std. or equivalent vocational training with NCrF level 4	**UG Certificate**	4.5
2	2^{nd} yr. of UG Degree	A candidate with Diploma in appropriate branch of Engineering/ UG Certificate/ Equivalent Vocational or Technical Program NCrF level 4.5	**UG Diploma (Engg.)**	5.0
3	3^{rd} yr. of UG Degree	A candidate with 10+3+1/12+2/ UG Diploma (Engg.) in appropriate domain with NCrF level 5	**B. Sc (Engg.)***	5.5
4	Final yr. of UG Degree	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	**B. Tech (on completion of 164 credits with a minimum CGPA of 5)**	6
	Final yr. of UG Degree with Honours	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	**B. Tech (Honors)** **182** credits (Additional 18 credits over and above **164** credits in the same discipline	6
	Final yr. of UG Degree with a minor in (Other Discipline).	A candidate with 3 yrs. Bachelor degree in Vocation / B.Sc. (Engg.) with NCrF level 5.5	**B. Tech with Minor** **182** credits. Additional 18 credits over and above **164** credits in other disciplines	6

*** It is mandatory to earn 10 credits through Internship/Training/Specialized courses before the award of Qualifications at Exit.**

3.2 Duration of the B. Tech. programme

(a) TheB. Tech Programme shall extend over a period of total duration of 4 years for students admitted during first year of the programme.

(b) The total duration shall be 3 years for students admitted to second year under lateral entry scheme.

(c) The maximum period which a student can take to complete a fulltime academic programme is eight years / Six years for Lateral entry diploma students for B.Tech.

(d) Each year shall have the following schedule with 5½days a week. Suggested break down of Academic Year into Semesters

1.	No. of Semesters / Year	There are three semesters in an academic year. Two Main semesters (Odd, Even) followed by a summer semester. Normally the Odd Semester will be from August to December and Even Semester from January to May during a calendar year. The optional summer semester is offered during the vacation period of the even semester. The summer semester is offered considering the demand for such courses of needy students, subject to the availability of time, faculty, and other resources under a fast-track mode as the available instructional days during even semester vacation periods are less. However, the number of instructional hours needed to cover the syllabi shall be maintained (equivalent to that in the regular semester) with a greater number of instruction hours per week. (Note: The summer semester is primarily to assist slow learners and/or failed students in the main semesters. The summer semester may be used to arrange Add-On courses for other students and/or for deputing them for practical training elsewhere)
2.	Semester Duration	Main semester (Odd, Even) each 20 Weeks; Summer Semester 8 Weeks
3.	Academic Activities (Weeks)	**ODD / EVEN Semester** Registration of Courses & Course Work (16) Examination Preparation and Examination (04) Total (20) **Summer Semester** Registration of Courses & Course Work (05) Examination Preparation and Examination (03) Total (08) **Declaration of results:** 02 weeks from the date of last examination **Inter- Semester Recess:** After each Main Semester (02) **Total Vacation:** 10 weeks (for those who do not register for summer semester) and 4 weeks (for those who register for summer semester)

(Note: In each semester, there will be provision for students for Registration of courses at the beginning, dropping of courses in the middle and withdrawal from courses towards the end, under the advice of faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and ensure their better monitoring by Faculty Advisors).

A candidate shall be allowed a maximum duration of eight years from the first semester of admission to become eligible for the award of Bachelor degree.

The calendar of events in respect of the programme shall be fixed by the Institution from time to time, but preferably in line with the suggested academic calendar of the NITTE (Deemed to be University).

4. DEGREE PROGRAMMES

4.1 Undergraduate B. Tech. Degree Programmes are offered in the following disciplines by the respective programme hosting departments listed below:

i)	Biotechnology Engineering	(BT)
ii)	Computer Science & Engineering	(CS)
iii)	Computer Science and Engineering (Cyber Security)	(CB)
iv)	Civil Engineering	(CV)
v)	Electronics & Communication Engineering	(EC)
vi)	Electronics Engineering (VLSI Design and Technology)	(VT)
vii)	Electronics & Communication (Advanced Communication Technology)	(AC)
viii)	Electrical & Electronics Engineering	(EE)
ix)	Information Science & Engineering	(IS)
x)	Mechanical Engineering	(ME)
xi)	Artificial Intelligence and Machine Learning Engineering	(AM)
xii)	Computer and Communication Engineering	(CC)
xiii)	Robotics and Artificial Intelligence Engineering	(RI)
xiv)	Artificial Intelligence and Data Science	(AD)
Other teaching departments are –		
i)	Chemistry	(CY)
ii)	Humanities	(HU)
iii)	Management and Social Sciences	(MG)
iv)	Mathematics	(MA)
v)	Physics	(PH)

4.2 The provisions of these regulations shall be applicable to any new discipline that may be introduced from time to time and appended to the above list.

5.CREDIT SYSTEM:

In the Credit System, the course work of students is unitized, and each unit is assigned one credit after a student completes the teaching-learning process as prescribed for that unit and is successful in its assessment.

5.1 **Credit Definition:** The following widely accepted definition for credit can provide the good flexibility to the students and strengthens CBCS under the University. Here, one unit of course work and its corresponding one credit (while referring to a main semester) shall be equal to:

- Four-credit theory courses shall be designed for 50 hours of the Teaching-Learning process.
- Three-credit theory courses shall be designed for 40 hours of the Teaching-Learning process.
- Two-credit theory courses shall be designed for 25 hours of the Teaching-Learning process.
- One credit theory course shall be designed for 15 hours of the Teaching-Learning process.

The above figures shall also be applicable in the case of summer semester. Other student activities which are not demanding intellectually, or which do not lend to effective assessment, like practical training, study tours, attending guest lectures shall not carry any credit.

5.2 Credit Assignment and Lower & Upper Limits for Course Credits Registration in a Semester

All courses comprise of specific Lecture/Tutorial/Practical/Project (L-T-P-J) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

- 1-hour Lecture per week is assigned1.0 Credit.
- 2-hourTutorialsessionperweekisassigned1.0Credit.
- 2-hourLab.Session/project workperweekisassigned1.0credit.

For example,

- A theory course with L-T-P schedule of 3-2-0 hours will be assigned 4.0 credits.
- A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0credit.
- Calculation of Contact Hours / Week – A Typical Example
- As advised by faculty advisor, a student may register, between a minimum of **16credits and up to a maximum of 28credits.**

The maximum number of credits a student can register during a summer semester shall be 16. However, in special cases, the student may be permitted to register additional credits with the approval of the Department Undergraduate Committee (DUGC). There is no minimum number of credits fixed for course registration during summer semester.

Example:

An LTP-C of 2-2-2-4 means 2 instructional units based on classroom lecture (L), one instructional unit of tutorial (T), one laboratory (P) based instructional unit all delivered during a calendar week and repeated for the entire duration of the semester to earn 4 credits (C) after passing the course.

6 REGISTRATION

6.1 Every student after consulting his Faculty Advisor in parent department shall register for the approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will be allowed to register within one week of the last date by paying a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the University at the end of each semester, like ODD, EVEN, summer and it forms the basis for determining the student’s performance in that semester.

6.1.1 Each course will be identified by a unique Course Code of seven alpha-numerals (two alphabets followed by 5 digits). The alphabets reflect the discipline to which the course belongs. The first numeral (after the alphabet) indicates the learning level (based on pre-requisites) of the course, and the rest of the three numerals indicate a running serial number. Each course also has its version to track the revisions carried out in its syllabus over the time as represented by the last numerical separated by hyphen (-). Example: EE1001-1 represents the course is offered by EE Dept., Level-1, course serial number is 001 and the version is 1.

6.2 Mandatory Pre-Registration for higher semester

In order to facilitate proper planning of the academic activities of the Semester, it is necessary for the students to declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks prior to the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions:

- Satisfied all the academic requirements to continue with the programme of studies.
- Cleared all Institute, hostel and library dues and fines, if any, of the previous semester.
- Paid all required fees of the Institute and the hostel for the current semester.
- Has not been debarred from registering on any specific grounds by the Institute.

6.3 Registering for Backlog Courses

6.3.1 Students who have not cleared a course (Theory/ Lab/ project) are shown with "F" grade. A course having an 'F' grade will be considered as a backlog and it has to be re- registered in the subsequent semesters. F graded courses are eligible to register the next level course (pre-requisite is met).

6.3.2 Re-registration fee will be as per the university norms existing at the time of re-registration. When a course is re-registered, the evaluation marks of that course shall be treated as cancelled/ reset.

6.3.3 To provide an early opportunity for students to clear their backlog of courses, efforts will be made to offer as many courses as possible during Odd, Even and summer semesters.

7 ADD/DROP/AUDIT OPTIONS

7.1 Registration of courses

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with subject teacher and under faculty advice. The permissible course load to be either average credits (20) or to be within the limits of minimum (16) and maximum (28) credits.

7.2 DROP-option

During a specified period at the middle of a semester student's performance in CIE is reviewed by the faculty advisor. Following poor performance by a student he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses to be re-registered by these students and taken up for study at a later point of time.

7.3 Withdrawal from courses (Letter Grade "W")

During a specific period specified towards the end of the semester, student's performance in CIE is reviewed by the faculty advisors. Following poor performance by a student in identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with mention in the Grade card (Grade "W"). Such courses are to be re-registered by these students and taken up for study at a later point of time.

7.4 AUDIT-option (Letter Grade "U")

A student can register for courses for audit only, with a view to supplement his/her knowledge and/or skills. The audit courses shall not be considered in determining the student's academic performance (SGPA and CGPA) in the semester. "U" grade is awarded to such courses and will be reflected in the grade card on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses. However, CORE courses shall not be made available for audit.

8 COURSE STRUCTURE:

8.1 Types of courses

A "Course" is defined as a unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. A course has identified course outcomes, modules / units of study, specified teaching-learning methods and assessment schemes. A course may be designed to include lectures, tutorial, practical, laboratory work, field work, project work, internship experiences, seminars, self-study components, online learning modules etc. in any combination.

The following types of courses are included in the B. Tech. program:

(a) **Humanities, Social Sciences, and Management Courses (HSMC):** These are common courses for all disciplines.

(b) **Basic Science Courses (BSC):** Physics, Chemistry and Mathematics: These are mandatory for all disciplines.

(c) **Engineering Science Courses (ESC):** Basics of Electrical/ Electronics/ Civil/ Mechanical/ Computer Engineering, etc. These are mandatory for all disciplines.

(e) **Professional Core Courses (PCC):** These are the professional Core Courses, relevant to the chosen specialization/ branch. The core courses shall be compulsorily studied by students, and it is mandatory to complete them to fulfill the requirements of a Program.

(f) **Professional Elective Courses (PEC):** These are professional Electives, relevant to the chosen specialization/branch and can be chosen from the pool of courses. It shall be supportive to the discipline providing extended scope/enabling exposure to some to other discipline /domain and nurturing student proficiency skills.

(g) **Open Elective Courses (OEC):** These are the Elective Courses from other technical areas and/ or from emerging fields. Students of other departments shall opt for these courses to fulfilling of eligibility and prerequisite mentioned in the syllabus.

(h) **Integrated Professional Core Courses (IPCC):** It refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC shall be 04 considering L: T: P as 3:0:1 or L: T:P as 2:1:1, (where L, T and P represents credits not hours per week)

(i) **University Core Courses (UCC): These are compulsory core courses with common course codes across all the disciplines.**

i. **Project Work (PROJ):** Provide experiential learning opportunities for students. Students are required individually, or in a small group, select and complete a project that may include review, design, development, curation, analysis etc. with application of skills and knowledge relevant to area od study. Mini-project and Project work carried out at the parent Institution, or any university / Government recognized organization without affecting the regular class work

ii. **Seminar (SEM):** Each student has to present the seminar on specific topic chosen from the relevant field /list provided by the department under the supervision of a faculty coordinator.

iii. **Internship (INT):** The internship (a form of experimental learning) program is a workplace based professional learning experience that offers supervised exposure to real life work experience in an area related to field of study or career interest. An internship maybe undertaken at a workplace such as industry/ R&D organization / Government organization, or any other reputed organization / institution recognized for the purpose by the University. The internship program not only helps fresh pass-outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions

(j) **Mandatory Non-Credit Courses (MNC):** These courses are mandatory, without the benefit of a grade or credit, passing in each mandatory course is required to qualify for the award of degree.

- Assessment of these courses is conducted in the college and will include only Continuous Internal Evaluation (CIE). University Semester End Evaluation (SEE) will not be necessary for these courses.
- Minimum 40% of the prescribed CIE marks is required to secure a pass grade in these courses.
- The ‘PP’ grade is awarded for a Pass in the course and ‘NP’ grade is awarded for a Fail in the course. In case ‘NP’ grade is awarded, the student has to re-register for the same course wherein he has no alternative options.
- The “PP” and “NP” grades do not carry grade points and hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However, such non-credit mandatory courses are required to be included in the students’ performance record (transcript) with Pass or Fail (PP or NP).
- Courses that come under this category are the following.
    - Skill Development Lab, Engineering Visualization, Employability Skill Development, Environmental studies, Proficiency in a Language etc.

(k) **Ability Enhancement Courses (AEC)** These courses are designed to help students to enhance their skills in language, communication and personality development etc. They also promote a deeper understanding of courses like social sciences, ethics, culture, human behavior human rights, and the law. Ability Enhancement Courses are based upon the content that leads to Knowledge enhancement.

(l) **Universal Human Values Courses (UHV):** The courses which teach holistic perspective based on self-exploration about themselves (human being), family, society, and nature. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature. These are mandatory for all disciplines.

8.2 Typical Breakdown for the B.Tech. Degree Curriculum:

No.	Course Category	Credit Range	Suggested Credits
1.	Basic Science Courses (BSC)	18-23	22
2.	Engineering Science Courses (ESC)	10-15	13
3.	Emerging Technology Courses (ETC)	03-05	03
4.	Programming Language Courses (PLC)	03-05	03
5.	Professional Core Courses (PCC)	52 – 58	55
6.	Professional Elective Courses (PEC)	12-18	15
7.	Open Elective Courses (OEC)	6	6
8.	Humanities, Social Sciences and Management courses (HSMC)	09-15	15
9.	Ability Enhancement Courses (AEC)	8	8
10.	Mandatory Non-credit Courses (MNC)	Non-Credit	0
11.	Holistic Education Courses (HEC)	2	2
12.	Vocational Education Courses (VEC)	1	1
13.	Project Work (PROJ) (UCC)	10-12	10
14.	Internship (INT) (UCC)	8-12	11
15.	Note: **Student can register between 16 to 28 credits per semester**		
	Total minimum Credits to be earned: 164		**164**

8.2.1 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components, the semester wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies (BOS). The BOS will consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

8.3 The earned Credit Requirement for the B.Tech. Degree is 164.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to student to plan their career.

8.4 Program structure and suggested Course offerings:

I /II SEMESTER (AI&DS, AI&ML, CC, CS, IS, RI)

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week			SL#	Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P						
1.	BSC	MA1002 – 1	Calculus and Differential Equations	MA	3	0	0	2	3	50	50	100	3
2.	BSC	PH1004-1	Quantum Computing and Modern Physics	PH	3	0	2	2	3	50	50	100	4
3.	ESC	CS1001-2	Problem Solving through Programming	CS	3	0	2	2	3	50	50	100	4
4.	ESC	EC1001-1	Basic Electronics	EC	3	0	0	2	3	50	50	100	3
5.	ETC	IS1101-1	Fundamentals of Cyber Security	CS	3	0	0	2	3	50	50	100	3
6.	HSMC	HU1001-1	Technical English	HU	1	0	2	-	3	50	50	100	2
7.	UCC	HU1002-1	Constitution of India	HU	1	0	0	-	-	50	0	50	1
8.	BSC	MA1006 – 1	Mathematics with MATLAB	MA	0	0	2	-	-	50	0	50	1
TOTAL					**17**	**0**	**8**	**10**	**18**	**400**	**300**	**700**	**21**

Academic Activities beyond class hours	-	-	-	**5**
Learning hours per week	**17**	-	**8**	**15**

Total notional learning hours (L+T+P+J+SL)	Per Week	**40**
	Per Semester	**40X16 = 640**

I /II SEMESTER (AI&DS, AI&ML, CC, CS, IS, RI)

Sl. No	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week			SL#	Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P						
1.	BSC	MA1007 – 1	Discrete Mathematics and Transform Techniques	MA	4	0	0	3	3	50	50	100	4
2.	BSC	CY1003-1	Materials Chemistry for Computer Systems	CY	3	0	2	2	3	50	50	100	4
3.	ESC	EC1002-2	Applied Digital Logic Design	EC	2	0	2	1	3	50	50	100	3
4.	PLC	CS1005-2	Introduction to Python Programming	CS	2	0	2	1	3	50	50	100	3
5.	ESC	EE1001-2	Basic Electrical Engineering	EE	2	0	2	1	3	50	50	100	3
6.	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	-	1	50	50	100	1
7.	ESC	ME1004-1	Engineering Visualization	ME	0	0	2	-	0	50	0	50	1
8.	MNC	CV1005-1	Environmental Studies and Sustainability	CV	1	0	0	-	-	50	0	50	0
TOTAL					**15**	**0**	**10**	**8**	**17**	**400**	**350**	**700**	**19**

Academic Activities beyond class hours	-	-	-	**3**
Learning hours per week	**15**	-	**10**	**11**

Total notional learning hours (L+T+P+J+SL)	Per Week	**36**
	Per Semester	**36X16 = 576**

Mandatory Internship-I*

10.	INT	UC1001-1	Internship – I	Mandatory Intra Institutional Internship of duration (80 - 90 Hours) to be completed during I & II Semesters. *The grades will be included in the IV semester grade card (Refer to 11.5.2 for details)	100	--	100	2

III SEMESTER														
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**SL#**	**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**		**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**J**						
1.	BSC	MA2001-1	Statistics and Probability Theory	MA	3	0	0	0	2	3	50	50	100	3
2.	IPCC	CS2001-1	Data Structures	CC	3	0	2	0	2	3	50	50	100	4
3.	IPCC	CS2002-1	Object Oriented Programming	CC	3	0	2	0	2	3	50	50	100	4
4.	PCC	CC2103-1	Fundamentals of Computer Architecture and Organization	CC	3	0	0	0	2	3	50	50	100	3
5.	PCC	CC1104-2	Data Communications	CC	3	0	0	0	2	3	50	50	100	3
6.	PCC	CC1601-1	Unix and Shell Programming Lab	CC	0	0	2	0	1	3	50	50	100	1
7.	HSMC	HU2002-1	Developing Professional Skills	HU	1	0	0	0	-	3	50	50	100	1
8.	MNC	HU1003-1	Kannada (Balake / Samskrithika)	Any Dept.	1	0	0	0	-	-	50	0	50	0
9.	HEC	HU1005-1	Essence of Indian Culture	Any Dept.	1	0	0	0	-	-	50	0	50	1
				TOTAL	**18**	**0**	**6**	**0**	**11**	**21**	**450**	**350**	**800**	**20**

Academic Activities beyond class hours		-	-	-	-	**3**
Learning hours per week		**18**	**-**	**6**	**-**	**14**
Total notional learning hours (L+T+P+J+SL)	Per Week	**38**				
	Per Semester	**38X16 = 608**				

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
10.	MNC	MA1012-1	Bridge Course – Calculus and Differential Equations	MA	3	0	0	0	3	100	0	100	0

<table>
<tr><th colspan="17">IV SEMESTER</th></tr>
<tr><th rowspan="3">Sl. No</th><th colspan="2" rowspan="3">Course and Course code</th><th rowspan="3">Course Title</th><th rowspan="3">Teaching Dept.</th><th colspan="4">Teaching Hours/Week</th><th rowspan="3">SL#</th><th colspan="4">Examination</th><th rowspan="3">Credits</th></tr>
<tr><th>Theory Lecture</th><th>Tutorial</th><th>Practical/Drawing</th><th>PBL</th><th rowspan="2">Duration in hr</th><th rowspan="2">CIE Marks</th><th rowspan="2">SEE Marks</th><th rowspan="2">Total Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>J</th></tr>
<tr><td>1.</td><td>BSC</td><td>MA2005-1</td><td>Linear Algebra and Its Applications</td><td>MA</td><td>3</td><td>0</td><td>0</td><td>0</td><td>2</td><td>3</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>2.</td><td>IPCC</td><td>CS3004-1</td><td>Design and Analysis of Algorithms</td><td>CC</td><td>3</td><td>0</td><td>2</td><td>0</td><td>2</td><td>3</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>3.</td><td>IPCC</td><td>CC2001-1</td><td>Computer Networks</td><td>CC</td><td>3</td><td>0</td><td>2</td><td>0</td><td>1</td><td>3</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>4.</td><td>PCC</td><td>CS2102-1</td><td>Database Management Systems</td><td>CC</td><td>3</td><td>0</td><td>0</td><td>√</td><td>1</td><td>3</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>5.</td><td>PCC</td><td>CC2102-1</td><td>Foundations of Operating Systems</td><td>CC</td><td>3</td><td>0</td><td>0</td><td>0</td><td>1</td><td>3</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>6.</td><td>PCC</td><td>CS2601-1</td><td>Database Management Systems Lab</td><td>CC</td><td>0</td><td>0</td><td>2</td><td>0</td><td>1</td><td>3</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td>7.</td><td>HSMC</td><td>HU2001-1</td><td>Enhancing Self Competence</td><td>HU</td><td>2</td><td>0</td><td>0</td><td>0</td><td>-</td><td>3</td><td>50</td><td>50</td><td>100</td><td>2</td></tr>
<tr><td>8.</td><td>AEC</td><td>ME1654-1</td><td>Innovation and Design Thinking</td><td>ME</td><td>1</td><td>0</td><td>0</td><td>0</td><td>-</td><td>1</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td>9.</td><td>VEC</td><td>CC155x-1</td><td>Department Specific Vocational Education Course</td><td>CC</td><td>0</td><td>0</td><td>2</td><td>0</td><td>1</td><td>3</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td>10.</td><td>UCC</td><td>UC1001-1</td><td>Internship – I (Activity based Internship)</td><td></td><td colspan="6">Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations of I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester</td><td>100</td><td>-</td><td>100</td><td>2</td></tr>
<tr><td colspan="5">TOTAL</td><td>18</td><td>0</td><td>8</td><td>0</td><td>9</td><td>25</td><td>550</td><td>450</td><td>1000</td><td>24</td></tr>
<tr><td colspan="5">Academic Activities beyond class hours</td><td>-</td><td>-</td><td>-</td><td>-</td><td>6</td></tr>
<tr><td colspan="5"># Learning hours completed in previous academic year for carrying out Internship - I</td><td>-</td><td>-</td><td>-</td><td>-</td><td>4</td></tr>
<tr><td colspan="5">Learning hours per week</td><td>18</td><td>-</td><td>8</td><td>-</td><td>19</td></tr>
<tr><td colspan="3" rowspan="2">Total notional learning hours (L+T+P+J+SL)</td><td colspan="2">Per Week</td><td colspan="5">45</td></tr>
<tr><td colspan="2">Per Semester</td><td colspan="5">45X16 = 720</td></tr>
</table>

<table>
<tr><th colspan="15">Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs</th></tr>
<tr><td>11</td><td>MNC</td><td>MA1014-1</td><td>Bridge Course – Discrete Mathematics & Numerical Methods</td><td>MA</td><td>3</td><td>0</td><td>0</td><td>-</td><td>3</td><td>100</td><td>0</td><td>100</td><td>0</td></tr>
</table>

V SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	PBL (J)	SL#	Examination: Duration in hr	CIE Marks	SEE Marks	Total Marks	Credits
1.	IPCC	CC3003-1	Wireless Networks and Mobile Computing	CC	3	0	2	0	2	3	50	50	100	4
2.	IPCC	CC2002-1	Internet of Things	CC	3	0	2	0	1	3	50	50	100	4
3.	PCC	CC3101-1	Cryptography & Network Security	CC	3	0	0	0	1	3	50	50	100	3
4.	PCC	CC3601-1	Android Application Development Lab	CC	0	0	2	0	1	3	50	50	100	1
5.	PEC	CCx2xx-x	Professional Elective – I (Group-1)	CC	3	0	0	0	1	3	50	50	100	3
6.	HSMC	HU1006-1	Introduction to IPR	Any Dept.	1	0	0	0	-	1	50	50	100	1
7.	AEC	CCx6xx-1	Program Specific Ability Enhancement Course	CC	1	0	2	0	1	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0						
8.	HSMC	HU1011-1	Universal Human Values	Any Dept.	3	0	0	0	-	3	50	50	100	3
9.	AEC	HU1007-1	Social Connect & Responsibility	Any Dept.	1	0	0	0	-	1	50	50	100	1
10.	AEC	UM1003-1	Employability Skill Development	Any Dept.	1	0	0	0	-	-	50	0	50	1
TOTAL					**20/19**	**0**	**8/6**	**0**	**7**	**21**	**500**	**450**	**950**	**23**

		L	T	P	J	SL#
Additional Academic activities beyond class hours		-	-	-	-	8
Learning hours per week		20	-	8	-	15
Total notional learning hours (L+T+P+J+SL)	Per Week	43				
	Per Semester	43x16=688				

VI SEMESTER															
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**SL#**	**Examination**					**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**		**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**		
					L	**T**	**P**	**J**							
1	IPCC	CC3002-1	Next Generation Telecom Networks	CC	3	0	2	0	2	3	50	50	100		4
2	PCC	CC2104-1	Principles and Practices of Software Engineering	CC	3	0	0	0	2	3	50	50	100		3
3	PCC	CC3602-1	Security Lab	CC	0	0	2	0	2	3	50	50	100		1
4	PEC	CCx2xx-x	Professional Elective – II(Group-1)	CC	3	0	0	0	2	3	50	50	100		3
5	PEC	CCx3xx-x	Professional Elective – III(Group-2)	CC	3	0	0	0	2	3	50	50	100		3
6	OEC	XXx5xx-1	Open Elective –I	Any Dept.	3	0	0	0	1	3	50	50	100		3
7	HSMC	MG1003-1	Management & Entrepreneurship	Any Dept.	3	0	0	0	1	3	50	50	100		3
8	AEC	HU1008-1	Life Skills for Engineers	Any Dept.	1	0	0	0	-	1	50	50	100		1
TOTAL					**19**	**0**	**4**	**0**	**12**	**22**	**400**	**400**	**800**		**21**

Additional Academic activities beyond class hours	-	-	-	-	**5**
Learning hours per week	**19**	-	**4**	-	**17**

Total notional learning hours (L+T+P+J+SL)	Per Week	**40**
	Per Semester	**40x16=640**

VII SEMESTER															
Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week				SL#	Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	PBL		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J						
1	IPCC	CC3001-1	Cyber Security and Forensics	CC	3	0	2	0	2	3	50	50	100	4
2	PCC	CC3603-1	Advanced to Network Simulation Lab	CC	0	0	2	0	2	3	50	50	100	1
3	PEC	CCx2xx-x	Professional Elective – IV (Group 1)	CC	3	0	0	0	2	3	50	50	100	3
4	PEC	CCx3xx-x	Professional Elective – V (Group 2)	CC	3	0	0	0	1	3	50	50	100	3
5	OEC	XXx5xx-1	Open Elective –II	Any Dept.	3	0	0	0	1	3	50	50	100	3
6	HSMC	MG1002-1	Financial Management	Any Dept.	3	0	0	0	1	3	50	50	100	3
7	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	-	50	0	50	1
8	UCC	UC3001-1	Major Project Phase I	CC	-	-	4	-	2	-	100	0	100	2
				TOTAL	**16**	**0**	**8**	**-**	**11**	**18**	**450**	**300**	**750**	**20**

Additional Academic activities beyond class hours		**-**	**-**	**-**	**-**	**3**
Learning hours per week		**16**	**-**	**8**	**-**	**14**
Total notional learning hours (L+T+P+J+SL)	Per Week	**38**				
	Per Semester	**38x16=608**				

VIII SEMESTER														
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**SL#**	**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**		**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**J**						
1.	UCC	UC2001-1	Internship- II (Societal internship and Research/Industry Internship)	CC	Mandatory Research Internship / Industry internship for a total of 8 weeks (320 – 360 h) to be completed in one/two stretches during the vacation periods between IV to VII semesters (A minimum of total 320 hours)					3	50	50	100	8
2.	UCC	UC3002-1	Major Project Phase II	CC	Student should carry out project in research institute/industry/intra institute Center of Excellences. Two contact hours /week for interaction between the project guide and students. (24 hours per week) (360 hours per semester)					3	100	100	200	8
TOTAL					-	-	-	-	-	**6**	**150**	**150**	**300**	**16**
Additional Academic activities beyond class hours					-	-	-	-	-					
Learning hours per week					-	-	-	-	-					
Total notional learning hours (L+T+P+J+SL)				Per Week	-									
				Per Semester	**680**									

8.5 Eligibility for submission of Project Work Report

8.5.1 Project work during the 8th semester shall be taken up batch wise on completion of a minimum of **124 credits** and for Diploma lateral entry students (those who have joined second year B.Tech.) the same is **88 credits.**

8.5.2 Project work can be carried out as domain specific /interdisciplinary under the guidance of a faculty/ faculty members. They can also opt for advanced Internship or research Internship in an Industry/Research Institution/Center of excellence.

8.5.3 Project viva-voce examination shall be conducted individually.

8.6 ELECTIVES

8.6.1 A candidate shall take electives in each semester from groups of electives, commencing from 5th semester.

8.6.2 The minimum number of students to be registered for any Elective offered shall not be less than fifteen (15) and should not exceed forty (40)

8.6.3 A candidate shall opt for his/her choice of electives and register for the same at the beginning of each of 5^{th} to 7^{th} semesters if pre- registration is not done.

The candidate is permitted to opt for change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

9 ATTENDANCE REQUIREMENT:

9.1 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, and paper presentation.

9.2 The basis for the calculation of the attendance shall be the period of term prescribed by the institution by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course.

9.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up the shortage.

9.4 A candidate having shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded **'N' grade** in these courses.

9.5 He/she shall have to repeat those course(s) with 'N' grade and shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or summer semester.

9.6 Attendance in CIE and SEE:

Attendance at all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

10 WITHDRAWAL FROM THE PROGRAMME

10.1 Temporary Withdrawal

a) A student who has been admitted to a degree programme of the college may be permitted once during the course to withdraw temporarily, for a period of one semester, on the grounds of prolonged illness or grave calamity in the family etc., provided–

i. The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.

ii. The College is satisfied about the genuineness of the case and that even by considering the expected period of withdrawal, the student has the possibility to complete the programme requirements (164 credits) within the time limits specified by the university.

iii. The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.

iv. A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the student's roll list. The fees/charges once paid shall not be refunded.

v. A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

10.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

i) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after clearing all other dues if any.

ii) Those students who have received any scholarship, stipend, or other forms of assistance from the College shall repay all such amounts.

iii) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

11 EVALUATION SYSTEM

11.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

11.2 The Letter grades O, A+, A, B+, B, C, P and F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

11.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid-semester examinations and one semester end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE)	:	50% (50 marks)
Continuous Internal Evaluation (CIE)	:	50% (50marks)

CIE for Non-PBL Courses

i) Quizzes, Tutorials, Assignments, Seminars, etc.	:	10 marks
ii) Mid-semester Examinations	:	40marks

CIE for PBL Courses

i) Project Based Learning (PBL)	:	20 marks
ii) Mid-semester Examinations	:	30marks

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

11.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.

11.5 **Evaluation Scheme***(Refer Appendix-B for detailed evaluation guidelines)*: The course

Instructor shall announce in the class and/or display at the Notice board/faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

11.5.1 **Internship:** Mandatory Internship is in two parts. Internship-I (2weeks) and Internship-II (8 weeks)

11.5.2 **Internship-I**

11.5.2.1 All the students admitted to the 1st semester of engineering programs shall have to undergo Internship-I of 02 weeks during the first year. The internship shall include Inter / Intra Institutional activities. A viva – voce examination (Presentation followed by question-answer session) shall be conducted during the 2nd semester (for lateral entry students, during 3rd semester) and the prescribed credit shall be included in the 4th semester grade card.

11.5.2.2 All the students admitted to the 3rd semester of Engineering programs (Lateral Entry Category) shall have to undergo a mandatory internship of 02 weeks (during 3rd semester or the intervening period of the 3rd and 4thsemesters). The internship shall include Inter/Intra Institutional activities.

11.5.2.3 The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the student's internship progress and interact to guide them for the successful completion of the internship).

11.5.2.4 Procedure for the Evaluation of Internship-I

a) Students should submit the reports immediately on completion of the Internship to the respective mentors.

b) The Examination of internship will be carried out by the mentor.

c) The Internship-I shall be slated for 100 marks CIE only and will not have SEE.

d) Internship-I marks are based on CIE marks (25 marks for first presentation, 25 marks for second presentation, 50 marks for report and final presentation).

e) A Viva-Voce examination is Conducted during I/II/III Semesters (Presentation followed by question-answer session) and the prescribed credit shall be included in the IV semester grade card.

11.5.3 **Internship-II**

11.5.3.1 All the students admitted to engineering programs shall have to undergo Internship-II of 08 weeks during the second and third year of their Engineering studies.

11.5.3.2 During the intervening period of IV & V semesters and VI & VII semester, students shall be ready for industrial experience. Therefore, they shall choose to undergo 8 weeks Internship involving Innovation / Entrepreneurship/ or short term (about 2 weeks) societal related activities and 6 weeks Industry Internship.

11.5.4 **Project work evaluation:** The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a department committee constituted for this purpose. Seminar presentation, project report and final oral examination conducted by project evaluation committee at the department level shall form the SEE of the project work.

11.5.5 In the case of other requirements, such as, seminar, field work, comprehensive viva voce, if any, the assessment shall be made as laid down by the DUGC/Academic council.

11.5.6 There shall be no re-examination for any course in the credit system.

However, students

- who have abstained from attending CIE or SEE without valid reasons ("N" grade), or
- who have failed (F grade) to meet the minimum passing standards prescribed for CIE and/or SEE or
- who have been detained for shortage of attendance or who have withdrawn (W grade) who have dropped any course shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than "P" Grade in each case.
- While such students should re-register for same course(s) if core, they can re-register for alternative course(s) from among the elective courses, as the case may be. The re-registration shall be possible when the particular course is offered again either in a main (Odd/Even) or summer semester.

11.6 Qualifying standards

Evaluation Method	Qualifying Standard
Sessional (CIE)	Score: ≥40% (≥20 marks)
Terminal (SEE)	Score: ≥40% (≥20 marks)
For securing a final Pass	Total **40 % of the Course maximum marks (100)** i.e., the sum of the CIE and SEE marks prescribed for the Course is desired.

11.7 Grading System

The letter grade awarded to a student for his/her performance in a course is based on the Absolute Grading.

11.7.1 Absolute Grading – Letter Grade and its range

Grade point scale for absolute grading

Marks Range (%)	Grade Point	Letter Grade	Descriptor	Classification	CGPA
90 &above	10	O	Outstanding	First Class with Distinction	**7.00-& above**
80-89	9	A+	Excellent		
70-79	8	A	Very Good		
60-69	7	B+	Good	First Class	**6.00-6.99**
55-59	6	B	Above Average	Second Class	**5.50-5.99**
50-54	5	C	Average		**5.00-5.49**
40-49	4	P	Pass	Academic Probation / Non-compliance	**CGPA < 5.00***
00-39	0	F	Fails		
Absent	0	Ab	Absent	Fail	

*If a student secures CGPA< 5.0 at any point of time during his/her studies, he/she will be on Academic Probation/Noncompliance (refer section14.2 and 17.3 for more details.)

i) **Grade "N":** A candidate having shortage of attendance (<75%) in any course(s) or CIE marks less than 40% shall not be allowed to appear for SEE of such course(s). Such students will be awarded 'N' grade in these courses with a grade point of 0.

ii) The grade points given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in Arriving at the credit index of the student for that semester, as it is the sum total of all the credit points earned by the student for all the courses registered in that semester.

11.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range O-P. Letter grade "F" in any course implies failure of the student in that course and no credits earned.

11.8.1 The Transitional Grades "I", "W" and "X" would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (O-F) after the student completes the course requirements.

11.8.2 Grade "I": To a student having attendance ≥85% and CIE ≥ 70%, in a course, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

i) Illness or accident, which disabled him/her from attending SEE.
ii) A calamity in the family at the time of SEE, which required the student to be away from the College.
iii) However, the committee chaired by Principal is authorized to relax the requirement of CIE ≥ 70% if the student is hospitalized or advised long term rest after discharge from the hospital by the Doctor.
iv) Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that examination for which he or she is absent, failing which they will not be given permission.

11.8.3 **Grade "W":** To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice

11.8.4 **Grade "X":** To a student having attendance ≥85% and CIE ≥70%, in a course but SEE performance could result in a F grade in the course. **(No "F" grade awarded in this case, but student's performance record maintained separately).**

11.9 Summer / Fast Track semester

11.9.1 The students who have satisfied CIE and Attendance requirements for the course/s and obtained F grade in SEE are permitted to appear directly in ensuing examination/s as backlog paper/s. The students need not re-register for such course/s in the summer / fast track semester. In case the student wishes to improve CIE/ he/she has to re-register for summer / regular semester as and when offered next.

11.9.2 The student who obtains required attendance and CIE in summer semester, but obtains 'F' grade in SEE; is permitted to appear for SEE subsequently as backlog course/s. The student need not repeat course for Attendance and CIE.

11.9.3 The course/s for which the student does not possess satisfactory attendance and CIE score, shall be marked as 'N' in the Grade sheet. Such students are not permitted for SEE for the Courses marked as 'N' in Grade sheet. The students have to re-register only for course/s marked as 'N' in summer/ subsequent semester whenever that course is offered and obtain the required CIE and attendance. Subsequently, they are eligible to appear for SEE in such course/s.

11.9.4 Courses with Transitional Grades Viz "W","I", and "X" are also eligible to register in summer semester in case if they wish to improve the score in CIE.

11.9.5 All courses may not be offered in the summer semester. It is the discretion of the University to offer the courses based on the availability of resources. The Institutes shall notify the timetable for summer semester well in advance.

11.9.6 Summer Semester is optional; it is for the student to make best use of the opportunity.

11.9.7 A student is permitted to register for a maximum of 16 credits in Summer/ fast track semester.

11.9.8 A student has to choose those courses which are offered by the Institution in a given summer Semester.

11.9.9 In the summer semester, each course needs to be offered for the required number of lectures/ tutorial/ laboratory hours as prescribed in the syllabus.

11.10 Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students' performance like SGPA and CGPA and the courses taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

11.11 Re-Valuation and paper seeing.

Re-totaling of marks is permitted only for theory papers. The University, on application within the stipulated time and remittance of a prescribed fee for revaluation, shall permit revaluation for the course/s applied. The marks obtained after re-valuation shall be the final marks awarded.

11.12 The Make Up Examination

The Make Up Examination facility would be available to students who may have missed to attend the SEE of one or more course(s) in a semester for valid reasons and given the "I" grade; Also, students having the "X" grade shall be eligible to take advantage of this facility. **The makeup examination would be held as per dates notified in the Academic Calendar during the summer semester.** However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be same as the regular SEE for the course(s).

a) All the "I" and "X" grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding "I" and "X" grades after the last scheduled make-up examinations shall be automatically converted to "F" grade.
b) All the "W" grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ Summer semester and fulfill the passing standards for their CIE and (CIE+SEE).

11.13 Rules for grace marks

Grace marks up to 1% of the maximum total marks of the courses for which he/she is eligible and have registered (non-credit courses excluded) in the examination or 10 marks whichever is less shall be awarded to the failed course(s), (with a restriction of a maximum of 5 marks per course) provided on the award of such grace marks the candidate passes in that course(s).

12 EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices:

SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

$$SGPA = \frac{\sum[(CourseCredits) \times (GradePoint)]\text{(for all courses in that semester)}}{\sum[CourseCredits]}$$

CGPA is computed as follows:

$$CGPA = \frac{\sum[(CourseCredits) \times (GradePoint)] \text{(for all courses excluding those with F grade until that semester)}}{\sum[CourseCredits] \text{(for all courses excluding those with F grades until that semester)}}$$

13 COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitate the declaration of academic performance of a student at the end of a semester and at the end of successive semesters. Both would be normally calculated to the second decimal position.

14 REQUIREMENTS OF VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

14.1 All students are promoted to their next semester or year of their programme, irrespective of the academic performance.

14.2 However, at any stage of his/her study, if a student reaches a CGPA below 5.00, the student will be on **Academic Probation** and is permitted to register for a maximum of 16 credits during odd semester of an academic year. However, the student has the choice to re-register for the courses / courses in which he/she has obtained ‘F’ / ‘N’ grade.

14.3 A Student shall be declared fail if he / she

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not appeared for the SEE even after satisfying the attendance and CIE requirements.

14.4 Vertical Progression for regular students who have taken admission to first year:

Normally student is expected to complete a minimum of 85% of credits by the end of 7th semester. However, **for submission for B.Tech. Major Project in 8th semester, student should have completed at least 122 credits.**

14.5 Vertical Progression in case of Diploma students admitted to Second year (lateral entry):

14.5.1 Lateral entry students should complete at least 85% of credits by the end of 7^{th} semester. However, for **submission for B.Tech. Major Project in 8^{th} semester, student should have completed at least 88 credits.**

14.5.2 Diploma students should register for mandatory non-credit Mathematics Courses Bridge Courses (i) Calculus and Laplace Transforms and (ii) Probability and Differential Equations prescribed during III and IV semesters respectively. They shall attend these bridge course classes during the respective semesters to satisfy attendance and CIE requirements.

14.5.3 Completion of Mathematics Courses Bridge Courses (i) Calculus and Laplace Transforms and (ii) Probability and Differential Equations shall be mandatory for the award of degree.

14.6 Termination from the programme

A student shall be required to withdraw (discontinue) from the programme and leave the college on the following grounds.

i) Failure to secure a CGPA = 5.0 at the end of 8th Semester.

ii) Failure to earn a credit of 164 (124 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).

iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.

iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

15 AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of university examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class, and Second Class. This can be seen from the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks*	Class
$\geq$ 7.00	$\geq$ 70%	Distinction
$\geq$ 6.00	$\geq$ 60%	First Class
5.0$\geq$CGPA <6.00	50$\geq$ Percentage < 60%	Second Class

Percentage * = (CGPA) x 10

16 APPEAL FOR REVIEW OF GRADES

a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

17 AWARD OF DEGREE

17.1 (1) B.Tech. Degree

a) Students shall be declared to have completed the Programme of B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (164 credits for regular students registered for 4-year degree programmes & 124 for lateral entry students).

b) For the award of degree, a CGPA≥5.00 at the end of Programme shall be mandatory.

c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.

d) Earning of Activity Points:

i. Every student entering 4-year degree programme should earn 100 activity points & every student entering 4-year degree programme through Lateral Entry should earn 75 activity points as per the AICTE Activity Point Programme for the award of Engineering degree.

ii. The activities can be spread over the years (duration of the programme) any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.

iii. The Activity Points earned shall be reflected on the student’s eight semester Grade Card.

iv. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

v. In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

17.2 Honours / Minors Degree

17.2.1 B.Tech. (Honours)Degree

i. Students must earn a min of 18 additional credits in his/her own major programme discipline entitles a student to get ‘Honours’ credential.

ii. Students have to pay additional fees for all the courses registered for ‘Honours’

iii. Students with a minimum of 7.5 CGPA and no backlog at the end of 4th semester will qualify for registering course under ‘Honours’ credential.

iv. Students shall register for honours courses from 5th semester onwards.

v. Students should register for additional courses and plan to take courses that are prescribed under that ‘honors’ list as per ‘pre-requisite’ courses to earn the 'Honours' credential.

vi. Students who wish to acquire ‘Honours’ credential need to carry out ‘honours’ course registration along with their regular semester course registration.

vii. He/she accumulates credits by registering for the required courses, and if the requirements for ‘Honours’ are met within the prescribed minimum time limit of the programme, the ‘Honours’ will be awarded along with the degree.

viii. Also, the student should meet the following **requirements to become eligible for the ‘Honours’ award.**

- Minimum CGPA of 7.5 in this major discipline at the end of 8th semester
- Minimum CGPA of 7.0 in the registered 'Honours' courses

ix. In case a student withdraws from the 'Honours' registration in the middle of the programme, the 'Honours' courses successfully completed will be converted to 'Audit' courses and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheet.

x. It must be noted that, Honours award will be mentioned in the Degree Certificate as **"Bachelor of Technology in (specialization) with Honours".**

xi. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Honours' with similar details shown for other credited courses and the CGPA for 'Honours' will be indicated at the end of list of courses under 'Honours'.

xii. The grades obtained in the courses credited towards the 'Honours' award is not counted and shall have no influence on the GPA/ CGPA of the 'programme' student has registered.

17.2.2 Minor Degree

i. Students have to earn a min of 18 additional credits from the courses focused on discipline other than his/her major programme discipline entitles a student to get a 'Minor' credential.

ii. Students have to pay additional fees for all the courses registered for 'Minor'.

iii. Students with a minimum of **5.0** CGPA and no backlog at the end of 3rdsemester will only qualify for registering course under 'Minor' credential.

iv. Students shall register for Minor degree courses from 4th semester onwards.

v. All Departments will offer 'Minors' in their varied disciplines and will prescribe what set of courses and/or projects is necessary for earning a minor in that discipline.

vi. Students should register for additional courses and plan to take courses that are prescribed under that 'Minors' list as per 'pre-requisite' courses to earn the 'Minor' credential.

vii. If any of the courses listed under the 'minor' option is a course listed under his/her curriculum as PCC then the student cannot opt for that 'minor', since all minor courses need to be earned as additional courses to his/her programme curriculum and depts decision is final and binding.

viii. Students who wish to acquire a 'Minor' can register for 'minor' courses along with their regular semester course registration.

ix. Also, the student should have a minimum **CGPA of 5.0 in the 'Minor' courses registered to become eligible for the Minor credentia**l. This fact will also be reflected in the Consolidated Grade Sheet under a separate heading 'Minor in (specialization)'.

x. If the course requirements for a particular 'Minor' are met within the prescribed minimum time limit of the programme, the minor will be awarded along with the degree, and it will be mentioned in the **Degree Certificate as "Bachelor of Technology in (Major discipline) with Minor in (specialization)."**

xi. In case a student withdraws from the 'Minor', the 'Minor' courses successfully completed, will be converted to 'Audit' courses, and indicated accordingly in subsequent Grade Sheets and Consolidated Grade Sheet.

xii. The grades obtained in the courses credited towards the 'Minor' award are not counted and shall have no influence on the GPA/ CGPA of the programme the student has registered.

17.2.3 Additional norms for Honours/Minors

i. Students shall register for additional courses to earn Honours/Minors in consultation with their Class Advisor from the list of courses suggested by the DUGC.

ii. DUGC may recommend Massive Open Online Courses (MOOCs)/SWAYAM/NPTEL courses to students who wish to register for Honours/Minors after justifying and establishing the equivalence of curriculum. The decision of DUGC should be communicated to the Dean Academics and Controller of Examinations for seeking approval.

iii. A maximum of 40% credits prescribed for Honors/Minors may be earned through MOOCs/SWAYAM/NPTEL

iv. Students may choose to take up additional course work, from the MOOCs courses list suggested by various departments (which can be from SWAYAM/NPTEL) with proctored examinations as approved by the University and complete the same before the last working day of VIII semester with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates. Completed the course (40-59)– ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %)

v. In case, if in MOOCs (ex: Coursera), there is no proctored examination, the University will conduct a SEE as deemed to be fit for the award of Credits.

vi. The Credit equivalence for online courses shall be as follows –

- 4 weeks of online course duration – 1 credit (approx. 13-14 hours)
- 8 weeks of online course duration – 2 credits (approx. 26-28 hours) and
- 12 weeks of online course duration – 3credits (approx. 39-42 Hours)

17.3 Noncompliance

17.3.1 Noncompliance of CGPA ≥ 5.00 at the end of the Programme

a) Students, who have completed all the courses of the Programme but not having a CGPA ≥ 5.00 at the end of the Programme, shall not be eligible for the award of the degree.

b) In the cases of 17.3 (1) a, students shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Major), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

c) Students shall obtain written permission from the Controller of Examination to reappear in SEE to make up the CGPA equal to or greater than 5.00.

d) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥5.00, the students shall become eligible for the award of the degree. If

CGPA <5.00, the students shall follow the procedure laid in 17.3 (1) b.

e) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is≥5.00, the students shall become eligible for the award of the degree. If CGPA<5.00, the students shall follow the procedure laid in 17.3 (1) b.

f) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 17.3 (1) b.

g) In case, the students fail (i.e., earns F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in17.3 (1) b.

17.3.2 Noncompliance of Project/ Mini project

The project/mini project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements.

17.3.3 Noncompliance of Internship

All the students of B. Tech shall have to undergo mandatory Internship-I and Internship-II of total 10 weeks to earn a total of 10 credits in parts during the vacations at the end of 1/2/3 academic year. Evaluation of Internship shall be during III/IVand VIII semesters. Internship shall be considered mandatory for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfying the internship requirements.

The maximum duration for a student for complying with the Degree requirements is 16 – semesters from the date of first registration for his first semester (8 years from the date of admission to first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

18 GRADUATION REQUIREMENTS AND CONVOCATION

18.1 A student shall be declared to be eligible for the award of the degree if he/she has.

a) Fulfilled “Award of Degree” Requirements
b) No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centers
c) No disciplinary action pending against him/her.

18.2 The award of the degree must be recommended by the Governing council.

18.3 **Convocation:** Degree will be awarded for the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer "Award of Degree") within the specified date in order to arrange for the award of the degree during convocation.

19 AWARD OF PRIZES, MEDALS, CLASS & RANKS

19.1 For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the University for such awards. Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class as described in Section 15.

19.2 An attempt means the appearance/registration of a candidate for an examination in one or more courses either in part or failing a particular examination.

19.2.1 A candidate who fails/remaining absent (after submitting exam application) in the main examination and passes one or more subjects/courses or all subjects/courses in the supplementary/Make-up examination such candidates shall be considered as taken more than an attempt.

19.3 Merit Certificates and University Medals/ will be awarded on the basis of overall CGPA, governed by the specific selection criteria that may be formulated by the University for such Medals / Awards

19.3.1 Only those candidates who have completed the Program and fulfilled all the requirements in the minimum number of years prescribed (i.e., 3 years for Diploma lateral entry students or 4 years for students joined after 12th standard) and who have passed each semester in the **first attempt** are eligible for the award of Merit Certificates and /or University Medals.

19.3.2 Candidates who pass the subjects in the supplementary/make-up examinations are not eligible for the award of Medal or Merit Certificate.

20 CONDUCT AND DISCIPLINE

20.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

20.2 **As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.**

20.3 The following acts of omission/ or commission shall constitute gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

i. Ragging.

ii. Lack of courtesy and decorum; indecent behavior anywhere within or outs ide the campus.

iii. Willful damage or stealthy removal of any property/belongings of the College/Hostel or of fellow students/citizens.

iv. Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.

v. Mutilation or unauthorized possession of Library books.

vi. Noisy and unseemly behavior, disturbing studies of fellow students.

vii. Hacking in computer systems (such as entering into other Person's area without prior permission, manipulation and/or Damage of computer hardware and software or any other Cybercrime etc.).

viii. Plagiarism of any nature.

ix. Any other act of gross indiscipline as decided by the Senate from time to time.

x. Use of Mobile in the college Academic area.

xi. Smoking in College Campus and supari chewing.

xii. Unauthorized fund raising and promoting sales.

xiii. Commensurate with the gravity of offence the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

20.4 For an offence committed in (i) a hostel (ii) a department or in a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department, and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

20.5 All cases involving punishment other than reprimand shall be reported to the principal.

20.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

20.7 **Note:** Students are required to be inside the examination hall 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

****

21 APPENDIX -A

Definitions, terminology, and abbreviations

1. **NitteDU / University**
    a. Refers to Nitte (Deemed to be University)
2. **EC**
    a. Refers to Executive Council of Nitte (Deemed to be University)
3. **BoS**
    a. Refers to Board of Studies in Computer and Communication Engineering
4. **Institute/Institution**
    a. Refers to NMAM Institute of Technology, Nitte
5. **Program**
    a. A range of learning experiences over a specified period, leading to the award of a degrees / diploma / certificate. A program is completed when the courses that make up the program are completed, and other requirements as specified in the program regulations are met.
6. **Course**
    a. A unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. Often referred to as a "subject". A course has identified course outcomes, modules / units of study, specified teaching-learning methods and assessment schemes. A course maybe designed to include lectures, tutorials, practical, laboratory work field work, project work, internship experiences, seminars, self-study components, online learning modules etc. in any combination.
7. **Semester**
    a. An academic session, usually of 16 weeks duration, with a minimum of 90 working days during which coursework and assessments are to be completed. Typically, two semesters make up an academic year, with the first of these referred to as Odd Semester and the second as Even Semester.

    b. An additional short semester (usually 8 weeks) maybe offered between an even semester and subsequent odd semester (in the interval between two academic years) and are termed as summer semester. Summer semester is offered to enable students to register for:
        i. Fast-tracked courses required for clearing backlog courses
        ii. Fact-tracked courses for earning additional credit / completing non-credit mandatory requirement
        iii. Value added courses
        iv. The courses offered in summer semesters are bound by the same regulations as that of regular semesters, except that they are run at an accelerated pace to provide the required contact hours and conduct assessments within the 8-week period.
8. **Credit**
    a. A unit by which the course work is measured. It determines the number of hours of formal learning (contact hours) required per week. Credits are calculated based on the concept of "notional learning time". Notional learning time is the number of hours which a learner is expected to spend, on average, to achieve the specified

learning outcomes of the course. This may comprise a variable combination of scheduled learning activities, (lectures, seminars, labs etc.) and self-directed learning time (reading required prior to classes, working on assignments, examination preparation and completion of assessments and).

9. Credit equivalence of notional learning time for different types of activities

a. The credit values assigned to various teaching-learning activities are as follows:

Type of teaching-learning	Nature of activity	No. of contact hours per week equivalent to one credit	Total number of contact hours over a 16-week semester that is equivalent to one credit
Lectures / Seminars / synchronous virtual classes / synchronous webinars	Scheduled instruction	1:1	16
Tutorials	Scheduled instruction	2:1	32
Supervised Demonstrations /Laboratory sessions / Studio / Workshops / Workplace simulation / Skill Practice Sessions	Scheduled instruction	2:1	32
Supervised Field visits / community visits/Internships	Scheduled instruction	3:1	48
Scheduled self-directed study (individual or group)	Scheduled instruction	2:1	32
Asynchronous E-Learning modules (structured self-directed study	Independent learning	2:1	32
Student Seminar	Independent / small group learning	2:1	32
Project work / dissertation	Independent / small group learning	3:1	48

Internship for credit	Industry placement/ Research Internship	3:1	48

10. Choice-based credit system (CBCS)

A program structure for higher education which requires students to earn a minimum of credits by completing various types of courses, including electives, which facilitate a student to have some freedom in selecting his/her own choices, within as well as across disciplines.

11. Course registration

Refers to formal registration of the Courses in the study in every semester (Credits and Audit) by every student under the supervision of a faculty advisor. The institution will maintain records of the same and communicate it to the University.

12. Learning outcomes

a. Program Outcomes (PO) - Statements defining the skills, knowledge and attitude that graduates of a program will be able to demonstrate upon completing the program

b. Course Outcomes (CO) - Statements defining the skills, knowledge and attitude that students will be able to demonstrate upon completing the course. COs are mapped to the POs such that attaining the course outcomes leads to attainment of program outcomes.

c. Attainment of POs-COs are mapped to the POs such that attaining the course outcomes leads to attainment of program outcomes.

13. Evaluation

For all courses, evaluation will be based on both formative assessment (Continuous Internal Evaluation, CIE) and summative assessment (Semester End Evaluation, SEE). Weightage for CIE and SEE will be 50% each

13.1 Continuous Internal Evaluation (CIE)

Refers to periodic and continuous *formative assessment* of student’s performance during the semester by the teacher(s) of the course with the aim of providing timely feedback to students and for guiding “course corrections” by the teachers. The assessment methods may include tests, quizzes, assignments, project evaluations, portfolio evaluations, seminar assessments etc. CIE will have a weightage of 50% in the determination of final grading of the course.

13.2 Semester End Evaluation (SEE)

Refers to *summative assessment* that covers the entire course syllabus, conducted by the University, at the end of semester. Appropriate assessment methods aligned with the learning domain and teaching-learning methods are to be used. CIE will have a weightage of 50% in the determination of final grading of the course.

14. Grading

Course Grade refers to a qualitative measure of performance of a student in each course, based on the percentage of marks secured in Continuous Internal Evaluation (CIE) and Semester End Evaluation (SEE). A Letter grade is awarded for each course.

15. Semester Grade Point Average (SGPA)

Refers to the measure of a student's academic performance in a semester. It is calculated based on the credits and the grades obtained in the courses offered in the semester.

16. Cumulative Grade Point Average (CGPA)

Refers to the measure of the cumulative performance of a student in all the previous semesters and is computed from the 2nd semester onwards. It is calculated based on the credits and the grades obtained in all the courses taken.

17. Academic Bank of Credits (ABC)

The Academic Bank of Credits is a national-level facility for "credit transfer". It is provided by the Ministry of Education, Govt. of India, to promote the flexibility of the curriculum framework and interdisciplinary/multidisciplinary academic mobility of students across the Higher Education Institutions in the country. The banking and redemption of credits through ABC will be governed by the University's guidelines.

22 Appendix-B

Evaluation Guidelines

CIE and SEE details for various types of courses.

1. **Theory: PCC/IPCC/PEC/OEC**

1.1. Scheme of examinations: CIE+SEE =50+50=100 marks

1.2. Continuous internal evaluation (CIE):

1.2.1. CIE (Non-PBL Courses)

Type of Questions	Questions to be set (Can have sub questions a and b)	Questions to Be answered	Marks per question	Total marks
Mid Sem Exam-1				
40% of the total syllabus (Unit-1) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-2	2	1	10	10
Mid Sem Exam-2				
40% of the total syllabus (Unit-2) (15 Teaching hours)				
Descriptive Part-1	2	1	10	10
Descriptive Part-1	2	1	10	10
TASKS				
TASK	Task comprises of 5 class tests/quizzes/assignments conducted for each unit for a max mark of 10. All tests/quizzes/Assignments are compulsory			10
Maximum Marks				**50**

1.2.2 CIE (for courses having Project Based Learning (PBL) component)

Type of Questions	Questions to be set (Can have sub questions a and b)	Questions to be answered	Marks per question	Total marks
Mid Sem Exam-1				
40% of the total syllabus (Unit-1) (15 Teaching hours)				
Descriptive Part-1	2	1	8	8
Descriptive Part-2	2	1	7	7
Mid Sem Exam-2				
40% of the total syllabus (Unit-2) (15 Teaching hours)				
Descriptive Part-1	2	1	8	8
Descriptive Part-1	2	1	7	7
Project Based Learning (PBL)				
PBL	PBL comprises of implementation of theoretical concepts through projects / problem solving			20
Maximum Marks				**50**

1.2.3 Semester End Evaluation (SEE): 3 Hours Duration

Type of Questions	Module & Teaching hours	Questions to be set (Can have sub questions a, b and c)	Questions to be answered	Marks per question	Total marks
MCQ	Entire Syllabus	10 or 20	All Questions	2 or 1	20
Descriptive	• Unit-1 • 15 teaching hours	3	2	16	32
Descriptive	• Unit-2 • 15 teaching hours	3	2	16	32
Descriptive	• Unit-3 • 10 teaching hours	2	1	16	16
				Maximum Marks	**100**
SEE Marks with 50% Weightage					**50**

1.2.4 CIE & SEE for various types of courses

Sl. No.	Courses		Evaluation scheme			
			CIE (Minimum eligibility marks 40% of Max marks to appear for SEE)		SEE (Minimum Passingmarks40 % of Max marks)	
			Max Marks	Min eligibility marks required	Max Marks	Min passing marks required
1	Integrated Professional Core Course (IPCC)	Theory	30	12	50	20
		Practical	20	08	---	---
		Total	50	20	50	20
2	PCC with PBL component	Theory	30	12	50	20
		PBL component	20	08	--	--
		Total	50	20	50	20
3	PCC/PEC/OEC		50	20	50	20
4	Laboratory		50	20	50	20
5	Drafting		50	20	50	20
6	Mini Project		100	40	---	---
7	Inter/Intra Institutional Internship (2 weeks)		100	40	---	---

8	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship (In single or two stretches =Total 8 weeks)	100	40	100	40
9	Research Internship/ Advanced Industry Internship/Project work	100	40	100	40
10	Seminar	100	40	---	---

All university examination (SEE) shall be conducted for maximum of 100 marks. For assigning the letter grade the university examination marks secured by a student, except in case of serial no. 06, 07 and 10 shall be reduced to 50 marks and added to CIE marks.If the total marks result a fraction during reduction, it shall be rounded off to a nearest higher value.

2 Laboratory/Practical Course

2.1 Split-up of Marks for evaluation of Practical for 50 CIE marks and 50 SEE marks.

2.2 Split-up of Marks for evaluation of Laboratory work:

2.2.1 Laboratory in-charge faculty will follow rubrics given in Tables below for evaluation of laboratory courses.

2.2.2 In the case of Practical, the IA marks shall be based on the laboratory observation, records, viva and at least one practical test.

2.2.3 Continuous Evaluation in every lab session will be done using the format mentioned in the Table to evaluate PO9(Individual and teamwork) and PO10(Communication).

2.2.4 Rubrics used for continuous Evaluation of **laboratory courses involving experiments with hardware.**

<table>
<tr><th colspan="3">Lab conduction and Record</th><th colspan="3">LabInternal Assessment</th></tr>
<tr><td colspan="3">Split-up: 60% (30 Marks) of Maximum CIE marks (50).

Each experiment is to be evaluated for conduction with an observation book and record write-up (30 marks per experiment). The final marks for conduction and record is the average of all the specified experiments in the syllabus.</td><td colspan="3">Split-up: 40% (20 Marks) of Maximum CIE marks (50). One test of 20 Marks
In test, conduction of experiment and acceptable result with viva-voce will carry a weightage of 60% per experiment, with the rest 40% for procedural knowledge and regularity of the student.</td></tr>
<tr><td>Rubrics per Experiment</td><td>Marks Distribution</td><td>Remarks</td><td>Rubrics</td><td>Marks distribution</td><td>Remarks</td></tr>
<tr><td>Circuit</td><td>02</td><td>Evaluation of Record write-up to include weightage for</td><td>Write-up</td><td>04</td><td></td></tr>
</table>

Design	02	submission on time, neatness, etc.	Conduction	10	
Procedure	02		Results	06	
Conduction	06				
Viva	06				
Record write-up	12				
Total Marks	30		**Total Marks**	20	

2.2.5 Split-up of Marks used for continuous Evaluation of laboratory involving experiments with software.

Rubrics for Split up of Marks	**Methodology / Process Steps per Experiment**	**Marks**
#R1	Observation, Write up of Procedure / Algorithm/ Program execution and Conduction of experiment	12
#R2	Viva – Voce	06
#R3	Record writing	12
	Total Marks for each experiment	30
#R4	Internal Test: Lab Internal Assessment (i) Write-up of Procedure/Program/Algorithm (ii) Conduction/Execution (iii) Viva-Voce	 04 10 06
	Total Marks	20

3. Internship and Evaluation

3.1 Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative work force to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship(a form of experiential learning)program not only helps fresh pass–outs in gaining professional know–how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.

The following list provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21^{st}-century skills and to be acquired by graduates:

- Critical thinking, problem-solving, reasoning, analysis, interpretation, and synthesizing information.
- Scientific literacy and reasoning, the scientific method.

- Research skills and practices, interrogative questioning.
- Creativity, artistry, curiosity, imagination, innovation, and personal expression.
- Information and communication technology (ICT)literacy, media and internet literacy, data interpretation and analysis, computer programing.

- Oral and written communication, public speaking and presenting, listening.
- Economic and financial literacy, entrepreneurial skills.
- Global awareness, multi cultural literacy, humanitarianism.
- Environmental and conservation literacy, ecosystems understanding.
- Civic, ethical, and social-justice literacy.
- Leadership, teamwork, collaboration, cooperation, and facility inusing virtual workspaces.
- Perseverance, self-direction, planning, self-discipline, adaptability, initiative.
- Health and wellness literacy, including nutrition, diet, exercise, and public health and safety.

The internship experience will augment outcome- based learning process and inculcate various attributes mentioned above in a student in line with the graduate attributes defined by the NBA as well as NEP 2020.

Following are the intended objectives of internship training.

(i) Expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence create competent professionals in the industry.

(ii) Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.

(iii) Expose to the current technological developments relevant to the subject area of training.

(iv) Use the experience gained from the industrial internship in discussions held in the classrooms.

(v) Create conditions conducive to quest for knowledge and its applicability on the job.

(vi) Learn to apply technical knowledge in real industrial situations.

(vii) Gain experience in writing reports in technical works/projects.

(viii) Expose students to the engineer’s responsibilities and ethics.

(ix) Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control and safety measures.

(x) Promote academic, career and/or personal development.

(xi) Expose the students to future employers.

(xii) Make students available to industry for employment.

(xiii) Understand the psychology of the workers and their habits, attitudes, and approach to problem-solving.

(xiv) Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations.

3.2 Academic credit framework for the internship and project work undergone as part of the B.Tech. programme.

- A minimum of 20 credits of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted towards B. Tech. degree programme.
- Here, 1 credit is equivalent to minimum 40-45 hours of work. Therefore, a full-time intern is expected to spend 40 - 45 hours per week on Internship, Training, Project work, Seminar activities etc. This will result in about 800 to 900 hours of total internship and project duration for B. Tech programme.
- To derive the benefits of an internship, it is introduced in two/ three stages of the B.Tech. program.
- Internships may be full-time or part-time; they are full-time in the summer vacation and part-time during the academic session. The curriculum is flexible to adjust internship duration. Therefore, opportunities must be provided for experiences that cannot be anticipated when planning the course.
- The departments have the flexibility to schedule internship, Project work, Seminar etc. according to the availability of the opportunities. However, suggested minimum requirement regarding Internship duration and credits are as given in Table -B1.

Table-B1 Suggested Credit Framework for Internship, Project work and Seminar

Sl. No.	Title	Schedule	Duration	Activities	Credits
1	Internship-I	Ongoing First year academic session/ Summer vacation after 2nd Semester/ vacation during 3rd semester (for lateral entry students	02 weeks	Inter/ Intra Institutional Activities (Evaluation in 4th semester)	02
2	Internship-II	a) Summer vacation after 4th Semester	02-04 weeks	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship/ social internship	---
		b) Summer vacation after 6th Semester	04-06 weeks	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship	
		c) Total of a) and b) at the beginning of 8th semester	08 weeks	Evaluation in 8th Semester	08
3	Project work	8th Semester	16 weeks	Extended Industry Internship /Research Internship/ Project work	10
				Report preparation and writing	
				Seminar	01
Total Credits					**21**

Table-1 states that during the ongoing/ summer vacations after the 2nd Semester, students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

During the summer vacation after 4th/ 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

3.3 Internship Supervision

i) Internship shall be carried out under the supervision of a faculty mentor. The faculty mentor/guide should,

ii) Serve as a teacher, mentor, trainer, critic, leader, and boss.

iii) Provide sufficient time to guide the interns. (Interns are students or a trainee who does a job to gain work experience)

iv) Play a vital role, along with the Training and Placement Officer, in providing internship opportunities for the students.

v) Exhibit qualities such as leadership, strong communication skills, and patience.

vi) Provide letter of recommendation in due consultation with students and the industrial organization (if possible) where internship is intended to be carried out, endorsed by the authority (Principal/Institution Internship Coordinator).

3.3.1 Each faculty mentor shall supervise the students/Student batches allotted to them. Often, the supervision may be by an external expert. In such cases, the faculty mentor shall jointly guide the student/s without causing miscommunications / embarrassment to either side.

3.3.2 Depending on the activity taken up by the students, the internship shall be carried out individually or in batches having not more than three students.

3.3.3 Faculty Mentor, along with the external expert, shall scrupulously evaluate the work of an individual student or students of a batch and maintain the relevant documents.

3.3.4 For allotment of CIE marks, the institutions shall prepare the rubrics for each activity offered by the institution as given in Table - B2. The marks shall be allotted by the Internship committee designated by HOD in consultation with the mentors.

3.3.5 For all activities conducted by the institution, the attendance of the students shall be maintained by the faculty and maintained in their respective department.

3.4 Internship-I (Intra and Inter Institutional Internships)

While intra activities are within the institution, inter activates shall be between the concerned institution and neighboring institutions. Intra and Inter activities are the activities that are impetus to learning techniques. It adds to comprehensive growth of mind and associated activities.

As the students are at the verge of learning technical aspects and have limited time period of internship, it is preferable to expose students to polygonal activities instead of one type of activity. Therefore, activities completed by the students shall not be one type of activity but can be few within the time period of the internship. In this regard, Intra and Inter Institutional activities shall be completed under the supervision of a faculty on self-learning basis.

The faculty have to kindle the latent abilities of the students, encourage, guide, supervise and shape them to achieve the desired result. Therefore, a learning agenda in the form of specific learning objectives and outcomes shall be prepared prior to the start of the internship.

Whatever the activity/activities that is/are done under Intra and Inter Institutional activities, should ignite the inquisitiveness to learn, enhance the knowledge, thinking ability and imagination, planning, application of mind, execution ability, innovation attitude, listening and understanding, vocabulary, personal expression, public speaking, written communication, oral presentation of the subject matter, acquire leadership qualities and teamwork requirements, responsiveness, ethics, etc.

3.4.1 List of proposed activities

a. Activities concerned with the works of Indian scholars like Charaka and Susruta, Aryabhata, Bhaskaracharya, Chanakya, Madhava, Patanjali, Panini, and Thiruvalluvar, among numerous others.
b. Activities such as training with higher Institutions or Soft skill training
c. Contribution at incubation/ innovation /entrepreneurship cell of the institute.
d. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop.
e. Working for consultancy/ research project with-in the institute.
f. Learning MS Word, Excel, Microsoft equations, MS drawing tools, MS Power point, etc.
g. Coding.
h. Mini projects using commercially available assembled electronic products.
i. Debates, quizzes, and group discussions: On technical topics already studied (both in Kannada and English).
j. Essay competitions: Both in Kannada and English on technical topics already studied.
k. Survey and study of published literature on the assigned topic: Technical paper survey, Preparation of synopsis. Exposure to technical paper publications.
l. Photography.
m. Short film production: Contemporary aspects, technical aspects etc.
n. Internship in Disaster Management.
o. Solar energy connected activities that help common man.
p. Working with Smart City Administration.
q. Hackathon (it is a design sprint-like event in which computer programmers and others involved in software development, including graphic designers, interface designers, project managers, and others, often including domain experts collaborate intensively on software projects).
r. Industrial Safety, Fire Safety, Electrical Safety, Chemical Process Safety, Food Safety etc.
s. Internship and project work in Indian Knowledge System related Areas/Topics.
t. Industrial visits to Small Scale Industries/ Factories/ Cottage Industries/substation visit etc., and submission of report.

3.5 Documents to be submitted by Students for Internship Evaluation

3.5.1 Student's Diary

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students shall record in the daily training diary the day-to-day account of the observations, impressions, information gathered, and suggestions given, if any, and activities carried out. It should contain the sketches and drawings related to the observations made by the students. The daily training diary should be signed after everyday or at least twice a week by the faculty/incharge of the section(external expert)where the student has been working.

Student's Diary should be submitted by the students along with attendance record. It shall be evaluated on the basis of the following criteria:

- **i)** Regularity in the maintenance of the diary.
- **ii)** Adequacy and quality of information recorded.
- **iii)** Drawings, sketches, and data recorded.
- **iv)** Thought process and recording techniques used.
- **v)** Organization of the information

3.5.2 Internship report

After completion of Internship, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he / she has observed and learnt in the training period along with the internship outcomes. The training report should be signed by the mentor. The Internship report shall be evaluated on the basis of following criteria and/or other relevant criteria pertaining to the activity completed.

- **i)** Originality.
- **ii)** Adequacy and purposeful write-up.
- **iii)** Organization, format, drawings, sketches, style, language etc.
- **iv)** Practical applications, relationships with basic theory and concepts taught in the appropriate course.
- **v)** Variety and relevance of learning experience.

Procedure for the Evaluation of Internship-I

- **a)** Students should submit the reports immediately on completion of the Internship to the respective mentors.
- **b)** The Examination of internship will be carried out by the mentor.
- **c)** The Internship-I shall be slated for 100 marks CIE only and will not have SEE.
- **d)** Internship-I marks are based on CIE marks (25 marks for first presentation, 25 marks for second presentation,50 marks for report and final presentation).
- **e)** A Viva-Voce examination conducted during I/II/III Semesters (Presentation followed by question-answer session) and the prescribed credit shall be included in the IV semester grade card.

3.5.3 Assessment Rubrics for evaluation of Internship-I (Intra and Inter Institutional Activities)

Table– B2 Internship-IAssessment Rubrics Scheduledduringthefirst year (PrescribedPeriod02 weeksandPrescribedcredits:02)					
Sl No	**Sub Activity Head**	**Performance/ Appraisal**	**Assessment Rubrics (Allotted marks decide the letter grade)**	**Proposed Document as Evidence**	**Evaluated by**
1	Inter/Intra-Institutional Workshop/Training.	Excellent	80to100	**(i)** Student's Diary and **(ii)** Internship Report along with the certificate issued from relevant authorizedAuthority	Institute Faculty(mentor)together with External Expert, if any.
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
2	Working for consultancy/Research project.	Excellent	80to100		
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
3	Festival (Technical/Business/Others) Events.	Excellent	80to100		
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
4	Contribution in Incubation/Innovation/Entrepreneurship Cell.	Excellent	80to100		
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
5	Learning at Departmental Lab/Tinkering Lab/Institutional workshop.	Excellent	80to100		
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
6	Other than the above five activities	Excellent	80to100		
		Good	60to79		
		Satisfactory	40to59		
		Unsatisfactory and fail	<39		
Note: The total CIE marks shall be the sum of marks allotted to successfully completed activities by the student.					

3.6 Internship-II: (Innovation / Entrepreneurship/ Societal Internship/Industry Internship/Research Internship) (08 weeks) [Scheduled during the intervening period of IV & V semester and VI & VII semester]

During the intervening period of IV & V semesters and VI & VII semester, students shall be ready for industrial experience. Therefore, they shall choose to undergo Internship involving Innovation / Entrepreneurship/short term (about 2 weeks) societal related activities. Students may choose to work on innovation or entrepreneurial activities, or both resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry.

3.6.1 Innovation

Innovation refers to a new or improved product or process or a combination thereof that differs marginally or significantly from the unit's previous product. An innovation center is a place where students are encouraged to implement the innovative ideas formed through imagination, brainstorming sessions, design thinking and associated activities to bring them to reality. It is a place, where creative minds are shaped.

3.6.2 Entrepreneurship

Entrepreneurship refers to setting up a new business or businesses, taking on financial risks in the hope of profit. It involves investment to undertake production along with arranging inputs like land, labour, material and capital, introducing new techniques and products, identifying new sources for the enterprise, etc.

3.6.3 Incubation Center

An organized unit designed for innovation as well as to accelerate the growth and success of new entrepreneurial companies through mentorship and an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections.

3.6.4 Startup

An entity that develops a business model based on either product innovation or service innovation and makes it scalable, replicable, and self-reliant.

An entity shall be considered as a Startup.

i) Up to a period of ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.
ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.
iii) Entity is working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model with a high potential of employment generation or wealth creation.
iv) Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a Startup.

3.6.5 Societal (Social) related activities

Short term internship (about 2 weeks) at villages, slums or urban areas can be under social internship. The internship will be more fruitful if students work in teams. The teams can select one or more fields to do their best in the field of agriculture, watershed management, wastelands development, non-conventional energy, low-cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, blood bank, government schemes such as

i) (Swachch Bharat: Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign to eliminate open defecation and improve solid waste management.
ii) Accessible India: Accessible India Campaign or Sugamya Bharat Abhiyan is a program to serve the differently able community of the country.
iii) Digital India: A campaign to ensure the Government's services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or making the country digitally empowered in the field of technology.
iv) Beti Bachao and Beti Padhao: A campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls in India.
v) Environment and Energy Conservation and Education, legal aid, consumer protection and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts, and Guides.

Societal activities are one of the NBA graduate attributes that are part of PO6 and PO7, which are reproduced below.

vi) PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.
vii) PO-7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. Long term goal under Societal (social work) related activities, particularly at a rural area, results into a rural internship. In urban areas, student may adopt slum/ economically weaker section areas for short duration social internship to uplift the living conditions.

In view of the above, internship coordinators should encourage students to take up societal internship as far as possible.

3.6.6 Places for Innovation/Entrepreneurial Activities

Students shall carryout Innovation or Entrepreneurial activities or both at the Incubation Center and Entrepreneurship Cell of the parent institution or elsewhere such as ATAL Incubation Centers [A flagship of Atal Innovation Mission (AIM), NITI Aayog for promoting the culture of innovation and entrepreneurship in India], institutes of national importance, public sector units, IT companies, government organizations, and non-governmental organizations, industries including MSME, etc.

- **Institutes should deter students to opt for internships at places established for commercial benefits.**

3.6.7 Industrial Internships

The gap between the theoretical knowledge obtained in the classrooms and the practical skills required in the actual workplace scenarios is fast growing. This has put forth varied challenges to graduating students when it comes to job placements. As institutes cannot have a relevant facility to expose students to real time industrial environment, industrial internship is an appropriate solution.

The main objective of the industry internship is to ensure that the intern is exposed to a real job world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learnt during the academic period. The industry internship helps student's understanding of the analytical concepts and tools, hone their skills in the real-life situations and build confidence in applying the skills learnt.

3.6.7.1 Industry Internship Benefits

i) Have ample opportunities to attend seminars, symposiums, workshops etc. This in turn provides opportunity to establish rapports with professionals and pioneers in their respective fields for further growth.
ii) Have wide scope to publish paper/s in journals.
iii) Good recommendation letter/s that increase prospectus for further internships, higher studies, and placements.
iv) Helps to acquire team spirit, motivated acts, techniques to resolve conflicts, etc.
v) Helps to develop a lot of leadership skills.
vi) Increases the prospect of placement in the same concern, provided the intern has exhibited clear understanding of basics and successfully completed the internship.
vii) Fosters to substantiate the issues with facts and figures.

For AICTE Internship opportunities refer to https://internship.aicte-india.org/

3.6.8 Assessment Rubrics for Innovation / entrepreneurship/ Societal Internship Activities

Once the internship begins, the students are required to maintain diary/journal and submit a report regularly to the guide. These reports should summarize the activities in which the student was involved during the previous week period. At the end of the internship, each student is required to submit the hard copy of consolidated diary/journal and report for evaluation. The report should clearly indicate the learning and achievements of the internship.

Table–B3 Innovation / entrepreneurship / SocietalInternship Activities and Assessment Rubrics
Scheduled during the intervening period of IV & V semester and VI & VII Sem
(Prescribed Period 08 weeks: Credits 08)

Sub Activity Head	Performance/ Appraisal	Assessment Rubrics	Proposed Document as Evidence	Evaluated by
(1) Development of new product/Business Plan/registration of start-up/societal internship	Excellent	80 to100	(i) Student's Diary and (ii) Internship Report or the	(i)Institute Faculty (mentor) together with
	Good	60 to79		
	Satisfactory	40 to59		
	Unsatisfactory and fail	<39		
(2) Internship with	Excellent	80 to100		

Industry/Govt. /NGO/PSU/Any Micro/Small/Medium Enterprise.	Good	60 to79	activity report along with Certificate or Declaration from relevant Authorized Authority. Wherever, only Certificate is issued, Assessment shall be at the institute as per (i) and (ii) to decide the letter grade.	External Expert if any.
	Satisfactory	40 to59		
	Unsatisfactory and fail	<39		
Note: (i) The total CIE marks shall be the sum of marks allotted to successfully completed activities by the student.				

3.7 Research Internships / Extended Industry Internship

3.7.1 Research Internship /Extended Industry Internship of sufficient duration encourages students early on in their career. Its main goal is to give an opportunity to improve their analytical and technical skills in an international environment. Internship can be in an industry or at an appropriate workplace.

3.7.2 Research internships and industrial internships have different purposes and come with their set of benefits. A prior experience in any field is always preferred over a fresh start. Therefore, one of them can be selected depending on the interest the students have. Internships pose unexpected challenges and make students to think appropriately, tackle difficulties with ease and act in a scholarly way to get past the hurdles and practical constraints. An internship is always beneficial however good or bad it is.

3.7.3 Internships not only enhance one's learning but also identifies him/her as someone who has the commitment to approaching a project and completing it with or without the guidance. The internship learning is an impetus to professional development.

3.7.4 While research internship is a steppingstone to higher studies, an industry internship is a pathway for a placement. Those who are self-motivated and interested in search of new things that are original and unique can choose a research internship. Those who are interested in the real industry- experience and aspire to get a job soon after graduation can choose an industry internship.

3.7.5 Research Internships (Also known as dissertation internship) are focused research projects that push student's intellectual abilities beyond those driven by the classroom. Often, research internship typically helps solve problems which are usually part of major research projects. It involves a short theoretical or experimental research project supervised by a researcher.

3.7.6 The research internships, under the advice of a faculty supervisor, can be one's own selected project or a project on which a Researcher is researching or a new project/real – world project offered by an organization. The research area may be pertaining to single or multidisciplinary fields such as science, technology, engineering, mathematics, management, and business studies. Research internships can be carried out either individually or in teams (not exceeding 3 or 4 students).

3.7.7 Research internship opportunities, before graduation, may be in a laboratory of college, a research institute, or a company's R & D department. Apart from fixed working hours of the day of an organization, the researcher can devote sufficient time for other research related activities for an early and successful completion of the Research Internship.

3.7.8 Necessary Skills for Research Internship and Industrial Internship

For the internships to progress without hurdles and for successful completion, the Researchers should maintain a harmonious relationship with the guide/s, administrators, co – workers and others, and strictly adhere to the rules and regulations of the workplace. The other skills required or acquirable during the Internship are,

1. Good Communication skills.
2. Attention to detail.
3. Planning and scheduling.
4. Documentation.
5. Critical thinking.
6. Data collection.
7. Data analysis.
8. Ability to maintain quality, safety and/or infection control standards.
9. Appreciating and practicing the ethical issues.

3.7.9 Responsibilities of an Intern

Interns,

1. If working with a researcher, shall assist the researcher in an ongoing research project or work collaboratively in designing a new project of mutual interest.
2. Shall engage in literature survey and getting an insight of the research work at the initial stages.
3. Shall compile data, sort, file, implement ideas with minimal guidance and assist write papers.
4. Shall become familiar with a number of tools [meters (Electrical and Electronics, mechanical, computer, etc.)] used in data collection, software, graphic software, Statistical Package for the Social Sciences (SPSS) software [IBM's statistical software platform], etc.
5. Shall attain skills with Microsoft Word Office, Excel, PowerPoint, Outlook etc.
6. Shall give mid – term oral presentation to a committee for review and feedback.
7. Shall attend discussions, meetings, symposiums, classroom lectures, etc., to learn new scientific techniques, design experiments, analyze results, and formulate the different hypotheses.
8. Shall learn writing reports and be able to correspond independently.
9. Shall manage time effectively.
10. Shall keep a track of the progress of the project.
11. Shall develop integrative thinking.

3.7.10 Research internship Outcomes.

1. Generating technical paper/s and publish in refereed journal/s.
2. Possibility of acquiring an intellectual ownership and patent.

3. Build a prototype for an idea on which the research was carried out.
4. File patent/s.
5. Add academic knowledge to the field.
6. Enhanced ability in arranging meetings, presentations, seminars, trainings, etc.
7. Improved conscientiousness and ethics

3.7.11 Research internships Benefits.

1. Are a great way to pursue an academic career in teaching and research, as a Research Scientist at a Research Organization, Company, Industry sector, etc.
2. Establish professional networks for future career.
3. Pave way to join a research team and work alongside leading experts in the field.
4. Introduced to new ideas through interaction with like-minded students and others.
5. Develop research skills and knowledge in a specific area of interest.
6. Provide opportunities for growth, achievement, and personal development.
   Offer an opportunity to publish a research paper that will boost the resume while applying for Post Graduate Studies

4. Evaluation Procedure of UC3001-1 Research Internship/Extended Industry Project/Internship/Project work (16 weeks)

4.1 The students pursuing the course UC3001-1 shall submit the diary recordings of day-to-day activities to the concerned guide, reporting progress achieved in the course and seeking guidance to proceed with the internship. The interns should provide all the details to the guide, so that he/she can discuss with the employer to make the internship successful.

4.2 The intern should constantly update the guide about the progress of the internship. The guide should know the intern's internship tasks, duties, responsibilities, and potential projects. The evaluation of interns and their internship progress should be honest and constructive.

4.3 The hardcopy or softcopy of the diary maintained by the internes interns must be signed in regular intervals by the guide.

4.4 With reference to intern's feedback, the guides should propose changes in internship activities so that they are helpful to the internship.

4.5 Illustrations, drawings, photos, forms, samples, classified materials, etc., are to be included in the report only after obtaining the consent of the concerned authorities and should indicate the source all such material. The final report should also be submitted to the place where internship was carried out. The report should avoid a tone that is predominantly cynical or unduly critical of the employer or of those with whom the student intern has worked. The content of the report must be based on interns' own work.

4.6 Continuous Internal Evaluation (CIE)

The guides should evaluate the interns using the following as well as any other appropriate methods.

a) Punctuality of intern.
b) Conduct and character.
c) Tactfulness and politeness with colleagues and the public.
d) Attitude regarding professionalism.

e) Inquisitiveness and eagerness to learn.
f) Research attitude.
g) Problem-solving techniques.
h) Innovation mind-set.
i) Time management and meeting the deadline.
j) Receptiveness to feedback and critiques.
k) Ability to work in a team as a member.
l) Ability to work without supervision.
m) Supervisory skills and leadership skills.
n) Judgement and decision-making skills.
o) Writing skills, oral communication skills, technical communication skills, computer skills, analysis skills and business writing skills.
p) Appropriateness of technical skills.
q) Familiarization to writing technical papers, standards, codes, etc.
r) Reading Behavioural attitude.
s) Outcomes.
t) Successes and failures experienced.

4.7 Recommendation letter

The guide must state whether the intern,

a) Exceeded the expectations of the internship.
b) Met the expectations of the internship.
c) Did not meet the expectations of the internship.
d) Did work to a satisfactory level.
e) Did an unsatisfactory internship.

At the end, the guide should issue a recommendation letter.

4.8 Assessment of CIE marks

4.8.1 **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill and viva-voce in the ratio 50:25:25.

4.8.2 **Interdisciplinary:** The CIE marks awarded for the internship, shall be group wise at the institution level with the participation of all guides of the internship. Participation of external guide/s, if any, is desirable.

4.8.3 The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill and viva-voce in the ratio 50:25:25.

4.9 Assessment of SEE marks

4.9.1 Single discipline: Contribution to the internship and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the report, presentation skill and viva-voce in the ratio 50:25:25.

4.9.2 Interdisciplinary: Contribution to the internship and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to. Marks shall be awarded based on the evaluation of the report, presentation skill and viva-voce in the ratio 50:25:25

4.10 Evaluation of research Internship/Extended Industry Internship/Project Work:

Split-up of marks for evaluation of Project work for 100 CIE marks and 100 SEE marks.

Split-up	Rubrics		Marks
Report (50Marks)	Content Development	Abstract/Synopsis Write-up	10
		Selection of Topic/Relevance of the subject to concerned discipline	05
		Problem Identification	05
		Objectives and Methodology	05
	Problem-Oriented Exposition	Literature Survey (Papers/Sites/Sources Surveyed)	10
		Documentation/Systematic Approach	10
		Results (with inferences, Conclusions, etc.)	05
Project Presentation Skill (25Marks)		Quality of preparation of presentation	05
		Communication Skills	05
		Technical knowledge and awareness	05
		Individual involvement	10
Viva-Voce (25Marks)		The clarity in answering questions relating to fundamentals and concepts	10
		The clarity in answering the questions related to the project.	05
		The understanding ability of the questions asked	05
		The confidence in answering the questions asked.	05
		Total Marks	100

B. Tech. SYLLABUS

Effective from

Academic Year

2024 – 2025

Curriculum for Acquiring Professional Skills (CAPS)

With Scheme of Teaching & Examination

NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

Established under Section 3 of UGC Act 1956 **Off-Campus Centre, Nitte - 574 110, Karnataka, India**
Accredited with 'A+' Grade by NAAC

Scheme & Syllabus for B. Tech. (Computer and Communication Engineering)

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING
2024-25

B. Tech. in Computer and Communication Engineering

VISION:

To be a center of excellence in Computer Networks and Network Security education and research, to produce comprehensively trained, technically skilled, ethically strong, innovative engineers to excel globally, take future challenges and contribute for social welfare.

MISSION:

1. To provide excellent academic environment to students for continuous improvement in Computer Science and Computer Network specialization and by imparting education with innovation, skills, and positive attitude to make them competent engineers and leaders to solve the real-world problems to inculcate values of professional ethics, leadership qualities and lifelong learning.
2. To strengthen the industry partnership for collaborative work and prepare graduates in cutting edge Computer Network technologies in par with industrial standards by undertaking collaborative projects which offer opportunities for long term interaction between academia and industry.
3. To inculcate research, ethical values, professionalism, lifelong learning to make them globally competent and socially committed.
4. To provide resources that contributes to congenial learning environment and encourages students to pursue higher education and take competitive exams.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. Tech. in **Computer and Communication Engineering** will:

1. Demonstrate technical skills, competency in computer science, computer and communication networks and exhibit team management capability with proper communication and responsibility in their career.
2. Emerge as engineering professionals, innovators or entrepreneurs engaged in technology deployment and support the growth of economy of a country by with a lifelong learning attitude.
3. Use basic science and engineering ideas to carry out research, pursue higher studies in the multidisciplinary areas of computer and communication engineering to address the basic needs of the society.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

1. Gain both theoretical and practical knowledge to identify, formulate & solve challenges in Computer Network Engineering problems.
2. Apply computational knowledge, tools, techniques, and project development skills to provide innovative solutions for social wellbeing.

CREDIT DISTRIBUTION

No.	Course Category	Credit Range	Suggested Credits
1.	Basic Sciences (BSC)	18-23	22
2.	Engineering Sciences (ESC)	18-23	14
3.	Humanities, Social Sciences and Management (HSMC)	09-15	15
4.	Professional core Courses (PCC)	52 – 58	55
5.	Professional Elective Courses (PEC)	12-18	15
6.	Open Elective Courses (OEC)	9	6
7	Ability Enhancement Courses (AEC)	6	7
8.	Project Work (UCC)	12 (VI-2, VIII-10)	10
9.	Seminar on Current Topic (UCC)	01	01
10.	Internship (UCC)	10	10
11.	Mandatory Non-credit Courses (MNC) Environmental Science, Engineering Visualization, Skill Development Lab Group- A, Skill Development Lab Group- B, Employability Skill Development – I and Employability Skill Development – II	Non-Credit	Non-Credit
		Total Credits:	**164**

Note:

Student can register between 16 to 28 credits per semester.

Total minimum Credits to be earned: 164.

Course Numbering Scheme

Branch Code		Course Level	Course Code			Separator	Version
Letter	Letter	Number	Number	Number	Number	-	Number

Branch Code	**CC** is 2 Letter code for the Department of Computer and Communication Engineering
Course Level	Course Level is a 1-digit number that can have a value between 1-4 and indicates the prerequisite of a course. Level-1 courses are basic courses with no Engineering Courses as pre-requisites Level-2 course(s) have Level-1 course(s) as prerequisites Level-3 course(s) have Level-2 course(s) as prerequisites Level-4 course(s) have Level-3 course(s) as prerequisites
Course Code	Course Code is a 3 Digit number that can have a value between 001-999 and indicates the number assigned to a course based on the alphabetical order of Course Name, as per the following rules 001-199 is assigned to Professional Core Courses 001-099 for Integrated Professional Core Courses [4 Credit] 101-199 for Professional Core Theory Courses [3 Credit] 201-499 for Professional Elective Courses 201-299 Electives under Group I 301-399 Electives under Group II 401-499 for future use 501-599 for Open Elective Courses 551-599 for Vocational Education Courses 601-650 for Professional Core Lab Courses [1 Credit] 651-699 for Ability Enhancement Courses 701-799 for Courses offered to Honours Program
Separator	"**-**" is used as a separator between the Course code and the version
Version	Version is a 1-digit number that can have a value between 1-9 and indicates minor revisions of the same course.

Scheme & Syllabus
(I Year)

B. Tech (CC): Scheme of Teaching and Examinations 2024-28

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

I /II SEMESTER (AI&DS, AI&ML, CC, CS, IS, RI)

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week			SL#	Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P						
1.	BSC	MA1002 – 1	Calculus and Differential Equations	MA	3	0	0	2	3	50	50	100	3
2.	BSC	PH1004-1	Quantum Computing and Modern Physics	PH	3	0	2	2	3	50	50	100	4
3.	ESC	CS1001-2	Problem Solving through Programming	CS	3	0	2	2	3	50	50	100	4
4.	ESC	EC1001-1	Basic Electronics	EC	3	0	0	2	3	50	50	100	3
5.	ETC	IS1101-1	Fundamentals of Cyber Security	CS	3	0	0	2	3	50	50	100	3
6.	HSMC	HU1001-1	Technical English	HU	1	0	2	-	3	50	50	100	2
7.	UCC	HU1002-1	Constitution of India	HU	1	0	0	-	-	50	0	50	1
8.	BSC	MA1006 – 1	Mathematics with MATLAB	MA	0	0	2	-	-	50	0	50	1
TOTAL					**17**	**0**	**8**	**10**	**18**	**400**	**300**	**700**	**21**

Academic Activities beyond class hours	-	-	-	**5**
Learning hours per week	**17**	-	**8**	**15**

Total notional learning hours (L+T+P+J+SL)	Per Week	**40**
	Per Semester	**40X16 = 640**

CALCULUS AND DIFFERENTIAL EQUATIONS

Course Code	**MA1002-1**	**Course Type**	**BSC**
Teaching Hours/Week (L: T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	This course will enable the students to master the basic tools of differential calculus, partial differentiation, vector differentiation, differential equations, multiple integrals and become skilled for solving problems in science and engineering.

UNIT-I

Differential Calculus	**7 Hours**

Polar curves, angle between the radius vector and the tangent, angle of intersection of two curves, derivatives of arcs and radius of curvature- cartesian, parametric and polar forms. Rolle's theorem (without proof), mean value theorems and applications to simple problems, Taylor's theorem for functions of single variable.

Partial Differentiation	**8 Hours**

Partial derivatives of simple functions, total differentiation -differentiation of composite and implicit functions. Jacobians. Taylor's theorem forfunctions of twovariables, maxima and minima forfunctions of two variables, Lagrange's method of undetermined multipliers (with onesubsidiary condition).

UNIT-II

Vector Differential Calculus	**7 Hours**

Vector algebra(review), scalar and vector valued functions, gradient, directional derivative and hessian of multi-variable function, Divergence, and curl of a vector valued function. Solenoidal and irrrotational vectors.

Ordinary and Partial Differential Equations	**8 Hours**

Ordinary differential equations(review), linear and nonlinear differential equations. Second and higher order linear differential equations with constant coefficients.

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions. Classification of second order PDES. Solution of P.D.E by the method of separation of variables.

UNIT-III

Multiple Integrals	**10 Hours**

Double integrals and triple integrals, evaluation by change of order of integration, change of variables and applications to area and volume. Beta and Gamma functions and theirproperties.

Course Outcomes: At the end of the course student will be able to

1.	Apply the concept of radius of curvature and mean value theorems.
2.	Learn the concept of partial differentiation of a function with two or more independent variables, apply them to solve engineering problems and examine the given function for its extrema.
3.	Solve the vector functions and their derivatives for engineering applications.
4.	Apply the concepts of ordinary and partial differential equations in engineering problems.
5.	Apply the notion of multiple integrals to find areas and volumes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
MA1002-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
MA1002-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
2.	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
3.	Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, "Vector Analysis", Schuam's outlines series, 2nd edition, 2009.

REFERENCE BOOKS:

1.	G.B. Thomas and R.L.Finney, "Calculus and Analytic geometry", Pearson, 2002.
2.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi,2010.
4.	N.P. Bali and M.Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
5.	W.E. Boyce and R.C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.
6.	E.A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
7.	G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
8.	Shanthi Narayan, "Differential Calculus, 6th edition, Shyam Lal Charitable Trust, Delhi.

E Books / Moocs/ NPTEL

1.	*http://nptel.ac.in/courses/111106100/*
2.	*https://nptel.ac.in/courses/122101003*
3.	*http://nptel.ac.in/courses/111106100/*

QUANTUM COMPUTING AND MODERN PHYSICS

Course Code:	**PH1004 -1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Physics

Course Objectives:

1.	To study the principles of quantum mechanics and its application in quantum computing
2.	To study the concepts of semiconductors and semiconductor devices
3.	To study the properties of superconductors and their applications
4.	To understand the principle, working and applications of lasers.

5.	To understand the principle, working and applications of optical fibers.

UNIT-I

Quantum Computing	**15 Hours**

Introduction to Quantum Computing and Quantum Mechanics
Moore's law and beyond, Classical computing, Quantum Computing, differences between classical and Quantum computing, Origins of Quantum mechanics. Different formalisms in Quantum Mechanics: Schrodinger, Heisenberg's formalisms and Dirac's formalisms (Qualitative).

Linear vector spaces
Revision of matrix theory (matrix operations, Eigen matrix, transpose, conjugate, unitary, adjoint of a matrix). Linear vector spaces - Definition of a linear vector space, linear independence, basis and dimensions, orthogonality and orthonormality. Hilbert's space: Definition of Hilbert space, matrices as members of Hilbert space. Dual Space, row and column matrices transpose and conjugate, adjoint of matrices, Hermitian matrix.

Quantum mechanics in Dirac formalism and fundamentals of Quantum Mechanics
Dirac notations: Bra and Ket notations for vectors. Dirac representation and matrix operations: Familiarization of matrices as members of Hilbert space in Dirac notation: Matrix representation of 0 and 1 States, Identity Operator I, Applying I to$|0\rangle$ and $|1\rangle$ states, Pauli Matrices and their operations on $|0\rangle$ and $|1\rangle$ states, Unitary matrix and its operations on $|0\rangle$ and $|1\rangle$ states.

Fundamentals of Quantum Mechanics: Postulates of Quantum Mechanics (Representation of state, concept of operators, Eigenvalue problem: Eigenvalues and Eigenfunctions. normalization of eigenfunctions. Physical interpretation of Eigenvalues, Eigenfunctions and expansion coefficients. Schrodinger's equation in Dirac's notation, superposition, discussion of measurements). Entanglement and its importance in Quantum Computing (Qualitative)

Principles of Quantum Information & Quantum Computing:
Concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and Two qubits. Extension to N qubits (Mention only)

Quantum Gates: Concepts of gates, Single Qubit Gates: Quantum Not Gate, Pauli – X, Y and Z Gates, Hadamard Gate, Phase Gate (or S Gate), T Gate. Action of gates on Qubits, Numerical problems.

UNIT-II

Electrical Properties of Materials: Semiconductors	**11 Hours**

Semiconductors: Band structure - classification of solids. Semiconductors - intrinsic and extrinsic semiconductors, carrier generation. Direct and indirect band gap semiconductors. Fermi-Dirac Statistics, Fermi factor, Fermi energy level in intrinsic and extrinsic semiconductors and effect of temperature on Fermi level, intrinsic effect - maximum device temperature. Conductivity of intrinsic and extrinsic semiconductors - derivation. Effect of temperature on conductivity of intrinsic and extrinsic semiconductor.

Hall effect - derivation of Hall coefficient, carrier concentration and mobility. Applications of Hall effect. Numerical examples.

p-n junction: Junction formation, Unbiased and biased p-n junction, Devices: LED,

Photodiode and solar cell.	
Electrical Properties of Materials: Superconductors	**4 Hours**
Introduction to superconductors, characteristic properties. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors, Applications of superconductors. Numerical examples.	
UNIT-III	
Photonics: Lasers	**05 Hours**
Introduction to lasers, Characteristics of LASER, Interaction of radiation with matter, Einstein's coefficients, Requisites of a Laser System. Conditions for Laser action. Principle, Construction and Working of Nd:YAG laser and Semiconductor laser. Application of Lasers. Numerical problems.	
Photonics: Optical Fibers	**05 Hours**
Introduction to optical fibers, Principle of Optical Fibers (TIR), Propagation mechanism in optical fibers - Angle of Acceptance and Numerical Aperture (N.A.), Expression for NA, Fractional index change, Modes of propagation, Number of modes and V-Number, Types of Optical Fibers, Attenuation and Mention of Expression for Attenuation coefficient, Attenuation Spectrum of an Optical Fiber- Optical Windows. Discussion of Block Diagram of Point-to-Point Communication, Numerical problems.	

List of Experiments

1.	Energy gap of a semiconductor by four-probe technique.
2.	Hall effect
3.	Photo-Diode characteristics
4.	Semiconductor laser - Determination of wavelength by diffraction.
5.	LED characteristics and determination of Planck's Constant using LEDs.
6.	Solar cell characteristics
7.	Photo electric effect – Determination of the work function of the material of the emitter of a photocell.
8.	Determination of acceptance angle and numerical aperture of the given Optical fiber.
9.	I-V characteristics of Zener diode
10.	Dielectric constant by charging and discharging of a capacitor.

Course Outcomes: At the end of the course student will be able to

1.	**Describe** the fundamental principles of the Quantum Mechanics and quantum computing
2.	**Summarize** the properties of semiconductors and the working principles of semiconductor devices.
3.	**Summarize** the essential properties of superconductors and its applications.
4.	**Describe** the principles of LASERS and their relevant applications.
5.	**Describe** the principles of Optical fibers and their relevant applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
PH1004-1.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
PH1004-1.5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Parag K Lala, "Quantum Computing – A Beginner's Introduction", Indian Edition, McGraw Hill, Reprint 2020.
2.	B. G. Streetmann, "Solid State Electronic devices", 6th edition, Prentice Hall India Learning Private Limited.
3.	A. Ghatak, "Optics", Tata McGraw Hill Pub., 5th Edition, 2012.
REFERENCE BOOKS:	
1.	Michael A. Nielsen & Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge Universities Press, 2010 Edition.
2.	Vishal Sahani, "Quantum Computing", McGraw Hill Education, 2007 Edition.
3.	Maria Luisa Dalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli, "Quantum Computation and Logic: How Quantum Computers Have Inspired Logical Investigations", Trendsin Logic, Volume 48, Springer.
4.	Gupta and Kumar, "Solid State Physics", K. Nath & Co., Meerut.
5.	A. J. Dekker, "Electrical Engineering Materials", Prentice Hall India Pub., New Delhi, Reprint 2011.
6.	S. O. Pillai, "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.
7.	M. Ali. Omar, "Elements of Solid State Physics: Principles and Applications", Pearson Publishers.
8.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Education Private Limited, Special Indian Edition, 2009.
9.	Kenneth Krane, "Modern Physics", Wiley International, 3rd Edition, 2012.
10.	Michael Tinkham, "Introduction to Superconductivity", II Edition, McGraw Hill, INC
E Books / MOOCs/ NPTEL/ Web links	
1.	LASER: https://www.youtube.com/watch?v=WgzynezPiyc
2.	Superconductivity : https://www.youtube.com/watch?v=MT5Xl5ppn48
3.	Optical Fiber : https://www.youtube.com/watch?v=N_kA8EpCUQo
4.	Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
5.	Quantum Computing : https://www.youtube.com/watch?v=jHoEjvuPoB8
6.	Quantum Computing :https://www.youtube.com/watch?v=ZuvCUU2jD30
7.	Physics of Animation : https://www.youtube.com/watch?v=kj1kaA_8Fu4
8.	Statistical Physics Simulation : https://phet.colorado.edu/sims/html/plinko-

	probability/latest/plinkoprobability_en.html
9.	NPTEL Supercoductivity:https://archive.nptel.ac.in/courses/115/103/115103108/
10.	NPTEL Quantum Computing : https://archive.nptel.ac.in/courses/115/101/115101092
11.	Virtual LAB :https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
12.	Virtual LAB : https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	http://nptel.ac.in
2.	https://swayam.gov.in
3.	https://virtuallabs.merlot.org/vl_physics.html
4.	https://phet.colorado.edu
5.	https://www.myphysicslab.com

PROBLEM SOLVING THROUGH PROGRAMMING

Course Code:	**CS1001-2**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**3:0:2**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer Science & Engineering

Course Objectives:

1	Make students learn the basics of C programming language including the basic data types, Operators and Evaluating expressions in C.
2	Apply the concepts of decision making and looping in problem solving to demonstrate its usage using simple programs.
3	Apply the concepts of Arrays, User-defined functions and code reusability in problem solving along with parameter passing and returning with the help of user defined functions.
4	Demonstrate the usage of Strings and Structures
5	Demonstrate the usage of Pointers, and File handling that are essential for understanding the concepts with simple examples.

UNIT-I

Introduction To Computer and C language:	**16 Hours**

Introduction to computers: Introduction to Computer System and problem solving, Program Development steps, Introduction to Programming Languages, input, and output devices, Algorithm, Flowchart, Designing efficient programs. Evolution & Characteristics of C Language, Structure of a C Program, C Compilation Model. Characters set, C tokens, Keywords and identifiers, Constants, Variables, Data Types, and Declaration of Variables, Managing Formatted and Unformatted input/output functions.

Operators and Expressions:

Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment, Decrement operators, conditional operator, Bitwise operators, Special Operators. Arithmetic expressions, Evaluation of expressions, Precedence of Arithmetic operators, Type conversions in expressions, Operator precedence and associativity.

Decision control and Looping statements:

Decision making and Branching: Decision making with if statement, Simple if Statement, the if...else statement, Nesting of if...else statements, The else...if ladder, The switch statement, The ternary operator, The goto statement, break and continue statements.

Decision making and Looping:

The while statement, the do...while statement, the for statement, Jumps in Loops.

UNIT-II

Arrays:	**14 Hours**

Declaration of arrays, accessing the elements of an array, storing values in arrays, Operations on arrays, Passing arrays to functions, Two dimensional arrays, operations on two-dimensional arrays, two-dimensional arrays to functions, multidimensional arrays. Example Programs on arrays.

Functions:	
Introduction using functions, Function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions, Example Programs on Functions.	
Introduction to strings:	
Declaring and Initializing strings, String manipulation functions, String input and output functions.	
UNIT-III	
	10 Hours
Structures: Defining Structure, Declaration of Structure Variable, Accessing Structure members, copying and comparing structure variable, operation on individual member, nesting of structures, Array of structures. Application of pointers and function on Structures.	
Files: Basic file operations: Open, Close, Read, Write.	
Introduction to pointers: declaration and initialization of pointers, accessing the address of the variable, accessing the variable through the pointer.	
Suggested List of Experiments	
PART A	

1.	Write a C program to find the roots of a quadratic equation $ax^2+bx+c=0$
2.	Write a C program to find the sum of all the digits and occurrence of a digit in the number.
3.	Write a C program to find the GCD and LCM of given two numbers using Euclid's method.
4.	Write a C program to print the prime numbers in a given range.
5.	Write a C program to find if a given string is a palindrome or not using string manipulation functions.
6.	Write a C program to input N real numbers in 1-D array. Compute mean, variance and Standard Deviation. [Mean= sum/N, Variance = Σ (Xi-mean) 2 /N, STD Deviation= √variance.]
7.	Write a C program to read N integers into an array A and find the sum of elements using pointers.
8.	Write a C program to copy contents of one file to another file.

PART B

1.	Write a C program to perform a binary search for a given key integer in a single dimensional array of numbers in ascending order and report success or failure in the form of a suitable message.
2.	Write a C program to input N integer numbers into a single dimension array, sort them in to ascending order using selection sort technique, and then to print both the given array and the sorted array with suitable headings.
3.	Write a C program to transpose a matrix of order M x N and find the trace of the resultant matrix.
4.	Write a C program using functions to read two matrices A (M x N) and B (P x Q) and to compute the product of A and B if the matrices are compatible for multiplication.
5.	Write a C program using functions readmat( ), rowsum ( ), colsum ( ), totsum ( ) and

	printmat( ) to read the values into a two dimensional array A, find the sum of all the elements of a row, sum of all the elements of a column, find the total sum of all the elements of the two dimensional array A and print the results.
6.	Write a C program to perform a linear search for a given key integer in a single dimensional array of numbers and report success or failure in the form of a suitable message using functions.
7.	Write a C program to enter the information like name, register number, marks in 6 subjects of N students into an array of structures, and find the average & display grade based on average for each student.
8.	Write a C program, to implement a bubble sort technique using function to sort given N integers in ascending/ descending order as per user's preference.

Average	**Grade**
80-100	Distinction
60-79	First Class
40-59	Second Class
<40	Fail

Course Outcomes: At the end of the course student will be able to

1.	**Describe** the basics of computer system, basics of C and the process of problem-solving aspects using algorithmic solution for a given problem.
2.	**Apply** the knowledge to develop the C program using control statements such as branching and looping constructs for a given problem.
3.	**Apply** the knowledge of code re-usability, parameter passing and returning values to develop a maintainable C program using these concepts including arrays and functions.
4.	**Understand** the concepts of user defined and built-in functions using strings.
5.	**Identify and describe** the use of structures, pointers and file handing mechanisms in a C program.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓Course Outcomes													1	2	3
CS1001-2.1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	-
CS1001-2.2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CS1001-2.3	3	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CS1001-2.4	1	1	2	-	-	-	-	-	-	-	-	-	1	2	-
CS1001-2.5	2	2	3	-	-	-	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	E. Balaguruswamy, "Programming in ANSI C", Tata McGraw Hill, 3rd Edition, 2004.
2	Jacqueline A. Jones & Keith Harrow, "C Programming with Problem Solving", Pearson,

REFERENCE BOOKS:

1	Kernighan & Ritchie, "The C Programming (ANSI C)", Prentice Hall; 2ndEdition, 1998.
2	Rajiv Khanna, "Computer Concepts and C Programming", New Age International Pvt Ltd Publishers, 1st Edition, 2006.
3	Yashwant Kanetkar, "Let Us C", 5th Edition, BPB Publications, New Delhi, 2004.
E Books / MOOCs/ NPTEL	
1	http://www.lysator.liu.se/c/bwk-tutor.html#introduction
2	http://www.acm.uiuc.edu/webmonkeys/book/c_guide/
3	C programming Tutorial by Mark Burgers http://markburgess.org/CTutorial/C-Tut-4.02.pdf
4	http://nptel.ac.in/courses/106105085/4
5	https://www.lynda.com/C-training-tutorials/1249-0.html

BASIC ELECTRONICS

Course Code:	**EC1001-1**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To familiarize the student with Semiconductor devices like Diodes, Transistors and their applications
2.	To analyze the working of simple electronic circuits involving Op-amps, 555 Timer and Linear Regulator ICs.
3.	To understand the fundamentals of Modern communication system.
4.	To introduce the fundamentals of Embedded Systems

UNIT-I

Diodes and their Applications	**07 Hours**
Semiconductor Diode, Diode Equivalent circuits, Half Wave Rectifier, Full wave Bridge Rectifier, capacitor filter circuit (only qualitative approach). Zener Diode and its use in Voltage Regulation	
Transistors and their Applications	**09 Hours**
Bipolar Junction Transistor: Construction and operation, Common Emitter Characteristics RC coupled amplifier (frequency response excluded), BJT as a switch. **Field Effect Transistor:** Construction, Drain and Transfer Characteristics of Enhancement mode MOSFET, CMOS Inverter.	

UNIT-II

Op-Amp & Linear IC Applications	**11 Hours**
Introduction, Op-Amp Specifications, Differential & Common-Mode operation, Op-Amp applications: Inverting/Non-Inverting Amplifier, Summing, Integrator, Differentiator,	

Comparator. 555 Timer IC in Astable mode. 78XX series IC Voltage Regulators.

Feedback and Oscillator Circuits — **05 Hours**

Feedback– Principle and advantages of negative feedback, Voltage series feedback amplifier. Concept of positive feedback, Op-Amp Oscillators – RC phase shift, Hartley and Colpitts's Oscillator

UNIT-III

Fundamentals of Communication and Embedded Systems — **08 Hours**

Modern communication system scheme (Block scheme), Information source, Input Transducers, Transmitter, Channels, Receivers, Noise, Fundamentals of Cellular communication.
Embedded system definition, Elements of Embedded systems, Core of Embedded systems, Microprocessor v/s Microcontroller, Sensors and Actuators with examples.

Course Outcomes: At the end of the course student will be able to

1.	Explain the operation of Rectifiers; Design a rectifier circuit, given the specification for output Voltage, PIV, and ripple factor; Design a Zener voltage regulator for the given specification of output voltage and Power;
2.	Explain the construction and operation of Bipolar transistor in CE or CB Mode; Explain the use of BJT in Amplification as well as switching operations; Explain the construction and operation of JFET or MOSFET; Explain the operation of a CMOS Inverter;
3.	List the ideal and practical parameters for an Op-Amp; Define Op-amp Specifications; Explain the use of Op-Amp in Amplification, Summing, Integration, Differentiation and comparison; Design an Astable Multivibrator, using 555 Timer IC, for the given frequency and duty cycle;
4.	List the advantages and disadvantage of Negative Feedback; Explain the impact of negative feedback on Amplifier gain, Input and Output Impedance for a Series Voltage Negative feedback; Explain the operation of Op-Amp based RC Phase-shift, Hartley, and Colpitts Oscillator
5.	Explain the scheme of a Modern Communication System; List the differences between a general computing system and Embedded System; Describe the differences between Harvard and Von-Neuman, RISC and CISC system architectures

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
EC1001-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.2	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.4	3	-	-	-	-	-	-	-	-	-	-	-
EC1001-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th

.	Edition, PHI, 2016
2.	Simon Haykin, "Introduction to Analog and Digital Communications", Wiley Publishers, 2nd Edition, 2019
3.	Theodore Rappaport, "Wireless Communications: Principles and Practice", Pearson, 2nd Edition, 2016
4.	Shibu K V, "Introduction to Embedded Systems", TATA Mc Graw Hill Edu., 2nd Edition, 2016
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/117107095
2.	https://nptel.ac.in/courses/117103063
3.	https://www.coursera.org/learn/electronics?#syllabus
4.	https://www.coursera.org/learn/diode-pn-junction-metal-semiconductor-contact?specialization=semiconductor-devices#syllabus
5.	https://www.coursera.org/learn/transistor-field-effect-transistor-bipolar-junction-transistor?specialization=semiconductor-devices

FUNDAMENTALS OF CYBER SECURITY

Course Code:	**IS1101-1**	**Course Type:**	**ETC**
Teaching Hours/Week (L: T: P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Define the area of cybercrime and forensics.
2.	Explain the motive and causes for cybercrime, detection, and handling.
3.	Investigate Areas affected by cybercrime.
4.	Illustrate tools used in cyber forensic

UNIT-I

Introduction to Cybercrime	**15 Hours**

Cybercrime - Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. [T1: 1.1-1.5]

Cyber offenses: How Criminals Plan Them

How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime. [T1: 2.1-2.6]

Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era. [T1: 3.1-3.11]

UNIT-II

Tools and methods used in Cybercrime	**14 Hours**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. [T1: 4.1-4.12]

Phishing and Identity Theft

Introduction to Phishing, Identity Theft (ID Theft). [T1: 5.1-5.3]

UNIT-III

Understanding Computer Forensics	**11 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. [T1: 7.1-7.19]

Course Outcomes: At the end of the course student will be able to

1.	Comprehend the Cybercrime and its origin
2.	Analyse the cybercrimes in mobile and wireless devices
3.	Apply tools and methods used in Cyber crimes

4.	Analyse Phishing and ID Theft
5.	Comprehend Digital Forensics

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
IS1101-1.1	2	-	-	-	-	1	-	3	-	-	-	-	-	-	-
IS1101-1.2	-	3	-	1	-	2	-	-	2	-	-	-	-	-	-
IS1101-1.3	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-
IS1101-1.4	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-
IS1101-1.5	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1.	Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1, 2014.
2.	James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials'', CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.
3.	Santosh B. J., K. V. S. S. S. S. Sairam, Shubham Kumar, Chandu Jagan Sekhar M., "Information and Cyber Security", Scientific International Publishing House, ISBN-978-93-5625-694-1.

TECHNICAL ENGLISH

Course Code	**HU1001-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L:T:P:S)	**1:0:2:0**	**Credits**	**02**
Total Teaching Hours	**15+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Identify the nuances of Phonetics, Intonation and enhance pronunciation skills
2.	Understand Technical Communication along with the barriers and application of effective Interpersonal Communication Skills
3.	Enhance basic English grammar and essentials of language skills
4.	Improve sentence structure through the utilization of cohesive devices, thereby fostering the development of both spoken and writing skills

UNIT – I

Phonetics & Pronunciation	**8 Hours**
Introduction to Phonetics; Word Stress, Rhythm and Intonation; Weak Forms and Strong Forms, Role of IPA in past tense and plural forms of words, Awareness of Different Accents	
Communication Skills	**8 Hours**
Introduction to Communication, Greeting and Introducing, Making Requests, asking for and Giving Permission, Offering Help Understanding Telephone Communication, Handling Calls, asking for and Giving Information, Telephone Etiquette	

UNIT – II

Language Skills	**16 Hours**
Basic English Grammar, Ability to identify, Analyze, Interpret and Describe the critical ideas, values, and themes through literary works	

UNIT – III

Writing Skills	**9 Hours**
Paragraph writing, Refutations, Linkers, Types of Letters	

Course Outcomes: At the end of the course students will be able to

1.	Identify the nuances of phonetics, intonation, and pronunciation to appreciate and incorporate Received Pronunciation
2.	Interpret and assess nuances of oral communication skills and non-verbal communication for professional usage
3.	Identify, interpret, and describe the critical ideas, values, and themes to appreciate literary pieces for its language and social interpretations
4.	Implement English vocabulary in both personal and professional contexts, enhancing language proficiency while also honing effective writing skills adaptable to various forms of written communication.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1001-1.1	1	1	-	-	-	-	-	2	-	2	-	3	-	-
HU1001-1.2	2	-	-	-	-	2	-	-	-	3	-	3	-	-
HU1001-1.3	-	2	-	-	-	-	3	2	-	3	-	3	-	-
HU1001-1.4	-	2	-	-	-	2	-	-	2	2	-	2	-	-

1: Low 2: Medium 3: High

TEXTBOOKS

1.	Tidings, Victor, R. et al. "A Textbook of English Language & Communication Skills", 2022.

REFERENCE BOOKS	
1.	Jones, D, "English Pronunciation Dictionary", 2011.
2.	Woods, "A Remedial English Grammar for Foreign Students", 2016.
3.	Kumar, S., "Communication Skills". Oxford University Press, 2011.
4.	CIEFL, Hyderabad. Exercises in Spoken English Part I. Oxford University Press.
5.	CIEFL, Hyderabad. Exercises in Spoken English Part II. Oxford University Press.
6.	CIEFL, Hyderabad. Exercises in Spoken English Part III. Oxford University Press.
7.	Zinsser, W. "On Writing Well", 1976.
8.	Swan, "Practical English Usage". Oxford University Press, 2014.
9.	Lyons, L. H., "Study Writing". Cambridge University Press, 2006.
10.	Subhashini, Victor, R. et al. , "A Textbook of English Language & Communication Skills", 2022.
E Resources	
1.	https://www.macmillandictionary.com/dictionary/british/

CONSTITUTION OF INDIA

Course Code	**HU1002-1**	**Course Type**	**UCC**
Teaching Hours/Week (L: T:P)	**1:0:0**	**Credits**	**01**
Total Teaching Hours	**13+0+0**	**CIE**	**50**

Teaching Department: Humanities

Course Objectives:

1.	Inculcate Social and Political consciousness of the Indian Polity.
2.	Understand Their Obligations, Responsibilities, Privileges and Rights, Duties, and the Role that they have to play in deciding the Administrative Machinery of the country.
3.	Develop National and Patriotic Spirit.
4.	Understand the nature and character of relations between union and state governments.
5.	Divulge the students about the statutory institutions and policies.

UNIT – I

Evolution of the Indian Constitution	**6 Hours**

1909 Act, 1919 Act, 1935 Govt of India Act, Constituent Assembly: Composition and Functions, Basic structure of Indian Constitution, Fundamental features of the Indian Constitution, Salient Features of Indian Constitution

UNIT – II

Structure of Government	**5 Hours**

Union Government: Legislature; Executive-President, Prime Minister, Council of Ministers;

Judiciary, Judicial Review, and activism. State Government: Executive: Governor, Chief Minister, Council of Ministers.
Local Government: Panchayat Raj Institutions, Urban Governance

UNIT – III

Statutory Institutions	**2 Hours**

Elections - Election Commission of India, National Human Rights Commission, National Commission for Women.

Course Outcomes: At the end of the course student will be able to

1.	Analyze the legalities and related issues of drafting, adoption, and enforcement of the Indian Constitution as a fundamental law of the nation and the provisions and privileges of Indian Citizenship
2.	Understand and judiciously use the fundamental rights, fundamental duties and privileges envisaged in the constitution propagating social harmony and equality and respecting the rights and liberties of other people.
3.	Contribute in protecting and preserving the sovereignty and integrity of India and have a compassion to all living creatures, uphold sense of brotherhood ness among all citizens of the nation and promote peace and harmony
4.	Respect the Constitutional Institutions and all noble ideals cherished during Indian struggle for freedom
5.	Develop a Spirit of belongingness to the country.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
HU1002-1.1	-	-	-	-	-	-	-	3	-	-	1	1	-	-
HU1002-1.2	-	-	-	-	-	-	-	2	-	-	1	1	-	-
HU1002-1.3	-	-	2	-	-	-	1	2	-	-	1	1	-	-
HU1002-1.4	-	-		-	-	-	-	1	-	-	-	-	-	-
HU1002-1.5	-	-	1	-	-	-	-	3	-	-	1	1	-	-

1: Low 2: Medium 3: High

Reference Materials:

1.	Introduction to the Constitution of India; Dr. Durga Das Basu; Twentieth Edition, LexisNexis Butterworths Wadhwa, Nagpur, Haryana, India, Reprint 2011.
2.	Introduction to Constitution of India; M.V. Pylee; Fourth Revised Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.
3.	Introduction to Constitution of India; Brij Kishore Sharma; Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
4.	An Introduction to Constitution of India and Professional Ethics; Prof. B R Venkatesh and Merunandan K B; Merugu Publications, Bangalore; Second Edition, 2007.

E Resources	
1.	*http://nptel.ac.in/courses/109104032/*
2.	*https://pothi.com/pothi/book/ebook-ministry-law-and-justice-constitution-india*
3.	*iasplanner.blogspot.com/2010/11/free-ebook-download-constitution-of.html*
4.	www.iasabhiyan.com
5.	Samvidhaan, Documentary by Prasaar Bharathi

Teaching Mathematics with MATLAB

Course Code:	**MA1006-1**	**Course Type**	**BSC**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**0+0+26+0**	**CIE Marks**	**50**

Teaching Department: Mathematics

Course Objectives:

1.	Understand the use of the basic operators, and some built-in functions of MATLAB.
2.	Create and work with arrays
3.	Create and display simple plots
4.	Solve by Symbolic and Numerical computation techniques

List of Experiments

1	Introduction to MATLAB: Basic Operators: Arithmetic, Logical and Relational Operators. Elementary math functions such as algebraic, trigonometric, logarithmic, exponential functions, Conditions and Loops.
2	Symbolic Computation, plotting curves, surfaces and vector fields.
3	Differentiation of composite and implicit functions.
4	Taylor's/ Maclaurin's series expansion of a function of a single variable.
5	Computation of partial derivatives and Jacobians
6	Evaluation of double/triple integrals with constant/variable limits.
7	Computation of angle between (a) radius vector and tangent ; (b) two curves
8	Computation of radius of curvature
9	Computation and visualization of (a) gradient of a scalar function ; (b) divergence and curl of a vector function
10	Solution (with solution curve) of first-order ordinary differential equation
11	Solution (with solution curve) of second and higher-order linear differential equation with constant coefficients
12	Computation of (a) eigenvalues and eigenvectors of a square matrix; (b) largest eigenvalue and the corresponding eigenvector of a square matrix; (c) rank of a square matrix
13	Solution of a system of linear equations by Gauss elimination method
14	Solution of a system of linear equations by Gauss-Seidel method

Course Outcomes: At the end of the course student will be able to

1.	Write and compile simple MATLAB codes. Implement basic operators and conditions and loops effectively.
2.	Write MATLAB programs gradually for the theoretically studied mathematical concept. Develop illustrations to demonstrate mathematical issues and their answers.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
MA1006-1-1.1	3	2		-	-	-	-	-	-	-	-	-	**-**	**-**	**-**
MA1006-1-1.2	3	2	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Rudra Pratap, “MATLAB”, OXFORD University Press, 2010.

2. Dorothy C. Attaway Ph.D., A practical introduction to prog. And problem-solving, 5th edition.

E-Resources

1. https://www.mathworks.com › matlab › matlab_prog

2. https://www.coursera.org/specializations/mathematics-engineers

3. https://www.coursera.org/specializations/matlab-programming-engineers-scientists

4. https://www.coursera.org/learn/matlab

B. Tech (CC): Scheme of Teaching and Examinations 2024-28
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2024-25)

I /II SEMESTER (AI&DS, AI&ML, CC, CS, IS, RI)

Sl. No	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week			SL#	Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P						
1.	BSC	MA1007 – 1	Discrete Mathematics and Transform Techniques	MA	4	0	0	3	3	50	50	100	4
2.	BSC	CY1003-1	Materials Chemistry for Computer Systems	CY	3	0	2	2	3	50	50	100	4
3.	ESC	EC1002-2	Applied Digital Logic Design	EC	2	0	2	1	3	50	50	100	3
4.	PLC	CS1005-2	Introduction to Python Programming	CS	2	0	2	1	3	50	50	100	3
5.	ESC	EE1001-2	Basic Electrical Engineering	EE	2	0	2	1	3	50	50	100	3
6.	AEC	BT1651-1	Biology for Engineers	BT	1	0	0	-	1	50	50	100	1
7.	ESC	ME1004-1	Engineering Visualization	ME	0	0	2	-	0	50	0	50	1
8.	MNC	CV1005-1	Environmental Studies and Sustainability	CV	1	0	0	-	-	50	0	50	0
				TOTAL	**15**	**0**	**10**	**8**	**17**	**400**	**350**	**700**	**19**

Academic Activities beyond class hours		-	-	-	**3**
Learning hours per week		**15**	-	**10**	**11**
Total notional learning hours (L+T+P+J+SL)	Per Week	**36**			
	Per Semester	**36X16 = 576**			

Mandatory Internship-I*								
9.	INT	UC1001-1	Internship – I	Mandatory Intra Institutional Internship of duration (80 - 90 Hours) to be completed during I & II Semesters. *The grades will be included in the IV semester grade card (Refer to 11.5.2 for details)	100	--	100	2

DISCRETE MATHEMATICS AND TRANSFORM TECHNIQUES

Course Code:	**MA1007 - 1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P):	**4:0:0**	**Credits:**	**04**
Total Teaching Hours:	**50+0+0**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	This course will enable the students to master the basic tools of set theory and relations, propositional and predicative logics, numerical methods, Fourier series and transforms and become skilled for solving problems in science and engineering.

UNIT-I

Logics	**8 Hours**

Propositional logic, logical operations, Rules of inference, Predicates calculus. Methods of Proof: Direct, Indirect and Proof by Contradiction and Contrapositive. Proofs by Mathematical Induction (both weak and strong inductions).

UNIT-II

Set Theory And Graph Theory	**11 Hours**

Relations- Relations and Digraphs, Properties of Relations, Equivalence Relations, Transitive Closure and Warshall's Algorithm.
Functions- permutations functions, functions for computer science.
Graphs: Basic terminologies, simple graphs, complete graphs, bipartite graphs. Adjacency matrices, incidence matrices and graph isomorphism. Connectivity- vertex and edge connectivity. Euler and Hamiltonian graphs and their applications. Planar graphs, graph coloring and their applications.

UNIT-III

Numerical Methods	**11 Hours**

Roots of algebraic and transcendental equations- Newton Raphson method, Regula Falsi method.
Numerical solution of ordinary differential equations- Taylor's series method, Modified Euler's method and Runge –Kutta method of fourth order.
Numerical solution of partial differential equations-classification of partial differential equations, examples, solution of Laplace and Poisson equations by standard five point formulae, solution of heat and wave equations.

UNIT-IV

Fourier Series and Fourier Transform	**10 Hours**

Periodic functions, Euler's formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series. Fourier transform, inverse Fourier transform, convolution theorem, Fourier sine and cosine transforms. Discrete Fourier transform (DFT) and Fast Fourier transform (FFT)- applications.

UNIT-V

Z-Transforms	10 Hours
Z-transforms of standard functions, Bilateral Z- Transform. ROC, linearity, Time shift, Convolution, Scaling & Differentiation in Z-Domain, Time reversal property, Initial and Final Value Theorems. Inverse Z-transform: Partial Fraction Method, Power series/ division method, Contour integral Method. Unilateral Z-Transform: Properties, Solution of difference equations.	

Course Outcomes: At the end of the course student will be able to

1.	Establish by deduction the validity of an argument using inference rules.
2.	Represent a relation in terms of matrix and digraph, apply permutation functions for encoding and decoding simple text massages. Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems.
3.	Apply numerical methods to find solutions of algebraic equations and ordinary differential equations and partial differential equations.
4.	Apply the analytical technique to express periodic function as a Fourier sine and cosine series and apply the concepts of Fourier- transforms to solve engineering problems.
5.	Apply the concepts of Z- transforms to solve engineering problems.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
MA1007 - 1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1007 - 1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kenneth H. Rosen, "Discrete Mathematics and its applications",Tata McGraw Hill, V Edition, 2003.
2.	B.S. Grewal, J. S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 6th edition, 2002.
3.	Martin Vetterli, Jelena Kovacevic and Vivek Goyal, "Foundations of Signal Processing", Cambridge University Press, 2014.

REFERENCE BOOKS:

1.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
2.	Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures" III edition, PHI 2001.
3.	Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education,

	Asia, IV Edition-2002.
4.	J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with applications to computer Science", Tata McGraw Hill-1987.
5.	S. S. Sastry, "Introductory methods of Numerical Analysis", Prentice Hall, 2nd edn.1990.
6.	M. K. Jain, S.R.K. Iyengar and R.K. Jain "Numerical methods for Scientific and Engineering computations", Wiley Eastern, edn.1985.
E Books / MOOCs/ NPTEL	
1.	http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html
2.	http://cglab.ca/~discmath/notes.html
3.	http://ocw.mit.edu/courses/mathematics/ (online course material)

MATERIALS CHEMISTRY FOR COMPUTER SYSTEMS

Course Code:	**CY1003-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1	To understand the basic components of Electrochemical cells and relate their principles to battery technology.
2	To Identify the different types of polymers and polymer composites, their synthetic routes and applications, and Analytical techniques.
3	To understand the basic components of sensors, PCB, and synthesis and properties of nanomaterials.
4	To Identify the synthetic approaches undertaken for designing nanomaterials, and materials used in display devices.
5	To understand the prime problems associated with e-waste and subsequent remedial measures undertaken.

UNIT-I

Electrode & Energy Systems	**8 Hours**

Electrode System: Introduction to galvanic cell. Reference electrode - Introduction, calomel electrode – construction, working and applications. Concentration cell –Definition, construction, working, and numerical problems. Ion selective electrode–definition, construction, and advantages of glass electrode, determination of pH using glass electrode.

Energy Systems: Introduction to batteries, construction, working, and applications of Lithium-ion batteries. Fuel cells, Construction, working and applications of methanol-oxygen fuel cell.

Polymers & Analytical Techniques	**07 Hours**

Polymers: Introduction, Molecular weight –Number average, weight average, and numerical problems. Preparation, properties, and commercial applications of carbon fibre. Conducting polymers– synthesis and conducting mechanism of polyacetylene and commercial applications.

Analytical Techniques: Principle and instrumentation of Conductometry; its application in the estimation of weak acid and strong acid. Principle and instrumentation of Potentiometry; its application

in the estimation of iron.	
UNIT-II	
Sensors, PCB and Nanomaterials	**08 Hours**
Sensors: Introduction, working, principle, and applications of Optical sensors and electrochemical sensors. Sensors for the measurement of dissolved oxygen (DO). Electrochemical gas sensors for SO_x and NO_x. **Printed Circuit Boards**: Electroless plating – Introduction, Electroless plating of copper in the manufacture of double-sided PCB and its applications. **Nanomaterials:** Introduction, classification, preparation of nanomaterials by sol-gel and co-precipitation method with example. Properties, synthesis, and applications of carbon nanotubes.	
Memory Devices and Display Systems	**07 Hours**
Memory Devices: Introduction, Basic concepts of electronic memory. Classification of electronic memory devices, types of organic memory devices (organic molecules, polymeric materials, organic-inorganic hybrid materials). **Display Systems**: Photoactive and electroactive materials, Nanomaterials, and organic materials used in optoelectronic devices. Liquid crystals (LCs) - Introduction, classification of LCs, and types of mesophases. Applications in Liquid Crystal Displays (LCDs)-Electro-optic effect. Light emitting electrochemical cells.	
UNIT-III	
E-Waste Management & Green Fuels	**10 Hours**
E-waste Management: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products; health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, pyro metallurgical methods, direct recycling). Extraction of gold from E-waste. Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies). **Green Fuels:** Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Generation of energy (green hydrogen) by electrolysis of water by PEM method.	

List of Experiments

1.	Determination of strength of an acid in Pb-acid battery (Demonstration).
2.	Determination of Total Hardness of a water sample using disodium salt of EDTA.
3.	Estimation of iron in TMT bar by diphenylamine/external indicator method.
4.	Synthesis of polyurethane (Demonstration).
5.	Conductometric estimation of a strong acid with standard NaOH solution.
6.	Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
7.	Determination of pKa of vinegar using pH sensor (Glass electrode).
8.	Determination of the viscosity coefficient of a given liquid using Ostwald’s viscometer.
9.	Estimation of Copper present in electroplating effluent by optical sensor (colorimetry).
10.	Colorimetric determination of iron.
11.	Conductometric estimation of a weak acid using standard NaOH solution.
12.	Estimation of Sodium present in soil/effluent sample using a flame photometer.
13.	Synthesis of biodiesel (Demonstration).
14.	Synthesis of Iron-oxide Nanoparticles (Demonstration).

Course Outcomes: At the end of the course student will be able to

1	Understand the basic components of Electrochemical cells and relate their principles on sensors

	and Analytical techniques.
2	Identify the different types of polymers and polymer composites, their synthetic routes and applications and Analytical techniques.
3	Understand the basic components of Electrochemical cells and relate their principles to sensors.
4	Identify the synthetic approaches undertaken for designing nanomaterials, materials used in display devices.
5	Understand the prime problems associated with e-waste and subsequent remedial measures undertaken.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
CY1003-1.1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CY1003-1.5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	P. C. Jain & Monica Jain, "Engineering Chemistry", Dhanpat Rai Publications, New Delhi, 2015.
2	R. V. Gadag and Nityananda Shetty, "A Text Book of Engineering Chemistry", 2nd Edition, I. K. International Publishing house, 2016.
3	S. S. Dara & S. S. Umare, "A Textbook of Engineering Chemistry", 12th Edition, S. Chand & Company Ltd., 2011.

REFERENCE BOOKS:

1	Baskar, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2013.
2	Satya Prakash & Manisha Agrawal, "Engineering Chemistry", Khanna Book Publishing, Delhi.
3	Bahl & Tuli, "Essentials of Physical Chemistry", S. Chand Publishing.
4	Sunita Rattan, "Applied Chemistry", Kataria.
5	D. Grour Krishana, "Engineering Chemistry – I", Vikas Publishing.
6	F. W. Billmeyer, "Text Book of Polymer Science", John Wiley & Sons, 4th Edition, 1999.
7	G. A. Ozin & A. C. Arsenault, "Nanotechnology A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
8	Kirby W. Beard, "Linden's Handbook of Batteries", Fifth Edition, Mc GrawHill, 2019.
9	Takatoshi Tsujimura, "OLED Display Fundamentals and Applications", Wiley–Blackwell, 2012.
10	MaxLu, Francois Beguin, Elzbieta Frackowiak, "Super capacitors: Materials, Systems, and Applications", Wiley-VCH;1stedition, 2013.
11	H. Panda, "Handbook on Electroplating with Manufacture of Electro-chemicals", ASIAPACIFIC BUSINESS PRESS Inc., 2017.
12	Sudharani, "Laboratory manual in Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi.
13	"Expanding the Vision of Sensor Materials", National Research Council 1995, Washington, DC: The National Academies Press. doi:10.17226/4782.

14	Mahesh B and Roopa Shree B, "Engineering Chemistry", Sunstar Publisher, Bengaluru, ISBN978-93-85155-70-3, 2022
15	F. H. Froes,et al., "High Performance Metallic Materials for Cost Sensitive Applications", John Wiley & Sons, 2010.
16	K. R. Mahadik and L. Satyanarayana, "Instrumental Methods of Analysis", Nirali Prakashan, 2020.
17	Douglas A. Skoog, F. James Holler, Stanley R. Crouch, "Principles of Instrumental Analysis", Seventh Edition, Cengage Learning, 2020.
18	V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, "Polymer Science", NewageInt. Publishers, 4th Edition, 2021.
19	Hari Singh, "Nanostructure materials and nanotechnology", Nalwa, Academic press, 1st Edition, 2002.
20	O. G. Palanna, "Engineering Chemistry", Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
E-Books / MOOCs/ NPTEL	
1	http://libgen.rs/
2	https://nptel.ac.in/downloads/122101001/
3	https://nptel.ac.in/courses/104/103/104103019/
4	https://ndl.iitkgp.ac.in/.
5	https://www.youtube.com/watch?v=faESCxAWR9k

APPLIED DIGITAL LOGIC DESIGN

Course Code:	**EC1002-2**	**Course Type:**	**ESC**
Teaching Hours/Week (L: T: P)	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**25+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	To understand the basics of Number Systems, Logic Gates and Boolean Functions.
2.	To understand simplification of the Boolean Equations using Boolean Algebra, Karnaugh Maps and QM method.
3.	To design combinational Logic Circuits like Adders/Subtractors, Binary Comparators, Decoders, Encoders, and Multiplexers.
4.	To understand the operation of Flip-Flops, Master-Slave Flip-Flops and Conversion of Flip Flops.
5.	To design Shift Registers and Counters.

UNIT-I

Fundamentals of Digital Design	**10 Hours**

Difference between Analog and Digital Signals, Number Systems: Decimal, Binary, Octal and Hexadecimal. Binary Addition and Subtraction, Digital Logic Gates, Boolean Algebra, Boolean Functions: Canonical Forms, Completely and Incompletely Specified Functions, Simplification of Boolean Functions using Boolean Algebra, Karnaugh Map and Quine-

McCluskey Method, Realization of Boolean functions using Basic Gates and Universal Gates.

UNIT-II

Combinational Logic and Sequential Logic Circuits	**10 Hours**

Introduction to Combinational Logic Circuits, Half/Full Adders/Subtractors, Parallel Adders/Subtractors, Binary Comparators, Decoders, Encoders, Multiplexers.
Basic Bistable Element, SR Flip-Flop, D Flip Flop, JK Flip Flop, T Flip Flop, Master Slave JK Flip Flop, Characteristic Equations, Conversion of Flip Flops.

UNIT-III

Applications of Flip Flops	**05 Hours**

Design of Shift Register using D- flip flop, Design of Counters: Asynchronous counters using T-flip flop, Synchronous Counters using D-flip flop and T Flip Flop.

Suggested List of Experiments

1.	Introduction to Digital Circuit Simulation Software.
2.	Introduction to Basic gates, Universal gates.
3.	Realization of Logic Circuits using Universal gates.
4.	Realization of Combinational Logic Circuits.
5.	Realization of Sequential Logic Circuits.

Course Outcomes: At the end of the course student will be able to

1.	Compare Analog & Digital Signals; Convert the number from one numbering system to another; Analyze Boolean functions.
2.	Simplify the logic expressions using Boolean Algebra or K-Map or QM Method; Realize the logic expressions using Basic/Universal Gates.
3.	Analyze and Design different Combinational Logic Circuits such as Adders, Subtractors, Binary Comparators, Decoders, Encoders and Multiplexers.
4.	Describe the operation of Flip Flops, Mater-Slave Flip Flops and Conversion of Flip Flops.
5.	Make use of Flip Flops to design Shift Registers and Synchronous/Asynchronous Counters.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
EC1002-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1002-1.2	3	1	1	-	3	-	-	-	3	1	-	-
EC1002-1.3	3	2	1	-	3	-	-	-	3	1	-	-
EC1002-1.4	3	-	-	-	3	-	-	-	3	1	-	-
EC1002-1.5	3	1	1	-	3	-	-	-	3	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Morris Mano, "Digital Design", Prentice Hall of India, 3rd Edition.
2.	Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2002.
REFERENCE BOOKS:	
1.	John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
2.	D. P. Kothari and J. S Dhillon, "Digital Circuits and Design", Pearson, 2016.
3.	Charles H Roth, "Fundamentals of Logic Design", Cengage Learning.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/117106086

INTRODUCTION TO PYTHON PROGRAMMING

Course Code:	**CS1005-2**	**Course Type:**	**PLC**
Teaching Hours/Week (L: T: P):	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**25+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Construct python programs using data types and looping.
2.	Make use of python operators for manipulating lists, dictionaries and files.
3.	Design function-based Python programs.
4.	Design list, tuple related programs in Python.
5.	Write string handling programs in python.

UNIT-I

Introduction to Python and Function:	**10 Hours**

Python Concepts: Introduction to Python, Variables, Keywords, Identifiers, Literals, Operators, Comments, Control statements: if, if else, else if, nested if, for loop, while loop, do while, break, continue, pass.

Design with functions: Functions Overview, arguments and return values; formal vs actual arguments, named arguments, Recursive functions, Lambda functions, Modules

UNIT-II

Data structure and Files:	**10 Hours**

Data Structures: Strings, Lists, Tuples, Sets and Dictionaries (basic operations)

Introduction to Object oriented concepts: Class, object.

Files: Create a file, read and write operations with text and CSV files

UNIT-III

	05 Hours

Exception handling: Introduction to Exceptions and Errors, Handling exceptions using try-except-else-finally.

Introduction to Pandas

Data Visualization using Matplotlib

Suggested List of Experiments

1.	Experiments related to basic operation, data types and variables.
2.	Experiments related to operations of Lists, tuples and dictionaries.
3.	Experiments on writing functions and parameter passing.
4.	Experiments related to working with strings.
5.	Experiments related to file handling.

Course Outcomes: At the end of the course student will be able to

1.	Understand and experiment with the basics of python programming like data types and looping.
2.	Describe the concept of functions in python for solving real-world problems.
3.	Apply the Python operations for manipulating strings, lists, tuples and dictionaries.
4.	Demonstrate the proficiency in handling File Systems.
5.	Understand the basic knowledge on Exception handling and plotting graphs.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓Course Outcomes													1	2	3
CS1005-2.1	1	2	1	2	-	-	2	-	-	-	-	2	-	1	1
CS1005-2.2	-	2	-	-	-	1	-	-	-	-	-	1	-	2	-
CS1005-2.3	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1
CS1005-2.4	-	1	-	2	-	1	-	-	-	-	-	1	-	-	-
CS1005-2.5	-	-	1	3	-	-	2	-	-	-	1	2	-	2	-

1: Low 2: Medium 3: High

Textbooks:

1	Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, Cengage Learning, 2nd Edition, 2019.
2	Yashwanth Kanetkar, Adithya Kanetkar, “Let us Python”, 3rd Edition.
3	Mark Summerfield, “Programming in Python 3 - A Complete Introduction to the Python Language”, Second Edition, Addison-Wesley, 2009.
4	Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, 2013.

Online Resources:

1	https://www.w3schools.com/
2	https://www.programiz.com/python-programming/guide

BASIC ELECTRICAL ENGINEERING

Course Code:	**EE1001-2**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P)	**2:0:2**	**Credits:**	**03**
Total Teaching Hours:	**25+0+26**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To familiarize the student with the DC circuit analyses.
2.	To analyze single and three-phase AC circuits.
3.	To understand the working principle of electrical machines.
4.	To introduce fundamental concepts in EV, basic converters and special motors, electrical wiring protective devices and safety measures

UNIT-I

Circuit Fundamentals	**02 Hours**

Introduction to DC circuits, Basic nodal and mesh analysis excited by independent DC voltage sources, Power and Energy.

	08 Hours

AC Fundamentals: Generation of sinusoidal voltage, frequency of generated voltage, definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current, phasor representation of alternating quantities.

A.C. Circuits: Analysis of R, L, C, R-L, R-C and R-L-C series. Phasor Diagrams. Real power, reactive power, apparent power and power factor. Three-phase balanced circuits, voltage and current relations in star and delta connections. Measurement of three phase power using two wattmeter.

UNIT-II

DC Machines	**03 Hours**

Faradays Laws, self and mutually induced emfs. Constructional details, Principle of operation of generator and motor, Expression for back emf, Types of dc motors, Characteristic of dc motors (shunt and series motors only) and Applications.

Single-Phase Transformers	**03 Hours**

Necessity of transformer, Principle of operation. Types of Transformers, Emf equation, losses, efficiency, problems on emf equation and efficiency, Autotransformer, Applications.

Induction Motors	**03 Hours**

Concept of rotating magnetic field, Construction and working of a three-phase Induction Motor, Slip and its significance, Torque slip characteristics (qualitative). Necessity of a starter, Principle of operation Single Phase Induction Motor. Applications

UNIT-III

Electric Vehicles	**04 Hours**
Fundamentals, Block diagram of EV and its components. Motors used in EV – BLDC, Permanent Magnet Synchronous Machine (PMSM) -Working principle. **SMPS:** Concept of step up and step-down converter (Basic equation and Block diagram representation), Applications. Block diagram of UPS and applications.	
Domestic Wiring	**02 Hours**
Types of wiring. Two-way and Three-way control of lamp. Elementary discussion on Circuit protective devices: Fuse and Miniature Circuit Breaker (MCB's). **Personal safety measures**: Electric Shock and Precautions against shock. Potential between neutral and ground. Necessity of Earthing, Earthing types- Pipe and Plate earthing.	
*One additional tutorial class will be allotted every week	

	Suggested List of Experiments
1.	Verification of KVL and KCL for DC circuits.
2.	Measurement of current, power and power factor of incandescent lamp, fluorescent lamp, CFLand LED lamp.
3.	Sinusoidal steady state response of R-L, and R-C circuits- impedance calculation and verification
4.	Voltage and Current relationships of three phase star/delta circuits.
5.	Measurement of three-phase power using two wattmeter method
6.	Load test on a single-phase Transformer.
7.	Speed load characteristic of a 3-phase Induction Motor.
8.	Time characteristic of fuse
Demonstration Experiments	
1.	Demonstration of fuse, MCB by creating a fault.
2.	Two-way and Three-way Control of lamp and formation of truth table.
3.	Demonstration of cut out sections of electrical machines (DC machines, Induction machines and Synchronous machines).
4.	Demonstration of EV and its Components.

Course Outcomes: At the end of the course student will be able to

1.	Analyze the DC Circuits using mesh & node methods to compute power and energy.
2.	Analyze voltage & current phasor relationships in single phase & three phase AC circuits to compute circuit parameters.
3.	Describe the fundamentals of electromagnetism, construction, operating principle of DC & Induction motor to study performance characteristics.
4.	Apply principle of single-phase transformer to compute transformer efficiency.
5.	Describe fundamental concepts in EV, converters, domestic wiring, protection and safety schemes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
EE1001-2.1	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.4	2	3	-	-	-	-	-	-	-	-	-	-	-	-
EE1001-2.5	2	3	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2.	S. K. Sahdev, "Basic Electrical Engineering (with Lab Manual)", January 2022
3.	Lecture Notes on Basic Electrical Engineering, Department of E&E, NMAMIT, Nitte. (New version)
4.	Hughes, Edward, "Electrical Technology", Pearson Education Publications, 10th Edition, 2010.
5.	A. Chakarbarti, M. L. Soni and P. V. Gupta, U. S. Bhatnagar, "Power system engineering", Gagan Kanur, Dhanapat Rai and Co Pvt. Ltd, 2013.

REFERENCE BOOKS:

1.	Vincent Del Toro, "Electrical Engineering Fundamentals", 2nd Edition, Pearson, 2015.
2.	H. Cotton, "Electrical Technology", CBS, 7th Edition, 2005.
3.	A. Mittle and V. N. Mittle, "Basic Electrical Engineering", Tata McGraw Hill, 2005.
4.	Debashisha Jena, "Basic Electrical Engineering", Wiley India Private Limited, 2012.
5.	M.V. Deshpande, "Elements of Power Station Design", 1st edition, PHI learning, 2009.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/downloads/108105053/
2.	http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-1.pdf
3.	Basic Electrical Technology Lectures by Dr. L Umanand Department of Power Electronics Group, CEDT IISC Bangalore available at http://www.nptelvideos.in/2012/11/basic-elerical-technology.html

BIOLOGY FOR ENGINEERS

Course Code:	**BT1651-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S):	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To learn the types of cells, biomolecules and life processes
2.	To know the applications inspired by nature in various streams
3.	To be updated application of biology in real life scenarios.

UNIT-I

Introduction for Biology for Engineers	**05 Hours**

Why Biology for Engineers? Cell Types & Properties: Prokaryotes - Bacteria, Viruses and Fungi, Eukaryotes - Plant and Animal Cells, Biomolecules, Life Processes at Cellular Level.

UNIT-II	
Applications Inspired by Nature	**05 Hours**
Composites in Construction, Termite Mound architecture, Counter current heat exchangers, Design of aeroplane, helicopter and submarine, Information Theory and Biology, SONAR, Medical Devices.	
UNIT-III	
Real Life Scenarios	**05 Hours**
Recent scenarios in Environment, Agriculture and Medical Technology.	

Course Outcomes: At the end of the course student will be able to

1.	Ascertain the importance of biology and interpret the basics of cell and life processes.
2.	Summarize the applications inspired by nature and understand the recent advances in application of biology.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1651-1.1	3	-	-	-	-	-	-	-	1	-	-	1
BT1651-1.2	3	3	-	-	-	-	2	-	1	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Suraishkumar, G. K. “Biology for Engineers”, Oxford University Press India, 2019.
2.	Chakraborty, T, Akthar N, “Biology for Engineers”, PHI learning Print Book ISBN: 9789391818142 eBook ISBN: 9789391818197

REFERENCE BOOKS:

1.	Rao C. V., “Biology for Engineers”, 2021.
2.	Raven, P. H. and Johnson G. B. “Biology”, 4^{th} Ed. WCB publishers, 2010.
3.	Ethier, R. S. and Simmons C. A. “Introductory biomechanics- From cells to organisms”, Cambridge University Press, 2012.

ENGINEERING VISUALIZATION

Course Code:	**ME1004-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**0:0:3:0**	**Credits**	**1**

Total Teaching Hours	26	CIE + SEE Marks	50+00

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To impart and inculcate understanding of the concept of orthographic projection and projection of plane surfaces and solids in different position in first angle projection system.
2.	To develop the lateral surfaces of solid objects and to draw the isometric projection of simple solids.

UNIT-I

Orthographic Projection	**02 Hours**

Introduction to orthographic projection, Quadrants, principal planes, principal views, Difference between First angle and third angle projection, Dimensioning, Conventions employed for drawing.

Projection of plane surface	**06 Hours**

Triangle, Square, Rectangle, Pentagon, Hexagon and Circle in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)

UNIT-II

Projection of Solids	**06 Hours**

Prisms, Pyramids, Cones and Cylinders in simple position (Resting on HP with inclination to HP and VP, true length with true inclination only)
Orthographic projection of simple components using their isometric projection.

UNIT-III

Development of Lateral surfaces of solids	**06 Hours**

Right regular Prisms, Pyramids, Cylinders and cones (with single section plane)

Isometric projection	**06 Hours**

Isometric scale, Isometric dimensions, to draw Isometric views of simple solids and machine components using their orthographic projections.

Course Outcomes: At the end of the course student will be able to

1.	Draw the orthographic projections of a plane and solids for a given position using Solid Edge software.
2.	Draw the development of lateral surfaces of standard solid objects using Solid Edge software. Draw isometric projection of solid objects individually or in combination using Solid Edge software.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
ME1004-1.1	3	1							1	1		2	2	1
ME1004-1.2	3	1							1	1		2	2	1

1: Low 2: Medium 3: High	
TEXTBOOKS:	
1.	N. D. Bhat & V. M. Panchal, Pramod R. Ingle, "Engineering Drawing", 53rd Edition, Charotar Publishing House, Gujarat, 2014.
2.	K. R. Gopalakrishna, "Engineering Drawing", Subhas publishers, Bangalore , 32nd Edition, 2012.
REFERENCE BOOKS:	
1.	"A Primer on computer aided Engineering Drawing", VTU, Belgaum, 8thedition, 2011.
2.	Shah, "Engineering Drawing and Computer Graphics", Pearson, 2010.
3.	Agarwal & Agarwal, "Engineering Graphics", TMH, Second edition, 2013.
4.	P. S. Gill, "A Text book of Engineering Graphics and Drafting", 11th Edition, S. K. Kataria & sons, New Delhi, 2009.

ENVIRONMENTAL STUDIES AND SUSTAINABILITY

Course Code:	**CV1002-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P)	**1:0:0**	**Credits**	**00**
Total Teaching Hours	**15+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Civil Engineering

Course Objectives:

1.	To raise consciousness about environmental conditions and to imbibe environmentally appropriate behaviour.
2.	To equip the engineering undergraduates to identify the significance of environmental practice in their daily life and in the engineering practices.
3.	To make them conscious of understanding the environment where we live and act up on.

UNIT-I

03 Hours

Environment

Definition, significance of environmental studies- current scenario, local, regional, national and global problems

Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere. Layers of atmosphere and its role.

Parts of Earth- lithosphere and its role; hydrological cycle

Eco system - Definition, ecology and environment, ecosystem components: biotic and abiotic components; ecological balance; elements of ecosystem: biotic, abiotic; producers, consumers and decomposers.

Habitat, range of life, Biome, balanced eco- system, food chain, food web and ecological pyramids

Human activities - The Anthropogenic System- human activities like growing food, building shelter and other activities for economy and social security. Soil erosion, water logging - definition. Organic farming- definition.	
Natural resources	**03 Hours**
Resources - Natural resources, water, minerals, Fossil fuels and energy **Water resources** - Global water resources: distribution, uses of water for irrigation, domestic and industrial purposes in India. **Quality aspects** - Water quality parameters, drinking water standards for turbidity, pH value, total hardness, iron, fluoride, lead, arsenic, nitrate **Mineral resources**- Metallic minerals, non-metallic minerals Fossil fuels - Coal and petroleum **Forest Wealth** - Components of the forest, key benefits of forests. Deforestation-environmental effects of deforestation and remedies Sustainable development- definition, objectives **Material cycles -** Carbon, Nitrogen, and Sulphur cycles.	
UNIT-II	
Environmental pollution: Definition, harmful effects related to public health	**03 Hours**
Water pollution: Definition, types, and sources – agriculture (pesticides and fertilizers), industry, domestic and mining, harmful effects, water borne and water induced diseases- definition, common diseases and their causatives, Fluoride problem in drinking water **Land pollution**: Definition, sources_ agriculture, housing, industry, mining, transportation. Types of municipal Solid waste Disposal (Sanitary landfills, composting, incineration (in brief) and effects **Air Pollution**: Definition, types, and sources: industry, mining, agriculture, transportation, and effects **Noise pollution**: Definition, sources, mining, industries, rail-roads, aviation, effects and control measures	
Energy	**02 Hours**
Different types of energy- Non-renewable energy; fossil fuels- coal, oil, and natural gas- brief description only. Nuclear energy- nuclear power plants, Renewable energy: solar energy- Photovoltaic systems for street and domestic lighting, solar water heating-brief description only Wind energy- definition, merits and demerits, Hydro power- definition, merits, and demerits. Biomass energy- definition, sources of bioenergy, biogas, biofuels, India's position in renewable energy Hydrogen as an alternative future source of energy- brief scope, fuel cells.	
UNIT-III	
Current environmental issues of importance	**04 Hours**

Population growth- Definition, growth rate, effects, remedies Urbanization - Definition, environmental impacts and remedies Global warming and climate change-
Concept of greenhouse effect, sources of greenhouse gases, effects, and remedial measures of greenhouse gases
Acid rain: Definition, causes and effects, control measures. Ozone Depletion: Definition, causes, effects, and control measures.
Environmental Impact Assessment- EIA definition, objectives, and benefits of EIA.

Course Outcomes: At the end of the course student will be able to

1.	Identify the significance of environmental practice in their daily life and in the Engineering practices.
2.	Create awareness about environmental conditions.
3.	Follow environmentally appropriate behaviour.
4.	Understand the importance of their surroundings.
5.	Understand Current environmental issues of importance

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CV1002-1.1	-	2	-	-	-	-	-	2	-	-	-	-	1	-	-
CV1002-1.2	-	-	-	1	-	-	-	-	-	1	-	-	1	-	-
CV1002-1.3	1	-	-		1	-	-	-	-	-	-	-	1	-	-
CV1002-1.4	1	-	-	1	-	-	-	-	-	-	-	-	1	-	-
CV1002-1.5	-	-	3	-	-	-	-	-	-	-	3	-	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi, 2005.
2. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, London, 2005.

REFERENCE BOOKS:

1. Balasubramanya, N and Chatwal, Gurdeep R., "Environmental Studies", Himalaya Publishing House, Mumbai, 2007.
2. Barucha, E., "Environmental Studies", University Grants Commission, New Delhi, 2004.
3. Bhatia, S. C., "Environmental Chemistry", CBS Publishers, New Delhi, 2005.
4. De, A.K. and De, A. K., "Environmental Studies", 2006.
5. Keller, Edward A., "Environmental Geology", CBS Publishers and Distributors, Delhi, 1985.

INTERNSHIP-I

Course Code	**UC1001-1**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P)	**-**	**SEE Marks**	-
Total Hours of Pedagogy	80-90 Hours	**Total Marks**	**100**

	(During I/II semesters)		(Evaluation in I/II/III Semester and grades earned shall be included in IV Semester grade card)
Credits	**2**	**Exam Hours**	**--**

Course objective

1. This course is meant to provide students an opportunity to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the institution; contribution at incubation/ innovation /entrepreneurship cell of the institution; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research projects within the institution and Participation in all the activities of Institute's Innovation Council.

Activities: Refer Appendix B - 3.4 for details

Course outcomes

1. Experience the working in Inter / Institutional activities
2. Work in teams and communicate efficiently both written and oral.
3. Develop the ability to do work in different activities, which will provide the necessary understanding and contribute to the same and provide a foundation to undergo higher level training in subsequent internships.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
UC2001-1.1	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**-**
UC2001-1.2	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**-**
UC2001-1.3	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**-**
															1: Low 2: Medium 3: High

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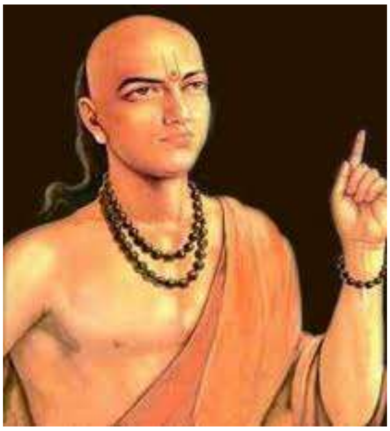
HOLISTIC COMPONENTS

HUMANITIES

Holistic education is not only about teaching the basic subjects, but it is more about redefining the way a student should be taught. The purpose of holistic language teaching is the development of the learners' ability to handle both their language oral skills as well as maximizing their life skills. The department contributes to educational life and workspaces that are creative and meaningful. Multidisciplinary and holistic learning is an ancient method used in Indian education system as well as the other parts of the world. This is the reason that such type of education system was advocated by scholars like Kautilya, Banabhatta, Plato, and Aristotle among many others. Holistic approach is essentially a student-centered strategy rather than a teacher centered one.

Holistic education through courses allied to Humanities is created within the inclusive connections of social and human experience. A curriculum built around such stages is considered holistic if they involve the practices that integrates language acquisition and fills multiple cognitive demands in interlocking activities that spiral learning. Through the applied learning style of a person--mind, body and spirit students will learn more effectively the nuances of language, responsibilities towards social fabrics and ethics.

The approach strives to make a learner construct his own understanding of the text he/she interacts with and converses with others according his understanding. Intensive experiential and group sessions, a co-created learning ambience and hands-on engagement through real-life cases, field trips and internships to make learning exciting, rigorous and transformative. As a part of the holistic approach and its philosophy, a student is educated beyond core academics providing him/her virtuous and holistic education. This helps the students to discover their individuality and comprehend the significance of life purposefully, creatively, and morally in a complex world. Krishnamurti writes If the unity of life and the oneness of its purpose could be clearly taught to the young, how much brighter would be our hopes for the future! (Krishnamurti, J. 1974).



MATHEMATICS

INDIAN MATHEMATICIANS

It is essential to know about the ancient, medieval and modern time Indian mathematicians and their contribution to Science and Mathematics. Ancient Indian mathematicians have contributed immensely to the field of mathematics. The invention of zero is attributed to Indians and this contribution outweighs all other made by any other nation since it is the basis of the decimal number system, without which no advancement in mathematics would have been possible. The number system used today was invented by Indians and it is still called Indo-Arabic numerals because Indians invented them and the Arab merchants took them to the western world.

Here we are introducing some of the important Indian mathematicians from ancient times.

Aryabhata: (500 A. D.) - Studied at the University of Nalanda, which was considered as a great centre of learning. Aryabhata was a greatIndianmathematician.He gave the value of "π" as 3.1416, claiming for the 1st time, that it was approximation. Aryabhata also dealt with other aspects of mathematics and Astronomical calculations, namely Geometry, Mensuration, Squareroot, Cuberoot, Progression and Celestialsphere. He presented a method to solve an intermediate equation of certain type that are important in astronomy and computer science.

Bhaskara : (1100 A. D.) - was a great Mathematician and Astrologer. He was the first Mathematician to declare confidently that any term divided by ZERO is infinity and the sum of any term and infinity is infinity. His concept of "Tatkalikagati", which means instantaneousmotion, used by astronomers to determine the motion of the planet accurately brought credit to him. He explained the solutions of quadratic and cubic equations. He stated the Rolle's theorems in analysis, the mean value theorem.

Srinivas Ramanujan : was an Indian Mathematician who made significant contributions to mathematical analysis, Number theory and continued fractions. He made many important contributions in the field of mathematics with his wonderful and unique knowledge. That's why his birthday is celebrated as Mathematics Day.

PHYSICS

The ancient world had considered Physical Sciences, Chemical Sciences, Earth Sciences, Biological Sciences, Mathematical Sciences etc. as study of nature, which were all studied under the banner of Philosophy. Even today, the philosophers are studying Metaphysics which connects physical attributes to mind. Physics is a branch of science which deals with the study of matter and energy. The Physical Science was a matter of interest for all the civilizations including Vedic era of India dating back to over 3000 years. The physical science in ancient India was majorly restricted to Astronomy and Astrology. It was **Kanada**(600 B.C.) who presented holistic approach of physics, by blending science, philosophy and religion through 'Vaisesika Sutra'. Their essence is the atomic theory of matter. He gave the name 'Paramanu' (Atom), to be the indivisible entity of matter. The idea of chemical change was also put forward by Kanada. Bharadwaja is credited with teaching missile technology. Aryabhata(500 A.D.) was a great astronomer. He was the first to state that the earth is round and it rotates on its own axis, creating day and night. He declared that the moon is dark and shines only because of sunlight. Aryabhatta contributed greatly to the field of science particularly astronomy. Varaha mihira (500 A.D.) studied astrology and astronomy and declared that the earth was spherical. He also proposed that the moon and planets are lustrous not because of their own light but due to sunlight. Bhaskra (1100 A. D.) was a great scientist his concept of "Tatkalikagati", which means instantaneous motion, used by astronomers to determine the motion of the planet accurately brought credit to him.Brahmagupta(598 A.D.) calculated the instantaneous motion of a planet, gave correct equations for parallax, and some information related to the computation of eclipses and is widely regarded as one of the most accomplished of the ancient Indian astronomers.

"If you wish to make an apple pie from scratch, you must first invent the universe."So said astronomer Carl Sagan in an episode of his landmark television series, Cosmos. Embedded in Sagan's memorable quip is a certain holistic understanding of the universe — a notion that the existence of any one thing is intimately tied to the existence of everything else. There are no apple pies without apples; there are no apples without the proper climate for growing apple trees; there is no proper climate for growing apple trees without a planet on which the apple trees can grow — and so on, all the way back to the Big Bang.Pythagoras and his followers held mathematics in an almost holy regard, and they saw numbers as a basic form of matter. According to their view, all things had numbers, and the objects of the universe — including human societies — were arranged in harmonious mathematical relationships with one another.

All sciences were originated from philosophy. Physics was called natural philosophy until the 19th century, but once it was proven to be correct it was no longer philosophy and became a science. Physics is the science of the natural world, more specifically dealing with the matter, energy, space-time, and fundamental forces that govern the physical world. In physics we study a wide range of physical phenomena from subatomic particles to large galaxies of the material universe, and use empirical data and mathematics to find results and conclusions. Physics is also deeply concerned with arriving at knowledge about the ultimate nature of reality. Since we cannot know whether we have discovered everything which would affect our theories of the universe, all such theories are perpetually subject to modification or change. Mathematics is a language and a tool that we use in physics to explain the universe. Quantum physics is a mathematical description that rules the tiny world of atoms and subatomic particles in our universe. Without quantum physics, much of the information technology that we rely on, from microcircuits to lasers, would not exist. Today many scientists argue that metaphysics plays an important role in quantum mechanics at a deeper level; the nature of reality is all mathematical. This could be an example of how metaphysical assumptions can get in the way of our understanding the paradoxical nature of quantum mechanics. But even when quantum mechanics appears a mystical science of metaphysics, it is not metaphysics but productive science.

Thus, the Physics though has many branches and uses many other branches of science and philosophy, in the past and the present, its aim is to understand the whole universe which is nothing but matter and energy which is seen or unseen.

CHEMISTRY

ANCIENT SEERS OF INDIA – CHEMISTRY

In ancient India, chemistry was called **Rasayan Shastra, Rasa-Vidya, Rasatantra and Rasakriya** all of which roughly mean '***Science of Liquids***'. There also existed chemical laboratories which were called **Rasakriya-nagaram/Rasakriya-shala**, which literally mean '***School where liquids are activated***'. Rigveda (earlier than 1500 BCE) mentions many fermented drinks and methods of fermentation, apart from various metals. Soma juice from the stems of the soma plant was considered a divine drink. The Vedic Indians were acquainted with the art of dyeing with certain natural vegetable colouring matters. A type of pottery, now known as 'Painted Grey Ware', is also associated with the Vedic period.

Ancient chemistry in India grew out of the early efforts to develop an elixir; to turn base metals into gold and on metallurgy. Chemical techniques in India can be traced back all the way to the Indus valley or Harappan civilisation (3rd millennium BCE). Pre-Harappan Indians were acquainted with the art of making baked or burnt clay pottery as well as painting the same with two or more colours (by addition of iron oxide, manganese oxide, etc.). Kautilya'sArthashaastra (3rd or 4th century BCE) has a lot of information on prevailing chemical practices. Apart from mines and minerals, it discusses the details of precious stones (pearl, ruby, beryl, etc.); preparation of fermented juices (sugarcane, jaggery, honey, jambu, jackfruit, mango, etc.) and oil extraction.

It is said that **Maharshi Kanada** was the first to propound that the *Parmanu* (atom) was an indestructible particle of matter and that Universe is made up of *Kana*. When matter is divided and sudivided, we reach a stage beyond which no division is possible, the undivisible element of matter is*Parmanu*. Kanada explained that this indivisible, indestructible y cannot be sensed through any human organ.

Nagarjuna (931 A.D.) from Somnath in Gujarat was a chemist/alchemist, who concentrated his efforts in transforming the base metals into gold. His reputation was such that people believed Nagarjuna to be in communion with gods and goddesses who had blessed him with the power of changing base metals into gold and extracting the 'elixir of life'.

Prafulla Chandra Ray (1861-1944), an Indian chemist, is often referred to as the Father of Chemistry in India.He received his BS in 1882 and his PhD in 1887 from University of Edinburgh.In 1896, he announced a major discovery of a new compound, mercurous nitrite.

Today's Science and Technology has been greatly inspired by the contributions of these wise seers. Indians have continued to show their global impact in the Field of Science.

In the 21st century, biochemist **Har Gobind Khorana** won the Nobel Prize (1968) for demonstrating how the nucleotides in nucleic acids control the synthesis of proteins.

Thus, the seers of ancient India have contributed significantly in the development of Modern Chemistry.

BIOTECHNOLOGY

Biology for Engineers

Science deals with matter. It is based on starting from scratch with what a human can observe, test, and rationalize. Ancient sages have worked hard to be seen as the only reliable providers of knowledge to the world. In 1875, the VymaanikaShaastra, a 4th Century BC text written by Sage Bharadwaj was discovered in a temple in India. It contains 3000 shlokas in 8 chapters which was physically delivered by the ancient Hindu Sage Bharadwaj. The book greatly deals with the operation of ancient vimanas and included information on steering, precautions for long flights, protection of the airships from storms and lightning and how to switch the drive of solar energy or some other form of energy. One of the chapter will reveal the secrets of constructing aeroplanes that cannot be broken or cut, that is indestructible, that is fire resistant. It also deals with the secret of making planes motionless and invisible. It also describes how to defeat the enemy planes etc. as per the Sage Bharadwaj the vimanas were classifies as per the Yugas. During the period of Krita Yuga, Dharma was establishes firmly. The pushpak Vimana which was used by Ravan was an Aerial vehicle. He used this vehicle to kidnap Sita from jungle and took him to his Kingdom Srilanka. Ramayana was during the Treta Yug in which the Vimanas were highly discovered. During this period "Laghima" gave them the power to lighten their vehicle do they can travel freely in the air.

COMPUTER, INFORMATION SCIENCE& ENGINEERING

The Indians (**Aryabhata**, 476 BC - 550 BC) contributed **Zero (0)** to the number system**.** So that numeric system and computing world found an ease in solving numerical problems using computer programs.

Acharya **Pingala** was an ancient Indian mathematician who lived around 300 BCE. He wrote the Chandaḥśāstra, where he analysed**Sanskrit poetry mathematically**. It also contained the first known explanations of **digit zero**, **binary numbers, Fibonacci numbers and Pascal's triangle**.

Baudhayana (8th century BCE) composed the BaudhayanaSulba Sutra, which contains examples of Pythagorean triples, such as: (3,4,5), (5,12,13), (8,15,17), (7,24,25) and (12,35,37) as well as a statement of the Pythagorean theorem for the sides of a square: "The rope which is stretched across the diagonal of a square produces an area double the size of the original square."

In Indian astronomy, the study of **trigonometric functions** flourished in the Gupta period, especially due to **Aryabhata (sixth century CE),** who discovered the **sine function**.

Quadratic equation of the form $ax^2 + bx + c = 0, a \neq 0$ and is given by $x = (-b \pm \sqrt{(b^2 - 4ac)}) / 2a$. was discovered by **Sridharacharya** in the 11th century.

The largest numbers the Greeks and Romans used were 106. In 5000 BC **Indians used numbers as big as**10^{53} (10 to the power 53) with specific names. The largest used number today is **Tera**10^{12}.

Kaṭapayadi numerical notation is an ancient Indian system to depict letters to numbers for easy remembrance of numbers as **words or verses**.

For example: क(Ka)=1 ख(Ka)=2 ग(Ga)=3 घ(Ga)=4 ज़(Gnya)=5 च(Cha)=6 छ(Cha)=7 ज(Ja)=8 झ(Ja)=9 अ(Nya)=0. The modern **Hasing technique in computing system** which is resembling was then being used in the **Indian Katapayadi system**. For example, the hashing number based on Katapayadi system would be as follows for '**Gurudev'**

Gu=Ga(is the consonant)=3, Ru=Ra(is the consonant)=2, De=Da(is the consonant)=8 Va=Va(is the consonant)=4, So Gurudeva = 4823.

In the recent decades, following are the few of the major contributors to the computing world:

1. In 1996 the USB port invented by the **Ajay Bhatt,** an Indian at Intel Oregon which involved low level **programs delt with embedded C Language** to perform flexible IO transfer and opened up an area to use plug-and-play devices efficiently.
2. The Pentium chip invented by **Vinod Dham,** that **made C compiler to speed up the program execution** and do well with **GUI applications (both System and User Level) that are written in C language.**
3. **Amit Singhal** is an Indian who rewrote (search engine in 2001) the **google algorithm** (C language coding embedded with Assembly Language service routines in Windows and Unix/Linux). Then on the Google processes over 40,000 search queries every second on average which translates to over **3.5 billion searches per day** and **1.2 trillion searches per year** worldwide.

Few of the contribution as Author of CP and Educators of C language:

1. **Yashavant Kanetkar** is an Indian computer science author, known for his varieties of C Programming books.
2. **E. Balagurusamy : An Computer scientist** known for **Programming in ANSI C.**

ELECTRONICS AND COMMUNICATION ENGINEERING

The idea of a holistic approach to engineering design and education has been envisioned to meet the perceived and emerging needs for innovation in the 21st century. Many engineering educators,

practicing engineers and engineering students have already recognized the gaps and areas of potential improvements in the knowledge acquisition process implemented in current engineering degree programs when compared to current societal and technological issues and developments.
Society and humanity have progressed drastically over the past few generations. Engineers as a network of professional problem solvers have been heavily involved in these global communities and the engineering profession is evolving from one that focuses on targeted, isolated issues, to one that embraces challenges that incorporate physical, economic, environmental, and humanitarian aspects.
Currently, engineering students are required to take classes on ethics, liberal studies and technology and society courses, however engineering students are not prefaced with the importance of rounding out their education with these topics, and while social issues are discussed, they are not related to engineering specifically. That being said, explicitly linking the technical aspects of engineering to society is paramount in training effective problem solvers for the 21st century. With some exposure to multi-disciplinary, inter-disciplinary and trans-disciplinary approaches to engineering and design, students will be better prepared for their future careers in industry or research fields.
The functional requirements for the perceived solution were determined by the expected outcomes and what students should take away after experiencing the new educational product. Some of them are:
• students will be inspired and driven to seek opportunities in engineering for environmental, social, medical, and human development/poverty issues.
• students will be able to identify the issues that are emerging from new technology, how to mitigate the negative aspects and reduce the amount of impact, while leveraging the positive outcomes.
• students will have respect and knowledge of the importance of ethics and policy matters in the field of engineering and be able to determine between unethical and an ethical situation in a proactive manner.
The courses should overcome the challenges of the current engineering educational system. Approaching the degree from a holistic perspective. The integrated system that fosters collaboration among faculty and students. A new organizational and pedagogical model, which emphasizes knowledge integration and interweaves thematic content threads throughout the curriculum should be proposed.

- Foundations thread (math and science) Key mathematical concepts lay the foundation for understanding the anchoring concepts in courses throughout the ECE curriculum. The foundations thread unpacks mathematics and physics concepts to help students learn fundamentals in ECE topics like circuits, signals and systems, and electromagnetics. The foundations thread champion spearheads the collaboration between the math and ECE departments to introduce and promote the value and utility of mathematics in ECE courses, as well as the importance of mathematical thinking.
- Creativity thread (research, design, and optimization tools) The creativity thread is intended to integrate research and design throughout the undergraduate experience. By showing the impact of research, students will see the practical applications and potential breakthroughs of fundamental ECE concepts. Likewise, exposing students to design at every level of the undergraduate experience allows them to experience the excitement of engineering by applying their foundational knowledge to a tangible product.
- Professional formation thread (communications, cultural adaptability, ethics, leadership, and teamwork) Partnering with faculty and industry leaders to ensure students develop professional skills meaningfully and effectively to enhance student-industry interactions.

ELECTRICAL AND ELECTRONICS ENGINEERING

Agastya Samshita available at Prince's Library of Ujjain in India, dates back to the first millennium BC, contains a detailed description construction of an electric battery/cell along with way to utilize the battery to 'split' water into its constituent gasses. The method of generating electricity using modern battery cell resembles Agastya's method. The materials used by Sage Agastya for generating electricity were an earthen pot, copper plate, copper sulphate, wet saw dust, zinc amalgam. As quoted inAgastya Samhita the open circuit voltage and short circuit current of the prepared cell are 1.138 volts and 23 mA respectively. He articulates 100 earthen pots on water, has the power to change the form of water to oxygen and hydrogen. If hydrogen is contained in an air tight cloth, it can be used in aerodynamics, i.e. it will fly in air. In an iron vessel and in a strong acidic medium, gold or silver nitrate covers copper with a layer of gold or silver. The copper that is covered by gold is called Shatakumbha or artificial gold.

Rao Saheb Krishnaji Vajhe, an engineer from Pune while reading books related to science found the pages of Agastya Samhita with Damodar Tryambak Joshi of Ujjain. Dr. M. C. Sahastrabuddhe, the Head of the Sanskrit Department in Nagpur, when reading Agastya Samhita found the similarity of it with of Daniel Cell. He requested P.P. Hole, the Professor of Engineering at Nagpur to investigate on the same.

On the basis of the descriptions in Agastya Samhita Mr. Hole and his friend started preparing the apparatus for the experiment. While preparing the set up they could not understand the meaning of shikhigreeva and while checking the Sanskrit dictionary, they understood that it meant the neck of a peacock. They went to Maharaja Park and asked the chief when a peacock would die. The chief was very angry and asked them to give in an application. After few days during a conversation with an Ayurveda expert he confirmed that shikhigreeva is copper sulphate, which solved their problem. Thus, a cell was formed and it had an open circuit voltage of 1.38 volts and short circuit current of 23 milli amperes. The results of the experimentation were communicated to Dr. M.C. Sahastryabuddhe. It was exhibited fourth general meeting at the Swadeshi Vigyan Sanshodhan Sanstha, Nagpur on August 7, 1990 to the scholars. It was concluded that the description was of an electric cell

On the basis on Agastya Samhita and other scriptures, Rao Saheb Vajhe, who spent his life in rummaging the Indian scientific scriptures, gave different names to electricity. The six ancient terminologies for electricity are:

- Tadit—produced by friction from leather or silk,
- Saudamini—produced by friction from gems or glass,
- Vidyut— from clouds or steam,
- Shatakoti alias Shatakumbhi—produced from a battery of hundreds of cells,
- Hradini—obtained from storage cells,
- Ashani—the one emanating from a magnetic rod.

MECHANICAL ENGINEERING

Mechanical engineering is one of the oldest disciplines of engineering, which requires the knowledge of mathematics, materials, physics and other engineering technologies. It is concerned with materials, processes and machines and requires the concepts of forces, moments, energy, entropy, work etc. The developments that are visible in all spheres of life have connection to mechanical engineering.

Engineering has made a significant contribution in the development of civilizations and contribution of mechanical engineering in areas like construction of large scale structures including for irrigation, architecture, military etc. is significant. Difficult problems of the society have been solved using simple concepts of mechanical engineering, say for eg. use of lever principle to move heavy objects. In fact, mechanical engineering made a significant contribution to the first cycle of industrial revolution, i.e., industrial revolution 1.0 during the 18^{th} century. James Watt is often called the 'Father of Mechanical Engineering', as his invention of steam engine led to significant developments during the industrial revolution and beyond. The earliest computers were mechanical devices with electronics.

Significant contributions have been made during the Vedic ages and the first ever mechanical device that was invented was wheel and potter. SurmyamSuiramiva identified metals like Fe, Cu, Ag, Au etc., during the Vedic times. People knew about materials and material processing during those times and identified terminologies for the same in Sanskrit and produced gold and silver coins.

Seers like Tritala, Jalayan, Karaa, Vayurathaa and Vidyutrathaa discovered about aerodynamics during Rig Veda period, much before Wright Brothers discovered about aero planes. Computational Fluid Dynamics (CFD) analysis, which we are talking about today for different analysis, was there in the Vimana Shastra slokas.

Mechanical and manufacturing technology of ancient India ensured processing of natural products and their transformation into goods of trade, commerce and export.

Many scientists have made significant contributions to this domain. Leonardo da Vinci (16^{th} century) studied and designed many mechanical systems that were related to transportation and warfare. In 17^{th} century, Isaac Newton contributed the Laws of Motion used in several applications. Rudolf Diesel (18^{th} century) was a German inventor, who created the first successful diesel engine and today diesel engines play a very important role in the transport and power sector in the world. Carl Frederich Benz (18^{th} century) was a German automotive engineer, who developed the first practical automobile.

Mechanical engineering has evolved over the years and today the advent of computer and IT tools has facilitated better mechanical engineering in terms of design, analysis, and manufacturing. A mechanical engineer needs to work in multiple domains and needs to possess multiple skills like design, redesign, analyze, test, manufacture etc. It has been one of the founding disciplines of engineering and has contributed and will keep contributing to the growth and developments in this physical world.

CIVIL ENGINEERING

Indian civilization was the oldest civilization in the world and has a strong tradition of science and technology. It was the land of sages, seers, scholars, and scientists. Hinduism is a knowledge-based civilization, the Vedic texts should not be ignored dismissed as mythologies or as the work of imagination or just containing some moral stories. The Veda means knowledge and they contain relevant knowledge otherwise these texts would not have survived the millennia years of the historic storm. Let us know some of the great work done in ancient times.

Ancient India not only practised scientific methods of design and construction but also documented them for future generations. Here are some tips given by ancient sages on selection of site and construction

(1) Vishwakarma Vastu Shastra- Vishwakarma explains the first point of construction in the ancient book

VastuShastra – 'पूर्वभूमिंपरिक्ष्येतपश्चात्वास्तुप्रकल्पयेत्', This means that before construction one should test the land. Vishwakarma further says that construction should not be done on the land which is very mountainous or on land with large cracks.

Vastu shastra literally "science of architecture" are texts on the traditional Indian system of architecture. These texts describe principles of design, layout, measurements, ground preparation, space arrangement, and spatial geometry. The designs aim to integrate architecture with nature, the relative functions of various parts of the structure, and ancient beliefs utilising geometric patterns (yantra), symmetry, and directional alignments.

(2) Kashyap Shilpa (Craft) – In this ancient book, Kashyap Rishi has said that the foundation should be dug until water is seen because this way you would ensure that you have reached the rock level and the foundation would be strong.

(3) Bhrigu Samhita – In this scripture saint Bhrigu says that before buying land, one should test it for form, colour, juice, smell and touch. Rishi Bhrigu also explains its methods in his book.

Ancient cities of India found on the basis of archaeological discoveries:

- Rama was the world's first king to build a bridge across the sea. But he did not do it on his own. He sought the help of a great engineer called Nala according to Valmiki Ramayana. Any wise man will seek local knowledge when he ventures into new places. Nala knew the shallow areas across the sea in and around Tamilnadu. American space agency NASA also confirmed that there was a bridge through the satellite pictures. Any wise engineer will use such naturally elevated areas instead of deep waters to build a bridge.
- Bageeratha changed the course of the mighty river Ganges. The vast forest areas of modern Bihar, Uttar Pradesh, and West Bengal were made into fertile lands by his marvelous engineering feat. In those days very few people lived in those jungles. Puranas say that Bageeratha did penance for several thousand years to do this that too 'standing in one foot'. This is a phrase Indians use very often. Even the great Tamil poet Tiruvalluvar uses the simile of Stork that stands in one foot to catch a fish. This is the hidden language to say that he tried for a very long time with focused attention.
- Vedic Saint Agasthya discovered the land route to South India via Vindhyas. The Puranas say that he "subdued the arrogance of the hills", this is hidden language. Till Agastya's this great discovery kings and travellers used only sea routes. Since they knew the secret of monsoon winds they can travel to West Bengal or Maharashtra from Sri Lanka in a few months' time.
- Uparichara Vasu, an ancient king made mountain passes for the benefit of land travellers. He was a Vasu king ruling over the Chedi kingdom. Mahabharata says that he kicked the Kolahal Mountain which was blocking the flow of the Shaktimati River. This is a hidden language to say that he diverted the river for irrigation by cutting the hills.
- In short Bageerathan, Agastya, and Uparichara Vasu are the earliest engineers who built dams across the rivers. But unlike modern engineers, they did not use cement or mortar but they used the hills themselves. To avoid the force they made checks and balances. They use a hidden language saying that Shiva bore the force when Ganga came down from heaven.
- Parasuraman retrieved a lot of lands and gave it to Indians. A Pandya king called Nilam Tharu VilNediyon built sea walls to prevent the sea from invading the land.

- Balraman always travelled with an axe to clear the forests and make them cultivable. He was a great agriculturist. When Krishna spent most of his time in politics, his brother Balarama did constructive work.
- The Mohanjodaro, created 3000 years ago, is considered as a wonderful piece of civil engineering. Found in archaeological excavations even the ruins prove that this town was well settled and its buildings and roads – all were made using symmetry and geometrical measurements. The roads found in this city were straight and were made from east to west and north to south and surprisingly they were at an angle of 90 degrees from each other. Buildings were also constructed in proportion. The intersection of the corners, the heights of the walls was equal. The city had public buildings, gardens, a restaurant, a large public bath as well as residential buildings. There was a provision for bathroom, living room etc in the residential buildings. The public buildings were 11.82m long, 7.01m wide and 2.44m high, and there were two streams of water. The building material and bricks of the walls were coated with a substance on which there was no effect of water. Archaeological research shows that people living here were well-versed in the construction techniques.
- Indus Valley Cities such as Harappa, Mohanjadaro, Lothal, Dholavira, Kalibangan need no new interpretations. The well-laid cities with uniform brick structures, Great Bath, most hygienic drainage systems, grain storage barns, and wells are all already well known to the world.
- Dwarka, also known as Lord Krishna's city, also narrates a similar story. Dr S R Rao discovered Dwarka in the archaeological excavation and found that the ancient city (Dwarka Nagar) was well built and settled. There was a wall around the city. The stones used for the construction of buildings did not erode despite the fact that the city was very close to the sea. Two-storey buildings, roads and water system are also found in the city. Copper, bronze and some alloys with zinc mixed up to 34 percent have also been found during the excavation. The size of columns, windows, etc reveals that they were designed with a complete mathematical precision.
- South Indian Tamil saint Appar always travelled with a pickaxe to clear the bushes from the temple towers. He simply followed Balarama. Great Chola king Karikalan built a dam across river Cauvery in Kal Anai. The Grand Anicut was an engineering wonder of ancient Tamils. It was built around the 1st century AD. Big temples of India, the number of which runs into thousands, stand as monumental proof for the engineering skills of Indians. Mamallapuram and other Pallavacave temples are well-known milestones in Indian architecture.
- The Group of Monuments at Hampi are also recognized as a UNESCO World Heritage Site. The Vittala temple—the stone chariot – is the most iconic symbol of Hampi. The Virupaksha Temple at Hampi was built in the seventh century by the Chalukya rulers.

Virupaksha and Vithala Temple in Hampi

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Scheme & Syllabus for
B. Tech. (Computer and Communication Engineering)

HIGHER SEMESTER COURSES

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING
2024-25

DEPARTMENT: COMPUTER AND COMMUNICATION ENGINEERING

VISION:

To be a center of excellence in Computer Networks and Network Security education and research, to produce comprehensively trained, technically skilled, ethically strong, innovative engineers to excel globally, take future challenges and contribute for social welfare.

MISSION:

1. To provide excellent academic environment to students for continuous improvement in Computer Science and Computer Network specialization and by imparting education with innovation, skills, and positive attitude to make them competent engineers and leaders to solve the real-world problems to inculcate values of professional ethics, leadership qualities and lifelong learning.
2. To strengthen the industry partnership for collaborative work and prepare graduates in cutting edge Computer Network technologies in par with industrial standards by undertaking collaborative projects which offer opportunities for long term interaction between academia and industry.
3. To inculcate research, ethical values, professionalism, lifelong learning to make them globally competent and socially committed.
4. To provide resources that contributes to congenial learning environment and encourages students to pursue higher education and take competitive exams.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. Tech. in **Computer and Communication Engineering** will:

1. Demonstrate technical skills, competency in computer science, computer and communication networks and exhibit team management capability with proper communication and responsibility in their career.
2. Emerge as engineering professionals, innovators or entrepreneurs engaged in technology deployment and support the growth of economy of a country by with a lifelong learning attitude.
3. Use basic science and engineering ideas to carry out research, pursue higher studies in the multidisciplinary areas of computer and communication engineering to address the basic needs of the society.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

1. Gain both theoretical and practical knowledge to identify, formulate & solve challenges in Computer Network Engineering problems.

2. Apply computational knowledge, tools, techniques, and project development skills to provide innovative solutions for social wellbeing.

B.Tech. (CC): Scheme of Teaching and Examinations 2024-28

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

2nd Year Scheme

III SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Dept.	Teaching Hours/Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	PBL (J)	SL#	Examination: Duration in hr	CIE Marks	SEE Marks	Total Marks	Credits
1.	BSC	MA2001-1	Statistics and Probability Theory	MA	3	0	0	0	2	3	50	50	100	3
2.	IPCC	CS2001-1	Data Structures	CC	3	0	2	0	2	3	50	50	100	4
3.	IPCC	CS2002-1	Object Oriented Programming	CC	3	0	2	0	2	3	50	50	100	4
4.	PCC	CC2103-1	Fundamentals of Computer Architecture and Organization	CC	3	0	0	0	2	3	50	50	100	3
5.	PCC	CC1104-2	Data Communications	CC	3	0	0	0	2	3	50	50	100	3
6.	PCC	CC1601-1	Unix and Shell Programming Lab	CC	0	0	2	0	1	3	50	50	100	1
7.	HSMC	HU2002-1	Developing Professional Skills	HU	1	0	0	0	-	3	50	50	100	1
8.	MNC	HU1003-1	Kannada (Balake / Samskrithika)	Any Dept.	1	0	0	0	-	-	50	0	50	0
9.	HEC	HU1005-1	Essence of Indian Culture	Any Dept.	1	0	0	0	-	-	50	0	50	1
				TOTAL	**18**	**0**	**6**	**0**	**11**	**21**	**450**	**350**	**800**	**20**

		L	T	P	J	SL
Academic Activities beyond class hours		-	-	-	-	**3**
Learning hours per week		**18**	-	**6**	-	**14**
Total notional learning hours (L+T+P+J+SL)	Per Week	**38**				
	Per Semester	**38X16 = 608**				

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs														
10	MNC	MA1012-1	Bridge Course – Calculus and Differential Equations	MA	3	0	0	0	3	100	0	100	0	

IV SEMESTER

Sl. No	Course and Course code	Course Title	Teaching Dept.	Teaching Hours/Week: Theory Lecture	Tutorial	Practical/ Drawing	PBL	SL#	Examination: Duration in hr	CIE Marks	SEE Marks	Total Marks	Credits

					L	T	P	J						
1.	BSC	MA2005-1	Linear Algebra and Its Applications	MA	3	0	0	0	2	3	50	50	100	3
2.	IPCC	CS3004-1	Design and Analysis of Algorithms	CC	3	0	2	0	2	3	50	50	100	4
3.	IPCC	CC2001-1	Computer Networks	CC	3	0	2	0	1	3	50	50	100	4
4.	PCC	CS2102-1	Database Management Systems	CC	3	0	0	√	1	3	50	50	100	3
5.	PCC	CC2102-1	Foundations of Operating Systems	CC	3	0	0	0	1	3	50	50	100	3
6.	PCC	CS2601-1	Database Management Systems Lab	CC	0	0	2	0	1	3	50	50	100	1
7.	HSMC	HU2001-1	Enhancing Self Competence	HU	2	0	0	0	-	3	50	50	100	2
8.	AEC	ME1654-1	Innovation and Design Thinking	ME	1	0	0	0	-	1	50	50	100	1
9.	VEC	CC155x-1	Department Specific Vocational Education Course	CC	0	0	2	0	1	3	50	50	100	1
10.	UCC	UC1001-1	Internship – I (Activity based Internship)		Mandatory Intra Institutional Activity based Internship of 2 weeks duration (80 - 90 h) to be completed during the vacations of I & II Semesters. Lateral entry students have to complete the Internship - I during the vacation of III semester						100	-	100	2
TOTAL					**18**	**0**	**8**	**0**	**9**	**25**	**550**	**450**	**1000**	**24**

Academic Activities beyond class hours		-	-	-	-	**6**
# Learning hours completed in previous academic year for carrying out Internship - I		-	-	-	-	**4**
Learning hours per week		**18**	-	**8**	-	**19**
Total notional learning hours (L+T+P+J+SL)	Per Week	**45**				
	Per Semester	**45X16 = 720**				

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
11	MNC	MA1014-1	Bridge Course – Discrete Mathematics & Numerical Methods	MA	3	0	0	0	3	100	0	100	0

B.Tech. (CC): Scheme of Teaching and Examinations 2024-28

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

3rd Year Scheme

V SEMESTER							
Sl. No.	**Course and Course code**	**Course Title**	**ac hin g**	**Teaching Hours/Week**	**SL #**	**Examination**	**Cr edi**

					Theory Lecture L	Tutorial T	Practical/ Drawing P	PBL J		Duration in hr	CIE Marks	SEE Marks	Total Marks	
1.	IPCC	CC3003-1	Wireless Networks and Mobile Computing	CC	3	0	2	0	2	3	50	50	100	4
2.	IPCC	CC2002-1	Internet of Things	CC	3	0	2	0	1	3	50	50	100	4
3.	PCC	CC3101-1	Cryptography & Network Security	CC	3	0	0	0	1	3	50	50	100	3
4.	PCC	CC3601-1	Android Application Development Lab	CC	0	0	2	0	1	3	50	50	100	1
5.	PEC	CCx2xx-x	Professional Elective – I (Group-1)	CC	3	0	0	0	1	3	50	50	100	3
6.	HSMC	HU1006-1	Introduction to IPR	Any Dept.	1	0	0	0	-	1	50	50	100	1
7.	AEC	CCx6xx-1	Program Specific Ability Enhancement Course	CC	1	0	2	0	1	3	50	50	100	2
		HU1010-1	Research Methodology	Any Dept.	2	0	0	0						
8.	HSMC	HU1011-1	Universal Human Values	Any Dept.	3	0	0	0	-	3	50	50	100	3
9.	AEC	HU1007-1	Social Connect & Responsibility	Any Dept.	1	0	0	0	-	1	50	50	100	1
10.	AEC	UM1003-1	Employability Skill Development	Any Dept.	1	0	0	0	-	-	50	0	50	1
TOTAL					**20/19**	**0**	**8/6**	**0**	**7**	**21**	**500**	**450**	**950**	**23**

Additional Academic activities beyond class hours	**-**	**-**	**-**	**-**	**8**
Learning hours per week	**20**	**-**	**8**	**-**	**15**

Total notional learning hours (L+T+P+J+SL)	Per Week	**43**
	Per Semester	**43x16=688**

VI SEMESTER														
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**SL#**	**Examination**				**Credits**
					Theory Lecture L	**Tutorial T**	**Practical/ Drawing P**	**PBL J**		**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	IPCC	CC3002-1	Next Generation Telecom	CC	3	0	2	0	2	3	50	50	100	4

			Networks											
2	PCC	CC2104-1	Principles and Practices of Software Engineering	CC	3	0	0	0	2	3	50	50	100	3
3	PCC	CC3602-1	Security Lab	CC	0	0	2	0	2	3	50	50	100	1
4	PEC	CCx2xx-x	Professional Elective – II(Group-1)	CC	3	0	0	0	2	3	50	50	100	3
5	PEC	CCx3xx-x	Professional Elective – III(Group-2)	CC	3	0	0	0	2	3	50	50	100	3
6	OEC	XXx5xx-1	Open Elective –I	Any Dept.	3	0	0	0	1	3	50	50	100	3
7	HSMC	MG1003-1	Management & Entrepreneurship	Any Dept.	3	0	0	0	1	3	50	50	100	3
8	AEC	HU1008-1	Life Skills for Engineers	Any Dept.	1	0	0	0	-	1	50	50	100	1
TOTAL					**19**	**0**	**4**	**0**	**12**	**22**	**400**	**400**	**800**	**21**

Additional Academic activities beyond class hours		-	-	-	-	5
Learning hours per week		**19**	**-**	**4**	**-**	**17**
Total notional learning hours (L+T+P+J+SL)	Per Week	**40**				
	Per Semester	**40x16=640**				

B.Tech. (CC): Scheme of Teaching and Examinations 2024-28

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

4th Year Scheme

	VII SEMESTER						
Sl. No.	**Course and Course code**	**Course Title**	**ac hin g**	**Teaching Hours/Week**	**SL #**	**Examination**	**Cr edi**

					Theory Lecture	Tutorial	Practical/ Drawing	PBL		Duration in hr	CIE Marks	SEE Marks	Total Marks	
					L	T	P	J						
1	IPCC	CC3001-1	Cyber Security and Forensics	CC	3	0	2	0	2	3	50	50	100	4
2	PCC	CC3603-1	Advanced to Network Simulation Lab	CC	0	0	2	0	2	3	50	50	100	1
3	PEC	CCx2xx-x	Professional Elective – IV (Group 1)	CC	3	0	0	0	2	3	50	50	100	3
4	PEC	CCx3xx-x	Professional Elective – V (Group 2)	CC	3	0	0	0	1	3	50	50	100	3
5	OEC	XXx5xx-1	Open Elective –II	Any Dept.	3	0	0	0	1	3	50	50	100	3
6	HSMC	MG1002-1	Financial Management	Any Dept.	3	0	0	0	1	3	50	50	100	3
7	HEC	HU1009-1	Indian Knowledge Systems	Any Dept.	1	0	0	0	-	-	50	0	50	1
8	UCC	UC3001-1	Major Project Phase I	CC	-	-	4	-	2	-	100	0	100	2
				TOTAL	**16**	**0**	**8**	**-**	**11**	**18**	**450**	**300**	**750**	**20**

Additional Academic activities beyond class hours		**-**	**-**	**-**	**-**	**3**
Learning hours per week		**16**	**-**	**8**	**-**	**14**
Total notional learning hours (L+T+P+J+SL)	Per Week	**38**				
	Per Semester	**38x16=608**				

	VIII SEMESTER													
Sl. No.	**Course and Course code**		**Course Title**	**Teaching Dept.**	**Teaching Hours/Week**				**SL#**	**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**PBL**		**Duration in hr**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**J**						
1.	UCC	UC2001-1	Internship- II	CC	Mandatory Research					3	50	50	100	8

			(Societal internship and Research/Industry Internship)		Internship / Industry internship for a total of 8 weeks (320 – 360 h) to be completed in one/two stretches during the vacation periods between IV to VII semesters (A minimum of total 320 hours)									
2.	UCC	UC3002-1	Major Project Phase II	CC	Student should carry out project in research institute/industry/intra institute Canter of Excellences. Two contact hours /week for interaction between the project guide and students. (24 hours per week) (360 hours per semester)					3	100	100	200	8
TOTAL					**-**	**-**	**-**	**-**	**-**	**6**	**150**	**150**	**300**	**16**
Additional Academic activities beyond class hours					**-**	**-**	**-**	**-**	**-**					
Learning hours per week					**-**	**-**	**-**	**-**	**-**					
Total notional learning hours (L+T+P+J+SL)				Per Week	**-**									
				Per Semester	**680**									

B.Tech. (CC): Scheme of Teaching and Examinations 2023-27

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Department specific Vocational Education Course [VEC]	
Course Code	**Course Title**
CC1551-1	Programming in C++ with Examples
CC1552-1	Unix Shell and System Programming

Value Added Courses [VAC]	
Course Code	**Course Title**
noc25-cs59	Programming, Data Structures And Algorithms Using Python
-	Technology Business – Interactions

B.Tech. (CC): Scheme of Teaching and Examinations 2024-28

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

List of Professional Elective Courses [PEC]			
Group-1		**Group-2**	
Code	**Elective Course Title**	**Code**	**Elective Course Title**
Computational Fundamentals Electives			
CC2201-1	Artificial Intelligence and Machine Learning	CC3301-1	Virtual Reality
CC3201-1	Big Data Analytics	CC3302-1	Cloud Computing
CC3202-1	Advanced Java	CC3303-1	Semantic Web
CC3203-1	Mathematical Foundations of Computer Networks	CC3304-1	Social and Web Analytics
		CC3305-1	Web Engineering
Computer Networking Technologies Electives			
CC3211-1	Adhoc Wireless Networks	CC3311-1	Multimedia Communication
CC3212-1	Network Design and Analysis	CC3312-1	Network Management
CC3213-1	Network Engineering	CC3313-1	Software Defined Networking
CC3214-1	Wireless Sensor Networks	CC3314-1	Optical Communication and Networking
Cyber Security Electives			
CC4221-1	Introduction to Blockchain Technology	CC3321-1	Digital Watermarking and Steganography
CC3221-1	Introduction to Cyber Physical Systems	CC3322-1	Ethical Hacking
Applied Computational Electives			
CC3231-1	Computer vision	CC3331-1	Digital Image Processing
CC3232-1	Embedded System design	CC3332-1	Graphics and Animation
CC3233-1	Human Computer Interaction	CC3333-1	Pattern Recognition
CC3234-1	Natural Computing	CC3334-1	Soft computing Paradigm
CC3235-1	Neural Networks and fuzzy logic		

List of NPTEL Courses offered as Professional Elective Courses	
NPTEL Course Code	**NPTEL Course Title**
noc25-cs02	Advanced Computer Networks
noc25-cs11	Cloud Computing
noc25-cs09	Business Intelligence and Analytics
noc25-cs22	Deep Learning for Natural Language Processing
noc25-cs61	Quantum Algorithms and Cryptography

Courses from Basic Science

STATISTICS & PROBABILITY THEORY

Course Code:	**MA2001-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**MA1002-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Understand the basic principles of probability, Bayes theorem, understand the definitions of discrete, continuous, and joint random variables, compute the mean, variance, and covariance of random variables.
2.	Define the binomial, uniform, Poisson, exponential and normal random variables use these principles in problem solving situations.
3.	Understand the concepts of statistical population and sample, variables, and attributes. Learn about moments and their use in studying various characteristics of data and various distributions.

UNIT-I

PROBABILITY THEORY	**16 Hours**

Finite sample space, probability, conditional probability and independence, Bayes' theorem. One dimensional random variable: discrete and continuous random variable, probability functions, cumulative distribution function, expectation and variance.
Two-dimensional random variable: joint pdf, marginal pdf's, covariance (CO1)
Distributions: Binomial, Poisson, Uniform, Normal and exponential distributions.
Moment generating function- properties and simple problems. (CO2)

UNIT-II

SAMPLING DISTRIBUTION AND ESTIMATION	**14 Hours**

Random Sample, Sample mean, sample variance, sampling distribution of mean, Central limit theorem, sampling distributions of proportions and sums. Student's t-distribution, Chi-square distribution. Sample distribution of variance.
Estimation: Point estimation, interval estimation, confidence intervals for means and variance. (CO3)

CURVE FITTING AND REGRESSION

Least square principle, fitting of straight lines, polynomials, and exponential curves.
Correlation, Rank correlation, Coefficient of correlation, Linear regression. (CO4)

UNIT-III

STOCHASTIC PROCESS	**10 Hours**

Stochastic processes, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, transition probabilities, Birth-death process, Queuing theory – M/M/1 Model, simple problems. (CO5)

Course Outcomes: At the end of the course student will be able to

1.	Apply the concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.
2.	Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the areas of their application.
3	Explain the concept of correlation and the difference between positive and negative correlation.

.	Compute the correlation coefficient, r, Explain and apply the least square errors method numerically and algebraically to find the curve of best fit.
4.	Able to apply the central limit theorem to sampling distribution. Translate real-world problems into probability models.
5.	Identify and apply the most appropriate stochastic process technique for a given applied problem. Calculate probabilities of absorption and expected hitting times for discrete time Markov chains with absorbing states.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
MA2001-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2001-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Paul L Meyer, "Introductory Probability and Statistical Applications", Addison-Wesley Publishing Company, 2nd Edition (Reprint), 1970.
2.	Hogg and Craig, "Introduction to mathematical Statistics", Pearson Education, New Delhi, 6th Edition.

REFERENCE BOOKS:

1.	Schaum Outlines, "Probability and Statistics", Mc Graw Hill, 3rd edition, 2010.
2.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi,2010.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/110107114
2.	https://nptel.ac.in/courses/111105090
3.	https://nptel.ac.in/courses/111102098

LINEAR ALGEBRA AND ITS APPLICATIONS

Course Code:	**MA2005-1**	**Course Type:**	**BSC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50+50**
Prerequisites	**MA1002-1, MA1007-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Learn to apply elementary row operations to solve linear systems of equations and find the eigenvalues and eigenvectors of a matrix.
2.	Find the eigenvalues and eigenvectors of a square matrix using the characteristic polynomial and will know how to diagonalize a matrix, when this is possible
3.	Understand real vector spaces and subspaces, linear independence and dependence, and find basis and dimension of a vector space, row space, column space and null space of a matrix.
4.	Define a linear transformation and find the matrix associated with it; determine the kernel and range of a transformation; find inner product of vectors, orthogonal and an orthonormal basis.
5.	Learn basic concepts of real quadratic forms, decomposition of matrices and solve problems on the same.

UNIT-I	
Matrices	**15 Hours**
Elementary transformation of a matrix, Echelon form and rank of a matrix. Consistency and solution of system of linear equations - Gauss elimination method, LU Decomposition method and approximate solution by Gauss Seidel method. Trace, relation between trace and Eigen values of a matrix, Eigen values and Eigen vectors of symmetric matrices, Rayleigh's power method to find the largest eigen value and eigen vector of square matrices. Diagonalization.	
UNIT-II	
Vector Space	**08 Hours**
Vector spaces, subspaces, linearly dependent and independent vectors, basis and dimension, coordinates, row space, column space and null space.	
Linear Transformations	**07 Hours**
Linear transformations, algebra of linear transformations, representation of transformations by matrices, isomorphism, Range and Null space of a linear transformation. Rank – nullity theorem. Inner products, orthogonal sets of projections, Gram-Schmidt's orthogonalization process.	
UNIT-III	
Matrix Decompositions	**10 Hours**
Quadratic forms, QR-factorization, least-squares problems, singular value decomposition and principal component analysis.	

Course Outcomes: At the end of the course student will be able to

1.	Solve the system of linear equations for exact or approximate solutions.
2.	Compute and use eigenvectors and eigenvalues.
3.	Analyze finite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces.
4.	Relate matrices and linear transformations, apply the properties of inner product and determine orthogonality on vector spaces and orthogonal bases.
5.	Derive and utilize Quadratic forms, SVD and QR factorization of the matrix for efficiently solving problems in practice.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓

↓ **Course Outcomes**													**1**	**2**
MA2005-1.1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA2005-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Kenneth Hoffman And Ray Kunze, "Linear Algebra", Prentice-Hall, 2nd edition, 1971
2.	David C. Lay, "Linear Algebra and Its Applications", Pearson Education, Inc., 5th edition, 2016.
REFERENCE BOOKS:	
1.	Seymour Lipschutz And Marc Lars Lipson, "Schaum's outlines - Linear Algebra", McGraw-Hill, 4th Edition, 2002.
2.	Gilbert Strang, "Introduction to Linear Algebra", Wellesley-Cambridge Press, 5th Edition, 2016.
3.	Gerald Farin, Dianne Hansford, "Practical Linear Algebra, A Geometry Toolbox", Chapman and Hall, 4th edition, 2021.
4.	Sheldon Axler, "Linear Algebra Done Right", Springer Nature, 3rd Edition, 2015.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/111101115
2.	https://archive.nptel.ac.in/courses/111/106/111106135/
3.	https://nptel.ac.in/courses/110104024

Bridge Courses for Lateral Entry Students

CALCULUS & DIFFERENTIAL EQUATIONS (Common to AM\CC\CS\IS\DS\RI)			
Course Code:	MA1012-1	Course Type:	MNC
Teaching Hours/Week (L: T: P):	3:0:0	Credits:	00

Total Teaching Hours:	40+0+0	CIE + SEE Marks:	100+00

Teaching Department: Mathematics

Mandatory Non – credit course (MNC):
This course is prescribed to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, they shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.
MNC Courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree

Course Objectives:
This course will enable the students to master the basic tools of differential calculus, partial differentiation, Vector differentiation and Integration and become skilled for solving problems in science and engineering.

UNIT-I

DIFFERENTIAL CALCULUS	**07 Hours**
Polar curves, angle between the radius vector and the tangent, angle of intersection of two curves, derivatives of arcs and radius of curvature -cartesian, parametric and polar forms (No Derivation). Taylor's theorem for functions of single variable. Mean value theorems.	
PARTIAL DIFFERENTIATION	**08 Hours**
Partial derivatives of simple functions, Total differentiation - differentiation of composite and implicit functions. Taylor's theorem for functions of two variables, maxima and minima for functions of two variables.	

UNIT-II

VECTOR DIFFERENTIAL CALCULUS	**07 Hours**
Vector algebra(review), scalar and vector valued functions, gradient, directional derivative and hessian of multivariable function, Divergence and curl of a vector valued function.	
ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS	**08 Hours**
Ordinary differential equations(review), linear and nonlinear differential equations. Second and higher order linear differential equations with constant coefficients. Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions. Solution of P.D.E by the method of separation of variables.	

UNIT-III

MULTIPLE INTEGRALS	**10 Hours**
Double integrals and triple integrals, Evaluation by change of order of integration, change of variables and applications to area and volume.	

Course Outcomes: At the end of the course student will be able to

1.	Apply the concept of radius of curvature and mean value theorems.
2.	Learn the concept of partial differentiation of a function with two or more independent variables, apply them to solve engineering problems and examine the given function for its extrema.
3.	Solve the vector functions and their derivatives for engineering applications.

4.	Apply the concepts of ordinary and partial differential equations in engineering problems.
5.	Apply the notion of multiple integrals to find areas and volumes.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
MA1012-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1012-1.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1012-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
MA1012-1.4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1012-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.
3.	Murray R. Spiegal, "Vector Analysis", Schuam Publishing Co.

REFERENCE BOOKS:

1.	G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry", Pearson, 2002.
2.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
3.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi,2010.

DISCRETE MATHEMATICS & NUMERICAL METHODS

(Common to AM/CC/CS/IS/DS/RI)

Course Code:	**MA1014-1**	**Course Type:**	**MNC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**00**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**100+00**

Teaching Department: Mathematics

Mandatory Non – credit course (MNC):

This course is prescribed to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, they shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

MNC Courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree

Course Objectives:

This course will enable the students to master the basic tools of set theory and relations, propositional and predicative logics, numerical methods, Fourier series and transforms and become skilled for solving problems in science and engineering.

UNIT-I

Set Theory and Logic	07 Hours
Sets- operations on sets, product sets and partitions (review) Relations- representation of relations as matrices and digraphs, equivalence relations. Functions- permutations functions, functions for computer science. Fundamentals of logic- Propositional logic, logical operations(review), rules of inference Predicates calculus.	
Graph Theory	**08 Hours**
Graphs: Basic terminologies, some special simple graphs, bipartite graphs, adjacency matrices, incidence matrices, graph isomorphism, connectivity- vertex and edge connectivity, Euler and Hamiltonian graphs and their applications, planar graphs, graph coloring and their applications.	

UNIT-II

Numerical Methods	15 Hours
Roots of algebraic and transcendental equations- Newton Raphson method, Regula Falsi method. Numerical solution of ordinary differential equations- Taylor’s series method, Modified Euler’s method and Runge –Kutta method of fourth order. Numerical solution of partial differential equations- Classification of partial differential equations, examples, solution of Laplace and Poisson equations by standard five-point formulae, solution of heat and wave equations by explicit method.	

UNIT-III

Fourier Series and Transforms	10 Hours
Periodic functions, Euler’s formulae, Fourier series of odd and even functions, functions with arbitrary period, half range series. Fourier transform, inverse Fourier transform, Convolution theorem, Fourier sine and cosine transforms.	

Course Outcomes: At the end of the course student will be able to

1.	Represent a relation in terms of matrix and digraph, apply permutation functions for encoding and decoding simple text messages and establish by deduction the validity of an argument using inference rules. Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems
2.	Identify suitable data structure for representing a graph, apply the concept of connectivity in real life problems.
3.	Apply numerical methods to find solutions of algebraic equations and ordinary differential equations.
4.	Apply numerical methods to solve partial differential equations
5.	Apply the analytical technique to express periodic function as a Fourier sine and cosine series and apply the concepts of Fourier- transforms to solve engineering problems.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2

MA1014-1.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1014-1.2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1014-1.3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1014-1.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
MA1014-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2015.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition (Reprint), 2016.

REFERENCE BOOKS:

1.	T. Veerarajan, "Engineering Mathematics", McGraw-Hill, New Delhi, 2008.
2.	B. V. Ramana, "Higher Engineering Mathematics", Tata Mc Graw –Hill, New Delhi,2010.

Integrated Professional Core Courses

DATA STRUCTURES

Course Code:	**CS2001-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CS1001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Outline the concepts of data structures, types, operations, structures, pointers and implement pointers, structures and pointer to structures
2.	Implement linear data structures stacks, queues and usage of stacks in various applications.
3.	Implement the operations of singly linked lists and circular linked lists, doubly linked list and circular doubly lists.
4.	Identify and differentiate different types of binary trees and binary search trees data Structures and also implement them.
5.	Illustrate and classify threaded binary trees, expression trees, graphs and techniques of hashing.

UNIT-I	**15 Hours**
Introduction: Data Structure, Classification (Primitive and non-primitive), data structure operations, Arrays, Pointers and structures, Dynamic Memory Allocation Functions, Representation of polynomials and polynomial addition. **Linear Data Structures – Stacks**, Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks **Applications of Stack:** Conversion of Expressions, Evaluation of expressions, Recursion: Implementation, Simulating Recursion, examples on Recursion	
UNIT-II	**15 Hours**
Linear Data Structures – Queues: Introduction and Definition Representation of Queue: Array and Structure, representation of Queue, Various queue structures: ordinary queue, circular queue, priority queue **Linear Data Structures - Linked Lists:** Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List, Circular Linked List, Doubly Linked List: Representation and Operations, Circular doubly Link list: Representation and Operations. Linked List representation of stack, Linked List representation of queue.	
UNIT-III	**10 Hours**
Nonlinear Data Structures - Tree Data Structures: Basic Terminologies, Binary Trees: Properties, Representation of Binary Tree: Linear representation, Linked representation, Operations on Binary Tree: Insertion, traversals. Introduction to Binary Search Tree. Expression Tree: Constructing expression tree from postfix expression, traversals, Application of tree: Evaluation of expression, programming examples Threaded binary Tree: types, B-Trees, B+ Trees, AVL Trees: Definition, Constructing a general AVL tree. **Nonlinear Data Structures – Graphs:** Representation of graphs: Set Representation, Linked representation, Matrix representation. **Hashing**: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing	

Suggested List of Experiments	
1.	Pointer implementations using arrays and structures
2.	Stack static implementation.
3.	Queue static implementation.
4.	Application of stack data structure.
5.	Different types of queues.
6.	Tower of Hanoi problem using recursion.
7.	Singly Linked list implementation.
8.	Dynamic implementation of stack data structure.
9.	Dynamic implementation of queue data structure.

10.	Circular linked list implementation.
11.	Doubly linked list and Circular doubly linked list implementation.
12.	Binary Tree Construction and Tree traversal operations.
13.	Construction of Binary search tree and Postfix expression tree.

Course Outcomes: At the end of the course student will be able to

1.	Acquire the fundamental knowledge of various types of data structures and pointers using that knowledge and design the programs using pointers.
2.	Apply the fundamental programming knowledge of data structures to design stack and use them for solving problems.
3.	Apply the fundamental programming knowledge of data structures to design queues and use them for solving problems.
4.	Design various functions for implementation of singly linked lists, circular linked lists and doubly linked list.
5.	Implement and apply the concept of binary trees and binary search tree data structure, advanced trees, representation of graphs and hashing techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
Course Outcomes													**1**	**2**	**3**
CS2001-1.1	3	1	-	-	-	-	-	-	-	-	-	-	1	3	-
CS2001-1.2	3	1	-	-	-	-	-	-	-	-	-	-	1	3	-
CS2001-1.3	3	1	-	-	-	-	-	-	-	-	-	-	1	3	-
CS2001-1.4	3	1	-	-	-	-	-	-	-	-	-	-	1	3	-
CS2001-1.5	3	1	-	-	-	-	-	-	-	-	-	-	1	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aaron M. Tenenbaum, YedidyahLangsam& Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2009.
2.	Ellis Horowitz and SartajSahni, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2014.

REFERENCE BOOKS:

1.	Seymour Lipschutz, “Data Structures, Schaum’s Outlines”, Revised 1st edition, McGraw Hill, 2014.

E Books / MOOCs/ NPTEL

1.	Data Structures Using C, ISRD Group, Tata McGraw Hill, 2006
2.	Data Structures Using C, ReemaThareja, 2nd edition, Oxford University Press, 2014
3.	Introduction to Data Structures by edx , URL:https://www.edx.org/course/
4.	Data structures by Berkley, URL: https://people.eecs.berkeley
5.	Advance Data Structures by MIT OCW , URL:https://www.mooclab.club/
6.	Data Structure by Harvard Extension School, URL: http://www.extension.harvard.

OBJECT ORIENTED PROGRAMMING

Course Code:	**CS2002-1**	**Course Type:**	**IPCC**
Teaching Hours/Week (L:T:P: S):	**3:0:2:0**	**Credits:**	**04**
Total Teaching Hours:	**40+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite:	**CS1001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Learn fundamental features of object-oriented language and JAVA programming constructs.
2.	Develop and run simple Java programs using OOPS concepts of java.
3.	Create multi-threaded programs and event-driven graphical user interface (GUI) programming using swing packages.

UNIT-I

INTRODUCTION: **15 Hours**

Introducing Classes–Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this keyword, Method overloading, using objects as parameters, Argument passing, returning objects, Access control, static, final

Inheritance – Inheritance Basics, super keyword, create a Multilevel Hierarchy, when constructors are called? Method Overriding, using abstract classes, Using final with Inheritance.

Packages and Interfaces – Packages, Access protection, Importing Packages, Interfaces.

(Textbook 1, Chapter – 6-9)

UNIT-II

Exception Handling and Multithread Programming: **15 Hours**

Exception Handling – Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try statements, throw, and throws, finally.

Multithreaded Programming – The Java Thread Model, The Main Thread, creating a Thread, Creating Multiple Threads, Thread synchronization, using isAlive() and join(), Thread Priorities.

File Handling – Reading and writing Serial Access Files, basic File Methods.

Event Handling - Two Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces.

(Textbook 1, Chapter – 10-11, 19, 22)

UNIT-III

Frameworks: **10 Hours**

Generics-What are Generics? A Simple Generics Example, the general form of a generic class, Creating a Generic method.

Collections framework- Collection Interfaces – Stack and Queue, Collection classes – ArrayList, LinkedList, Stack and Queue.

(Textbook 1, Chapter – 14, 17)

Swings – The origins of Swing, Two key Swing features, The Swing Packages: A simple Swing Application; Event Handling, Jlabel, JTextField; The Swing Button: JList, JRadioButton, JCheckBox, JComboBox, JTable.

(Textbook 1, Chapter - 29, 30)

Suggested List of Experiments	
1.	Use java program to demonstrate the OOP concepts.
2.	Demonstrate the file handling using Java
3.	Implement the java programs that uses the concepts of exception handling, multi-threading.
4.	Developing of user interfaces using the swings concepts of Java.
5.	Develop Java program to store and retrieve data from database.
6.	Java programs to establish network connectivity
7.	Demonstrate the web application development using servlets and JSP
8.	Mini Project

Course Outcomes: At the end of the course student will be able to

1.	Develop classes and apply object-oriented features to solve real world problems.
2.	Develop robust Java programs using exception handling features, implement multiple inheritance using interfaces and organize the application classes using packages.
3.	Develop programs that can run concurrent tasks using multithreading and perform basic file operations.
4.	Develop GUI applications using Java swings and manage various events generated by user interactions with the UI using event handling mechanisms.
5.	Develop type independent classes using generics; Choose and apply the right data structure to manage collection of data using the collections framework.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
Course Outcomes													**1**	**2**	**3**
CS2002-1.1	3	1	3	-	1	-	-	-	-	-	-	2	2	3	-
CS2002-1.2	3	1	3	-	2	-	-	-	-	-	-	2	-	3	-
CS2002-1.3	3	1	3	-	3	-	-	-	-	-	-	2	-	3	-
CS2002-1.4	3	1	3	-	3	-	-	-	-	-	-	2	2	3	-
CS2002-1.5	3	1	3	-	3	-	-	-	-	-	-	2	-	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Herbert Scheldt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
2.	Jan Graba, An Introduction to Network Programming with Java, 2007, Springer Publications.

REFERENCE BOOKS:

1.	Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN:9788131720806
2.	Rajkumar Buyya,SThamarasiselvi, xingchen chu, Object oriented Programming with Java, Tata McGraw Hill education private limited.
3.	Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4.	E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

E Books / MOOCs/ NPTEL	
1.	Online course material by Oracle :http://docs.oracle.com/javase/tutorial/index.html
2.	https://www.udemy.com/courses/search/?q=java&price=pricefree&view=grid
3.	Oracle: www.oracle.com/events/global/en/java.../java-a-beginners-guide-1720064.pdf

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code:	**CS3004-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**04**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2001-1, CS1001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Analyze the non-recursive and recursive algorithms and to represent the efficiency of these algorithms in terms of the standard Asymptotic notations.
2.	Devise the Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3.	Explain the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4.	Get the idea of Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.
5.	Describe and illustrate the idea of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

UNIT-I

INTRODUCTION	**08 Hours**

What is an Algorithm? Fundamentals of Algorithmic Problem Solving
(Text Book-1: Chapter 1: 1.1 to 1.2)
FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY: Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical Analysis of Non-recursive and Recursive Algorithms
(Text Book-1: Chapter 2: 2.1 to 2.4

BRUTE FORCE:	**07 Hours**

Background, Selection Sort and Bubble sort, Sequential search and Brute-Force String Matching algorithms with complexity analysis, Exhaustive search
(Text Book-1: Chapter 3: 3.1, 3.2,3.4)
DIVIDE AND CONQUER: General Method, Merge sort, Quick sort, Binary Search algorithms with Complexity analysis.
(Text Book-1: Chapter 4: 4.1 to 4.3)

UNIT-II

DECREASE & CONQUER	**08 Hours**

General method, Insertion Sort algorithm, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting with complexity analysis

TRANSFORM AND CONQUER: General method, Balanced Search Trees: AVL trees, 2-3 trees, Heaps and Heap sort algorithms with complexity analysis.

TIME AND SPACE TRADEOFFS	**07 Hours**

Sorting by counting, Input Enhancement in String Matching: Horspool's algorithm and analysis.
(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7:7.1, 7.2)
DYNAMIC PROGRAMMING: General method, The Floyd-Warshall Algorithm, The Knapsack problem, and memory function with complexity study
(Text Book-1: Chapter 8: 8.2 and 8.4).

UNIT-III

GREEDY TECHNIQUE:	**10 Hours**

General method of Greedy technique, Minimum Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Single-Source Shortest Paths using Dijkstra's Algorithm, Huffman Trees
(Text Book-1: Chapter 9: 9.1 to 9.4)
The Bellman-Ford algorithm, (Text Book-2: Chapter 24: 24.1).
BACKTRACKING: General method, State space trees and algorithms for N-Queens problem, Subset-sum problem
(Text Book-1: Chapter 12: 12.1 selected topics)
BRANCH AND BOUND: General method, Solving job Assignment Problem, Travelling Salesman problem, Knapsack Problem using branch and bound method
(Text Book-1: Chapter 12: 12.2)
P,NP and NP Complete Problems (Text Book-1: Chapter 11: 11.3)

<u>List of DAA Lab Programs</u>

1. Design, Develop and Implement C Programs to solve the following problems using Brute Force technique.
   a) Bubble sorting and selection sorting.
   b) Linear search
   c) String Matching
2. Design, Develop and Implement C Programs to solve the following problems using Divide and Conquer technique.
   a) Binary search
   b) Quick sort
   c) Merge sort
3. Design, Develop and Implement C Programs to solve the following problems using Decrease and Conquer technique.
   a) Insertion sort
   b) Depth First Search
   c) Breadth First Search
   d) Topological Sorting
4. Design, Develop and Implement C Programs to solve Horspool's algorithm using Space and time tradeoff technique.
5. Design, Develop and Implement C Programs to solve Heap Sorting using Transform and Conquer technique.

6. Design, Develop and Implement C Programs to solve the following problems using Dynamic Programming
   a) Floyds and Warshall's method
   b) Knapsack problem
7. Design, Develop and Implement C Programs to solve the following problems using Greedy technique.
   a) Prims and Kruskal's Algorithm
   b) Dijkstra's algorithm
8. Design, Develop and Implement C Programs to solve the following problems using Backtracking and Branch Bound technique.
   a) N Queen's Problem
   b) Travelling salesman Problem

Course Outcomes: At the end of the course student will be able to

1.	Explain the concept of algorithm, show the efficiency of algorithm using asymptotic notation and analyze the algorithm mathematically.
2.	Develop the algorithm using brute force and divide & conquer technique for solving the problem.
3.	Make use of decrease and conquer, transform and conquer approaches to solve problems and compare their efficiencies.
4.	Solve the problems by applying dynamic programming approaches and analyze the same. Utilize time and space trade off techniques to improve time efficiency.
5.	Apply and analyze greedy method, backtracking, branch and bound methods to solve problems and to describe P, NP and NP Complete problems

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
CS3004-1.1	3	3	3	-	-	-	-	-	-	-	-	1	3	1	1
CS3004-1.2	2	2	2	-	1	-	-	-	-	-	-	1	3	1	1
CS3004-1.3	2	2	2	-	1	-	-	-	-	-	-	1	3	1	1
CS3004-1.4	3	3	3	-	1	-	-	-	-	-	-	1	3	1	1
CS3004-1.5	3	3	3	-	1	-	-	-	-	-	-	1	3	1	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.

2. Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2014.

REFERENCE BOOKS:

1. Horowitz E., Sahni S., Rajasekaran S, "Computer Algorithms", Galgotia Publications, 2001.

2.	R.C.T. Lee, S.S. Tseng, R.C. Chang &Y.T.Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2005.
E Books / MOOCs/ NPTEL	
1.	http://www.facweb.iitkgp.ernet.in/~sourav/daa.html
2.	http://nptel.ac.in/courses/106101060/https://www.coursera.org/specializations/algorithms
3.	http://nptel.ac.in/courses/106101060/https://www.coursera.org/specializations/algorithms

COMPUTER NETWORKS

Course Code:	**CC2001-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**04**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC1104-2**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the network-layer design issues and types of routing algorithm.
2.	Explore the types and characteristics of congestion control algorithms.
3.	Identify the quality of services incorporated in network layer.
4.	Understand the working of internetworking and addressing in network layer.
5.	Explore transport layer protocols and standards.

UNIT-I	**15 Hours**

Network layer design issues: Store and Forward packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual Circuit and Datagram Subnets.
Routing algorithms: The Optimality Principal, Shortest Path Routing, Flooding. Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, Routing for Mobile Hosts, Routing in Ad hoc Networks.
Congestion Control Algorithms: Approaches to Congestion Control, Traffic-Aware Routing, Admission Control, Traffic Throttling, Load Shedding;

UNIT-II	**15 Hours**

Quality of Service: Application Requirements, Traffic Shaping, Packet Scheduling, Admission Control, Integrated Services, Differentiated Services
Internetworking: How networks differ, How Networks can be connected, Tunneling, Internetwork Routing, Fragmentation.
The Network Layer in the Internet: The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, OSPF, BGP, Internet Multicasting, Mobile IP.

UNIT-III	**10 Hours**

The Transport Layer: The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives,
Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery.
The Internet Transport Protocols (UDP): Introduction to UDP,
The Internet Transport Protocols (TCP): Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, TCP Connection Management Modeling, TCP Sliding Window, TCP Timer Management, TCP Congestion

Control.

Suggested List of Experiments

1.	Write a program to implement following: a) Computing Hamming distance between two given codeword b) Error detection using traditional internet checksum
2.	Write a program to implement Error detection using CRC-16
3.	Write a program for congestion control using leaky bucket algorithm.
4.	Write a program to implement following flow control algorithms. a) Stop and wait protocol. b) Go-Back-N Protocol
5.	Write a program to implement Bellman-Ford algorithm.
6.	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
7.	Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.

Part-B

1	DHCP server configuration using Cisco Packet Tracer
2	Simulation of ARP/RARP using Cisco Packet Tracer
3	Simulation of TCP and UDP (FTP, Web, Email Server configuration)
4	Simulation of DNS Server using CISCO PACKET TRACER Networking tool
5	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
6	Use Wireshark to understand the operation of TCP/IP layers: • Ethernet layer: Frame header, Frame size etc. • Data Link Layer: MAC address, ARP (IP and MAC address binding) • Network Layer: IP Packet (header, fragmentation), ICMP (Query and Echo) • Transport Layer: TCP ports, TCP handshake segments etc

Course Outcomes: At the end of the course student will be able to

1.	Explain the network layer design issues and analyse various routing algorithms.
2.	Analyse and compare congestion control approaches in network layer.
3.	Describe the quality of services (QoS) provided by network layer and identify appropriate QoS for a given application.
4.	Explain the working of internetworking, interpret IP addressing and routing in internet.
5.	Summarize transport layer services and its elements; explain internet transport protocols.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CC2001-1.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CC2001-1.2	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CC2001-1.3	3	1	-	-	-	-	-	-	-	-	-	1	3	-
CC2001-1.4	3	2	-	-	2	-	-	-	-	-	-	1	3	1
CC2001-1.5	3	1	-	-	2	-	-	-	-	-	-	1	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Andrew S. Tanenbaum David J. Wetherall, Computer Networks, 5th Edition, Pearson, 2014
REFERENCE BOOKS:	
1.	Kurose & Ross, Computer Networking. ATop-Down Approach, 5th Edition, Mc Graw Hill, 2013
2.	WilliamStallings, Data and Computer Communication, 8th Edition, Prentice Hall, 2007
3.	Peter L Dordal, An Introduction to Computer Networks, Open Book, http://intronetworks.cs.luc.edu/, 2020
E Books / MOOCs/ NPTEL	
1.	Computer networks: A video course by Prof. Sujoy Ghosh, IIT Khargpur, https://nptel.ac.in/courses/106/105/106105081/
2.	Fundamentals of Network Communication, Coursera, https://www.coursera.org/learn/fundamentals-network-communications
3.	Digital Networks Essentials, EdX, https://www.edx.org/course/digital-networks-essentials
4.	Introduction to Computer Networking, Stanford School of Engineering, https://online.stanford.edu/courses/cs144-introduction-computer-networking

WIRELESS NETWORKS AND MOBILE COMPUTING

Course Code:	**CC3003-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**04**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understanding the fundamentals of mobile computing and its applications.
2.	Explore the types of mobility in cellular networks.
3.	Examine the context, architecture, and design elements of application in mobile environment.
4.	Understand the parameters that impact user experience in the mobile interfaces.
5.	Identify the scenarios when a handover takes place and examine the future mobile communication technologies.

UNIT-I	**15 Hours**

Introduction to mobile computing: Mobile Technologies, Anatomy of a Mobile Device, Survey of Mobile Devices Applications of Mobile Computing

Types of Mobility: Mobility in cellular based wireless network: channel allocation, interference, handoffs and location management. IP mobility: Mobile IP and IDMP

UNIT-II	**15 Hours**

Impacts of mobility and portability in computational model and algorithms for mobile environment: Disconnected operation. Analysis of algorithms and termination detection.

Data delivery models: push and pull. Data dissemination in wireless channels.

Broadcast disks. Effects of caching.

Application Design: Context, Information Architecture, Design Elements, Mobile Web vs Native Applications

The User Experience: The Small Screen Problem, The Unified Look and Feel Paradigm, The iPhone Human Interface Guidelines, The Blackberry User Interface Guidelines, Common User Interface

Guidelines.

UNIT-III	10 Hours

Mobile Databases and Handover Management: Indexing in Air, Mobile Databases and transaction. Handover management, location management, registration, tunneling and encapsulation, route optimization, dynamic host configuration.
Logical mobility: Migrating processes, mobile agents
Upcoming Technologies: Convergence of Media and Communication Devices, Security Issues. Next era: Cloud Computing

List of Experiments:

1. Introduction to NetSim and Understanding the working of basic networking commands -Ping, Route Add/Delete/Print, ACL.
2. Perform the process of call connection and call release of cellular Mobile system.
3. Understand the events involved in NetSim DES (DiscreteEvent Simulator) in simulating flow of one packet from a Wired node to a Wireless node.
4. Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyze the performance.
5. Wireless LAN protocols. To create scenario and study the performance of network with CSMA/CA protocol and compare with CSMA/CD protocols.
6. Implementing distance vector routing algorithm.
7. To understand the Public IP Address; NAT (Network Address Translation)
8. Study the working and routing table formation of Interior routing protocols, iRouting Information Protocol (RIP) and Open Shortest Path First (OSPF).

Course Outcomes: At the end of the course student will be able to

1.	Explain the concepts of mobile computing and its applications.
2.	Discuss the concepts such as, channel allocation, handoffs, interference and IP mobility.
3.	Analyse the Impacts of mobility and portability in computational model and algorithms for mobile environment.
4.	Identify the application design of wireless networks and user experience.
5.	Analyze the handovers in enabling mobility and maintaining connectivity in mobile computing environments and the various technologies behind it.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3003-1.1	3	-	2	-	-	-	-	-	-	-	-	1	2	**1**
CC3003-1.2	-	-	3	-	-	-	-	-	-	-	-	1	2	**1**
CC3003-1.3	-	-	3	-	-	-	-	2	-	-	-	1	2	**1**
CC3003-1.4	-	2	-	-	3	-	-	-	-	-	-	1	2	**2**
CC3003-1.5	2	3	-	-	-	-	-	-	-	-	-	1	2	**1**

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Kumkum Garg, Mobile Computing, First Edition, Pearson Education, 2010
2.	Rajkamal, mobile computing, Second Edition, Oxford University Press, 2012

REFERENCE BOOKS:	
1.	T. Mikkonen, Programming Mobile Devices: An Introduction for Practitioners, Wiley, 2007.
2.	S. Hashimi, S. Komatineni, D. MacLean, Pro Android 2, Apress, 2010.
3.	D. Mark and J. LaMarche, Beginning iPhone 3 Development: Exploring the iPhone SDK, Apress, 2009.
4.	A. Rizk, Beginning BlackBerry Development, Apress, 2009.
E Books / MOOCs/ NPTEL	
1.	https://nptel.ac.in/courses/106106167 Introduction to Wireless and Cellular Communications, IIT Madras
2.	https://onlinecourses.nptel.ac.in/noc21_ee66/preview Introduction to Wireless and Cellular Communications – NPTEL
3.	https://archive.nptel.ac.in/courses/117/102/117102062/ Wireless Communication – NPTEL

INTERNET OF THINGS

Course Code:	**CC2002-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**4**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC1104-2**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the IOT Fundamentals and Design aspects
2.	Understand the IOT programming Concept using Arduino /Raspberry Pi and interfacing with IOT devices
3.	Outline the various IOT Communication Protocols
4.	Understanding IOT Application Development.
5.	Discuss few Case Studies in IOT based Applications

UNIT-I	
Introduction to IoT	**08 Hours**
Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.	
Hardware Elements of IoT	**07 Hours**
Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.	
UNIT-II	
Software Elements of IoT	**08 Hours**
Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.	
IoT Application Development:	**07 Hours**
Solution framework for IoT applications- Implementation of Device integration, Data acquisition	

and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT-III

IoT Case Studies	**10 Hours**

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Suggested List of Experiments

1. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2seconds.
2. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
3. To interface DHT11 sensor with Arduino/Raspberry Pi and write a programe to print temperature and humidity readings.
4. To interface LED using relay with Arduino/Raspberry Pi and write a program to turn ON LED.
5. To interface Servo Motor with Arduino/Raspberry Pi and write a program to rotate the shaft 180 degree.
6. To interface Ultra sonic sensor with Arduino/Raspberry Pi and write a program to display the object detected distance.
7. To interface Smoke sensor with Arduino/Raspberry Pi and write a program to display message when smoke is Detected.
8. To interface with Arduino, write a program for soil moisture detection using MOISTURE sensor.
9. To interface with Arduino, write a program for detecting motion using PIR sensor.
10. To interface with ESP-32, write a program to perform ON and OFF of LED.

Course Outcomes: At the end of the course student will be able to

1.	Explain the IOT Architecture design principles and its application
2.	Outline the Various Hardware elements that is required to establish communication between IOT Components
3.	Explain various Protocol standard used for IOT Communication
4.	Describe the Application of IOT to felicitate device integration, data storage, Authorization.
5.	Outline the various Applications of IOT

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC2002-1.1	3	2	-	-	-	-	-	-	-	-	-	-	1	**2**
CC2002-1.2	3	2	-	-	-	-	-	-	-	-	-	-	1	**2**
CC2002-1.3	3	2	-	-	-	-	-	-	-	-	-	-	1	**2**
CC2002-1.4	3	2	-	-	-	-	-	-	-	-	-	-	1	**3**
CC2002-1.5	3	2	-	-	-	-	-	-	-	-	-	-	1	**3**

1: Low 2: Medium 3: High

1. Vijay Madisetti, Arshdeep Bahga, İnternet of Things, “A Hands on Approach”, University

	Press, 2015
2.	Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2022
3.	Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press, 2017
REFERENCE BOOKS:	
1.	Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi, 2018
2	Adrian McEwen, “Designing the Internet of Things”, Wiley, 2013
3	Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs

NEXT GENERATION TELECOM NETWORKS

Course Code:	**CC3002-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**04**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the evolution of telecom networks from 2G/3G to 4G/5G and beyond.
2.	Explore the use cases of next-generation telecom networks and understand Milimeter wave communication.
3.	Learn about key technologies and architectures driving next-generation telecom networks.
4.	Acquire knowledge of advanced concepts such as IoT, SDN, NFV, and D2D Communications.
5.	Understanding the fundamentals, resource allocation and transceiver algorithms for Massive MIMO

UNIT-I

Historical Trend for Wireless Communication	**15 Hours**

Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios

Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

UNIT-II

5G Architecture:	**15 Hours**

Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture – High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment.

D2D Communications: from 4G to 5G – Radio Resource Management for Mobile Broadband D2D – Multi-hop D2D Communications for Proximity and Emergency Services – Multi-operator D2D Communication.

UNIT-III

Massive Multiple-Input Multiple –Output Systems :	**10 Hours**
MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models.	

List of Experiments:

1. Plot the characteristic curve of throughput versus offered traffic for a Pure and Slotted ALOHA system.
2. Measures of Network Performance: Throughput and Delay
3. Implement the VLAN operation in L2 and L3 Switches
4. Implement the Access and Trunk Links in VLANs
5. Implement the Wi-Fi Multimedia Extension (IEEE 802.11 EDCA)
6. Implement the IoT – Multi-Hop Sensor-Sink Path
7. Implement the One Hop IoT Network over IEEE 802.15.4
8. Performance Evaluation of a Star Topology IoT Network.
9. Simulate and study 5G Handover procedure.

Course Outcomes: At the end of the course student will be able to

1.	Describe and explain the evolution of 5G, system concepts and spectrum challenges
2.	Explain millimeter wave communication and computer hardware technologies
3.	Explore the 5G functional and physical architecture along with its requirements
4.	Describe and explain the requirements and fundamental techniques for D2D Communication
5.	Summarize the fundamentals, resource allocation and transceiver algorithms for Massive MIMO

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3002-1.1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**
CC3002-1.2	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**
CC3002-1.3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**
CC3002-1.4	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**3**
CC3002-1.5	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**3**

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	sif Oseiran, Jose F. Monserrat and Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016
2.	Rodriquez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015

REFERENCE BOOKS:

1.	Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, “5G System Design – Architectural and Functional Considerations and Long Term Research”, Wiley, 2018

E Books / MOOCs/ NPTEL

1.	https://www.coursera.org/learn/5g-network-fundamentals
2.	https://courses.mooc.fi/org/uh-cs/courses/5g-mooc/chapter-3
3.	https://onlinecourses.nptel.ac.in/noc23_ee61/preview

CYBER SECURITY & FORENSICS

Course Code	**CC3001-1**	**Course Type**	**IPCC**
Teaching Hours/Week (L: T: P: S)	**3:0:2:0**	**Credits**	**04**
Total Teaching Hours	**40+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the basic concepts of cryptography and its role in ensuring the confidentiality and integrity of sensitive information.
2.	Understand the concept of anti-forensics and why attackers employ techniques to cover their tracks during cyber-attacks.
3.	Understand and differentiate between common fraud techniques, including phishing, smishing, vishing, and mobile malicious code, and their impact on individuals and organizations.
4.	Understand the case studies and real-world examples of malware attacks and techniques for detecting and responding to malicious code and attacks.
5.	Understand the foundational principles of digital forensics science and its application in cybercrime investigations, encompassing memory forensics techniques and also the importance of cyber laws in the Indian context.

Unit I	**15 Hours**

CYBER SECURITY FUNDAMENTALS:

Information Assurance Fundamentals: Authentication, Authorization, Nonrepudiation, Confidentiality, Integrity, Availability; Basic Cryptography; Symmetric Encryption: Example of Simple Symmetric Encryption with Exclusive OR (XOR) and Improving upon Stream Ciphers with Block Ciphers; Public Key Encryption; The Domain Name System (DNS) : Security and the DNS; Firewalls: History Lesson, What's in a Name? Packet-Filtering Firewalls, Stateful Firewalls, Application Gateway Firewalls.

ATTACKER TECHNIQUES AND MOTIVATIONS:

How Hackers Cover Their Tracks (Antiforensics): How and Why Attackers Use Proxies, Types of Proxies, Detecting the Use of Proxies, Tunnelling Techniques - HTTP, DNS, ICMP, Intermediaries, Steganography, and Other Concepts, Detection and Prevention;

Unit II	15 Hours
Fraud Techniques: Phishing, Smishing, Vishing, and Mobile Malicious Code - Mobile Malicious Code, Phishing against Mobile Devices; Rogue Antivirus - Following the Money: Payments; Click Fraud - Pay-per-Click, Click Fraud Motivations, Click Fraud Tactics and Detection. Threat Infrastructure: Botnets, Fast-Flux, Advanced Fast-Flux. **MALICIOUS CODE:** Rootkits - User Mode Rootkits, Kernel Mode Rootkits; Spyware; Attacks against Privileged User Accounts and Escalation of Privileges - Many Users Already Have Administrator Permissions, Getting Administrator Permissions; Token Kidnapping; Virtual Machine Detection - Fingerprints Everywhere, Understanding the Rules of the Neighborhood, Detecting Communication with the Outside World, Putting It All Together, The New Hope.	

Unit III	10 Hours
UNDERSTANDING COMPUTER FORENSICS: Introduction, Digital forensics science, The need of computer forensics, Cyber forensics and digital evidence, Digital forensics life cycle, Network Forensics, Computer forensics and steganography. Relevance of OSI 7layer model to Computer Forensics, Forensics and social networking sites: The security and privacy threats. Challenges in computer forensics, Special tools and techniques. **DEFENSE AND ANALYSIS TECHNIQUES:** Memory Forensics, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems (excluding: Physical or Virtual Machines), Intrusion Detection Systems. **CYBER CRIME AND CYBERSECURITY:** Introduction, why do we need cyber laws: Indian context, The Indian IT Act, Challenges to Indian Law and cybercrime scenarios in India, Consequences of not addressing the weakness in information technology Act. Digital Signatures and Indian Act. Cyber Crime and Punishment.	

Suggested list of experiments

1. Implementing the image steganography
2. Detecting the location of ip addresses
3. Implementing the man-in-the-middle attack scenario
4. Implementing the honeypots
5. Implementing keyloggers
6. Creating a virus code in the program and detecting the same.
7. Implementing the detection of proxies

Course Outcomes: Upon completion of this course, students will be able to:

1.	Evaluate the strengths and limitations of different cryptographic algorithms and techniques in various security scenarios.
2.	Apply knowledge of anti-forensics concepts and techniques to real-world scenarios and case studies, including incident response and forensic investigations.
3.	Discuss preventive measures and countermeasures to mitigate the risks posed by common fraud techniques, including user awareness training, security protocols, and technological solutions.
4.	Analyse case studies and real-world examples of malware attacks, including ransomware, trojans, and botnets, to understand their tactics, techniques, and impact on individuals and organizations.
5.	Employ the computer forensic techniques to inhibit the cyber threat and determine the various defense and analysis techniques and interpret the associated IT laws in place.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
CC3001-1.1	2	-	2	-	-	-	-	3	-	-	-	1	3	-
CC3001-1.2	-	3	1	-	-	-	-	1	-	-	-	1	3	-
CC3001-1.3	-	3	2	-	-	-	-	1	-	-	-	1	3	-
CC3001-1.4	2	-	1	-	-	-	-	1	-	-	-	1	2	-
CC3001-1.5	-	-	1	-	-	-	-	3	-	-	-	1	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Cyber security essentials --Edited by James Graham, Richard Howard, Ryan Olson, publication: CRC press, Taylor and Francis group, 2011.
2. Cyber Security –Nina godbole, Sunit Belapure, Publication: John Wiley, 2012.

REFERENCE BOOKS:

1. Yuri Diogenes, Erdal Ozkaya, "Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics (Kindle Edition)", 2018.
2. Joseph carson, "Cybersecurity for Dummies", Thycotic Special Edition, 2018
3. Scott Augenbaum, "The Secret to Cybersecurity A Simple Plan to Protect Your Family and Business from Cybercrime", 2019

Professional Core Courses (Theory)

FUNDAMENTALS OF COMPUTER ARCHITECTURE AND ORGANIZATION

Course Code:	**CC2103-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1002-1, CS1001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	To impart basic concepts of computer architecture and organization
2.	To explain key skills of constructing cost-effective computer systems.
3.	To familiarize the basic CPU organization.
4.	Explore preliminaries and working of various memory devices.
5.	Develop the skill to analyze advances in learning IO communication

UNIT-I

Structure of Computers: **07 Hours**

Computer types, Functional units, Basic operational concepts, Von Neumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes.

Computer Arithmetic: **08 Hours**

COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.

UNIT-II

Basic Computer Organization and Design: **08 Hours**

Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt.
Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC.

Register Transfer and Micro-Operations: **07 Hours**

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit.
MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

UNIT-III

Memory System, Input Output, Multiprocessors: **10 Hours**

Memory Hierarchy, Semiconductor Memories, RAM (Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.
INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA.
MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence

Course Outcomes: At the end of the course student will be able to

1.	Identify various components of computer and their interconnection.
2.	Identify basic components and design of the CPU: the ALU and control unit.
3.	Compare and select various Memory devices as per requirement.
4.	Compare various types of IO mapping techniques.

5.	Critique the performance issues of cache memory and virtual memory.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
CC2103-1.1	3	1	1	-	3	-	-	2	1	-	3	1	2	3
CC2103-1.2	3	3	1	-	3	-	-	2	1	-	3	1	2	3
CC2103-1.3	3	3	1	-	3	-	-	2	1	-	3	1	2	3
CC2103-1.4	3	3	2	-	3	-	-	2	1	-	3	1	2	3
CC2103-1.5	3	3	2	-	3	-	-	2	1	-	3	1	2	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture - A quantitative approach, Morgan Kaufmann/ Elsevier, 4th Edition, 2007

REFERENCE BOOKS:

1. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
2. David Culler and J.P. Singh with Anoop Gupta, Morgan Kaufmann, Parallel Computer Architecture: A Hardware/Software Approach, 1998.

E Books / MOOCs/ NPTEL

1. https://onlinecourses.nptel.ac.in/noc20_cs41/preview
2. https://www.coursera.org/learn/introduction-high-performance-computing#syllabus

DATA COMMUNICATIONS

Course Code:	**CC1104-2**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisites	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the fundamental terminologies, communication models and architecture of data communication
2.	Understand the basics of signals, analog and digital transmission techniques.
3.	Explore various multiplexing and spread spectrum techniques applied in data communication.
4.	Understand Data link control protocols for reliable and noisy channels and learn switching techniques in Wide Area Networks (WAN).
5.	Explore wired and wireless LAN technologies along with congestion control techniques.

UNIT-I	**15 Hours**

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models**: Protocol Layering, TCP/IP Protocol suite, The OSI model.
Introduction to Physical Layer-1: Data and Signals**,** Digital Signals, Transmission Impairment, Data Rate limits, Performance, **Digital Transmission**: Digital to digital conversion (Only Line coding: Polar, Bipolar

and Manchester coding).
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes.
Analog Transmission: Digital to analog conversion.
Transmission Media: Introduction, Guided Media, Unguided Media: Wireless.

UNIT-II	15 Hours

Bandwidth Utilization: Multiplexing and Spread Spectrum.
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction.
Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).
Media Access control: Random Access, Controlled Access and Channelization

UNIT-III	10 Hours

Switching: Introduction, Circuit-Switched Networks, Packet Switching.
Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, **Wireless LANs:** Introduction, IEEE 802.11 Project and Bluetooth.

Course Outcomes: At the end of the course student will be able to

1.	Recall and define key terminologies related to data communication and networking, outline the networking models, TCP/IP protocol architecture and standardization in protocols.
2.	Illustrate signal encoding and digital data communication techniques, describe transmission media used in data communications.
3.	Demonstrate a comprehensive understanding of the functionalities and mechanisms involved in Multiplexing techniques, Spread Spectrum technologies and elucidate their roles in modern communication systems. Also, apply error detection and correction techniques for a given data.
4.	Explain the principles behind Data Link Control Protocols and differentiate between Media Access Control protocols.
5.	Describe switching techniques and explain the protocol architecture of wired and wireless LAN.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC1104-2.1	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC1104-2.2	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC1104-2.3	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC1104-2.4	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC1104-2.5	3	2	-	-	-	-	-	-	-	-	-	1	3	-

1: Low, 2: Medium, 3: High

TEXT BOOKS:

1.	Behrouz A. Forouzan, “Data Communications and Networking”, 5th edition, Tata McGraw Hill.

REFERENCE BOOKS:

1.	Data and Computer Communications, 10th Edition, William Stallings, Pearson Education, 2013, ISBN: 0133506487, 9780133506488.
2.	William A. Shay, “Understanding Data Communications and Networks”, 2nd Edition,

	Thomson
3.	Godbole, "Data Communications and Networks", Tata McGraw-Hill, 2002
4.	Michael A. Gallo & William M. Handcock, "Computer Communications and Networking Technologies", 2003 Edition, Thomson Asia.
E Books / MOOCs/ NPTEL	
1.	http://nptel.ac.in/downloads/106105080/
2.	http://www.nptelvideos.in/2012/11/data-communication.html
3.	http://nptel.ac.in/courses/106105082/
4.	https://www.youtube.com/playlist?list=PL374944B232C0B48E
5.	http://freevideolectures.com/Course/2278/Data-Communication
6.	http://eng.uok.ac.ir/abdollahpouri/Network/A.Leon-Garcia_Communication_Networks.pdf
7.	https://vtucsenotes.wordpress.com/2014/02/23/computer-networks/

DATABASE MANAGEMENT SYSTEMS

Course Code:	**CS2102-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Provide a strong foundation in database concepts, design and application
2.	Understand the concepts of relational model and relational algebra in database design.
3.	Learn structured query language (SQL) to an intermediate/advanced level and evaluate the result set.
4.	Model normalized database structures by creating simple database systems and understanding the concepts of relational database designs and dependencies.
5.	Illustrate the concepts of File organization and Indexing, concurrency control and transactions in databases.

UNIT-I

Databases and Database Users, Database system concepts	**15 Hours**

Databases and Database Users: Introduction, An Example, Characteristics of the database approach.
Database System Concepts and Architecture: Three-Schema Architecture and data Independence, Database languages and interfaces.
Data Modeling Using the Entity–Relationship (ER) Model: Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues. **The Relational Data Model and Relational Database Constraints**: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, transactions, and dealing with constraint violations.
The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory. Binary Relational Operations: JOIN and

DIVISION, Additional Relational Operations; Examples of Queries in Relational Algebra.
Relational Database Design by ER-to-Relational Mapping: Relational Database Design Using ER to-Relational Mapping.
(T1: 1.1, 1.2, 1.3, 2.2, 2.3, 3.3-3.7, 5.1-5.3, 8.1-8.5 ,9.1)

UNIT-II

BASIC SQL	**15 Hours**

Basic SQL:SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update Statements in SQL,
More SQL: Complex Queries, Views, and Schema Modification: More complex SQL retrieval queries, Specifying constraints as assertions and Actions as Triggers, Views in SQL, Schema Change Statements in SQL.
Basics of Functional Dependencies and Normalization for Relational Databases: Informal design guidelines for relation schemas, Functional Dependencies, Normal Forms Based on Primary Keys, general definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.
Relational Database Design Algorithms and Further Dependencies: Inference Rules, Equivalence, and Minimal cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema.
(T1: 6.1-6.4 ,7.1-7.4, 14.1-14.5, 15.1, 15.2,15.3)

UNIT-III

Storage and Indexing, Query Evaluation, Transaction Management	**10 Hours**

Storage and Indexing: File Organizations and Indexing, Index Data structures, Comparison of File Organizations.
Tree Structured Indexing: B+ Tree: A Dynamic Index Structure.
Overview of Query Evaluation: Introduction to Query Optimization, What a Typical Optimizer Does.
Overview of Transaction Management: The ACID Properties, Transactions and Schedules. Concurrent Execution of Transactions, Lock-Based Concurrency Control.
Concurrency Control: 2PL, Serializability and Recoverability
(T2: 8.2, 8.3, 8.4, 10.2, 12.4, 12.6, 14.4, 16.1-16.4, 17.1)

Course Outcomes: At the end of the course student will be able to

1.	Illustrate the concepts of database objects for the given problem.
2.	Identify and enforce integrity constraints on a database using RDBMS.
3.	Apply structured query language for (SQL) for database manipulation.
4.	Model normalized database structures by creating simple database systems.
5.	Illustrate the concepts of transactions, indexing and concurrency control in databases.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓ 1**	**PSO↓ 2**
CS2102-1.1	2	-	-	-	-	-	-	-	-	1	-	1	1	2
CS2102-1.2	2	2	-	-	-	-	-	-	-	1	-	1	1	2
CS2102-1.3	2	3	-	-	-	-	-	-	-	1	-	1	1	2
CS2102-1.4	2	2	3	-	-	-	-	-	-	1	-	1	1	2
CS2102-1.5	2	-	-	-	-	-	-	-	-	1	-	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ramez Elmasri and Shamkant B. Navathe, Database Systems Models, Languages, Design and Application Programming, 7th Edition, 2017, Pearson.
REFERENCE BOOKS:	
1.	SilberschatzKorth and Sudharshan, Database System Concepts, 6th Edition, McGraw Hill, 2013.
E Books / MOOCs/ NPTEL	
1.	https://www.udemy.com/course/introduction-to-basic-database-concepts/, Introduction to Basic Database Concepts (Udemy).
2.	https://www.udemy.com/course/database-management-systems-mysql/, Database Management Systems – MySQL (Udemy).
3.	https://swayam.gov.in/nd1_noc19_cs46/preview, Database Management System (Swayam).

FOUNDATIONS OF OPERATING SYSTEMS

Course Code:	**CC2102-1**	**Course Type**	**PCC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1004-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Explain the concepts, principles, and services of operating system.
2.	Identify fundamental operating system concepts such as processes, inter-process communication, threads, CPU scheduling and demonstrate them.
3.	Assess the need of concurrency and synchronization and apply them to write concurrent programs and analyze the cause for the occurrence of deadlocks and determine solutions to overcome the deadlocks.
4.	Study the concepts of main memory and virtual memory allocation methods and demonstrate them.
5.	Analyze the need for file system concepts, directory implementation and introducing to Virtualization and the Cloud.

UNIT-I

OS Overview, Process concepts, Scheduling and IPC	**15 Hours**

OPERATING SYSTEM STRUCTURE: Operating system services, User and Operating System interface, System calls, System Services, Linkers and Loaders, Operating System Structure.
(Text 2: Chapter 2).
PROCESS MANAGEMENT: Process concept; Process scheduling; Operations on processes; Inter-process communication. **(Text 2: Chapter 3).**
CPU SCHEDULING: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling. **(Text 2: Chapter 5).**
INTERPROCESS COMMUNICATION: Race Conditions, Critical Regions, Mutual Exclusion with Busy Waiting, Sleep and Wakeup, Semaphores, Mutexes, Monitors, Message Passing, Shared Memory. **(Text 1: Chapter 2(2.3 onwards)/ Text 2: Chapter 6).**

UNIT-II

Deadlocks, Main Memory and Virtual Memory	**15 Hours**

DEADLOCKS: System model; Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, avoidance, detection, and recovery from deadlock**. (Text 2: Chapter 8)**
MAIN MEMORY: Paging, Structure of page table, Swapping. **(Text 2: Chapter 9)**
VIRTUAL MEMORY: Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing, Allocating Kernel Memory. **(Text 2: Chapter 10)**

UNIT-III

File systems concepts and Virtualization	**10 Hours**

FILE-SYSTEM INTERFACE: Access Methods, Directory Structure, Protection.
FILE-SYSTEM IMPLEMENTATION: Directory Implementation, Allocation Methods, Free-Space Management. **(Text 2: Chapter 13 & 14)**
VIRTUALIZATION and THE CLOUD
Requirements for virtualization, Type 1 and type 2 hypervisors, Techniques for efficient virtualization, Are Hypervisors Microkernels Done Right? Memory Virtualization, I/O Virtualization, Virtual Appliances, Virtual Machines on Multicore CPUs, Licensing Issues. Clouds as a Service, Virtual Machine Migration, Checkpointing. **(Text 1: Chapter 7)**

Course Outcomes: At the end of the course student will be able to

1.	Recognize the structural components of operating system and its services.
2.	Show how to start and stop processes and threads; describe and evaluate CPU scheduling strategies.
3.	Give an example of the critical section problem and show how Peterson's method works. Examine the situation of deadlock and ascertain how to avoid and prevent it.
4.	Compile a summary of the main memory and virtual memory allocation techniques and create a timetable for replacing pages based on the requested number of pages.
5.	Classify file systems based on operations and implementations and file system concepts; be familiar with cloud computing and virtualization.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC2102-1.1	2	-	1	-	-	-	-	-	-	-	-	-	-	2
CC2102-1.2	2	-	2	-	-	-	-	-	-	-	-	-	-	2
CC2102-1.3	2	-	3	-	-	-	-	-	-	-	-	-	-	2
CC2102-1.4	2	-	1	-	-	-	-	-	-	-	-	-	-	2

CC2102-1.5	2	-	3	-	-	-	-	-	-	-	-	-	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Modern Operating Systems, 4th ed, by Andrew S. Tanenbaum, Herbert Bos, Prentice Hall, 2015.
2.	Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 10th Edition, John Wiley & Sons, 2018, ISBN: 9781119320913.
REFERENCE BOOKS:	
1.	D.M Dhamdhere: Operating systems - A concept-based Approach, 2nd Edition, Tata McGraw-Hill, 2002.
2.	P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006
3.	Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley, 1990.
E Books / MOOCs/ NPTEL	
1.	http://www.uobabylon.edu.iq/download/M.S%2020132014/Operating_System_Concepts,_8th_Edition%5BA4%5D.pdf
2.	http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System- Concepts--9th2012.12.pdf
3.	https://freevideolectures.com/university/iit-bombay/
4.	https://www.cse.iitb.ac.in/~mythili/os/

CRYPTOGRAPHY & NETWORK SECURITY

Course Code	**CC3101-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA2005-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the fundamentals of symmetric cipher model in cryptography.
2.	Understand the design principles of block ciphers and principles of public-key cryptosystems and their importance in modern cryptography
3.	Familiarize with the public-key cryptosystems and various key management techniques.
4.	Understand the principles of remote user authentication and its significance in securing access to systems and resources
5.	Understand the concept of secure socket layer and secure shell along with their importance in negotiating secure connections and overview of IP security (IPSec) and its role in securing IP communications at the network layer.

UNIT-I **15 Hours**

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and The Data Encryption Standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, DES, Block cipher design principles, number of rounds, design of function F, key schedule algorithm, AES algorithm introduction.

Public-Key Cryptography and RSA: Principles of Public-key cryptosystems. Public-key cryptosystems. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.

UNIT-II **15 Hours**

Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, Elliptic curve cryptography, Analog of Diffie-Hellman key exchange, Elliptic curve encryption/decryption.

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, Hierarchical key control, Decentralized key control, Symmetric key distribution, public key authority, public keys certificates, X- 509 certificates.

User Authentication: Remote user Authentication principles, Kerberos, Remote user Authentication using Asymmetric encryption, identity management.

UNIT-III **10 Hours**

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL. Cipher Suites, Secure Shell (SSH)

IP Security: IP Security overview, IPSec, Security associations, IP traffic processing, Encapsulating Security payload, encryption and authentication algorithms, Padding, Anti replay service, transport, and tunnel modes

Course Outcomes: At the end of the course student will be able to

1.	Evaluate real-world applications and scenarios where symmetric key cryptography is used to protect sensitive information
2.	Apply the principles of block ciphers and public-key cryptosystems to design and implement secure cryptographic solutions for real-world applications.
3.	Implement various key management techniques in practical scenarios, including the use of digital certificates and key revocation mechanisms.
4.	Evaluate the significance of secure authentication protocols, such as Kerberos, in establishing trust between users and remote systems.
5.	Discuss the architecture and components of SSL and SSH protocols, along with IPSec modes of operation, such as transport mode and tunnel mode, and their applications in different network configurations

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3101-1.1	2	2	-	-	2	-	-	-	-	-	-	2	1	-
CC3101-1.2	2	2	-	-	2	-	-	-	-	-	-	2	2	-
CC3101-1.3	3	-	-	-	3	-	-	-	-	-	-	2	1	-
CC3101-1.4	3	-	-	-	3	-	-	-	-	-	-	2	1	-
CC3101-1.5	-	2	-	-	3	-	-	-	-	-	-	3	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. William Stallings, Cryptography and Network Security, Pearson 6th Edition, 2013.

REFERENCE BOOKS:

1. V K Pachghare, Cryptography and Information Security, PHE, 2013.

PRINCIPLES AND PRACTICES OF SOFTWARE ENGINEERING

Course Code:	**CC2104-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Outline software engineering principles and activities involved in building large software programs.
2.	Understand the importance of architectural decisions in designing software.
3.	Describe the process of Agile project development.
4.	Recognize the importance of software testing and describe the intricacies involved in

	software evolution.
5.	Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT-I

Introduction	**08 Hours**

Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.

Software Processes:

Models: Waterfall Model, Incremental Model and Spiral Model; Process activities.

Requirements Engineering:	**07 Hours**

Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management

UNIT-II

System Models	**08 Hours**

Context models, Interaction models, Structural models, Behavioral models.

Architectural Design: Architectural design decisions. Architectural Views and patterns, Application architectures.

Design and implementation:	**07 Hours**

Object oriented Design using UML.

Agile Software Development:

Agile methods, Plan-driven and Agile development, Extreme Programming, Agile project management.

UNIT-III

Project Management	**10 Hours**

Risk management, Teamwork.

Project Planning:

Software pricing, Plan-driven development, Project Scheduling

Quality Management: Software quality, Reviews and inspections, Software measurement and metrics, Software standards.

Course Outcomes: At the end of the course student will be able to

1.	Recognize the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility.
2.	Describe the waterfall, incremental and iterative models and architectural design in implementing the software.
3.	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4.	Describe the methods for maintaining software system.
5.	Discuss project planning and management and illustrate the quality of software products.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC2104-1.1	-	3	1	-	-	-	-	2	-	-	-	-	1	2
CC2104-1.2	1	3	1	-	-	-	-	1	-	-	-	-	1	2
CC2104-1.3	1	1	3	-	-	-	-	1	-	-	-	-	2	3
CC2104-1.4	1	3	2	-	-	-	-	1	-	-	-	-	1	2
CC2104-1.5	1	2	2	-	-	-	-	1	-	-	-	-	1	2

	1: Low 2: Medium 3: High
TEXTBOOKS:	
1.	Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education, 2012.
REFERENCE BOOKS:	
1.	Roger S. Pressman: “Software Engineering-A Practitioners approach”, 7th Edition, Tata McGraw Hill, 2017.
2.	Pankaj Jalote: “An Integrated Approach to Software Engineering”, 3^{rd} Edition, Wiley, India, 2010.
E Books / MOOCs/ NPTEL	
1.	http://agilemanifesto.org/
2.	http://www.jamesshore.com/Agile-Book/
3.	https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx
4.	https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx

Professional Core Courses (Lab)

UNIX AND SHELL PROGRAMMING LAB

Course Code:	**CC1601-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**0+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Execute programs written in C under UNIX environment.
2.	Demonstrate how to use the basic Bourne Shell commands like cat, grep, ls, more, ps, chmod etc.
3.	Study about simple filters, grep and sed filters.
4.	Demonstrate various file operations in UNIX
5.	Write AWK script to process text in a file

List of Experiments

1.	a) Write a shell that takes a valid directory name as an argument and recursively descend all the subdirectories, finds the maximum length of any file in that hierarchy and writes this maximum value to the standard output. b) Write a shell script that accepts a path name creates all the components in that path name as directories. For example, if the script is named mpc, then command mpc a/b/c/d should create directories a, a/b, a/b/c, a/b/c/d.
2.	a) Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permission are identical, output common permission and otherwise output each file name followed by its permissions. b) Write a shell script which accepts valid log in names as arguments and prints their corresponding home directories, if no arguments are specified, print a suitable error message.
3.	a) Write shell script to implement terminal locking (similar to the lock command). It should prompt the user for a password. After accepting the password entered by the user, it must prompt again for the the matching password as confirmation and if match occurs, it must lock lock the keyword until a matching password is entered again by the user, Note that the script must be written to disregard BREAK, control-D. No time limit need be implemented for the lock duration. b) Create a script file called file-properties that reads a file name entered and outputs it properties.
4.	a) Write a shell script that accept one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory. b) Write a shell script that displays all the links to a file specified as the first argument to the script. The second argument, which is optional, can be used to specify in which the search is to begin. If this second argument is not present, the search is to begin in current working directory. In either case, the starting directory as well as all its subdirectories at all levels must be searched. The script need not include any error checking.
5.	a) Write a shell script that accepts as filename as argument and display its creation time if file exist and if it does not send output error message.

	b) Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits.
6.	a) Write a shell script to find a file/s that matches a pattern given as command line argument in the home directory, display the contents of the file and copy the file into the directory ~/mydir 15 b) Write a shell script to list all the files in a directory whose filename is at least 10 characters. (use expr command to check the length)
7.	a) Write a shell script that gets executed displays the message either “Good Morning” or “Good Afternoon” or “Good Evening” depending upon time at which the user logs in. b) Write a shell script that accept a list of filenames as 16 its argument, count and report occurrence of each word that is present in the first argument file on other argument files.
8.	a) Write a shell script that determine the period for which a specified user is working on system and display appropriate message. b) Write a shell script that reports the logging in of a specified user within one minute after he/she log in. The script automatically terminates if specified user does not log in during a specified period of time.
9.	a) Write a shell script that accept the file name, starting and ending line number as an argument and display all the lines between the given line number. b) Write a shell script that folds long lines into 40 columns. Thus, any line that exceeds 40 characters must be broken after 40th, a “\” is to be appended as the indication of folding and the processing is to be continued with the residue. The input is to be supplied through a text file created by the user.
10.	a) Write an awk script that accepts date argument in the form of dd-mm-yy and displays it in the form if month, day and year. The script should check the validity of the argument and in the case of error, display a suitable message. b) Write an awk script to delete duplicated line from a text file. The order of the original lines must remain unchanged.
11.	a) Write an awk script to find out total number of books sold in each discipline as well as total book sold using associate array down table as given below. Electrical 34 Mechanical 67 Electrical 80 Computer Science 43 Mechanical 65 Civil 98 Computer Science 64 b) Write an awk script to compute gross salary of an employee accordingly to rule given below. If basic salary is < 10000 then HRA=15% of basic & DA=45% of basic If basic salary is >=10000 then HRA=20% of basic & DA=50% of basic.

Course Outcomes: At the end of the course student will be able to

1.	Interpret various commands to be familiarize with Unix operating system.
2.	Develop shell scripts to solve a given problem.

3.	Apply the concept of file attributes and filters to understand about the file permissions and pattern matching.
4.	Develop shell script to perform various file operations in UNIX environment.
5.	Develop AWK script to process text in a UNIX file system.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC1601-1.1	3	-	-	-	3	-	-	-	-	-	-	-	-	1
CC1601-1.2	2	1	2	-	3	-	-	-	-	-	-	-	-	3
CC1601-1.3	2	1	2	-	3	-	-	-	-	-	-	-	-	3
CC1601-1.4	2	1	2	-	3	-	-	-	-	-	-	-	-	3
CC1601-1.5	2	1	2	-	3	-	-	-	-	-	-	-	-	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	"Unix and Shell Programming", M.G. Venkateshmurthy, Pearson Education, 2005.
2.	"UNIX and Shell Programming", Behrouz A. Forouzan and Richard F. Gilberg, Thomson 2005. (Chapters Appendix H,9).

E Resources

1.	https://swayam.gov.in/nd2_aic20_sp05/preview

DATABASE MANAGEMENT SYSTEMS LAB

Course Code:	**CS2601-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**0:0:2**	**Credits**	**01**
Total Teaching Hours	**0+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**Nil**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Learn how to design ER and schema diagrams for the given database problems and understand the mapping structure of entity relationship to tables.
2.	Implement SQL queries using Data Definition and Data Manipulation Languages.
3.	Develop SQL queries through a variety of database problems.
4.	Understand the concept of stored procedures, triggers, and cursors in developing database applications.
5.	Make use of complex and advanced query concepts in the developments of real time application using the databases.

List of Experiments

1	Design and implementation of SQL queries involving various constructs of SQL as discussed in the Unit-II of the CS2102-1 syllabus. **Note:** 1. Create the tables by properly specifying the primary keys and the foreign keys.

	2. Enter at least four tuples for each relation
2	**i. Insurance Database** Consider the Insurance database given below PERSON (driver – id #: String, name: string, address: string) CAR (regno: string, model: string, year: int) ACCIDENT (report-number: int, accd-date: date, location: string) OWNS (driver-id #: string, regno: string) PARTICIPATED (driver-id: string, Regno: string, report-number: int, damage amount: int) 1. Find the total number of people who owned cars that were involved in accidents in 1989. 2. Find the number of accidents in which the cars belonging to "John Smith" were involved. 3. Update the damage amount for the car with reg number "KA-12" in the accident with report number "1" to $3000.
3	**ii. Order Database** Consider the following relations for an order processing database application in a company: CUSTOMER (cust #: int, cname: string, city: string) ORDER (order #: int, odate: date, cust #: int, ord-Amt: int) ORDER – ITEM (order #: int, item #: int, qty: int) ITEM (item #: int, unit price: int) SHIPMENT (order #: int, warehouse#: int, shipdate: date) WAREHOUSE (warehouse #: int, city: string) 1. Produce a listing: CUSTNAME, #oforders, AVG_ORDER_AMT, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer. 2. For each item that has more than two orders, list the item, number of orders that are shipped from atleast two warehouses and total quantity of items shipped 3. List the customers who have ordered for every item that the company produces
4	**iii. Student enrollment** Consider the following database of student enrollment in courses & books adopted for each course: STUDENT (regno: string, name: string, major: string, bdate:date) COURSE (course #: int, cname: string, dept: string) ENROLL (regno: string, course#: int, sem: int marks:int) BOOK _ ADOPTION (course#: int, sem: int, bookISBN: int) TEXT (book-ISBN: int, book-title: string, publisher: string, author: string) 1. Produce a list of text books (include Course #, Book-ISBN,Book-title) in the alphabetical order for courses offered by th 'CS' department that use more than two books. 2. List any department that has all its adopted books published by a specific publisher 3. List the bookISBNs and book titles of the department that has maximum number of students

5	**iv. Book Dealer** The following tables are maintained by a book dealer: AUTHOR (author-id: int, name: string, city: string, country: string) PUBLISHER (publisher-id: int, name: string, city: string, country: string) CATALOG (book-id: int, title: string, author-id: int, publisher-id: int, category-id: int, year: int, price: int) CATEGORY (category-id: int, description: string) ORDER-DETAILS (order-no: int, book-id: int, quantity: int) 1. Find the author of the book which has maximum sales. 2. Increase the price of the books published by a specific publisher by 10% 3. Find the number of orders for the book that has minimum sales
6	**v. Banking enterprise** Consider the following database for a banking enterprise: BRANCH (branch-name: string, branch-city: string, assets: real) ACCOUNT (accno: int, branch-name: string, balance: real) DEPOSITOR (customer-name: string, accno: int) CUSTOMER (customer-name: string, customer-street: string, customer-city: string) LOAN (loan-number: int, branch-name: string, amount: real) BORROWER (customer-name: string, loan-number: int) 1. Find all the customers who have atleast 2 accounts at all the branches located in a specific city. 2. Find all the customers who have accounts in atleast 1 branch located in all the cities 3. Find all the customers who have accounts in atleast 2 branches located in a specific city.
7	Implementation of a mini project that involves a user interface design, database design and design of SQL queries to suit the need of the designed application.

Course Outcomes: At the end of the course student will be able to

1.	Make use of ER diagrams concepts to design a database for a given real world scenarios
2.	Make use of Schema diagrams concepts to design a database for a given real world scenarios.
3.	Analyse abstract problems and apply a combination of hardware and software to address problems. Implement database creation using Data Definition Language (DDL) concepts.
4.	Apply the DML (Data Manipulation Language) Concepts to query the Database.
5.	Apply the concepts of complex queries in database environment.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CS2601-1.1	1	2	-	2	-	-	-	-	-	1	1	-	-	**-**
CS2601-1.2	1	2	-	2	-	-	-	-	-	1	1	-	-	**-**
CS2601-1.3	2	2	-	2	2	-	-	-	-	1	1	-	-	**3**

CS2601-1.4	2	2	-	2	2	-	-	-	-	1	1	-	-	**-**
CS2601-1.5	2	2	-	2	2	-	-	-	-	1	1	-	-	**2**

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Ramez Elmasri and Shamkant B. Navathe, Database Systems Models, Languages, Design and Application Programming, Pearson, 7th Edition, 2017.

REFERENCE BOOKS:

1. Silberschatz, Korth and Sudharshan, Database System Concepts, Sixth Edition, Mc-Graw Hill, 2010.

E Books / MOOCs/ NPTEL

1. https://swayam.gov.in/nd1_noc19_cs46/preview , Database Management System, Swayam.
2. https://www.coursera.org/learn/intro-sql, Introduction to Structured Query Language (SQL), coursera.
3. https://www.coursera.org/projects/introduction-to-relational-database-and-sql, Introduction to Relational Database and SQL.

ANDROID APPLICATION DEVELOPMENT LAB

Course Code:	**CC3601-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L:T:P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**0+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**CS2002-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Describe the architecture and overview of android.
2.	Develop a mobile application on Android Platform using UI components and Android Components.
3.	Develop applications supporting services and broadcast receivers.
4.	Manage the user data using databases and shared preferences.
5.	Explore the graphical features and animations that can be used in mobile application development.

List of Experiments

1.	**First Week:** Android Overview (T1 – 1.5), Setting up development Environment, Hello World Example, Traversing an Android App Project Structure, Installing and running App Devices (T1 – 2.2, 2.3, 2.4, 2.7) Lab Experiment: Simple Program to display Hello World on App Screen and Looking into the res folder, Manifest.xml file, values folder and activity_main.xml file
2.	**Second Week:** App User Interface – UI Resources (Layout, View), UI Elements (Button, TextView, EditText, RadioButton, RadioGroup) (T1 – 4.1, 4.2, 4.3, 4.4, 4.5) Lab Experiment: Mobile Application to develop a simple Calculator, Application to generate a random color on each button click, Application to change background color using radio buttons
3.	**Third Week:**

	UI Elements – ImageView, CheckBox, DatePicker, TimePicker (T1 – 4.4, 4.5) Lab Experiment: Mobile Application to toast the list of items checked, Application to change image in Image View on button click, Application to select date and time and display it using Date Picker and Time Picker
4.	**Fourth Week:** UI Elements – Spinner, List View, Options Menu, Context Menu (T1 – 4.4, 4.5) Lab Experiment: Implement option menu and context menu to perform mathematical operations, Application to dynamically and statically add items to a list
5.	**Fifth Week:** Activity – States and Life cycle, Interaction among Activities (T1 - 4.6, 4.7) Lab Experiment: Mobile Application to demonstrate the activity life cycle by logging the activities in the Logcat, Application to demonstrate interaction between activities
6.	**Sixth Week:** Threads and AsyncTask, UI Elements – ProgressBar (T1 – 5.1, 5.2, 5.3, 5.4) Lab Experiment: Implement an AsyncTask to count from 1 to 100 in background and display the progress using progress bar, Implement the same using threads
7.	**Seventh Week:** Service, Notifications, Intents – Implicit and Explicit Intents (T1 – 5.5, 5.6) Lab Experiment: Implement a service to play music in background, Demonstrate Call, demonstrate usage of Browser and Maps using Intent class
8.	**Eighth Week:** Broadcast Receivers, Telephony and SMS (T1 - 5.8, 5.9, 5.10) Lab Experiment: Implement broadcast receiver to read the battery percentage from cellphone and change background color based on level, Application to send SMS using SMS Manager, Application to read phone call state using Telephony APIs
9.	**Ninth Week:** Mobile Databases – SQLite (T1 – 6.5) Lab Experiment: Application to insert data entered by user into database and display the values in database (using SQLiteDatabase and DBHelper)
10.	**Tenth Week:** Shared Preferences, Content Providers (T1 – 6.3, 6.6) Lab Experiment: Implement an application to store and retrieve data by using Shared Preference.
11.	**Eleventh Week:** Android Animation, Text to Speech (T1 – 7.3) Lab Experiment: Application to implement Android Animations – Fade, Rotate, zoom, blink, implement application to convert text to speech.
12.	**Twelfth Week:** Audio, Video, Images (T1 –8.2, 8.3) Lab Experiment: Mobile Application to capture image using Camera and set the image as background, Mobile Application to capture video.
13.	**Thirteenth Week:** Sensors in Android, Android Sensor Framework, Motion Sensors - Accelerometer and Gyroscope (T1 – 10.2, 10.3, 10.4) Lab Experiment: Mobile Application to use Accelerometer and display coordinates, Application to use gyroscope and change Background color using sensor values.
Following experiments can be considered for practice purpose	
PART A	
1.	Design four checkboxes namely any four food items and one button. Find total amount of

	food items selected in Toast message after clicking the button.
2.	Design simple calculator application that performs basic arithmetic operations. Use ADD, SUB, MUL, DIV buttons to perform operations, CLEAR button to reset the fields, and edit text widgets for reading operands, displaying result value.
3.	Create an application which generates a random color on each click.
4.	Implement the options menu concept in the application to choose between two activities (Give appropriate titles to activities).
5.	Implement context menu concept in application to change the background color.
6.	Design an application to send SMS using Intent class.
7.	Design a phone call application that takes a phone number from the user.
8.	Write an application to toast your joining date and course selected for engineering using a Date picker and List view/Spinner.
9.	Write an application to make a dialogue box to confirm the change of background color or image.
10.	Design an application that captures the image using a camera and set the captured image as the background for your application.
PART B	
1.	Implement a service concept to play the music in the background for long duration and perform a foreground job.
2.	Implement an AsyncTask to count from 1 to 1000 in the background and the display the progress using progress bar on the screen.
3.	Implement broadcast receiver to carry out the of following: Read battery charge of your mobile, display it using progress bar and change the background color.
4.	Write an application to insert the data entered by a user into a database and display all the values in database.
5.	Write an application to search for a given USN from a student database and call to that student.
6.	Design a simple resume builder application using two activities that take basic information namely Name, Email Id, Mobile No, Gender, Qualification, and Profile Picture from the user. Use appropriate text widgets for (Name, Email Id, Mobile No, Qualification), radio buttons for gender, Imageview for the profile picture.
7.	Write an application that creates a notification message that will launch another activity after clicking on it.
8.	Implement web view concept in application that contains two activities and opens default web page/user entered web page.
9.	Implement an application to store and retrieve data by using shared preference. (Include save, delete and retrieve operations)
10.	Implement the following animation concept i. Blink ii. Move the image object iii. Rotate. iv. Zoom in and Out

Course Outcomes: At the end of the course student will be able to

1.	Explain the architecture, project structure for Android and demonstrate mobile applications with UI Elements
2.	Build Mobile applications for android OS using activities.
3.	Apply the concepts of AsyncTask, services and Broadcast receivers in developing mobile

	applications.
4.	Develop Mobile Applications that supports data handling with Shared Preferences and implements databases.
5.	Develop android applications by applying graphical features, animations and multimedia features

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3601-1.1	2	2	2	-	3	-	-	1	-	-	-	1	-	1
CC3601-1.2	2	2	2	-	3	-	-	1	-	-	-	1	-	3
CC3601-1.3	2	2	2	-	3	-	-	1	-	-	-	1	-	3
CC3601-1.4	2	2	2	-	3	-	-	1	-	-	-	1	-	3
CC3601-1.5	2	2	2	-	3	-	-	1	-	-	-	1	-	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Anubhav Paradhan, Anil V Deshpande, Mobile apps Development, 1st Edition, Wiley Publication, 2014.
2.	Barry Burd, Android Application Development All in one for Dummies
3.	Teach Yourself Android Application Development in 24 Hours, SAMS Publication.

E Resources

1.	https://developer.android.com/training/index.html
2.	https://www.udacity.com/course/new-android-fundamentals--ud851
3.	https://www.tutorialspoint.com/android/index.htm
4.	https://www.javatpoint.com/android-tutorial
5.	https://developer.android.com/guide/
6.	https://www.udemy.com/course/learn-android-application-development-y/

SECURITY LAB

Course Code:	**CC3602-1**	**Course Type:**	**PCC**
Teaching Hours/Week (L: T: P: S):	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours:	**0+0+26+0**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**MA2005-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the concepts of symmetric encryption algorithms.
2.	Understand the public-key cryptography techniques.
3.	Understand the basic concepts in digital signature standard.
4.	Understand the concepts of intrusion detection systems.
5.	Understand hashing techniques and its implementation.

Suggested List of Experiments

1. Implementation of Substitution and Transposition Techniques
    a. Caesar Cipher
    b. Playfair Cipher

   c. Hill Cipher
   d. Vignere Cipher
   e. Rail Fence Cipher
2. Implementation of Cryptographic Algorithms
   a. DES
   b. RSA Algorithm
   c. Diffie Hellman Algorithm
   d. MD5
   e. SHA 1
3. Implement the SIGNATURE SCHEME Digital Signature Standard
4. Providing secure data storage, secure data transmission and creating digital signatures
5. Setup a Honey Pot and Monitor the Honeypot on Network
6. Installation of rootkits and study the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA (Net Stumbler)
8. Demonstrate intrusion detection system

Course Outcomes: At the end of the course student will be able to:

1.	Demonstrate the symmetric encryption algorithms in practical scenarios, including encrypting and decrypting data using programming languages.
2.	Implement the public-key cryptography algorithms in practical scenarios, including generating key pairs and encrypting/decrypting data.
3.	Demonstrate the generation of digital signatures, verifying digital signatures, and managing digital certificates using cryptographic libraries and tools.
4.	Analyse the importance of real-time monitoring and alerting in intrusion detection systems to enable timely responses to security incidents.
5.	Implement the hashing algorithms in practical scenarios using programming languages.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3602-1.1	2	1	3	-	2	-	-	-	-	-	-	1	2	-
CC3602-1.2	2	1	3	-	2	-	-	-	-	-	-	1	1	-
CC3602-1.3	2	1	2	-	2	-	-	-	-	-	-	1	2	-
CC3602-1.4	2	2	2	-	1	-	-	-	-	-	-	1	1	-
CC3602-1.5	1	1	2	-	2	-	-	-	-	-	-	1	1	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	William Stallings, Cryptography and Network Security, Pearson 6th Edition, 2013.
2.	V K Pachghare, Cryptography and Information Security, PHE, 2013.
3.	Forouzan Mukhopadhyay, Cryptography and Network Security, Mc Graw Hill, 3rd Edition, 2015

E Resources

1.	https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev
2.	https://www.youtube.com/watch?v=VJelZrYc49c&list=PLLOxZwkBK52Ch0y2lLtfepy4Lt_SVkw
3.	https://www.youtube.com/watch?v=VJelZrYc49c&list=PLLOxZwkBK52Ch0y2lLtfepy4Lt_SVkw

ADVANCED NETWORK SIMULATION LAB

Course Code	**CC3603-1**	**Course Type**	**PCC**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**0+0+26**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the basic concept 5G Network Fundamentals
2.	Explore the mm-Wave Network Setup for 5G
3.	Evaluate the IoT Performance for 5G network
4.	Study the Vehicular Networks (VANETs) for mm wave and 5G Network
5.	Examine the MIMO Techniques for IoT.

Suggested List of Programs

1. Set up a basic 5G network with a single Base Station (BS) and three mobile nodes. Analyze the network performance.
2. Set up a basic mmWave network with a single Base Station (BS) and multiple User Equipment (UE) nodes.
3. Simulate network slicing in a mmWave network to provide different Quality of Service (QoS) for different applications.
4. Analyze the security aspects of a mmWave network and implement basic security measures.
5. Simulate communication between mmWave IoT devices and a central server. Analyze performance metrics such as energy consumption, latency, and packet delivery ratio.
6. Simulate the vehicular networks (VANETs) with high mobility. Test the impact on connectivity, handover performance, and throughput.
7. Implement and examine MIMO techniques tailored for IoT applications. Assess the benefits in terms of coverage, reliability, and energy efficiency for low-power IoT devices. Analyze the security aspects of a mmWave network and implement basic security measures.
8. Develop cross-layer optimization strategies that leverage MIMO capabilities to enhance network performance. Analyze the impact on throughput, latency, and reliability across various layers.
9. Simulate the integration of MIMO with OFDMA in LTE and 5G networks.
10. Design 5G network and manage the traffic using AIML for optimum throughput and latency.

Course Outcomes: At the end of the course students will be able to

1.	Design 5G network single Base Station (BS) and three mobile nodes
2.	Demonstrate the working of mm-wave for wifi network.
3.	Analyze the working of vehicular networks (VANETs) with high mobility
4.	Design the MIMO techniques tailored for IoT applications and analyze the impact on throughput, latency, and reliability across various layers
5.	Analyze the performance of 5G Network manage the traffic using AIML

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
CC3603-1.1	2	1	-	-	3	-	-	-	-	-	-	1	2	3
CC3603-1.2	2	1	-	-	3	-	-	-	-	-	-	1	2	3
CC3603-1.3	2	1	-	-	3	-	-	-	-	-	-	1	2	3
CC3603-1.4	2	1	-	-	3	-	-	-	-	-	-	1	2	3
CC3603-1.5	2	1	-	-	3	-	-	-	-	-	-	1	2	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Law, Averill, —Simulation Modeling and Analysis with Expert Software, 5th Edition, Mc Graw Hill, 2006.
2	J. B. Sinclair, —Simulation of Computer Systems and Computer Networks: A Process-Oriented Approach, 2004.
3	https://www.nsnam.org/

Professional Elective Courses

Professional Elective Courses (Computational Fundamentals)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code:	**CC2201-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS1005-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the fundamentals of AI and machine learning

2.	Understand the problem-solving Agents
3.	Explore machine learning algorithm
4.	Understand Association Analysis, Regression, Decision tree induction, Nearest-Neighbour classifier, Bayesian classifiers.
5.	Use different unsupervised learning techniques to solve the problem specification

UNIT-I	
Introduction to AI, Branches of Artificial Intelligence	**07 Hours**
What is AI? Acting Humanly: The Turing Test approach, Thinking Humanly: The cognitive modeling approach, thinking rationally: The laws of thought approach, Acting Rationally: The rational agent approach. The state of art. Machine Learning, Deep Learning, Natural Language Processing, Robotics, Expert Systems, Fuzzy Logic.	
Intelligent Agents	**08 Hours**
Agents and Environments, Good behavior: The concept of rationality, The nature of environments, properties of task environments, Structure of Agents: Agent Programs, Types of agent programs. Solving Problems by Searching: Problem solving Agents, well defined problems, and solutions, formulating problems, Example problems: Toy problems: Vacuum world, 8-Queen's problem, Real world problem: Airline Route finding problem	
UNIT-II	
Machine learning Foundations	**08 Hours**
Introduction to machine learning: What is machine learning? Examples of machine learning applications: Learning associations, Classification, Regression, Unsupervised learning, Reinforcement learning Data preprocessing: Types of data, attributes and measurements, types of datasets, Data quality, Aggregation, Sampling, Dimensionality reduction, Feature subset selection, Feature creation, Discretization and binarization, variable transformation Support vector machine: Maximum margin hyperplanes, Linear SVM: separatable case	
Association Analysis, Regression, Decision tree induction, Nearest-Neighbour classifier, Bayesian classifiers	**07 Hours**
Frequent itemset generation, The Apriori principle, candidate generation and pruning, Support counting, Rule generation: Confidence based pruning, Rule generation in apriori algorithm, Simple linear regression, least square method, analyzing regression errors, analysing goodness of fit, multivariate regression, Preliminaries, general approach to solving a classification problem how a decision tree works, how to build a decision tree, methods for expressing attribute test conditions measures for selecting the best split, algorithm for decision tree induction. Algorithm, characteristics of nearest neighbour classifier, Bayes theorem, using bayes theorem for classification, Naïve bayes classifier, Bayes error rate.	
UNIT-III	
Unsupervised learning algorithms	**10 Hours**
Cluster analysis: What is cluster analysis? Different types of clustering, different types of clusters K-means clustering: The basic K-means algorithm, K-means additional issues, Bisecting K-means, K-means and different types of clusters Agglomerative Hierarchical clustering: Algorithm, specific techniques, key issues in hierarchical clustering DBSCAN: Density centre-based approach, DBSCAN algorithm, BIRCH algorithm: Building CF tree, Global clustering.	
Course Outcomes: At the end of the course student will be able to	

1.	Explain basics of Artificial Intelligence and Machine Learning
2.	Describe types of intelligent Agents and its Application
3.	Apply different data preprocessing and Supervised learning Algorithms on real time data
4.	Analysis of association techniques using machine learning algorithm
5.	Define and analyze different types of clustering techniques

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC2201-1.1	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CC2201-1.2	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CC2201-1.3	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CC2201-1.4	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CC2201-1.5	2	2	-	-	-	-	-	-	-	-	-	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson 3rd Edition, 2016.
2.	Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2004
3.	Pang-NingTan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2009.

REFERENCE BOOKS:

1.	T. M. Mitchell, "Machine Learning", McGraw Hill, 1997
2	R. O. Duda, P. E. Hart and D. G. Stork Pattern Classification, Wiley Publications, 2001
3	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.

BIG DATA ANALYTICS

Course Code:	**CC3201-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2102-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the various types of digital data (structured, semi-structured,

	unstructured).
2.	Identify the pros and cons of NoSQL databases and understand the concepts of Hadoop.
3.	Understand the mapreduce technique and YARN framework.
4.	Understand the data types supported by Hive and its interaction with various file formats.
5.	Understand how organizations have successfully implemented and benefited from Big Data Analytics.

UNIT-I	
Introduction to Big Data	**15 Hours**
Introduction to big data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment. Big data technologies and Databases: Introduction to NoSQL, Uses, Features and Types, Need, Advantages, Disadvantages and Application of NoSQL, Overview of NewSQL, Comparing SQL, NoSQL and NewSQL, Introduction to MongoDB and its needs, Characteristics of MongoDB, Introduction of apache cassandra and its needs, Characteristics of Cassandra. Hadoop foundation for analytics: History, Needs, Features, Key advantage and Versions of Hadoop, Essential of Hadoop ecosystems, RDBMS versus Hadoop, Key aspects and Components of Hadoop, Hadoop architectures.	
UNIT-II	
Hadoop MapReduce and YARN framework	**15 Hours**
Hadoop MapReduce and YARN framework: Introduction to MapReduce, Processing data with Hadoop using MapReduce, Introduction to YARN, Components, Need and Challenges of YARN, Dissecting YARN, MapReduce application, Data serialization and Working with common serialization formats, Big data serialization formats; Big data with Hive and Pig: Overview of hive and its architecture, Hive data types and File format, Hive query language (HQL), Introduction to Pig, pig latin overview, Data types in Pig and Running Pig.	
UNIT-III	
Big data analytics	**10 Hours**
Big data analytics: Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.	
Course Outcomes: At the end of the course student will be able to	

1.	Explain the concepts of big data.
2.	Evaluate the advantages, disadvantages, and applications of NoSQL databases and explain the concepts of Hadoop foundations for analytics.
3.	Recognize why YARN was introduced and the challenges it addresses in managing resources efficiently.
4.	Choose the data types supported by Hive and its interaction with various file formats.

5.	Analyse the significance of BI tools in extracting insights from data.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
CC3201-1.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CC3201-1.2	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CC3201-1.3	2	1	-	1	-	-	-	-	-	-	-	1	1	1
CC3201-1.4	2	1	-	-	-	-	-	-	-	-	-	1	1	1
CC3201-1.5	2	1	-	-	-	-	-	-	-	-	-	1	1	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Seema Acharya, Subhashini Chellappan ,"Big Data and Analytics", Wiley,2017.
2.	Alex Holmes,"Big Data Black Book", Dreamtech,2015.

REFERENCE BOOKS:

1.	Minelli, Chambers, Dhiray,"Big Data Big Analytics", Wiley,2013.
2.	Chuck Lam, "Hadoop in Action", Dreamtech,2011.

ADVANCED JAVA

Course Code:	**CC3202-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2002-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the fundamental principles of object-oriented programming.
2.	Understand the fundamentals of file handling in Java.
3.	Familiarize with the concepts of Java Database Connectivity.
4.	Understand the basic concepts of network programming with Java.
5.	Develop server-side web applications using Java Server Pages.

UNIT-I	**15 Hours**

Revisit To OOP Concepts

Class, Object and Inheritance in Java. String buffer and string builders, Java beans, Introspection, Bean APIs, EJB concepts, Collection interfaces and Collection classes.

FILE HANDLING:

Serial Access Files, File Methods, Redirection, Command Line Parameters, Random Access Files.

UNIT-II	**15 Hours**

Java data base connectivity (JDBC):
The Vendor Variation Problem, SQL and Versions of JDBC, Creating an ODBC Data Source, Simple Database Access, Modifying the Database Contents, Transactions, Metadata, Scrollable Result SetsinJDBC2.0, Modifying Databases via Java Methods.

Network Programming with Java:
Basic Concepts, Protocols and Terminology, Clients, Servers and Peers, Ports and Sockets, The Internet and IP Addresses, Internet Services, URLs and DNS, TCP, UDP. The Inet Address Class, Using Sockets (TCP and UDP).

UNIT-III	10 Hours

Java servlets
Benefits, A simple Java Servlet, Anatomy of a Java Servlet, reading data from a client, Reading HTTP Request Headers, Sending data to a client, working with Cookies, Tracking Sessions.

JAVA SERVER PAGES(JSP):
JSP Tags, Form handling in JSP, User Sessions, Cookies, Session objects.

Course Outcomes: At the end of the course student will be able to

1.	Apply the knowledge of Java Programming to demonstrate the OOP Concepts.
2.	Demonstrate the file handling using JAVA.
3.	Develop Java Program to store and retrieve data from the database.
4.	Apply Java Programming to establish Network Connectivity also Demonstrate TCP and UDP sockets.
5.	Design and develop server side programs.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3202-1.1	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CC3202-1.2	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CC3202-1.3	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CC3202-1.4	3	3	-	-	-	-	-	-	-	-	-	-	2	2
CC3202-1.5	3	3	-	-	-	-	-	-	-	-	-	-	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. HerbertSchildt, “The Complete Reference Java”, 7th Edition, TataMcGraw-Hill, 2007
2. JanGraba, “An Introduction to Network Programming with Java”, Springer Publications, 2007
3. JimKeogh, “The Complete Reference J2EE”, TataMcGraw-Hill, 2002.

REFERENCE BOOKS:

1. H. M. Deitel, “Java –How to Program?”, PrenticeHall, 2004.

E Books / MOOCs/ NPTEL

http://www.mindview.net/Books/TIJ
http://docs.oracle.com/javase/specs/jls/se8/html/index.html

MATHEMATICAL FOUNDATION FOR COMPUTER NETWORK

Course Code:	**CC3203-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA2005-1, CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	To introduce the concepts of mathematical logic
2.	To introduce the concepts of sets, relations, and functions.
3.	To perform the operations associated with sets, functions, and relations.
4.	To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
5.	To use Graph Theory for solving problems

UNIT-I	
Basic Structures:	**08 Hours**
Basic Structures: Sets, Functions, Sequences, Sums and Matrices.	
Mathematical Logic	**07 Hours**
Propositional Logic, Applications of Propositional Logic, Propositional Equivalences Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs	
UNIT-II	
Relations	**08 Hours**
Relations and Their Properties, n-ary Relations and Their Application, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings	
Random variable and probability distribution	**07 Hours**
Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems	
UNIT-III	
Graph Theory	**10 Hours**
Graphs and Graphs models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring	

Course Outcomes: At the end of the course student will be able to

1.	Apply the fundamentals of set theory and matrices for the given problem
2.	Apply the types of distribution, evaluate the mean and variance for the given case study/ problem.
3.	Solve the given problem by applying the Mathematical logic concepts.
4.	Model the given problem by applying the concepts of graph theory.

5.	Design strategy using gaming theory concepts for the given problem.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
CC3203-1.1	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CC3203-1.2	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CC3203-1.3	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CC3203-1.4	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CC3203-1.5	-	1	3	-	-	-	-	-	-	-	-	-	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 8th Edition, Wiley – India.

REFERENCE BOOKS:

1.	D M Dhamdhere: Operating Systems – A Concept Based Approach, 2nd Edition, Tata McGraw – Hill, 2002.
2.	P C P Bhatt: Operating Systems, 2nd edition, PHI, 2006.
3.	Harvey M Deital: Operating Systems, 3rd edition, Addison Wesley, 1990.

E Books / MOOCs/ NPTEL

1.	https://www.coursera.org/specializations/mathematics-machine-learning
2.	www.coursera.org/learn/datasciencemathskills

VIRTUAL REALITY

Course Code:	**CC3301-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2002-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the basics concepts of Virtual Reality and Virtual environment.
2.	Visualize the concepts of geometric modeling in virtual environment.
3.	Develop animations and simulations for virtual environment.
4.	Understand the Virtual Reality Hardware & its Software.
5.	Understand the Virtual Memory and scheduling.

UNIT-I

Introduction and Overview of Operating Systems	**08 Hours**

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation – Virtual environments –requirement – benefits of

virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Color theory – Simple 3D modeling Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image.
Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction.

Virtual Environment:	**07 Hours**

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object in betweening – free from deformation – particle system-
Physical Simulation: Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT-II

Process Management	**08 Hours**

Concept of Processes and Programs, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, and Threads in Solaris.

VR Hardwares:	**07 Hours**

Human factors : Introduction – the eye - the ear- the somatic senses - VR Hardware: Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems

UNIT-III

Virtual Memory and Scheduling	**10 Hours**

VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.
VR Application: Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction.

Course Outcomes: At the end of the course student will be able to

1.	Explain the concepts of virtual reality, geometric modeling and its environment.
2.	Discuss the applications of different types of interpolation and translation mechanisms and physical simulations of objects.
3.	Explain the concepts of process creation, execution and termination in UNIX.
4.	Describe the various components and integration of virtual reality hardware.
5.	Discuss the concepts of virtual memory and scheduling.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3301-1.1	1	2	2	-	-	-	-	-	-	-	-	1	1	2
CC3301-1.2	3	2	2	-	-	-	-	-	-	-	-	1	1	2
CC3301-1.3	3	2	2	-	-	-	-	-	-	-	-	1	1	2

CC3301-1.4	3	2	2	-	-	-	-	-	-	-	-	1	1	2
CC3301-1.5	3	2	2	-	-	-	-	-	-	-	-	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

REFERENCE BOOKS:

1.	Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
2.	Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.
3.	William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/106106138
2.	https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/foundation-course-on-virtual-reality-and-augmented-reality/
3.	http://lavalle.pl/tutorials.html

CLOUD COMPUTING

Course Code:	**CC3302-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2102-1, CC2104-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the characteristics that differentiate cloud computing from traditional computing models.
2.	Identify and discuss the current challenges and open issues in cloud computing.
3.	Define virtualization and its role in computing.
4.	Explore prominent virtualization technologies such as XEN, VMware, and Microsoft Hyper-V.
5.	Explain how security monitoring contributes to identifying and mitigating security incidents.

UNIT-I

Introduction to Cloud Computing	**15 Hours**

Eras of computing, Parallel vs. Distributed Computing, Elements of Parallel Computing-(What is parallel computing , hardware architecture for Parallel processing, approaches to parallel programming, levels of parallelism, Laws of caution). Elements of Distributed Computing-(General concepts and definitions, components of a distributed system, Architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing-Remote procedure call, Service oriented computing).

Cloud computing Architecture: Introduction, Cloud reference models-(Architecture,Infrastructure/Hardware as a service, Platform as a service, Software as a service), Types of cloud – (Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds), Economics of cloud, Open challenges.

UNIT-II

Virtualization	**15 Hours**

Virtualization: – Introduction, characteristics of virtualized environments, taxonomy of virtualization technique- (execution of virtualization, other types of virtualization-Compute, Storage, Network, Desktop, Application). Virtualization and cloud computing, Pros and Cons of virtualization, Technology examples- XEN, VMware, Microsoft Hyper-V. Security Concerns,
Risk Issues: Cloud Computing- Security Concerns. A Closer Examination: Virtualization, A Closer Examination: Provisioning.
Securing the Cloud: Key Strategies and Best Practices: - Overall Strategy: Effectively Managing Risk-Risk Management: Stages and Activities. Overview of Security Controls, Cloud Security Controls Must Meet Your Needs, NIST Definitions for Security Controls, Unclassified Models, Classified Model The Cloud Security Alliance
Approach. The Limits of Security Controls - Security Exposure Will Vary over Time, Exploits Don't Play Fair. Best Practices: Best Practices for Cloud Computing- First Principals, Best Practices across the Cloud Community .Other Best Practices for Cloud Computing- Cloud Service Consumers, Cloud Service Providers. Security Monitoring.

UNIT-III

Cloud Security	**10 Hours**

The Purpose of Security Monitoring, Transforming an Event Stream, The Need for C.I.A. in Security Monitoring, the Opportunity for MaaS. Case studies: Public cloud- AWS, Windows Azure, Google App Engine. Private Cloud- Open stack, Eucalyptus.

Course Outcomes: At the end of the course student will be able to

1.	Explain the characteristics that differentiate cloud computing from traditional computing models.
2.	Outline the infrastructure management for cloud environment.
3.	Explore how virtualization enhances resource utilization and flexibility
4.	Describe the virtualization impacts resource efficiency, management, and cost.
5.	Explain the AWS security controls including confidentiality, integrity, and availability.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3302-1.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CC3302-1.2	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CC3302-1.3	2	1	-	1	-	-	-	-	-	-	-	1	1	1
CC3302-1.4	2	1	-	-	-	-	-	-	-	-	-	1	1	1
CC3302-1.5	2	1	-	-	-	-	-	-	-	-	-	1	1	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Buyya, Rajkumar, Christian Vecchiola and Thamarai Selvi; Mastering Cloud Computing

	Fundamentals and Applications Programming; McGraw Hill, 2013.
2.	G, Somasundarm and Alok Srivatsa; Information Storage and Managemnt; EMC Education Services, Wiley Publishing Inc., 2009.
3.	Sitaram, Dinakar and Geetha Manjunath; Moving to the Cloud - Developing Apps in the World of Cloud Computing; Elsevier, 2012.
4.	Sosinsky, Barrie; Cloud Computing Bible, Wiley India Pvt. Ltd, 2013.
REFERENCE BOOKS:	
1.	Hurwitz, Judith, Cloud computing for dummies, Wiley India Pvt Ltd, 2011.
2.	Rittinghouse, John, Cloud computing – implementation, management and security, CRC Press, First edition, 2009.

SEMANTIC WEB

Course Code:	**CC3303-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2102-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the History and Limitations of Web Intelligence.
2.	Learn about the key technologies and standards used in Semantic Web development.
3.	To understand Ontology Engineering.
4.	Acquire the skills to learn and develop Semantic Web Applications, Services and Technology
5.	Explore applications and use cases of Semantic Web technologies.

UNIT-I

Web Intelligence:	**07 Hours**
Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Semantic Road Map, Logic on the semantic Web.	
Knowledge Representation for the Semantic Web:	**08 Hours**
Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework (RDF) / RDF Schema, Ontology Web Language (OWL), UML, XML/XML Schema.	

UNIT-II

Ontology Engineering:	**08 Hours**
Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology	

Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Semantic Web Applications, Services and Technology:	**07 Hours**

Semantic Web applications and services, Semantic Search, e-learning,

UNIT-III

Semantic Bioinformatics	**10 Hours**

Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

Course Outcomes: At the end of the course student will be able to

1.	Recall the chronicle order of Web Generation and application of Modern techniques for Web Intelligence.
2.	Summarize the standard frameworks such as RDF, OWL UML and XML of Semantic Web.
3.	Discuss basics and methods of Ontology Engineering.
4.	Outline Semantic Web Applications, Services and Technology
5.	Explain the Semantic Bioinformatics, XML web services and Semantic Search Technology.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**		**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3303-1.1	3	1	1	-	3	-	-	2	1	-	3	1	2	3
CC3303-1.2	3	3	1	-	3	-	-	2	1	-	3	1	2	3
CC3303-1.3	3	3	1	-	3	-	-	2	1	-	3	1	2	3
CC3303-1.4	3	3	2	-	3	-	-	2	1	-	3	1	2	3
CC3303-1.5	3	3	2	-	3	-	-	2	1	-	3	1	2	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Berners Lee, Godel and Turing, Thinking on the Web, Wiley inter science, 2008.
2.	Peter Mika , Social Networks and the Semantic Web, Springer, 2007.

REFERENCE BOOKS:

1.	J. Davies, R. Studer, P. Warren, Semantic Web Technologies, Trends and Research in Ontology Based Systems, John Wiley & Sons, 2006.
2.	Liyang Lu Chapman and Hall, Semantic Web, and Semantic Web Services CRC Publishers (Taylor & Francis Group), 2007.
3.	Heiner Stuckenschmidt; Frank Van Harmelen, Information sharing on the semantic Web, Springer Publications, 2010.
4.	T. Segaran, C. Evans, J. Taylor, Programming the Semantic Web, O'Reilly, SPD, 2009.

E Books / MOOCs/ NPTEL

1.	https://www.mooc-list.com/tags/semantic-web
2.	https://open.hpi.de/courses/semanticweb

3.	https://ieeexplore.ieee.org/document/7397219
4.	https://onlinecourses.nptel.ac.in/noc24_cs14/preview

SOCIAL AND WEB ANALYTICS

Course Code:	**CC3304-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	To Understand the fundamentals of Social Media Analytics and Web analytics,
2.	Develop KPIs and to build scorecards & dashboards to track KPIs.
3.	Analyze the fundamentals of Mining twitter and create a twitter API connection
4.	Acquire the skills for Mining Facebook and develop Facebook’s Graph API.
5.	Define and explore the methods of Data Mining in social media.

UNIT-I

Introduction to web and social analytics: **09 Hours**

Overview of web & social media, Impact of social media on business, social media environment, how to leverage social media for better services, Usability, user experience, customer experience, customer sentiments, web marketing, conversion rates, ROI, brand reputation, competitive advantages.
Need of using analytics, Web analytics technical requirements., current analytics platforms, Open Source vs licensed platform, choosing right specifications & optimal solution, Web analytics and a Web analytics 2.0 framework (clickstream, multiple outcomes Relevant Data And its Collection using statistical Programming language R:Data, Participating with people centric approach, Data analysis basics (types of data, metrics and data, descriptive statistics, comparing, Basic overview of R:R-Data Types, R-Decision Making, R-Loops, R-functions, R-Strings, Arrays, R-Lists, R- Data Frame, R-CSV Files, R-Pie Charts, R-Bar charts, R-Barplots. Basic Text Mining in R and word cloud.

KPI/Metrics: **06 Hours**

Understand the discipline of social analytics, aligning social objectives with business goals, identify common social business objectives, developing KPIs; Standard vs Critical metrics. PULSE metrics on business and technical Issues, HEART metrics on user behavior issues; Bounce rate, exit rate, conversion rate, engagement, strategically aligned KPIs, Measuring Macro & micro conversions, On-site web analytics, off-site web analytics, the goal-signal-metric process. Case study on Ready-made tools for Web and social media analytics.

UNIT-II

Mining Twitter: **08 Hours**

Exploring Trending Topics, Discovering What People Are Talking About, and More: Why Is Twitter All the Rage?, Exploring Twitter’s API, Fundamental Twitter Terminology, Creating a

Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analyzing the 140 Character, Extracting Tweet Entities, Analyzing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms.

Mining Facebook:	**07 Hours**

Analyzing Fan Pages, Examining Friendships, and More**:** Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analyzing Social Graph Connections, Analyzing Facebook Pages, Examining Friendships.

UNIT-III

Data Mining in social media:	**10 Hours**

Introduction, Data Mining in a Nutshell, Social Media, Motivations for Data Mining in Social Media, Data Mining Methods for Social Media, Data Representation, Data Mining - A Process, Social Networking Sites: Illustrative Examples, The Blogosphere: Illustrative Examples, Related Efforts, Ethnography and Netnography, Event Maps

Introduction, Keyword Search, Query Semantics and Answer Ranking, Keyword search over XML and relational data, Keyword search over graph data, Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogeneous Networks.

Course Outcomes: At the end of the course student will be able to

1.	Illustrate the use of Social Media Analytics and Web analytics,
2.	Explain how to leverage social media for better services. Also, discuss and develop KPIs and to build scorecards & dashboards to track KPIs.
3.	Explore and analyze the fundamentals and diversities of Twitter Mining.
4.	Express and analyze text mining on Facebook social API.
5.	Discuss the data mining process in social networks and outline the concepts of Keyword Search over networks.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3304-1.1	3	2	3	1	-	-	-	3	-	-	-	-	3	3
CC3304-1.2	3	2	2	1	-	-	-	3	-	-	-	-	2	3
CC3304-1.3	3		2	3	-	-	-	3	-	-	-	-	3	3
CC3304-1.4	3	2	2	3	-	-	-	3	-		-	-	3	3
CC3304-1.5	3	2	2	2	-	-	-	2	-	-	-	-	3	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Matthew A. Russell," Mining of Social web, O'Reilly", Second Edition, 2013,
2.	Charu C Agarwal, "Social Network Data Analytics", Springer; October 2014.

REFERENCE BOOKS:

1.	Hand, Mannila, and Smyth, "Principles of Data Mining", Cambridge, MA: MIT Press,

	2001.
2.	Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", John Wiley &Sons; Pap/Cdr Edition, 2009.
3.	Tom Tullis, Bill Albert, "Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics", First Edition, Morgan Kaufmann ,2008.
4.	Jim Sterne, Social Media Metrics: "How to Measure and Optimize Your Marketing Investment", John Wiley & Sons ,2010.
5.	Brian Clifton, "Advanced Web Metrics with Google Analytics", Third Edition, John Wiley & Sons ,2012.
E Books / MOOCs/ NPTEL	
1.	https://www.mooc-list.com/tags/social-media-analytics
2.	https://www.coursera.org/courses?query=social%20media%20analytics
3.	https://mooc.es/course/social-media-data-analytics/
4.	https://onlinecourses.nptel.ac.in/noc23_cs106/preview

WEB ENGINEERING

Course Code	**CC3305-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CS2102-1, CC2104-1, CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the concepts and principles of Web Engineering.
2.	Learn to design dynamic and interactive web applications architectures and understand Database Management and Integration.
3.	Infer Customization Modeling and Content Modeling of Web Applications.
4.	Explore the goals, principles and guidelines for Web Application.
5.	Adapt the usability of Test Methods in web applications.

UNIT-I

Introduction to Web Engineering:	**07 Hours**
Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.	
Web Application Architectures & Modelling Web Applications:	**08 Hours**
Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization,	

Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling

UNIT-II

Customization Modeling	**08 Hours**

Customization Modeling, Modelling Framework-Modeling languages- Analysis Modeling for WebApps-The Content Model-The Interaction Model-Configuration Model.

Web Application Design:	**07 Hours**

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines-Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture- structuring- Accessing Information-Navigation Design- Functional Design-WebApp

UNIT-III

Testing Web Applications:	**10 Hours**

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches-Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing- Browser Testing-Usability Testing-Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.

Course Outcomes: At the end of the course student will be able to

1.	Familiarize the characteristics of web applications.
2.	Paraphrase the Model web applications architecture and Database Management Abilities
3.	Extend Customization Modeling and Content Modeling of Web Applications.
4.	Summarize Designing Preliminaries and Goals of Web Applications.
5.	Discuss the various Testing techniques of web applications.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3305-1.1	2	2	1	1	-	-	-	1	-	-	-	-	2	3
CC3305-1.2	2	2	2	3	2	-	-	2	-	-	-	-	2	3
CC3305-1.3	2	3	3	2	2		-	1	-	-	-	-	2	3
CC3305-1.4	2	3	3	2	3	-	-	3	-	-	-	-	2	3
CC3305-1.5	2	3	3	3	3	-	-	3	-	-	-	-	2	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Chris Bates, Web Programming: Building Internet Applications, Third Edition, Wiley India Edition, 2007.
2.	Gerti Kappel, Birgit Proll, Web Engineering‖, John Wiley and Sons Ltd, 2006

REFERENCE BOOKS:

1.	Guy W. Lecky-Thompson, Web Programming, Cengage Learning, 2008.

2.	John Paul Mueller, Web Development with Microsoft Visual Studio 2005, Wiley Dream tech, 2006.
3.	Roger S. Pressman, David Lowe, Web Engineering‖, Tata McGraw Hill Publication, 2007
E Books / MOOCs/ NPTEL	
1.	https://www.coursera.org/learn/getting-started-with-git-and-github
2.	https://www.coursera.org/projects/introduction-to-accessible-web-development
3.	Edx- HTML https://www.edx.org/search?q=html

Professional Elective Courses (Computer Networking Technologies)

ADHOC WIRELESS NETWORKS			
Course Code	**CC3211-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**3**
Total Teaching Hours	**40+0+0**	**CIE +SEE Marks**	**50+50**
Prerequisites	**CC2001-1**		
Teaching Department: Computer and Communication Engineering			

Course Objectives:

1.	Describe MAC Protocols for Ad hoc wireless Networks.
2.	Understand the concept of Routing protocols for Ad hoc wireless Networks.
3.	Familiarise the concepts of Table driven and Hybrid routing protocol.
4.	Describe the Transport layer protocols for Ad hoc wireless Networks.
5.	Explore the Security issues in wireless networks.

Unit I	15 Hours

Review of Wireless Networks: IEEE Wireless Standard, Basic 802.11 MAC layer mechanisms, CSMA/CA mechanisms, and other MAC layer functionalities.
Ad-hoc Networks: Introduction, Issues in Ad Hoc wireless networks, Ad-hoc wireless internet.
MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC

Protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks.
Classification of MAC Protocols: Contention based protocols: MACAW, FAMA busy tone protocols, receiver-initiated protocol: MARCH. Contention based protocols with reservation mechanisms: DPRMA, HRMA, FPRP. Contention-based MAC protocols with scheduling mechanism: DPS&MA.
Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing Protocol for Ad hoc wireless Networks, Classification of routing Protocols.

Unit II	15 Hours

Table driven routing protocol: DSDV, WRP, CGSR. On-demand routing protocol: DSR, AODV, LAR, FORP.
Hybrid routing protocol: CEDAR, ZRP. Hierarchical routing protocols: FSR. Metrics used by power aware routing protocols.
Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer Protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks: TCP-F, TCP with ELFN, TCP-BuS, ATCP, Split TCP. Other transport layer protocols for Ad hoc wireless Networks: ACTP, ATP.

Unit III	10 Hours

Security in wireless Ad hoc wireless Networks: Network Security requirements, Issues & Challenges in security provisioning, Network security attacks, Key Management, Secure routing in Ad hoc wireless Networks: SAR, SEAD, Security-Aware AODV.
Quality of service in Ad hoc wireless Networks: Introduction, Issues & challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explain the fundamentals of IEEE 802.11 MAC layer and its design issues.
2. Analyse the MAC protocols and routing protocols for Ad Hoc wireless network.
3. Classify and distinguish the Table driven and Hybrid routing protocols for ad hoc wireless networks.
4. Identify the design issues with Transport layer protocols in wireless networks and examine few solutions for the same.
5. Analyse the security and QoS issues and challenges with ad hoc wireless networks.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3211-1.1	3	1	-	-	-	-	-	-	-	-	-	1	3	-
CC3211-1.2	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC3211-1.3	3	1	-	-	-	-	-	-	-	-	-	1	3	-

CC3211-1.4	3	2	2	-	-	-	-	-	-	-	-	1	3	-
CC3211-1.5	3	2	-	-	-	-	-	-	-	-	-	1	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Siva Ram Murthy and B S Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Second Edition, C. Pearson Education, 2005.

REFERENCE BOOKS:

1. Prasant Mohapatra and Srikanth Krishnamurthy, "Ad Hoc Networks: Technologies and Protocols", Springer Science, 2005.
2. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications", Auerbach Publications, 2007.
3. Sudip Misra, Isaac Woungang, Subhas Chandra Misra, "Guide to Wireless Ad Hoc Networks", Springer-Verlag, 2009.
4. Mohammad Ilyas, "The Handbook of Ad Hoc Wireless Networks", Editor, CRC Press, 2003.
5. C. K. Toh, "Ad hoc Mobile Wireless Networks: Protocols & Systems", Prentice-Hall PTR, 2002.

NETWORK DESIGN AND ANALYSIS

Course Code:	**CC3212-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Provide a strong foundation in Networking Principles.
2.	Understand the concepts of Physical Network Design LAN.
3.	Learn about remote Access Technologies and Devices.
4.	Compare and analyze the various Internet routing protocols.
5.	Illustrate the concepts of software defined networks and delay tolerant networks.

UNIT-I	**15 Hours**

Networking Principles Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals – Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions.

Physical Network Design -Lan cabling topologies – Ethernet Switches – High speed and

Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches.

UNIT-II	15 Hours

Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

Logical Design and Management IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSMand CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN –RMON and SNMP

UNIT-III	10 Hours

Innovative Networks Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers – Network Function Virtualization – Needs of the Data Centres – SDN solutions for data centres - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing.

Course Outcomes: At the end of the course student will be able to

1.	Recall the fundamental concepts and networking principles of multiplexing, switching and various end to end semantics involved in wireless networks.
2.	Discuss the various elements required for physical network design.
3.	Explore the remote Access Technologies and Devices used in it.
4.	Investigate various Internet routing protocols and the ensign issues.
5.	Illustrate the concepts of software defined networks and delay tolerant networks.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3212-1.1	3	-	2	-	-	-	-	-	-	-	-	1	2	2
CC3212-1.2	3	-	2	-	-	-	-	-	-	-	-	1	2	1
CC3212-1.3	3	-	1	-	-	-	-	-	-	-	-	1	2	2
CC3212-1.4	3	-	1	-	-	-	-	-	-	-	-	1	3	2
CC3212-1.5	2	-	3	-	3	-	-	-	-	-	-	1	3	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Larry Peterson and Bruce Davie, —Computer Networks: A Systems Approach, 5th edition, Morgan Kauffman, 2011
2.	Paul Goransson, Chuck Black, —Software Defined Networks: A Comprehensive Approach, Morgan Kauffman, 2014

REFERENCE BOOKS:

1.	Paritosh Puri, M. P. Singh, Asurvey paper on routing in delay tolerant networks,

	International Conference on Information and Computer Networks (ISCON), 2013, DOI:10.1109/ICISCON 2013.6524206
2.	W. Richard Stevens, Bill Fenner and Andrew M Rudoff, —Unix Network Programming: The Sockets Networking API: Volume 1, 3rd Edition, Addison Wesley, 2003
3.	Ying Dar Lin, Ren-Hung Hwang and Fred Baker, —Computer Networks: An Open-Source Approach, McGraw Hill, 2011
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc24_ee58/preview Network Analysis - NPTEL is a comprehensive course covering circuit elements, sources, and network theorems applied to solve linear problems
2.	https://www.stclaircollege.ca/courses/mit642-introduction-network-analysis-and-design-network-design Introduction To Network Analysis And Design

NETWORK ENGINEERING

Course Code	**CC3213-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understanding the various optimization techniques of TCP/IP stack.
2.	Understand the concepts of TCP congestion control techniques.
3.	Recognize the concepts of Loss Recovery Techniques and congestion avoidance.
4.	Learn the different techniques of Congestion Signaling.
5.	Provide a strong foundation to active queue management and Data Center Networks.

UNIT-I	**15 Hours**

TCP/IP stack optimizations: Optimizations proposed for improving the performance of TCP/IP: Building blocks of TCP and TCP Fast Open, Primer on Latency and Bandwidth: Busting the Myth, History of TCP/IP and Importance of Internet Standardization, Building Blocks of TCP and Slow Start Restart (SSR), TCP Window Scaling, Impact of TCP 3-way handshake and Slow Start on HTTP Traffic, TCP's AIMD Algorithm, Packet Loss Detection Techniques in TCP, TCP Tahoe and TCP Reno, Selective Acknowledgements (SACK) for TCP

UNIT-II	**15 Hours**

Loss Recovery Techniques in TCP: Rate Halving and PRR (Proportional Rate Reduction)
Introduction to Queue Management Algorithms: Random Early Detection (RED), Gentle RED, Nonlinear RED and Self Configuring RED, Adaptive RED
Congestion Signaling Mechanisms: Explicit Congestion Notification (ECN), ECN+, ECN+/Wait, ECN+/TryOnce and ABE

UNIT-III	10 Hours

Active Queue Management: Controlled Delay (CoDel) Queue Discipline, Proportional Integral (PI) Controller and PI Controller Enhanced (PIE) queue disciplines.
Introduction to Data Center Networks, Data Center TCP (DCTCP): Differences between the Internet architecture and DCN architecture, Performance problems in DCNs and existing solutions such as Data Center TCP (DCTCP).

Course Outcomes: At the end of the course student will be able to

1.	Recall the different approaches for TCP/IP optimizations.
2.	Explain the various methods of handling congestion in TCP/IP.
3.	Discuss the concepts of lossy recovery techniques and congestion avoidance.
4.	Recall the different types of congestion signaling mechanisms.
5.	Outline the optimization techniques of networking protocols for Data Center Networks.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
CC3213-1.1	3	-	1	-	-	-	-	-	-	-	-	1	1	2
CC3213-1.2	2	-	3	-	-	-	-	-	-	-	-	1	1	2
CC3213-1.3	3	-	2	-	-	-	-	-	-	-	-	1	1	2
CC3213-1.4	3	-	3	-	-	-	-	-	-	-	-	1	1	2
CC3213-1.5	3	-	2	-	-	-	-	-	-	-	-	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Grigorik, Ilya. High Performance Browser Networking: What every web developer should know about networking and web performance. " O'Reilly Media, Inc.", 2013.

REFERENCE BOOKS:

1. Kurose, James F. Computer networking: A top-down approach featuring the internet, 6/E. Pearson Education India, 2005
2. Khan, S. U., & Zomaya, A. Y. (Eds.). (2015). Handbook on Data Centers. Springer, 2015
3. Peterson, L. L., & Davie, B. S. Computer networks: A Systems Approach. Elsevier, 2007.

E Books / MOOCs/ NPTEL

1. https://archive.nptel.ac.in/courses/106/105/106105183, Computer Networks and Internet Protocol - NPTEL
2. https://onlinecourses.nptel.ac.in/noc21_cs94/preview, Demystifying Networking -

	Course

WIRELESS SENSOR NETWORKS			
Course Code	**CC3214-1**	**Course Type**	**PEC**
Number of Contact Hours/Week	**3:0:0:0**	**Credits**	**3**
Total Number of Contact Hours	**40+0+0**	**CIE +SEE Marks**	**50+50**
Prerequisites	**CC2001-1**		
Teaching Department: Computer and Communication Engineering			

Course Objectives:

1. Describe the characteristics of wireless sensor network
2. Understand and explain the features of medium access control protocol for wireless sensor networks.
3. Familiarise the routing challenges and design issues in Wireless Sensor networks
4. Understand the data aggregation operation in wireless sensor network.
5. Explain the Operating Systems for Wireless Sensor Networks.

Unit I	15 Hours

CHARACTERISTICS OF WSN

Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

MEDIUM ACCESS CONTROL PROTOCOLS

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit II	15 Hours

ROUTING AND DATA GATHERING PROTOCOLS

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing – Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit III	10 Hours

EMBEDDED OPERATING SYSTEMS
Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Course Outcomes: Upon completion of this course, students will be able to:

1. Outline the basics, characteristics and challenges of Wireless Sensor Network.
2. Apply the knowledge to identify appropriate physical and MAC layer protocol.
3. Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement.
4. Explain the features of OS used in Wireless Sensor Networks and build basic modules.
5. Survey of different types of Operating System and discuss its Issues.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC3214-1.1	3	1	-	-	-	-	-	-	-	-	-	1	2	-
CC3214-1.2	3	1	-	-	-	-	-	-	-	-	-	1	2	-
CC3214-1.3	3	1	-	-	-	-	-	-	-	-	-	1	2	-
CC3214-1.4	3	1	-	-	-	-	-	-	-	-	-	1	2	-
CC3214-1.5	3	1	-	-	-	-	-	-	-	-	-	1	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Network, John Wiley & Sons, 2005

REFERENCE BOOKS:

1. David Gay and Philip A. Levis, TinyOS Programming, Cambridge University Press, 2009
2. Mohammad S. Obaidat, Sudip Misra, Principles of Wireless Sensor Networks, Cambridge University Press, 2014

MULTIMEDIA COMMUNICATION			
Course Code	**CC3311-1**	**Course Type**	**PEC**

Number of Contact Hours/Week	**3:0:0:0**	**CIE +SEE Marks**	**50+50**
Total Number of Contact Hours	**40+0+0**	**Exam Hours**	**03**
Prerequisites	**CC1104-2**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1. Familiarise the Evolution and convergence of multimedia communication.
2. Explore knowledge to analyse and design multimedia communication systems.
3. Understand the role and significance of application layer in multimedia communication.
4. Understand the role and significance of Middleware layer in multimedia communication.
5. Understand the role and significance of Network layer in multimedia communication.

Unit I	**15 Hours**

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework.
Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards.

Unit II	**15 Hours**

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.
Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.

Unit III	**10 Hours**

Network Layer: Network Aspects of Standardization Projects, Network Functions, Network Traffic Analysis, Quality of Service (Qos) in Network Multimedia Systems, Generic Networks, Access Broadband Networks, Core Broadband Networks, Content Delivery Networks.

Course Outcomes: Upon completion of this course, students will be able to

1. Outline the basic concepts and principles of multimedia communication, including technology and standardization famework.
2. Analyze the role and processes of standard organizations such as ITU-T, ISO/IEC and IETF in developing standards for multimedia communication and protocols.
3. Describe the application layer concepts, protocols, and standards to design and develop multimedia applications and services in multimedia communication.
4. Explain the middleware concepts, technologies, and architecture to design the Media coding and Media Streaming in multimedia communication.
5. Elaborate the Quality of Services and different types of networks available in multimedia communication.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
CC3311-1.1	3	-	1	-	-	-	-	-	-	-	-	1	3	-
CC3311-1.2	3	-	1	-	-	-	-	-	-	-	-	1	3	-
CC3311-1.3	3	-	1	-	-	-	-	-	-	-	-	1	3	-
CC3311-1.4	3	-	1	-	-	-	-	-	-	-	-	1	3	-
CC3311-1.5	3	-	1	-	-	-	-	-	-	-	-	1	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.
3. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Volume 1-Media C oding and Content Processing, 2nd Edition, Pearson, 2003.
4. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

NETWORK MANAGEMENT

Course Code	**CC3312-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**3**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understanding Network Management Fundamentals.
2.	Familiarity with Network Management Protocols and Tools.
3.	Explain the Performance Monitoring and Analysis.
4.	Describe the Incident Response and Troubleshooting.
5	Explain the concepts of ADSL.

UNIT-I

Introduction — **08 Hours**

Analogy of Telephone Network Management, Data and Telecommunication Network Distributed Computing Environments, TCP/IP Based Networks: The Internet and Intranets, Communications

Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network	
Basic Foundations:	**07 Hours**
Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.	
UNIT-II	
SNMPv1 Network Management	**08 Hours**
Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP	
Management – RMON	**07 Hours**
Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology;	
UNIT-III	
Asymmetric Digital Subscriber Line Technology	**10 Hours**
Role of the ADSL Access Network in an Overall Network, ADSL Architecture, Channeling, Encoding Schemes, ADSL Network Management Elements, Configuration Management, Fault Management, Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles. Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management-Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent them. Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.	

Course Outcomes: At the end of the course student will be able to

1.	Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
2.	Applying network management guidelines to network administration.
3.	Describe the Architecture of SNMP and its Operations.
4.	Outline the concepts/ behavior of RMON in different types of networks.
5.	Describe the network management and related concepts of ADSL.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3312-1.1	3	2	-	-	1	-	-	-	-	-	-	-	**2**	-
CC3312-1.2	2	2	-	-	1	-	-	-	-	-	-	-	**2**	-
CC3312-1.3	3	2	-	-	1	-	-	-	-	-	-	-	**2**	-
CC3312-1.4	2	2	-	-	1	-	-	-	-	-	-	-	**2**	-
CC3312-1.5	2	2	-	-	1	-	-	-	-	-	-	-	**2**	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1.	J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

SOFTWARE DEFINED NETWORKING

Course Code	**CC3313-1**	**Course Type**	**PEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**3**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1. Explore the foundational concepts of Software Defined Networking (SDN) and its key components
2. Understand the concept of separating the control and data planes and its benefits in network management.
3. Identify and describe the fundamental characteristics of SDN, basic principles and key components.
4. Explore the additions and enhancements introduced in successive versions of the OpenFlow protocol
5. Understand definition, growing demand, and emerging technologies use cases of SDN within data center environments.

Unit I	15 Hours

Introduction to SDN

Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

Textbook 1: Chapter 1,2

Need for SDN

Evaluation of Switches and Control planes, SDN Implications, Data center Needs, Forerunner of SDN, Software Defined Networks is Born, Sustain SDN interoperability, Open-source contribution.

Textbook 2: Chapter 2,3

Unit II	15 Hours

Working of SDN

Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.

The Open Flow Specifications

Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

Textbook 2: Chapter 4,5

Unit III	10 Hours

Data Center

Data centers definition, Data centers demand, tunneling technologies for Data centers Path technologies in data centers, Ethernet fabrics in Data centers, SDN use case in Data centers.

Textbook 2: Chapter 7

Course Outcomes: Upon completion of this course, students will be able to:

1. Define and explain the basic concepts of Software Defined Networking (SDN), including the control plane, data plane, and the separation of control and data planes.
2. Analyze the need for SDN in modern networking environments and evaluate the shortcomings of traditional network architectures and how SDN addresses the same.
3. Explain the operations involved in SDN, including communication between SDN devices, the role of controllers in network management and explore various applications of SDN technology.
4. Analyze the OpenFlow specifications, identifying the additions and enhancements introduced in each version, and discussing their significance in advancing SDN technology.
5. Recall the definition of data centers and their primary functions; explain tunneling and path technologies employed in data centers.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC3313-1.1	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC3313-1.2	3	2		-	-	-	-	-	-	-	-	1	3	-

CC3313-1.3	3	2	-	-	-	-	-	-	-	-	-	1	3	-
CC3313-1.4	3	3	-	-	-	-	-	-	-	-	-	1	3	-
CC3313-1.5	3	3	2	-	-	-	-	-	-	-	-	1	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Thomas D. Nadeau & Ken Gray, SDN Software Defined Networks, O'Reilly publishers, First edition, 2013.
2. Paul Goransson, Chuck Black, Software Defined Networks, A Comprehensive Approach, MK Publications.

REFERENCE BOOKS:

1. Siamak Azodolmolky, Software Defined Networking with OpenFlow, Packt Publishing, 2013

OPTICAL COMMUNICATION AND NETWORKING

Course Code	**CC3314-1**	**Course Type**	**PEC**
Number of Contact Hours/Week	**3:0:0:0**	**Credits**	**3**
Total Number of Contact Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisites	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives

1. Understand the fundamentals optical fiber communication.
2. Explain the various aspects of transmission characteristics and techniques used in coupler and connectors for optical fiber communication
3. Know different types of sources and detectors used optical fibers
4. Describe the fundamentals of optical receiver and its measurement techniques.
5. Understand the principle of different types of optical networks.

Unit I	**15 Hours**

INTRODUCTION:

Introduction, Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers – SM fibers.

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:

Attenuation – Material absorption losses in silica glass fibers – Linear and Nonlinear Scattering losses - Fiber Bend losses – Midband and farband infra red transmission – Intra and inter Modal Dispersion – Over all Fiber Dispersion – Polarization- nonlinear Phenomena. Optical fiber connectors, Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers.

Unit II	**15 Hours**

SOURCES AND DETECTORS:

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono, and hetero structures - internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise –Noise sources, Signal to Noise ratio, Detector response time.

FIBER OPTIC RECEIVER AND MEASUREMENTS:

Fundamental receiver operation, Preamplifiers, Error sources – Receiver Configuration – Probability of Error – Quantum limit.

Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wavelength Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

Unit III	10 Hours

OPTICAL NETWORKS:

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks – Wavelength Routed Networks – Nonlinear effects on Network performance – Performance of WDM + EDFA system – Solitons – Optical CDMA – Ultra High-Capacity Networks.

Course Outcomes: At the end of the course student will be able to

1. Explain the propagation of optical signals for single mode and multimode in different fiber structures.
2. Estimate the fiber losses and quantum efficiency due to attenuation factor, dispersion, and total carrier recombination lifetime.
3. Describe the concepts of different types of sources and detectors in optical networks.
4. Discuss the concepts of optical receiver characteristics to estimate the receiver sensitivity, and quantum limit.
5. Explain the concept of SONET/SDH and WDM network models for wavelength connectivity and multiplexing techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC3314-1.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CC3314-1.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CC3314-1.3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CC3314-1.4	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CC3314-1.5	3	1	-	-	-	-	-	-	-	-	-	-	2	-

1: Low 2: Medium 3: High

TEXTBOOK:

1. Optical Fiber Communications. Principles and Practice, 3rd Edition, John M. Senior, Pearson, 2009
2. Optical Fiber Communication – Gerd Keiser – Mc Graw Hill – Third Edition, 2003

REFERENCE BOOK:

1. J. Gower, "Optical Communication System", Prentice Hall of India, 2001
2. Rajiv Ramaswami, "Optical Networks ", Second Edition, Elsevier, 2004.
3. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley &

Sons, 2004.
4. R.P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press, 2007.

Professional Elective Courses (Cyber Security)

INTRODUCTION TO BLOCKCHAIN TECHNOLOGY

Course Code	**CC4221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC3101-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the basics and evolution of Blockchain Technology.
2.	Explore the cryptographic primitives used in Blockchain technology.
3.	Understand Ethereum smart contract and its elements.
4.	Explore Solodity programming and learn how to execute and deploy smart contracts using the Remix IDE.
5.	Explore the Hyperledger Fabric.

UNIT-I

Introduction to Blockchain	**15 Hours**

Introduction: Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized Organizations.

Cryptographic primitives: Symmetric cryptography, Stream ciphers, Block ciphers, Block encryption mode, Keystream generation modes, Message authentication modes, Electronic code book, Cipher block chaining, Counter mode, Data Encryption Standard (DES) Advanced Encryption Standard (AES), Asymmetric cryptography; Public and private keys, Encryption and decryption using RSA, Cryptographic Hash Function, Properties of a hash function, Digital signatures :Sign then encrypt, Encrypt then sign, Merkle tree.

UNIT-II

Smart Contracts and Ethereum	**15 Hours**

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian Contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum

blockchain, Precompiled contracts.
Introducing solidity: Types, Value types: Boolean, Integers, Address, Array value types (fixed size and dynamically sized byte arrays), Literals, Integer literals, String literals, Hexadecimal literals, Enums, Function types, Internal functions, External functions, Reference types, Arrays, Structs, Data location, Mappings, Global variables, Control structures, Events, Inheritance, Libraries, Functions, Layout of a solidity source code file.
Truffle Basics and Unit Testing, Debugging Contracts Remix IDE: Programs execution.

UNIT-III

Exploring Hyperledger Fabric	**10 Hours**

Exploring Hyperledger Fabric: Building on the foundations of open computing, Fundamentals of the Hyperledger project, The Linux Foundation, Hyperledger, Open source and open standards, Hyperledger frameworks, tools, and building blocks, Hyperledger Fabric component design, Principles of Hyperledger design, Hyperledger Fabric reference architecture, Hyperledger Fabric runtime architecture, Strengths, and advantages of componentized design

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental concepts behind blockchain technology including decentralization.
2.	Discuss cryptographic primitives and its applications in Blockchain technology.
3.	Explain the basics of smart contract and identify the various elements of Ethereum smart contract
4.	Develop simple smart contract using Solidity programming
5.	Outline the framework, design principles and architectural design of Hyperledger fabric.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC4221-1.1	3	-	2	-	-	-	-	-	-	-	-	1	3	-
CC4221-1.2	3	-	2	-	-	-	-	-	-	-	-	1	3	-
CC4221-1.3	2	-	2	-	-	-	-	-	-	-	-	1	3	-
CC4221-1.4	2	-	3	-	3	-	-	-	-	-	-	1	1	2
CC4221-1.5	2	-	2	-	1	-	-	-	-	-	-	1	1	2

TEXTBOOKS:

1. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, 2018.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd, Venkatraman Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

REFERENCE BOOKS:

1. Melanic Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015.
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners-Guide to Block chain Technology and Leveraging Block Chain Programming”, 2017.

3. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017.
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi, 2018.

INTRODUCTION TO CYBER PHYSICAL SYSTEMS

Course Code	**CC3221-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisites	**CC1104-2**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1	Understand the fundamental concepts of cyber-physical systems.
2	Explore the concepts of processors, sensors, actuators, and automated systems
3	Understand the synchronous and asynchronous models
4	Understand the concepts of security in cyber-physical systems
5	Understand the applications of cyber physical systems

Unit I	**15 Hours**

Introduction: Cyber-Physical System, Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS.
CPS Platform components: CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model.

Unit II	**15 Hours**

Synchronous and Asynchronous Model: Reactive Components, Components Properties, Components Composing, Synchronous Designs and Circuits, Asynchronous Processes and operations, Design Primitives in Asynchronous Process, Coordination Protocols in Asynchronous Process, Leader Election, Reliable Transmission.
Security of Cyber-Physical Systems: Introduction to CPS Securities, Basic Techniques in CPS Securities, Cyber Security Requirements, Attack Model and Countermeasures, Advanced Techniques in CPS Securities.

Unit III	**10 Hours**

CPS Application: Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber-Physical Systems, WSN based Cyber-Physical Systems, Smart Cities.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explain the concepts of cyber physical systems and its challenges.
2. Describe solutions to automated systems to make life easier.
3. Apply concepts of synchronous and asynchronous processes to enhance existing systems.
4. Develop concepts, logics towards solving an unknown problem in research and industry.
5. Applications of cyber physical systems to health care, Smart Grid, and WSN.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes / Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CC3221-1.1	2	2	-	-	2	-	-	-	-	-	-	2	3	-
CC3221-1.2	2	2	-	-	2	-	-	-	-	-	-	2	3	-
CC3221-1.3	3	-	-	-	3	-	-	-	-	-	-	2	3	-
CC3221-1.4	3	-	-	-	3	-	-	-	-	-	-	2	3	-
CC3221-1.5	-	2	-	-	3	-	-	-	-	-	-	3	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. R. Alur, “Principles of Cyber-Physical Systems,” MIT Press, 2015.
2. Raj Rajkumar, Dionisio de Niz and Mark Klein, “Cyber-Physical Systems”, Addison-Wesley, 2017

REFERENCE BOOKS:

1. E. A. Lee and S. A. Seshia, “Introduction to Embedded Systems: A Cyber-Physical Systems Approach”, 2011.
2. Rajeev Alur, “Principles of Cyber-Physical Systems”, MIT Press, 2015
3. Fei Hu, “Cyber-Physical Systems”, CRC Press 2013

DIGITAL WATERMARKING AND STEGANOGRAPHY

Course Code	**CC3321-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2001-1**		

Course Objectives:

1.	Understand the basic principles, characteristics, various approaches and applications of digital watermarking and steganography.
2.	Acquire the various concepts of watermarking for digital authentication and authorization schemes related to electronic documents, image, and video.
3.	Gathering the various concepts of steganography to access the sensitive information concealing of message and image.
4.	Understanding the concepts of audio, video within another file using steganophy techniques.
5.	Understand the efficient data hiding methods against steganalysis techniques.

UNIT-I	15 Hours

Importance of Watermarking - Application and Properties of Watermarking - Models of Watermarking - Basic Message Coding: Mapping Message into Message Vectors, Error Correction Coding - Watermarking with Side Information - Analyzing Errors.

Spatial Domain: Correlation based Watermarking, Least Significant bit Watermarking - **Frequency domain**: Discrete Wavelet Transform Watermarking, Discrete Fourier Transform Watermarking, Discrete Cosine Watermarking, Quantization Watermarking, Haar Transform Watermarking, Hadamard Transform Watermarking - Robust Watermarking - Fragile and Semi Fragile Watermarking.
Watermarking Security: Security Requirements, Watermark Security and Cryptography, Watermarking Attacks and Tools - Content Authentication: Exact Authentication, Selective Authentication, Localization, Restoration.

UNIT-II	15 Hours

Basics and Importance of Steganography - Applications and Properties of Steganography.
Steganography: LSB embedding, Steganography in palette images -Steganography in JPEG images: JSteg data hiding in spatial and transform domain -Steganography Security.
Audio Steganography: Temporal domain techniques, Transform domain techniques, Cepstral Domain .
Video Steganography: Introduction Video Streams, Substitution-Based Techniques, Transform Domain Techniques, Adaptive Techniques, Format-Based Techniques - Cover Generation Techniques Video Quality Metrics - Perceptual Transparency Analysis - Robustness against Compression and Manipulation.

UNIT-III	10 Hours

Steganalysis Principles - Statistical Steganalysis: Steganalysis as detection problem -Modeling images using features, Receiver operating Characteristics.
Targeted Steganalysis: Sample pair analysis, Targeted attack on F5 using Calibration, Targeted attack on embedding.
Blind Steganalysis: Features for steganalysis of JPEG images (cover vs all- stego and one class neighbor machine).

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental concepts, principles, characteristics and performance measures of digital watermarking and steganography.

2.	Describe the various concepts of watermarking for digital authentication and authorization schemes related to electronic documents, image, and video.
3.	Explain the basic concepts, applications, and properties of Steganography.
4.	Apply the various concepts of steganography to access the sensitive information concealing of message, image, audio or video within another file.
5.	Design and implement efficient data hiding methods against steganalysis techniques.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	
↓ Course Outcomes													1	2
CC3321-1.1	3	1	-	-	-	-	-	-	-	-	-	1	1	2
CC3321-1.2	3	1	-	-	-	-	-	-	-	-	-	1	1	2
CC3321-1.3	3	1	-	-	-	-	-	-	-	-	-	1	1	2
CC3321-1.4	3	1	-	-	-	-	-	-	-	-	-	1	1	2
CC3321-1.5	3	1	-	-	-	-	-	-	-	-	-	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Frank Y. Shih, Digital Watermarking and Steganography Fundamentals and Techniques, 2nd Edition, CRC Press, United States, 2020.

2. J. Fridrich, Steganography in Digital Media: Principles, Algorithms, and Applications, 1st Edition, Cambridge University Press, United Kingdom, 2010.

REFERENCE BOOKS:

1. I. J. Cox, M. L. Miller, J. A. Bloom, T. Kalker, and J. Fridrich, Digital Watermarking and Steganography, 2nd Edition, Amsterdam: Morgan Kaufmann Publishers In, United States, 2008.

ETHICAL HACKING

Course Code	**CC3322-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisites	**CC2001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1	Understand the fundamental concepts of ethical hacking and networks.
2	Familiarize with software exploitation techniques and basics of cryptography techniques.
3	Understand the various types of hacking and denial of service attacks.
4	Explore the major security attacks like DDoS, Phishing attacks etc.
5	Understand the idea of hardware hacking and SQL injection attack.

Unit I	15 Hours

Introduction

Introduction to ethical hacking, types of ethical hacking, hacking methodology and terminology, concept of networking, TCP/IP protocol stack, IP addressing and routing, TCP & UDP, IP subnetting, routing protocol, IP version, routing examples, Nessus installation: Process & operation details.

Software exploitation

Metasploit Exploiting system software, Metasploit social engineering works, Metasploit social Engineering works, MITM attack, Basic concept of cryptography, private key cryptography, public key cryptography, cryptographic hash function.

Unit II	15 Hours

Hacking types and Daniel of service

Digital signature & certificate, applications, steganography, biometrics, network-based attacks, DNS and Email security, side channel attacks, password cracking, phishing attack, malware, wifi hacking, Dos and DDos attack, DoS/DDos Attack Techniques, DoS/DDos Attack Tools, DoS/DDos Protection Tools.

Unit III	10 Hours

Hardware hacking and SQL injection

Elements of hardware security, physical unclonable function, hardware Trojan, web application vulnerability scanning, SQL injection authentication bypass, SQL injection error based, SQL injection error based on web application, SQLMAP, cross site scripting, file upload vulnerability, NMAP tool, network analysis using Wireshark.

Course Outcomes: Upon completion of this course, students will be able to

1. Explain the fundamentals of ethical hacking and working of internetworks and protocols.
2. Discuss types of software exploitation techniques and cryptographical approaches against security attacks.
3. Summarize the concepts of hacking and various techniques that facilitate authentication.
4. Explain the security vulnerabilities and associated attacks.
5. Discuss the hardware vulnerabilities, SQL injection and analysis tools.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC3322-1.1	2	2	-	-	2	-	-	2	-	-	-	2	2	-
CC3322-1.2	2	2	-	-	2	-	-	2	-	-	-	2	1	-
CC3322-1.3	3	2	-	-	1	-	-	2	-	-	-	2	1	-
CC3322-1.4	3	-	-	-	1	-	-	2	-	-	-	2	1	-

CC3322-1.5	-	2	-	-	3	-	-	3	-	-	-	3	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. V. D. Dudeja, Cyber Crime and Law Enforcement, Commonwealth Publishers, 2017.
2. C. H Wu and J.D. Irwin, Introduction to Computer network and Cybersecurity, CRC Press, 2013.

REFERENCE BOOKS:

1. W. Stallings, Cryptography and Network Security: Principles and Practice, Pearson Publication, 2017.
2. Jon Erickson, Hacking: The Art of Exploitation, 2nd Edition, 2008.

Professional Elective Courses (Applied Computations)

COMPUTER VISION

Course Code	**CC3231-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**3**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA2005-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Define and describe fundamental concepts of computer vision.
2.	Understand the basic image processing methods.
3.	Describe the part of object recognition and detection.
4.	Understand the concepts of Regions of Images, and Segmentation.
5	To Recognizing Faces and Objects.

UNIT-I

Introduction to Computer Vision:	**07 Hours**

Goal, areas, Human Vision, Segmentation, Perception, Semantic information, Special effects, Modeling, Applications; Linear Algebra: Vectors & matrices, Transformation matrices, Matrix inverse, Matrix rank, SVD.

Pixels, Features, and Cameras: Pixels and Filters:	**08 Hours**

Images as functions, Linear Systems (filters), Convolution & Correlation. Edge detection: Simple, Canny, RANSAC; Feature detector: Local invariant, Harris, DOG, SIFT; Camera Models.

UNIT-II

Camera	**08 Hours**

Pinhole Cameras, Cameras & lenses, Projection matrix, Intrinsic parameters, Extrinsic parameters; Stereo Vision: Epipolar geometry, Parallel images, Images rectification, Solving correspondence problem, Active Stereo Vision System.

Regions of Images, and Segmentation	**07 Hours**

Basic Concepts of Segmentation: Gestalt theory; Agglomerative, K-means & Mean-shift Clustering; Optical flow, Feature tracking, Applications; Advanced Image Parsing Topic and

Applications: Binary, Image Matting; Figure-ground Segmentation Using Clustering Algorithms.

UNIT-III

Recognizing Faces and Objects	**10 Hours**

Basic Concepts in Recognition & its pipeline, Nearest Neighbor Match; PCA and Eigenfaces; Tracking Millions of People: Detection, Tracklet Generation & Association;

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental concepts of images, edge detection and feature description techniques.
2.	Explain how features, cameras, pixels, and filters are convolutional and correlated.
3.	Explain the concepts of image projection and stereo vision
4.	Describe the image segmentation and Advanced Image Parsing.
5.	Describe the process of recognizing faces and objects.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3231-1.1	2	1	1	-	-	-	-	-	-	-	-	1	-	**1**
CC3231-1.2	2	1	1	-	-	-	-	-	-	-	-	1	-	**-**
CC3231-1.3	2	1	1	-	-	-	-	-	-	-	-	1	-	**1**
CC3231-1.4	2	1	1	-	-	-	-	-	-	-	-	1	-	**1**
CC3231-1.5	2	1	1	-	-	-	-	-	-	-	-	1	-	**-**

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Computer Vision: Algorithms and Applications, Richard Szeliski, Microsoft Research, Electronic draft, 2010.
2.	Computer Vision: A Modern Approach, David A. Forsyth & Jean Ponce, Prentice Hall; 2nd edition, 2011.
3.	Multiple View Geometry in Computer Vision, Hartley & Zisserman, Cambridge University Press; 2nd edition, 2004.

REFERENCE BOOKS:

1.	Machine vision, Jain, Ramesh and Rangachar Kasturi and Brian G. Schunck; McGraw-Hill, 1995.
2	Introductory computer vision and image processing, Low, Adrian; McGraw-Hill, 1991.
3	Digital image processing, Gonzalez, Rafael C. and Richard E. Woods; Addison-Wesley, 3rd Edition, 1998.

EMBEDDED SYSTEM DESIGN

Course Code	**CC3232-1**	**Course Type**	**PEC**
Number of Contact Hours/Week	**3:0:0:0**	**Credits**	**3**

Total Number of Contact Hours	40+0+0	CIE +SEE Marks	50+50
Prerequisites	**CC2102-1**		

Teaching Department: Computer and Communication Engineering

Course objectives:

1. Understand the microprocessor principles and its architectures.
2. Familiarise of DSP Processors, SoCs and Microcontrollers in embedded systems.
3. Learn the fundamental concepts of Real – Time Operating Systems.
4. Understand the software architectures and Embedded Software development tools.
5. Understand the series of ATOM processors and its architectures.

Unit I	15 Hours

Embedded system definition, characteristics, design metrics; Processor, IC and design technologies; Embedded system examples, Digital Camera building blocks, Combinational and sequential building blocks.

Use of DSP Processors, SoCs and Microcontrollers in embedded systems. Overview of 8051 microcontroller. Timers, ADCs, Keypad controllers, LCD controllers, stepper motor and DC motor control, Custom Single Purpose processor design examples: GCD Generator, 4-bit multiplier, Communication bridge. Memory – Composing memory, memory hierarchy and Cache memory, interfacing-Serial, Parallel and Wireless Protocols.

Unit II	15 Hours

Introduction to Real – Time Operating Systems, features, Examples of RTOS, typical RTOS functions. Interrupt handling and latency, Shared data problems, Tasks and Task States, Task scheduling, Inter-task communication and synchronization, Semaphores, Message Queues, Mailboxes and Pipes, Reentrant functions, Typical software architectures, Embedded Software development and testing tools, JTAG debugger, typical system boot flow diagram

Unit III	10 Hours

Intel ATOM Processor Architecture, Platform architecture and Micro architecture details, Overview of Assembly language programming of ATOM Processor, Low power issues of ATOM processor, ATOM processor series. Intel ATOM Processor kit details, I/O options available, Keyboard and Mouse interface, GPS, GSM and RFID interface – Hands On, Overview of Device drivers.

Course Outcomes: Upon completion of this course, students will be able to

1. Explain the concept of embedded systems to understand and differentiate microcontroller and microprocessor architecture.
2. Apply the knowledge of microcontroller interface to input and output devices and its organization memory devices.
3. Explain different features of real time operating systems.
4. Utilize skill to integrate real time operating systems with hardware and software and its testing tools.
5. Design and explain the architecture of embedded system using Intel Atom boards.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2
CC3232-1.1	3	1	-	-	-	-	-	-	-	-	-	-	-	1
CC3232-1.2	3	1	-	-	-	-	-	-	-	-	-	-	-	1
CC3232-1.3	3	1	-	-	-	-	-	-	-	-	-	-	-	1
CC3232-1.4	3	1	-	-	2	-	-	-	-	-	-	-	-	1
CC3232-1.5	3	2	-	-	-	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Frank Vahid and Tony Givargis, “Embedded Systems Design – A unified Hardware/Software Introduction”, John Wiley, 2002.
2. David E. Simon, “An Embedded Software Primer”, Pearson Education Asia, First Indian Reprint 2000.
3. Kenneth Ayala, “8051 Microcontroller Architecture, Programming and Applications”, West publishing, 1991

REFERENCE BOOKS:

1. Lori Matassa and Max Domeika, “Break away with Intel Atom Processors: A guide to Architecture Migration”, Intel Press, 2010
2. Peter Barry, Patrik Crowley, “Modern Embedded Computing”, Morgan Kaufmann Publishers, 2012.

HUMAN COMPUTER INTERACTION

Course Code	**CC3233-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA1002-1, CS1001-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Explain the fundamental principles, theories, and models that underpin HCI.
2.	Describe User-Centered Design.
3.	Explain few Evaluation Techniques.
4.	Describe Emerging Technologies and Trends.
5	Understand the concepts of Cognitive architecture and its design.

UNIT-I

INTRODUCTION, INTERACTIVE SYSTEM DESIGN	**08 Hours**
Course Objectives and overview, Historical evolution of the field. concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, prototyping techniques.	
MODEL-BASED DESIGN AND EVALUATION	**07 Hours**
Introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitt's law and Hick-Hyman's law, Model based design case studies.	
UNIT-II	
Guidelines in HCI, Empirical research methods in HCI	**08 Hours**
Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walk-through. Introduction (motivation, issues, research question formulation techniques), Experiment design and data analysis (with explanation of one-way ANOVA).	
Task modeling and analysis	**07 Hours**
Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and(classical) Petri Nets in dialog design	
UNIT-III	
Cognitive architecture, Design - Case Studies	**10 Hours**
Introduction to CA, CA types, relevance of CA in IS design, Model Human Processor (MHP). Case Study 1- Multi- Key press Hindi Text Input Method on a Mobile Phone, Case Study 2 - GUI design for a mobile phone based Matrimonial application. Case Study 3 - Employment Information System for unorganized construction workers on a Mobile Phone	

Course Outcomes: At the end of the course student will be able to

1.	Explain the basics of HCI and different HCI models.
2.	Describe the concept of interactive system design and different types of models GOMS Family.
3.	Explain the research methods and the guidelines to be followed in designing HCI.
4.	Explain the Task modeling and Design of finite state machines.
5.	Describe the Cognitive architecture of human processor model and elaborate the different types of case studies.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3233-1.1	2	1	2	-	-	-	-	1	-	-	-	-	-	1
CC3233-1.2	2	1	2	-	-	-	-	1	-	-	-	-	-	1
CC3233-1.3	2	1	2	-	-	-	-	1	-	-	-	-	-	1
CC3233-1.4	2	1	2	-	-	-	-	1	-	-	-	-	-	1
CC3233-1.5	2	1	2	-	-	-	-	1	-	-	-	-	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Jennifer Preece, Helen Sharp and Yvonne Rogers, Interaction design: Beyond Human-Computer Interaction, 4th edition Helen Sharp, John Wiley and Sons, 2015.
2.	Ben Shneiderman and Catherine Plaisant, Designing the User Interface: Strategies

	for Effective Human-Computer Interaction, 6th Edition, Pearson, 2017
REFERENCE BOOKS:	
1.	Dix, Finlay, Abowd and Beale, Human-Computer Interaction, 3rd Edition, Pearson Publisher, 2003
2	Wickens, Lee, Liu, and Gordon-Becker, Introduction to Human Factors Engineering, 2nd Edition, Pearson Publishers, 2004

NATURAL COMPUTING

Course Code	**CC3234-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA1002-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand various concepts from nature to a nature computing.
2.	Understand the various applicable natural computing techniques.
3.	Describe the swarm intelligence in natural computing.
4.	Comprehend the optimization technique in swarm intelligence and its algorithms.
5.	Understand the computation techniques can be applied to new natural materials.

UNIT-I	
Introduction:	**08 Hours**
Introduction: From Nature-to-Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and agents – Parallelism and Distributivity Interactivity, Adaptation- Feedback-Self-Organization- Complexity, Emergence and, Bottom-up Vs. Top-Down- Determination, Chaos and Fractals.	
Computing Inspired by Nature	**07 Hours**
Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming	
UNIT-II	
Swarm Intelligence	**15 Hours**
Introduction - ant colonies, ant foraging behavior, ant colony optimization, saco and scope of aco algorithms, ant colony algorithm (aca), swarm robotics, foraging for food, social adaptation of knowledge, particle swarm optimization (pso)	
UNIT-III	
Computing With New Natural Materials	**10 Hours**
DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing.	
Course Outcomes: At the end of the course student will be able to	

1.	Explain the concepts and complexity behind natural computing.
2.	Discuss the idea of natural computing techniques.
3.	Explain the concepts of swarm intelligence.
4.	Discuss the different optimization techniques of swarm intelligence.
5.	Outline natural computing techniques such as DNA computing.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3234-1.1	1	1	-	-	-	2	2	-	-	-	-	-	-	1
CC3234-1.2	1	1	-	-	-	2	2	-	-	-	-	-	-	1
CC3234-1.3	2	3	-	-	-	3	3	-	-	-	-	-	-	1
CC3234-1.4	3	3	-	-	-	3	3	-	-	-	-	-	-	1
CC3234-1.5	1	2	-	-	-	3	3	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

REFERENCE BOOKS:

1.	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
2.	Albert Y. Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
3.	Marco Dorrigo, Thomas Stutzle,” Ant Colony Optimization”, PHI, 2005

E Books / MOOCs/ NPTEL

1.	Melanie Mitchell: An Introduction to Genetic Algorithms. MIT Press, 1998.
2.	Xin-She Yang: Nature-Inspired Metaheuristic Algorithms. Luniver, 2010.
3.	Brabazon, O'Neill, McGarraghy: Natural Computing Algorithms. Springer, 2015.
4.	http://www.drps.ed.ac.uk/21-22/dpt/cxinfd11007.htm

NEURAL NETWORKS AND FUZZY LOGIC

Course Code	**CC3235-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2201-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the fundamental concepts and principles of neural networks and Back Propagation.
2.	Learn about different Deep learning strategies.

3.	Analyze the elements and properties of Convolution Neural Networks and related models.
4.	Explore the capsules and related models of Convolution Neural Networks.
5.	Acquire the knowledge of Fuzzy Logic and Decision Making.

UNIT-I

Neural Networks Training	**15 Hours**

Learning in neural network: output vs hidden layers; linear vs nonlinear networks; Back propagation: learning via gradient descent; recursive chain rule (backpropagation); if time: bias- variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU; Deep learning strategies**:** GPU training, regularization, RLUs, dropout.

UNIT-II

Convolution Neural Networks	**15 Hours**

Invariance, stability, Variability models (deformation model, stochastic model), Scattering networks, Group Formalism, Properties of CNN representations: invertibility, stability, invariance, Covariance/invariance: capsules and related models, Connections with other models: dictionary learning, LISTA, localization, regression, Embeddings (DrLim), inverse problems, Extensions to non- Euclidean domains.

UNIT-III

Fuzzy Logic	**10 Hours**

Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, Fuzzy Rules, Models, Fuzzy Reasoning and Fuzzy Inference Systems.
Decision Making and Expert Systems: Single person, multi person, Multi criteria and Multistage decision making, Expert system features, architecture, and applications.

Course Outcomes: At the end of the course student will be able to

1.	Illustrate the various training methods of neural networks.
2.	Explain the concept of convolution and apply this for neural network design.
3.	Remembering the Convolution Neural Networks properties and techniques
4.	Apply the capsules and related models of Convolution Neural Networks.
5.	Summarizing the operations of Fuzzy logic and Decision Making.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3235-1.1	3	2	3	2	-	1	-	1	-	2	2	-	1	2
CC3235-1.2	3	2	3	2	-	-	-	1	-	3	-	-	1	2
CC3235-1.3	3	2	3	2	3	-	-	1	2	2	2	-	2	2
CC3235-1.4	3	2	3	2	-	-	-	1	-	3	-	-	1	2
CC3235-1.5	3	2	2	1	3	-	-	1	2	2	2	1	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Simon Haykin, Neural Networks and Learning Machine (3e), Pearson Education, New Delhi, 2016.
2.	Timothy J.Ross, Fuzzy Logic with Engineering Applications (3e), Wiley, USA, 2011.

REFERENCE BOOKS:	
1.	Duda, R.O., Hart, P.E., and Stork, D.G.,"Pattern Classification", Wiley-Interscience. Second Edition. 2001.
2.	Russell, S. and Norvig, N, Artificial Intelligence: "A Modern Approach", Prentice Hall Series in ArtificialIntelligence. 2003.
3.	Hastie, T., Tibshirani, R. and Friedman, J,"The Elements of Statistical Learning", Springer. 2001.
4.	James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition., 2003.
5.	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall, 1995.
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc21_ge07/preview
2.	https://www.everand.com/book/453160794/Neural-Networks-and-Fuzzy-Logic
3.	https://www.digimat.in/nptel/courses/video/127105006/L01.html

DIGITAL IMAGE PROCESSING

Course Code	**CC3331-1**	**Course Type**	**PEC**
Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**Credits**	**3**
Total Number of Contact Hours	**40+0+0**	**CIE +SEE Marks**	**50+50**
Prerequisites	**MA2005-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives

1. Understand the relationships between Pixels using Knowledge of 4, 8 and M adjacency.
2. Familiarise the frequency domain and smoothing Frequency-Domain Filters.
3. Explore image segmentation techniques and understand the properties of Region-Based Segmentation.
4. Understand the Standards for different image compression techniques.
5. Familiarise the color image sharpening, smoothing, compression, segmentation and transformation for an image

Unit I	**15 Hours**

Introduction: What Is Digital Image Processing? Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals - Elements of Visual Perception, Brightness Adaptation and Discrimination, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels.

Image Enhancement in the Spatial Domain - Background, Some Basic Gray Level

Transformations, Histogram Processing. Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Image Enhancement in the Frequency Domain- Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters.

Unit II	**15 Hours**

Sharpening Frequency Domain Filters, Homomorphic Filtering, Image Segmentation- Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, the Use of Motion in Segmentation.
Image Compression - Fundamentals Image Compression, Models Elements of Information, Theory Error-Free Compression, Lossy Compression, Image Compression Standards.
Morphological Image Processing - Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation Some Basic, Morphological Algorithms.

Unit III	**10 Hours**

Color Image Processing - Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.

Course Outcomes: Upon completion of this course, students will be able to

1. Explain the fundamentals of digital image processing.
2. Analyze the smoothing spatial filters, sharpening spatial filters by applying mathematical knowledge.
3. Analyze the frequency-domain filters, design and formulate Image segmentation techniques.
4. Illustrate and design image compression standards and analyze the concept of Morphological Image Processing by applying mathematical knowledge.
5. Analyze the color image processing techniques, illustrate color image sharpening, smoothing, compression, segmentation and transform.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3331-1.1	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CC3331-1.2	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CC3331-1.3	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CC3331-1.4	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CC3331-1.5	3	2	1	-	-	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOK:

1. Rafel C Gonzalez and Richard E Woods, “Digital Image Processing”, Pearson Education, Second Edition, 2003.

REFERENCE BOOKS:

1. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt. Ltd., 1997.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Thomoson Learning, Brooks/Cole, Second Edition. 2001.
3. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis", Prentice-Hall, India, 2002.
4. Steven W. Smith, "The Scientist and Engineers Guide to Digital Signal Processing", California Technical Publishing, Second Edition, 1999.

GRAPHICS AND ANIMATION

Course Code	**CC3332-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the concepts of Computer Graphics, its applications, software, devices, and technologies.
2.	Explore the concepts of scan conversion and two-dimensional transformations.
3.	Familiarize with the visible-surface determination algorithms.
4.	Understand the different representations of curves.
5.	Understand computer animation and image manipulation and storage concepts.

UNIT-I

Introduction to Computer Graphics	**08 Hours**

Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan), Video Basics.

Scan conversion:	**07 Hours**

Digital Differential Analyzer (DDA) algorithm, Bresenhams' Line drawing algorithm. Bresenhams' method of Circle drawing, Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Clipping Lines algorithms– Cyrus-Beck, Cohen- Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.

Two-Dimensional Transformations: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations.

UNIT-II

Visible-Surface Determination:	**08 Hours**

Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison of the methods.

Plane Curves and Surfaces:	**07 Hours**

Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, Representation of Space Curves, Cubic Splines, Bezier Curves, B-spline Curves, Bezier Surfaces.

UNIT-III

Computer Animation and Image Manipulation and Storage:	**10 Hours**

Computer Animation: Principles of Animation, Key framing, Deformations, Character Animation, Phsics-Based Animation, Procedural Techniques, Groups of Objects.

Image Manipulation and Storage: What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.

Course Outcomes: At the end of the course student will be able to

1.	Explain the basic concepts of computer graphics.
2.	Discuss the various scan-conversion algorithms and two-dimensional transformation.
3.	Explain the idea of visible-surface determination algorithms, its categories and comparisons.
4.	Explain the Plane Curves and Surfaces for different types of shapes.
5.	Discuss the notions of Computer Animation and the various operations on Images.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC3332-1.1	1	2	3	-	-	-	-	-	-	-	-	-	2	-
CC3332-1.2	-	3	-	-	-	-	-	-	-	-	-	-	2	-
CC3332-1.3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CC3332-1.4	2	-	3	-	-	-	-	-	-	-	-	-	2	-
CC3332-1.5	-	2	3	-	-	-	-	-	-	-	-	-	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Donald D. Hearn, Warren Carithers, M. Pauline Baker. Computer Graphics with OpenGL (4e), Pearson, Education, 2014.
2.	Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, CRC Press, 4th Edition, 2016.

REFERENCE BOOKS:

1.	Zhigang Xiang, Computer Graphics: Theory and Practice with OpenGL (3e), Pearson

	Education, 2016.
2.	Edward Angel, Interactive Computer Graphics- A top-down approach using OpenGL (5e), Pearson Education, 2012.
3.	Foley J. D., Van Dam A., Feiner S. K., Hughes J. F., Computer Graphics, Principles and Practice (3e), Addision-Wesley, 2014.
E Books / MOOCs/ NPTEL	
1.	https://www.walkineducate.com/courses/advance-diploma-in-graphics-and-animation/
2.	https://onlinecourses.swayam2.ac.in/ntr20_ed15/preview
3.	https://onlinecourses.swayam2.ac.in/cec20_cs08/preview
4.	https://www.classcentral.com/course/swayam-graphics-and-animation-development-january-2022-23776

PATTERN RECOGNITION			
Course Code	**CC3333-1**	**Course type**	**PEC**
Number of Contact Hours/Week	**3:0:0:0**	**Credit**	**3**
Total Number of Contact Hours	**40+0+0**	**CIE +SEE Marks**	**50+50**
Prerequisites	**MA1005-1, CC2201-1**		
Teaching Department: Computer and Communication Engineering			

Course Objectives

1. Understand the basic principles of Pattern Recognition systems and the Bayesian Decision Theory
2. Describe the Maximum likelihood and Bayesian parameter estimation.
3. Explain the Density Estimation, Parzen Windows, and kn-nearest neighbour estimation.
4. Familiarise the linear discriminant functions and minimizing the Perceptron criterion for problem solving.
5. Understand the unsupervised learning and clustering through the mixture densities and maximum-likelihood estimates.

Unit I	**15 Hours**

Introduction: Machine Perception, Pattern Recognition systems, Design cycle, learning and adaptation Bayesian Decision Theory: Introduction, Bayesian Decision theory – continuous features, classifiers, discriminant functions, and decision surfaces, normal density and discriminant functions, Bayes decision theory – discrete features.
Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian Estimation, Bayesian parameter estimation, problem of dimensionality, sufficient and exponential family, complex analysis & discriminants.

Unit II	**15 Hours**

Nonparametric Techniques: Introduction, Density Estimation, Parzen Windows, kn-nearest neighbour estimation, nearest neighbour rule, metrics and nearest-neighbour classification, fuzzy classification, reduced coulomb energy, approximations by series expansions.

Linear discriminant functions: Introduction, linear discriminant functions, generalized linear discriminant functions, minimizing the Perceptron criterion function, relaxation procedures, non separable behaviours, minimum squared-error procedures, Ho-Kashyap procedures.

Unit III	10 Hours

Unsupervised learning and clustering: Mixture densities and identifiability, maximum-likelihood estimates, application to normal mixtures, unsupervised Bayesian learning, data decryption and clustering, criterion functions and clustering, hierarchical clustering, on-line clustering. Component analysis, low-dimensional representations and multidimensional scaling.

Course Outcomes: Upon completion of this course, students will be able to:

1. Describe the iterative nature of the design cycle in machine perception and pattern recognition systems.
2. Determine the maximum likelihood and Bayesian parameter estimation.
3. Analyse the nonparametric techniques such as density estimation and nearest neighbour estimation.
4. Solve the linear discriminant functions, minimizing the perception criterion function and minimum squared error procedures.
5. Describe the various unsupervised learning and clustering methods.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CC3333-1.1	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CC3333-1.2	2	3	1	-	-	-	-	-	-	-	-	-	2	-
CC3333-1.3	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CC3333-1.4	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CC3333-1.5	2	1	1	-	-	-	-	-	-	-	-	-	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Richard O. Duda, Peter E. Hart and David G Stork," Pattern Classification", John Wiley & Sons, Inc.2nd Ed. 2001.
2. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons, Inc.1992.

REFERENCE BOOKS:

1. Christopher M. Bishop, "Pattern recognition and machine learning (information science and statistics).", Springer -Verlag New York Inc, 2006.
2. Anzai, Yuichiro, "Pattern recognition and machine learning", Elsevier, 2012.

SOFT COMPUTING PARADIGM

Course Code	**CC3334-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CC2201-1**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Understand the concepts of Artificial Intelligence, various types of production systems, and characteristics of production systems.
2.	Describe the various genetic algorithms.
3.	Understand the fundamental concepts of Neural Networks.
4.	Understand the fundamental concepts of Fuzzy logic.
5.	Understand the concepts of decision and expert systems.

UNIT-I

INTRODUCTION TO SOFT COMPUTING	**08 Hours**

Evolution of Computing, Soft and Hard Computing, Soft Computing characteristics, Constituents and Applications, AI Definitions, and Intelligent systems architecture.

GENETIC ALGORITHMS	**07 Hours**

Introduction to Genetic Algorithms (GA) – Conceptual GA algorithm, Reproduction operators Mutation and cross over, Applications of GA, Learning Definitions, strategies, Machine Learning Approach, applications and Architecture of learning agent.

UNIT-II

NEURAL NETWORKS	**08 Hours**

Introduction to Neural Networks, Applications, Structure and function of Biological Neuron, ANN introduction, Perceptron, Multi-layer feed forward Networks with Back propagation.

FUZZY LOGIC	**07 Hours**

Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, Fuzzy Rules, Models, Fuzzy Reasoning and Fuzzy Inference Systems.

UNIT-III

DECISION MAKING AND EXPERT SYSTEMS	**10 Hours**

Single person, multi person, Multi criteria and Multistage decision making, Expert system features, architecture and applications.

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamentals of soft computing and Artificial Intelligence and IS architecture.
2.	Describe the conceptual Genetic algorithms and its applications.
3.	Discuss the concepts of Neural Networks, its structures and its applications.
4.	Explain the different techniques of fuzzy logic.
5.	Explain the different types of decision making and applications of expert systems.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**

↓ **Course Outcomes**													**1**	**2**
CC3334-1.1	3	1	1	-	-	-	-	-	-	-	-	-	1	-
CC3334-1.2	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CC3334-1.3	2	1	2	-	-	-	-	-	-	-	-	-	1	-
CC3334-1.4	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CC3334-1.5	3	1	1	-	-	-	-	-	-	-	-	-	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2.	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall, 1995.
3.	James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition., 2003.
4.	Simon Haylion "Neural Networks", Prentice-Hall of India, 2003.

REFERENCE BOOKS:

1.	Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2.	David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning",
3.	S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
4.	S. N. Sivanandam, S. N. Deepa, "Introduction to Genetic Algorithms", Springer, 2007.
5.	Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers, 1992.

E Books / MOOCs/ NPTEL

1.	https://onlinecourses.nptel.ac.in/noc22_cs54/preview
2.	https://www.classcentral.com/course/youtube-introduction-to-soft-computing-47844
3.	https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

Ability Enhancement Courses

INNOVATION AND DESIGN THINKING

Course Code	**ME1654-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To explain the fundamental concept of innovation and design thinking
2.	To discuss the methods of implementing design thinking in the real world.
	Note: Teaching-Learning Process (General Instructions) These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes. 1. Lecturer method (L) does not mean only the traditional lecture method, but a ifferent type of teaching method may be adopted to develop the outcomes. 2. Show Video/animation films to explain concepts 3. Encourage collaborative (Group Learning) Learning in the class 4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it. 6. Topics will be introduced in multiple representations. 7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

List of Modules

1.	**Process of Design** Understanding Design thinking Shared model in team-based design – Theory and practice in Design thinking – Explore the presentation Tools for Design Thinking Real-Time design interaction capture and analysis – Empathy for design Teaching-Learning Process Introduction about the design thinking: Chalk and Talk method Theory and practice through presentation Case studies on design thinking for real-time interaction and analysis
2.	**Design Thinking in IT** Design Thinking to Business Process modeling – Scenario-based Prototyping DT For strategic innovations

	Growth – Storytelling representation – Strategic Foresight - Change – Sense Making – Maintenance - Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design. Teaching-Learning Process Case studies on design thinking and business acceptance of the design Business model examples of successful designs
3.	Design thinking workshop Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test Teaching-Learning Process Presentation by the students on the success of Live project on design thinking in a group of 4 students

Course Outcomes: Upon the successful completion of the course, students will be able to:

1.	Generate and develop design ideas through a different techniques
2.	Identify the significance of Design Thinking to Understand products

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
ME1654-1.1	-	-	-	-	-	-	2	2	-	-	-	-	1	1	1
ME1654-1.2	-	-	-	-	-	-	-	-	-	3	3	-	1	1	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011
4.	Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
5.	Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
6.	Jeanne Liedtka, Andrew King, Kevin Bennett, "Solving Problems with Design Thinking - Ten Stories of What Works", Columbia Business School Publishing Hardcover, 2013.

E Resources

1.	www.tutor2u.net/business/presentations/. /productlifecycle/default.html
2.	https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
3.	www.bizfilings.com › Home › Marketing › Product Developmen
4.	https://www.mindtools.com/brainstm.html
5.	https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
6.	www.vertabelo.com/blog/documentation/reverse-engineering https://support.microsoft.com/en-us/kb/273814
7.	https://support.google.com/docs/answer/179740?hl=en
8.	https://www.youtube.com/watch?v=2mjSDIBaUlM

	thevirtualinstructor.com/foreshortening.html https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf https://dschool.stanford.edu/use-our-methods/ 6. https://www.interactiondesign.org/literature/article/5-stages-in-the-design-thinking-process 7. http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 49 8. https://www.nngroup.com/articles/design-thinking/ 9. https://designthinkingforeducators.com/design-thinking/ 10. www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf
9.	Activity Based Learning (Suggested Activities in Class)/ Practical Based learning · http://dschool.stanford.edu/dgift/

RESEARCH METHODOLOGY

Course Code	**HU1010-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P:S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**

Teaching Department: Respective Department

Course Objectives

1.	Understand Research Formulation and Design
2.	Inculcate the ability to collect Data and its analysis
3.	Enhance knowledge of Soft Computing
4.	Comprehend Research Ethics and the art of publishing
5.	Develop Interpretative Skills and write reports

UNIT - I

Research Formulation and Design	**5 Hours**
Motivation and Objectives – Research methods vis-a-vis Methodology. Types of research – Descriptive vis-a-vis Analytical, Applied vis-a-vis Fundamental, Quantitative vis-a-vis Qualitative, Conceptual vis-a-vis Empirical, concept of applied and basic research process, Criteria of good research. Defining and formulating the research problem, Selecting the problem, Importance of Literature Review, Literature Review - Primary and Secondary sources, reviews, monograph, patents, research databases, Web as a source, Critical literature review, Identifying gap areas from Literature Review, Development of working hypothesis.	
Data Collection and Analysis	**5 Hours**
Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.	

UNIT - II

Soft Computing	5 Hours
Computer and its role in research, Use of statistical software SPSS, GRETL in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.	
Research Ethics and Scholarly Publishing	**5 Hours**
Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility, and accountability	

UNIT - III

Interpretation and Report Writing	5 Hours
Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports	

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate proficiency in research formulation, design, and problem-solving, applying various methodologies and techniques to effectively address research questions and hypotheses.
2.	Acquire competence in collecting, validating, and analyzing data using appropriate methods and statistical tools, enabling them to draw meaningful conclusions and insights from research datasets.
3.	Comprehend the role of soft computing techniques such as evolutionary algorithms and statistical software in optimizing research processes, effectively utilizing computational tools to enhance research efficiency and outcomes.
4.	Develop a thorough understanding of research ethics, intellectual property rights, and scholarly publishing standards, ensuring the responsible and ethical conduct of research and the dissemination of findings through reputable channels while upholding integrity and accountability.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1010-1.1	-	-	-	-	-	-	-	-	-	2	-	3	-	-
HU1010-1.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1010-1.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1010-1.4	-	-	-	-	-	-	-	-	2	2	-	2	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Garg, B. L., Karadia, R., Agarwal, F., & Agarwal, “An introduction to Research

	Methodology", RBSA Publishers, 2002.
2.	Wadehra, B. L. "Law relating to patents, trademarks, copyright designs and geographical indications", Universal Law Publishing, 2000.
3.	Kothari, C. R. "Research Methodology: Methods and Techniques". New Age International, 1990.
4.	Trochim, W. M. K. "Research Methods: the concise knowledge base", Atomic Dog Publishing, 2005.
5.	Sinha, S. C., & Dhiman, A. K., "Research Methodology", EssEss Publications. (2 volumes), 2002.
6.	Satarkar, S. V. "Intellectual property rights and copyright", EssEss Publications, 2000.
7.	Coley, S. M., & Scheinberg, C. A., "Proposal Writing", Sage Publications, 1990.
8.	Day, R. A. "How to Write and Publish a Scientific Paper", Cambridge University Press, 1992.
9.	Anthony, M., Graziano, A. M., & Raulin, M. L., "Research Methods: A Process of Inquiry". Allyn and Bacon, 2009.

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	**HU1007-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P:S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Respective Department

Course Objectives

1.	To Acquire the knowledge about Rural Society & Rural Economy
2.	To Know the working of rural Institutions and Development Programs

UNIT - I

Appreciation of Rural Society	**3 Hours**
Rural Society, Caste and Gender relations, Rural values, Nature and Resources, Rural infrastructure.	
Understanding Rural Economy & Livelihood	**3 Hours**
Agriculture, Farming, Landownership, Water Management, Animal Husbandry, Non-Farm Livelihoods and Artisans, Rural Entrepreneurs.	

UNIT - II

Rural Institutions	**3 Hours**
Traditional Rural Organizations, Self-help Groups, Panchayat Raj Institutions - Gram Sabha, Gram Panchayat, Standing Committees	
Rural Development Programmes	**3 Hours**
History of Rural Development in India, Current National Programmes - Sarva Shiksha Abhiyaan, Beti Bachao – Beti Padhao, Ayushmaan Bharath, Swachh Bharath, PM Awaas Yojana, Skill India, Decentralised Planning, NRLM, MNREGA	

UNIT - III

Corporate Social Responsibility (CSR)	3 Hours
Global Guidelines on CSR, Growing Importance of CSR, CSR in India	

Course Outcomes: At the end of the course student will be able to

1.	Comprehend Rural Society and its Economy
2.	Identify the working of Rural Administration and different rural schemes

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1007-1.1	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1007-1.2	-	-	-	-	-	-	-	-	-	-	2	3	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	UGC., "Unnat Bharat Abhiyan", 2020
2.	Agarwal, S.K., "Corporate Social Responsibility in India", SAGE Publication, 2008.
3.	Unnat Bharat Abhiyan. (n.d.). Unnat Bharat Abhiyan Brochure. Retrieved from https://unnatbharatabhiyan.gov.in/app/webroot/files/brochure.pdf

EMPLOYABILITY SKILL DEVELOPMENT

Course Code:	**UM1003-1**	**Course Type**	**AEC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**1**
Total Teaching Hours	**15+0+0+0**	**CIE + SEE Marks**	**50+00**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To explain the students the necessity of clearing the aptitude tests irrespective of the written test is for jobs or higher education.
2.	To assess the readiness of the students to appear for the aptitude test and assisting them to better it if already ready, else train them.
3.	To evaluate the understanding of the students in answering quantitative multiple-choice questions and guide them to improve it.
4.	To evaluate the preparedness of the students to answer the analytical and logical questions.
5.	To evaluate the quality of the students with regard to their professional language grammar, vocabulary and communication skills.

UNIT-I

Quantitative	06 Hours
Numbers (Odd, even, H.C.F & L.C.M, Square roots & cube roots, Average, Percentage), Ratios & Proportions, Partnership, Time & work, Pipes & Cistern, Speed, Problems on trains, Problems on boats & streams, Allegation & Mixtures.	

UNIT-II

Analytical/ Logical	**06 Hours**
Numerical logic (next number in series, odd man out), Coded language, Syllogism, Direction (N-E-W-S), Seating arrangement, Blood relations, Statement & Conclusion	
UNIT-III	
Verbal	**03 Hours**
Vocabulary (root words, prefix, suffix, synonyms, antonyms), One word substitution, Idiom/phrases, Sentence completion, Active & Passive voice, Direct and indirect speech.	

Course Outcomes: At the end of the course student will be able to

1.	Analyse and answer the quantitative multiple-choice questions.
2.	Analyse and answer the analytical and logical questions and demonstrate good communication skills.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
UM1003-1.1	3	3	-	-	-	-	-	-	2	2	1	-			
UM1003-1.2	3	3	2	-	-	-	-	-	2	2	1	-			

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aggarwal R.S, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing.
2.	Aggarwal R.S, "A modern approach to verbal and non-verbal reasoning", S Chand Publishing.

REFERENCE BOOKS:

1.	Bharath Patodi and Aditya Choudhary, "Verbal Ability & Comprehension", Disha Publication, Second edition, 2015.
2.	Shakuntala Devi, "Joy of numbers", Orient Black Swan.
3.	Shakuntala Devi, "More puzzles to puzzle you", Orient Black Swan.

E Books / MOOCs/ NPTEL

1.	https://www.indiabix.com
2.	https://www.faceprep.in

LIFE SKILLS FOR ENGINEERS

Course Code	**HU1008-1**	**Course Type**	**AEC**
Teaching Hours/Week (L:T:P:S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Understand Time Management, Stress Management and Personal Health Management
2.	Familiarize the Science behind Personal Health Management and Addictions
3.	Appreciate the importance of cultivating good hobbies, need for forming good habits and discarding bad habits and holding difficult conversations during crises
4.	Comprehend the importance of Creative Thinking, Continuous and Lifelong Learning, Collaboration and Team Work

UNIT - I	
Introduction to Life Skills Meaning and Importance of Life Skills, Competitive Job market, Fast paced changes in Technology, Proliferation of Electronic Gadgets, and harmful online content. **Time Management** Introduction to Time Management, Impulsive Behaviour vis-a-vis goal Directive Behaviour, Time log, Information Overload and coping with Information & Communication Technology (ICT) Revolution; Proliferation of Electronic Media; Exponential growth in online content; Impact of Information Overload on human brain	**3 Hours**
Science behind Personal Health Management Ignorance in Society on health issues, World Health Organization (WHO) - Definition of Health, Human Evolution, Importance of physical work for human body & mind, Dangers of sedentary lifestyle, Germ diseases versus Lifestyle diseases, Integrating physical exercise into daily life **Science behind Addictions** Addiction - Meaning, Neurology and Hormonal basics of Addictive Behaviour, how addictions are formed; Harmful effects of addictions on Physical and Mental Health, recognizing addictions in oneself, Coming out of addictions	**3 Hours**
UNIT - II	
Need for cultivating good hobbies Need for Hobbies in maintaining Work-Life Balance; how hobbies help in maintaining good physical and mental health, Various Hobbies **Habits** Difference between hobbies & habits, cultivating good habits & discarding bad habits: Role of habits for a successful life, how habits form; Analyzing one's own habits; Recognizing useless & harmful habits, Cultivating & Sustaining useful habits	**3 Hours**
Peer pressure and how to cope with it Human being as a Social Animal, Physical Pain & Social Pain; Awareness of Harmful Social Pressure, Role of Prefrontal Cortex in Judgement and Decision Making, why teenagers are vulnerable to peer pressure, strategies to overcome harmful peer pressure **Stress Management** Stress, Types of Stress, Fight & Flight Response of Humans; Harmful effects of	**3 Hours**

chronic stress; Symptoms of Poor Coping Skills of Stress, Stress & Psychiatric problems, Easy coping strategies for stress	
UNIT - III	
Continuous & Lifelong Learning Accelerated change in Technology Landscape, Shorter Life Cycles of Technologies, Need for Continuous Learning of other skills **Team Working Skills & Collaboration** Team Work – Meaning, Skills and Relevance, Importance of Collaboration to succeed in one's own career, How to be a good team member	**3 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Develop proficiency in vital life skills like time management, stress management, health management, and addiction awareness to effectively navigate personal and professional challenges, promoting their well-being and success.
2.	Cultivate a growth mindset, prioritizing continuous learning and collaboration, understanding the significance of ongoing skill development in adapting to changes in technology and the job market, and honing teamwork and collaboration abilities crucial for success in diverse professional settings.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1008-1.1	-	-	-	-	-	-	-	-	2	2	1	3	-	-
HU1008-1.2	-	-	-	-	-	-	-	-	1	3	2	3	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Lieberman, D.E., "The Story of the Human Body", Pantheon Books, 2013.
2.	Ratey, J.J., "Spark. Little Brown Spark", 2013.
3.	De Bono, E., "Creative Thinking", Penguin UK, 2016.
4.	Pachter, B., "The Power of Positive Confrontation", Da Capo Lifelong Books, 1999.
5.	Duhigg, C., "The Power of Habit", Random House Trade Paperbacks, 2012.
6.	Sharma, S., & Mishra, B., "Communication Skills for Engineers and Scientists", PHI Learning, 2009.
7.	Tracy, B., "Time Management", AMACOM, 2014.

Humanities & Management Courses

Course Code	**HU2001-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**2:0:0:0**	**Credits**	**02**
Total Teaching Hours	**25**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives

1.	Introspect and learn about oneself
2.	Develop professional writing skills
3.	Acquaint with the various social behaviour and etiquette
4.	Apply the techniques of fundamental communication skills
5.	Develop necessary techniques for formal presentations

UNIT - I

Personality Traits Types & Kinds of personality, Ways to Identify Self (SWOT Analysis, Johari Window), Concepts of Self-Management and Self-Motivation **Effective Communication Skills** One-way and Two-way Communication, Interpersonal & Social Skills	**09 Hours**

UNIT - II

Social Behaviour and Cultural Etiquette Time Management, Personal Grooming, Making Small Talk, Customs & Manners **Professional Presentation Techniques** Formal Presentation, Sensitivity towards multi-cultural workspaces.	**09 Hours**

UNIT - III

Job-Related Communication Resume & Cover Letter, Formal E-mails, Framing Requests, Greetings, Salutations, Close	**07 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Understand the importance of human conduct and various types of communication.
2.	Demonstrate knowledge of theory and competence in office communication.
3.	Be Familiar with the current practices of social behaviour.
4.	Prepare and deliver presentation appropriate for the workplace.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU2001-1.1	-	1	-	-	-	2	2	-	3	-	-	-	-	-
HU2001-1.2	-	-	-	-	-	-	-	3	2	1	-	1	-	-

HU2001-1.3	-	-	2	-	-	2	2	2	-	-	-	2	-	-
HU2001-1.4	-	3	-	-	-	-	-	-	2	3	2	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Adler, R. B., & Elmhorst, J. M. “Communicating at Work: Principles and Practices for Business and the Professions”, McGraw Hill College.
2.	Covey, S. R. “The 7 Habits of Highly Effective People”, Great Britain: Simon & Schuster, 2013.
3.	Gulati, S. “Corporate Grooming and Etiquette”, New Delhi: Rupa Publications India Pvt. Ltd, 2010.
4.	Luthans, F. “Organizational Behavior”, McGraw Hill International, 1998.
5.	Rath, T. “Strengths Finder 2.0.”, New York: Gallup Press, 2020.
6.	Rizvi, M. A. “Effective Technical Communication”, New Delhi: Tata McGraw-Hill, 2007.
7.	Robbins, S. P. “Organizational Behavior”, New Delhi: Prentice Hall, 2016.
8.	Carnegie, D. “How to Win Friends and Influence People”, New York: Gallery Books, 2019.
9.	Gaur, R. R., Sangal, R., & Bagaria, G. P. “Human Values and Professional Ethics”, New Delhi, India: Excel Books, 2010.

DEVELOPING PROFESSIONAL SKILLS

Course Code	**HU2002-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives:

1.	Developing an understanding of one's own strengths, weaknesses, values, and beliefs through exercises and assessments
2.	Enhancing verbal and non-verbal communication skills to express thoughts and feelings clearly, listen actively, and resolve conflicts constructively
3.	Building professional online presence through personal branding
4.	Learning techniques for setting achievable goals, prioritizing tasks, and managing time effectively to enhance productivity and personal fulfilment

UNIT - I

Understanding Personality	**02 Hours**

- Introduction to 16 types of personalities (Myers & Briggs) and their significance in professional growth
- MBTI Self-assessment exercise to identify individual Personality Type and areas for

development

Campus Placement: First Impressions	**04 Hours**

- Comprehensive overview of campus placement opportunities and challenges
- Crafting tailored resumes, cover letters, and portfolios for different job applications
- Self-Introductions: Styles and strategies

UNIT - II

Personal Branding and Professional Image	**02 Hours**

- Understanding the importance of personal branding in career advancement
- Developing a strong online presence through LinkedIn, and GitHub

Voicing Perspectives in Interviews and Group Discussions	**04 Hours**

- Exploring various interview formats
- Addressing common interview challenges and handling difficult questions with poise
- Group Discussions

UNIT - III

Goal Setting	**02 Hours**

- Work Ethics and Professionalism
- Setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for ongoing skill development and career advancement

Wrap-Up	**01 Hours**

- Participant feedback collection to assess the effectiveness of the modules

Course Outcomes: At the end of the course, students will be able to

1.	Demonstrate an increased awareness of their strengths, weaknesses, values, and beliefs and set a goal for their life
2.	Effectively express their thoughts and feelings verbally and non-verbally, demonstrate active listening skills, and employ constructive conflict resolution techniques in interpersonal interactions in interviews, GD and online platforms

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
HU2002-1.1	-	1	-	-	-	2	2	-	3	-	-	-	-	-
HU2002-1.2	-	-	-	-	-	-	-	3	2	1	-	1	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Adler, R. B., & Elmhorst, J. M. “Communicating at Work: Principles and Practices for Business and the Professions”, Edition number). McGraw Hill College.
2.	Covey, S. R. “The 7 Habits of Highly Effective People”, Great Britain: Simon & Schuster, 2013.
3.	Gulati, S. “Corporate Grooming and Etiquette”, New Delhi: Rupa Publications India Pvt. Ltd, 2010.
4.	Luthans, F. “Organizational Behavior”. McGraw Hill International, 1998.

5.	Rath, T. “Strengths Finder 2.0”, New York: Gallup Press, 2020.
6.	Rizvi, M. A. “Effective Technical Communication”, New Delhi: Tata McGraw-Hill, 2007.
7.	Robbins, S. P. “Organizational Behavior”, New Delhi: Prentice Hall, 2016.
8.	Carnegie, D. “How to Win Friends and Influence People”, New York: Gallery Books, 2019.
9.	Gaur, R. R., Sangal, R., & Bagaria, G. P. “Human Values and Professional Ethics”, New Delhi, India: Excel Books, 2010.

ಆಡಳಿತ ಕನ್ನಡ (Kannada for Administration)

Course Code	**HU1003-1**	**Course Type**	**MNC**
Teaching Hours/Week (L:T:P:S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+0**

Teaching Department: Respective Department

Course Objectives:

1.	ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ನಾಡು,ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಮೂಲಭೂತ ಸಂರಚನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
2.	ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ತಾಂತ್ರಿಕ ಕನ್ನಡ, ಆಡಳಿತಾತ್ಮಕ ಸಂವಹನ ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡವನ್ನು ಪರಿಚಯಿಸುವುದು.

UNIT – I

ಲೇಖನಗಳು: 1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ: ಹಂಪ ನಾಗರಾಜಯ್ಯ 2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ 3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ವಿವಿಧ ಕನ್ನಡ ಪುಸ್ತಕದಿಂದ ಆಯ್ದ ಲೇಖನ **ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕಪೂರ್ವ)** 1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸ 3. ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೆ - ಕನಕದಾಸ 4. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಷರೀಫ 5. ಶಿವಯೋಗಿ: ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿ 6. ಜನಪದ ಗೀತೆ: ಬೀಸುವ ಪದ, ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ	**6 Hours**

UNIT – II

ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕ) 1. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ: ಡಿ.ವಿ.ಜಿ. 2. ಕುರುಡು ಕಾಂಚಾಣ: ದ.ರಾ.ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು 4. ಹೆಂಡತಿಯ ಕಾಗದ: ಕೆ .ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ 5. ಮಬ್ಬಿನಿಂದ ಮಬ್ಬಿಗೆ: ಜಿ. ಎಸ್. ಶಿವರುದ್ರಪ್ಪ 6. ಆಮರ ಈ ಮರ: ಚಂದ್ರಶೇಖರ ಕಂಬಾರ 7. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು: ಸಿದ್ಧಲಿಂಗಯ್ಯ	**6 Hours**

ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಪರಿಚಯ, ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ 1. ಡಾ. ಸರ್.ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ – ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ: ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್ 2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ 3. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
UNIT – III	
ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ: 1. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ 2. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡ ಟೈಪಿಂಗ್ 3. ಕನ್ನಡ: ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ 4. ತಾಂತ್ರಿಕ ಪದಕೋಶ: ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು	**3 Hours**

Course Outcomes: At the end of the course student will be able to

1.	ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನು ಹಾಗೂ ಕನ್ನಡ ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡುನುಡಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು ಮತ್ತು ಕನ್ನಡಭಾಷೆಯ ವ್ಯಾಕರಣ ಮತ್ತು ಭಾಷಾ ರಚನೆಯ ನಿಯಮಗಳ ಅರಿವನ್ನು ಮೂಡಿಸುವುದು
2.	ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಬರೆಯುವಲ್ಲಿ ಉಂಟಾಗುವ ದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ಪರಿಹಾರವನ್ನು ಅರಿತುಕೊಳ್ಳುವುದು, ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವನ್ನು ಮೂಡಿಸುವುದು, ಮತ್ತು ಕನ್ನಡಭಾಷಾ ಅಭ್ಯಾಸದಲ್ಲಿ ಸಾಮಾನ್ಯ ಕನ್ನಡ ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವನ್ನು ಮಾಡಿಕೊಡುವುದು

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1003-1.1	-	-	-	-	-	-	-	3	-	-	1	1	-	-
HU1003-1.2	-	-	-	-	-	-	-	2	-	-	1	1	-	-

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
2.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
3.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.
4.	ಡಿ.ಎನ್. ಶಂಕರ ಭಟ್, ಕನ್ನಡವಾಕ್ಯಗಳ ಒಳರಚನೆ, ೨೦೦೬, ಭಾಷಾಪ್ರಕಾಶನ, ಮೈಸೂರು.
5.	ಕನ್ನಡ ಭಾಷಿಕ (ಅವಿಸ್ತರ)- ಪ್ರಬಂಧ ಮತ್ತು ಆಡಳಿತ ಕನ್ನಡ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮುಕ್ತ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಮೈಸೂರು.
6.	ಆಡಳಿತ ಕನ್ನಡ, ಎಚ್ಚೆಸ್ಕೆ, ಚೇತನ ಬುಕ್ ಹೌಸ್, ಮೈಸೂರು.

Balake Kannada (Communication in Kannada)

Course Code	**HU1003-1**	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P: S)	**1:0:0:0**	**Credits**	**0**
Total Teaching Hours	**15+0+0**	**CIE + SEE Marks**	**50+0**

Teaching Department: Respective Department

Course Objectives:

1.	The course will enable the students to cognize Kannada and communicate in basic Kannada language.
2.	Develop proficiency in conversing daily in Kannada, enriching basic Kannada vocabulary, and acquiring knowledge about Karnataka and its culture

UNIT - I

Basic Kannada Grammar — **6 Hours**

1. Personal Pronouns, Possessive Forms, Interrogative words
2. Possessive forms of nouns, Dubitive question and Relative nouns
3. Qualitative, Quantitative and Colour Adjectives, Numerals
4. Predictive Forms, Locative Case
5. Dative Cases, and Numerals
6. Ordinal numerals and Plural markers
7. Defective / Negative Verbs and Colour Adjectives
8. Permission, Commands, encouraging and Urging words (Imperative words and sentences)
9. Accusative Cases and Potential Forms used in General Communication
10. Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs
11. Comparative, Relationship, Identification and Negation Words
12. Different types of forms of Tense, Time and Verbs
13. Formation of Past, Future and Present Tense Sentences with Verb Forms
14. Karnataka State and General Information about the State
15. Kannada Language and Literature
16. Do's and Don'ts in Learning a Language

Unit – II

Kannada Language Script Part – 1	**6 Hours**

Unit – III

Kannada Vocabulary List & Kannada Words in Conversation	**3 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Understand the parts of speech of Kannada and acquire knowledge of the Kannada script.
2.	Be proficient in conversing daily in Kannada, enriching basic Kannada vocabulary, and gaining knowledge about Karnataka and its culture.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1003-1.1								3			1	1		
HU1003-1.2								2			1	1		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:	
1.	English –Kannada Rapidex Dictionary of Spoken Words, S N Raju, Bengaluru
2.	English Kannada Standard Dictionary, D K Bharadwaj, Sankeshwar Printers Pvt Ltd, Bengaluru
3.	ಮಾತಾಡುವ ಕನ್ನಡ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು (೨೦೧೬).
4.	ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡನಿಗಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.
5.	ಆಡಳಿತ ಪದಕೋಶ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿಪ್ರಾಧಿಕಾರ, ಬೆಂಗಳೂರು.
6.	ಕನ್ನಡ ಭಾಷಾಕೈಪಿಡಿ, ಸಂಗಮೇಶ ಸವದತ್ತಿಮಠ, ರೂಪರಶ್ಮಿ ಪ್ರಕಾಶನ, ಗುಲ್ಬರ್ಗ, ೧೯೯೫.
7.	ಡಿ.ಎನ್. ಶಂಕರ ಭಟ್, ಕನ್ನಡ ವಾಕ್ಯಗಳ ಒಳ ರಚನೆ, ೨೦೦೬, ಭಾಷಾ ಪ್ರಕಾಶನ, ಮೈಸೂರು.
8.	ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ- ಇಂಗ್ಲಿಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು.

ESSENCE OF INDIAN CULTURE

Course Code	**HU1005-1**	**Course Type**	**HEC**
Teaching Hours/Week (L:T:P:S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE**	**50**

Teaching Department: Respective Department

Course Objectives

1.	To facilitate students with the concepts of Indian Culture and to make them understand the roots of knowledge system.
2.	To acquaint students with Indian Culture and inculcate an ability to analyze it.
3.	To apply various approaches for the enhancement of living ideals based on Indian traditional knowledge.

UNIT - I

Introduction to Traditional Knowledge	**6 Hours**
Definition, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge and its characteristics, Traditional Knowledge vis-a-vis Indigenous Knowledge, Traditional Knowledge vis-a-vis Western Knowledge	

UNIT - II

Significance of Traditional Knowledge	**6 Hours**
Value of Traditional Knowledge in global economy, Role of Government in harnessing Traditional Knowledge, Traditional medicine system, Traditional Knowledge in agriculture, food and healthcare.	

UNIT - III

Holistic Healthcare for Human Well-being	**3 Hours**
Definition of Ayurveda, Ayurveda for Life, Health and Well-being, Introduction to principles of Ayurvedic healing and Astanga Ayurveda	

Course Outcomes: At the end of the course student will be able to

1.	Identify the concept, need and importance of protecting the Traditional Knowledge.
2.	Familiarize the Holistic Healthcare the various enactments related to Traditional Knowledge.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1005-1.1	-	-	-	-	-	-	-	-	1	2	2	3	-	-
HU1005-1.2	-	-	-	-	-	-	-	-	-	3	2	3	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Jha, A., “Traditional Knowledge System in India”, Atlantic Publishers, 2002.
2.	Kapoor, K., & Danino, M., “Knowledge Traditions and Practices of India”, 2012.
3.	Kapil Kapoor, Michel Danino, "Knowledge Traditions and Practices of India", Medknow Publications and Media.
4.	Jha, R.N., “Science of Consciousness Psychotherapy and Yoga Practices”, Delhi: Vidyanidhi Prakashan, 2015.
5.	TEDx Talks. (2015, February 6). Unleashing the Power of Traditional Medicine | Dr. Arvind Singh [Video file]. Retrieved from https://www.youtube.com/watch?v=LZP1StpYEPM

UNIVERSAL HUMAN VALUES

Course Code	**HU1011-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Enable students to appreciate values, skills and behaviour with an appropriate understanding of ‘Self’ to attain sustained happiness and prosperity with right aspirations of life.
2.	Develop a holistic perspective among the students towards physical needs and prosperity of life.
3.	Develop a holistic approach and understand the importance of co-existence and living in harmony ensuring mutually fulfilling interaction with society and nature.

UNIT - I

Need, Basic Guidelines, Content and Process for Value Education	**14 Hours**

Self-Exploration; 'Natural Acceptance' and Experiential Validation; Continuous Happiness and Prosperity; Right understanding, Relationship and Physical Facility; Understanding Happiness and Prosperity - living in harmony at various levels.

UNIT - II

Understanding Harmony in the Human Being, Family and Society	**13 Hours**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body; the needs of Self ('I') and 'Body'; the Body as an instrument; Holistic perspective of Physical needs and Prosperity.
Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT - III

Whole existence as Coexistence: Implications of the above Holistic Understanding of Harmony and Professional Ethics	**13 Hours**

Understanding the harmony in the Nature and Existence; Existence as Co-existence, Holistic perception of harmony at all levels of existence; Natural acceptance of human values, Professional Ethics

Course Outcomes: At the end of the course student will be able to

1.	have a better self-exploration and understanding with a capacity to identify the priorities of life with focus on human values having a holistic perspective of physical needs.
2.	understand and practice living in harmony, co-existence and natural acceptance and also to exhibit Professional Ethics in the workplace
3.	appreciate and connect to the values cherished by our ancestors
4.	understand the relevance of Universal Fraternity (Vasudaiva Kutumbakam) principle to build a healthy society and a nation with unity and integrity
5	Accept their personal ethical and moral responsibility to protect and preserve the environment they live-in, to maintain the moral health of the society and in nation building

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1011-1.1	-	-	2	-	-	-	-	3	-	-	2	2	-	-
HU1011-1.2	-	-	1	-	-	-	-	3	-	-	2	2	-	-
HU1011-1.3	-	-	1	-	-	-	-	3	-	-	2	2	-	-
HU1011-1.4	-	-	1	-	-	-	-	3	-	-	2	2	-	-
HU1011-1.5	-	-	1	-	-	-	-	3	-	-	2	2	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Gaur, R. R., Sangal, R., & Bagaria, G. P., "Human Values and Professional Ethics",

	New Delhi, India: Excel Books, 2010.
2.	Nagaraj, A. "Jeevan Vidya: Ek Parichaya", Amarkantak: Jeevan Vidya Prakashan, 1999.
3.	Tripathi, A.N. "Human Values", New Delhi: New Age Intl. Publishers, 2004.
4.	Leonard, A. "The Story of Stuff", 2007.
5.	Gandhi, M. K. "The Story of My Experiments with Truth", 1927.
6.	Schumacher, E. F. "Small is Beautiful: Economics as if People Mattered", 1973
7.	Andrews, C. "Slow is Beautiful: New Visions of Community, Leisure, and Joie de Vivre", 2006.
8.	Kumarappa, J.C. "Economy of Permanence", 2018.
9.	Sunderlal, P. "Bharat Mein Angreji Raj", 2021.
10.	Dharampal. "Rediscovering India, 2003.
11.	Gandhi, M. "Indian Home Rule", 2017.
12.	Azad, M. A. K. "India Wins Freedom", 1989.
13.	Rolland, R. "Vivekananda", 2017.
14.	Rolland, R. "Gandhi", 2002.

INTRODUCTION TO IPR

Course Code:	**HU1006-1**	**Course Type:**	**HSMC**
Teaching Hours/Week (L: T: P):	**1:0:0**	**Credits:**	**01**
Total Teaching Hours:	**15**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Respective Department

Course Objectives:

1.	Enhancing the learning system through innovation and creative thinking skills for effective business process.
2.	Acquaint with special challenges of starting new ventures.
3.	Facilitate Entrepreneurial skills in recognizing opportunities for competitive advantages.
4.	Provide insights of financial aspects in planning and executing a business plan.
5.	Ascertain the role of IPR to protect innovations and intangible assets.

UNIT-I

Intellectual Property Rights (IPR) **6 Hours**

Introduction to IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Uses in marketing

UNIT-II

Types of Intellectual Property **6 Hours**

Patent - Procedure, Licensing and Assignment, Infringement and Penalty, Trademark, Example of Trademarks - Domain name, Geographical Indications, Copyright, Industrial Designs, Class Discussion - Major Court Cases regarding violation of Patents

UNIT-III

Basic Tenets of Information Technology Act, 2000 **3 Hours**

IT Act – Introduction, E-Commerce and Legal Provisions, E- Governance, Digital signature and Electronic Signature, Cybercrimes

Course Outcomes: At the end of the course student will be able to

1.	Comprehend Innovation, its process and sources.
2.	Apply the process of building an innovative organization.
3.	Recognize the characteristics of different types of Entrepreneurships
4.	Formulate a business plan based on a business idea in Technology.
5.	Interpret basic tenets of Information Technology Act, 2000.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1006-1.1	-	-	-	-	-	-	-	-	-	2	-	3	-	-
HU1006-1.2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1006-1.3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
HU1006-1.4	-	-	-	-	-	-	-	-	2	2	-	2	-	-
HU1006-1.5	-	-	-	-	-	-	-	-	1	2	-	2	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Tidd, J., & Bessant, J., "Managing Innovation: Integrating Technological, Market and Organizational Change", Wiley, 2021.
2.	Case Study Materials: To be distributed for Class Discussion
3.	Reddy, G. B., "Intellectual Property Rights and the Law", Gogia Law Agency, 2012.
4.	Wadehra, B. L., "Law relating to Intellectual Property", Universal Law Publishing Co., 2011.
5.	Narayanan, P., "IPR", Eastern Law House Private Ltd, 2017.

MANAGEMENT & ENTREPRENEURSHIP

Course Code:	**MG1003-1**	**Course Type**	**HSMC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Any

Course Objectives:

1.	To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.

2	To discuss the ways in which work is allocation, structure of organizations, modes of communication and need of coordination between the manager and staff
3	To explain the role and importance of the entrepreneur and their functions in economic development and the concepts of entrepreneurship.
4	To discuss the importance of Small Scale Industries and methods for generating new business ideas and business opportunities
5	To introduce the concepts of financial concepts in enterprises.

UNIT-I	
Management:	**03 Hours**
Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art &Profession.	
Planning:	**03 Hours**
Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.	
Organizing and Staffing	**04 Hours**
Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.	
Directing and Controlling	**04 Hours**
Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling	
UNIT-II	
Social Responsibilities of Business:	**03 Hours**
Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics, and Corporate Governance.	
Entrepreneurship	**05 Hours**
Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.	
Modern Small Business Enterprises	**05 Hours**
Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).	
Institutional Support for Business Enterprises	**02 Hours**
Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions	

UNIT-III	
Finance Management in enterprises	**10 Hours**
Introduction, functions, Accounting and Bookkeeping, Financial Statements, Working Capital Management, Break even Analysis, Financial ratio Analysis.	

Course Outcomes: At the end of the course student will be able to

1.	Describe the field of management, the task of the manager, planning, and steps in decision making.
2.	Discuss the structure of the organization, importance of staffing, leadership styles, modes of communication, techniques of coordination, and importance of managerial control in the business.
3.	Describe the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
4.	Develop an understanding of the role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
5.	Apply the concepts of financial management for effective use in enterprises

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
MG1003-1.1	3	-	-	-	-	-	-	2	2	-	3	-	-	1
MG1003-1.2	3	-	-	-	-	-	-	2	2	-	3	-	-	2
MG1003-1.3	3	-	-	-	-	-	-	2	2	-	3	-	-	2
MG1003-1.4	3	-	-	-	-	-	-	2	2	-	3	-	-	2
MG1003-1.5	3	-	-	-	-	-	-	2	2	-	3	-	-	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.P. C. Tripathi, P. N. Reddy, "Principles of Management", McGraw Hill, 6th Edition, 2017.

2.Poornima M. Charanthimath, "Entrepreneurship Development and Small Business Enterprises", Pearson 2nd Edition, 2014.

3.W.D Stevenson, "Elements of Power System Analysis", 4th edition, TMH, 2001.

REFERENCE BOOKS:

1.Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 2007.

2.Harold Koontz, Heinz, Weihrich, "Essentials of Management: An International, Innovation and Leadership perspective", McGraw Hill, 10th Edition, 2016.

FINANCIAL MANAGEMENT

Course Code:	**MG1002-1**	**Course Type**	**HSMC**

Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Any

Course Objectives:

1.	Develop basic financial management knowledge essential to make a managerial career in professional life.
2.	Impart some of the crucial and basic skills required to work in the area of budgeting, investment and financial decision making.
3.	Enable in making a right decisions on selection of projects for investment.
4.	Understand the basics of finance and financial markets, project evaluation and selection.

UNIT-I

Time Value of Money	**15 Hours**

Financial Management: Concepts and Meaning – Introduction to Finance; Objectives of Financial Management; Profit Maximization; EVA; Changing Role of Financial Managers.
Time Value of Money: Techniques and Applications of Compounding and Discounting.

UNIT-II

Capital Budgeting and Working Capital	**15 Hours**

Capital Budgeting (Investment Evaluation Techniques): Payback Period Method; Present Worth Method; Annual Worth Method; Profitability index method; Estimation of IRR.
Cost of Capital: Sources of various Types of Capital; Cost of Debenture Capital; Cost of Preferential Capital; Cost of Term Loans; Cost of Equity Capital.
Working Capital: Factors influencing Working Capital Requirements.

UNIT-III

Inventory Management and Break Even Analysis	**10 Hours**

Inventory Management: Techniques of Inventory Management and Control – EOQ, ABC Analysis, Just-in-Time (JIT) System
Break Even Analysis: Estimation of Break-Even Point and Values.

Course Outcomes: At the end of the course student will be able to

1.	Describe the basic financial management skills required for a professional.
2.	Explain techniques and applications of compounding and discounting and calculate compounded/discounted amount for the given proposal.
3.	Evaluate the given investment option by capital budgeting techniques.
4.	Describe the basics of cost of capital and working capital. Determine the cost of capital for the given investment option.
5.	Describe the basics of inventory management and calculate the economic order quantity and reorder point for the given conditions. Calculate breakeven point for the given manufacturing setup.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	2	3
MG1002-1.1	3	-	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.2	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.3	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.4	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-
MG1002-1.5	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. M Y Khan, P K Jain , "Financial Management – Text, Problems & Cases",7th Edition, 2015; McGraw Hill Education (India) Pvt. Ltd, New Delhi.
2. I M Pandey, "Financial Management", 11th Edition, 2015; Vikas Publishing House Pvt. Ltd. (UP) India.
3. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", 4th Edition, Tata McGraw Hill Edition.

REFERENCE BOOKS:

1. Prasanna Chandra, "Financial Management", 6th Edition, 2004; Tata McGraw Hill Publishing Company Ltd, New Delhi.
2. S. D. Sharma, "Operation Research" , Kedar Nath Ram Nath Publishers, 2015.

INDIAN KNOWLEDGE SYSTEMS

Course Code	**HU1009-1**	**Course Type**	**HEC**
Teaching Hours/Week (L: T:P:S)	**1:0:0:0**	**Credits**	**01**
Total Teaching Hours	**15**	**CIE + SEE Marks**	**50+0**

Teaching Department: Respective Department

Course Objectives

1. Enhance the knowledge of History, Culture, Engineering Technology, Architecture and Traditional Knowledge of Ancient India to enrich understanding of its rich heritage
2. Integrate Ancient Indian wisdom into Modern Scientific paradigms; understand its scientific value and comprehend in comparison with contemporary knowledge systems

UNIT - I

Indian History — **6 Hours**

History - Land, Environment, and people in Ancient India; Ancient Education System, Takṣaśilā and Nālandā University, Hunting to Agriculture; Introduction to Vedas and Upanishads; Great Indian Epics; Indian Festivals

UNIT – II

Engineering, Technology, and Architecture	6 Hours

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology

UNIT - III

Science, Astronomy, and Mathematics	3 Hours

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, History and Culture of Astronomy, Sun, Earth, Moon, Eclipses, Rotation of Earth, Concepts of Zero and Pi, Number System, Pythagoras Theorem and Vedic Mathematics.

Course Outcomes: At the end of the course student will be able to

1.	Understand the relevance of studying history for comprehending cultural origins and preserving traditional knowledge, including the scientific insights within ancient texts like the Vedas and epics
2.	Transform Bhāratīya wisdom into practical applications within modern scientific paradigm to preserve and disseminate Indian knowledge systems for research and societal advancement

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes														
HU1009-1_.1	-	-	-	-	-	-	-	-	-	-	2	3	-	-
HU1009-1_.2	-	-	-	-	-	-	-	-	-	-	3	3	-	-

1: Low 2: Medium 3: High

REFERENCES:

1.	Tripati, R.S., "History of Ancient India", Motilal Banarsidass, 1942.
2.	Mahajan, V.D.. "Ancient India", S. Chand and Company, 1985.
3.	Ramasubramanian, K., & Srinivas, M.D., "Development of Calculus in India", 2010.
4.	Ramasubramanian, K., Srinivas, M.D., & Sriram, M.S., "The Traditional Indian Planetary Model and its Revision by Nilakantha Somayaji", 2011.
5.	Srinivas, M.D., "Proofs in Indian Mathematics", Hindustan Book Agency, 2005.
6.	Srinivas, M.D., "The Algorithmic Approach of Indian Mathematics", 2015.
7.	Srinivas, M.D. "Indian Tradition of Science: An Introductory Overview", 2016.
8.	Rahika, M., & Balasubramanian, A.V., "Ayurvedic Principles of Food and Nutrition", Part 1. Lok Swasthya Parampara Samvardhan Samithi, 1990.

Vocational Education Course

PROGRAMMING IN C++ WITH EXAMPLES			
Course Code	**CC1551-1**	**Course Type**	**VEC**
Teaching Hours/Week (L:T:P: S)	**0:0:2:0**	**Credits**	**01**
Total Teaching Hours	**0+0+26+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Familiarize with the procedural and object-oriented paradigm with concepts of classes, functions, data, and objects.
2.	Understand dynamic memory management techniques using pointers, constructors, destructors, etc.
3.	Explore the concept of function overloading, virtual functions, and polymorphism.
4.	Classify inheritance with the understanding of early and late binding.
5.	Understand the use of various OOPs concepts with the help of programs.

1.	Write a C++ program to declare a class called **Box** with private data members **length, breadth,** and **height** and the public member functions **setLength(), setBreadth(), setHeight()**. Declare a pointer to class. Compute the volume of the two objects using **compVolume()** function. **(Concept:** Pointer to Class and Access operator)
2.	Write a C++ program to read the data of N employees and compute the Net salary of each employee (**DA=52%** of Basic and Income **Tax (IT) = 30%** of the gross salary). For that, create an **Employee** class with Employee number, Employee **name, Basic, DA, IT, Net Salary**. **Concept:** Array of Objects
3.	Write a C++ program to allocate memory dynamically **for two objects**. The name of the class is **Square** with a data member called **side** and a constructor called **Square(int**) and **compArea()** member function. Use **new** and **delete** operators for memory allocation and deallocation. **Concept:** New and delete operator for memory allocation and deallocation of

	objects.
4.	Write a C++ program to allocate memory dynamically **for an array**. Read into the array the CGPA of each student and display the same in the sorted order. Use **new** and **delete** operators for memory allocation and deallocation. **Concept:** New and delete operator for memory allocation and deallocation of objects.
5.	Write a C++ program with two classes **ABC** and **XYZ** with one integer data member in each class. Write member functions to **read** and **display**, place a **friend function** called **max()** in these classes which takes the data members of these classes and computes a maximum of two data members. Demonstrate using the **main()** function. **Note**: Here one number is a member of one class and the other number is a member of some other class. **Concept:** Friend function and Reference variable.
6.	Write a C++ program to design a class called **IntegerDisplay** with both an integer variable and a static integer variable. Display both data using corresponding member functions namely **print_i() and print_si().** **Concept:** Application(s) of the Static keyword
7.	Write a Program to design a class having a **static member function** named **ShowCount()** which has the property of displaying the number of objects created of the class. **Concept:** Application(s) of the Static keyword
8.	Write a C++ program to demonstrate the working of a **copy constructor**. Implement a class called **Point** with private data members **X** and **Y** as the points and **getX()** and **getY()** are the getter functions to get the values and print the same using the main() function. **(Concept:** Copy constructor**)**
9.	Write a C++ program to **overload binary +** and **– operator** to add and subtract two complex numbers. Define relevant data members and member functions for reading and displaying the complex objects. **Concept:** Operator Overloading.
10.	Write a C++ program to create a class **Data** with **integer, character and float** data members. Demonstrate **Constructor Overloading** on this class with **all types of constructors** including default argument constructor. **Concept:** Constructor Overloading and default argument.
11.	Write a C++ program to demonstrate the uses of **constructors in derived class** concepts. The three classes that can be created are **Alpha, Beta** and **Gamma** in this order having an “is-a” relationship. Create at least one data member and one member function in each class. That is **n1** and **putAlpha()** in **Alpha class**, **n2** and **putBeta()** in **Beta class**, **n3** and **putGamma()** in **Gamma class**. (Any inheritance you can use but constructors in base class should have at least one parameter). **Concept:** Use of Constructors in Derived Classes.
12.	Write a C++ program for the diagram using **Hierarchical inheritance.** Base Class: **Student** with protected members **name, USN, age** and **getStudent()** member function. Two child classes: **Medical class** with **year** data member and **getMedical()**, **display()** functions and **Engineering class** with **sem** and **branch** data members and **getEngineering()**, **display()** member functions.

	Concept: Hierarchical Inheritance.
13.	Write a C++ program for the diagram using **Hybrid inheritance.** Create a base class **Student** with protected members **name, USN** and member functions **read()** and **print()**. Derive a child class called **Test** from **Student** class with **sub1, sub2** protected members and **getMarks()** and **putMarks()** are the two member functions of the class. Derive one more class called **Result** from both **Test** and **Sports** classes with a **total** data member which uses a **display()** function to print all the details of the student. **Concept:** Hybrid Inheritance.
14.	Write a C++ program for the diagram using the **Virtual Base class concept**. Create a Base class **Student** with protected members **name, USN** and member functions **read() and print()**. Derive a child class called **Test** from **Student** class with **sub1, sub2** protected members and **getMarks() and putMarks()** are the two member functions of the class. Derive one more class from the **Student** class **Sports** with members **score, getScore()** and **putScore()**. Finally, the class **Result** inherits from both **Test and Sports** classes with a **total** data member and uses a **display()** function to print all the details of the student. Create an array of n objects of **Result class** and demonstrate. **Concept:** Virtual Base class
15.	Write a C++ program to apply **bubble sort** on an array of integers and float using the concept of **function template**. **Concept:** Class Template.

Course Outcomes: At the end of the course student will be able to

1.	Describe the procedural and object oriented paradigm with concepts of classes, functions, data and objects.
2.	Utilize dynamic memory management techniques using pointers, constructors, destructors, etc in solving a problem.
3.	Apply the concept of function overloading, virtual functions and polymorphism.
4.	Classify inheritance with the understanding of early and late binding.
5.	Demonstrate the use of various OOPs concepts with the help of programs.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC1551-1.1	3	-	-	-	-	-	-	-	-	-	-	1	-	2
CC1551-1.2	2	1	2	2	-	-	-	-	-	-	-	2	-	2
CC1551-1.3	2	1	2	2	-	-	-	-	-	-	-	2	-	2
CC1551-1.4	2	1	2	2	-	-	-	-	-	-	-	2	-	2
CC1551-1.5	2	1	2	2	-	-	-	-	-	-	-	2	-	2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. Object Oriented Programming in C++ by Robert Lafore Techmedia Publication.
2. Object Oriented Programming in C++ Saurav Sahay Oxford University Press.
3. Object Oriented Programming in C++ R Rajaram New Age International Publishers 2nd.

E Resources

1.	Programming in C++ https://onlinecourses.nptel.ac.in/noc21_cs02/preview

UNIX SHELL AND SYSTEM PROGRAMMING

Course Code	**CC1552-1**	**Course Type:**	**VEC**
Teaching Hours/Week (L:T:P: S)	**0:0:2:0**	**Credits:**	**01**
Total Teaching Hours	**0+0+26**	**CIE + SEE Marks:**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Computer and Communication Engineering

Course Objectives:

1.	Execute UNIX commands and programs written in C under UNIX environment.
2.	Demonstrate how to use the basic Bourne Shell commands like cat, grep, ls, more, ps, chmod etc.
3.	Study about simple filters, grep and sed filters.
4.	Implement the Unix system process environment.
5.	Understand the Unix kernel environment.

List of Experiments

1.	**Basic Unix Commands, Simple Shell scripts** 1. Illustrate the usage of Unix commands and vi editor concept. 2. Implement a shell program to find and display largest and smallest of three numbers
2.	**Simple Shell scripts/Command Substitution** 1. Find the number n is divisible by m or not using shell script. Where m and n are supplied as command line argument or read from key board interactively 2. Plan and implement a shell program to search a pattern in a file that will take both pattern and file name from the command line arguments.
3.	**File attributes/expr command demonstration** 1. Design a shell program that takes two file names, checks the permissions for these files are identical and if they are identical, output the common permissions; otherwise output each file name followed by its permissions. 2. Implement a shell program to display the length of the name and also display first three characters and last three characters in the name in two different lines if the name contains at least 6 characters.
4.	**Arithmetic operators/Command Substitution** 1. Write a shell program to implement simple calculator operations. 2. Design a Shell Program that takes the any number of arguments and print them in same order and in reverse order with suitable messages.
5.	**String handling operations/Command Substitution** 1. For the given path names (E.g., a/b,a/b/c), design a shell script to create all the components in that path names as directories. 2. Develop a shell script that performs following string handling operations i) Calculate the length of the string ii) locate a position of a character in a string iii) extract last three characters from string

6.	**Command Substitution** 1. For every filename, check whether file exists in the current directory or not and then convert its name to uppercase only if a file with new name doesn't exist using shell script. 2. Execution of exercise Shell scripts
7.	**Process** 1. C program to do the following: Using fork( ) create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait( )) and prints its own process-id and the id of its child process and then exits. 2. C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell - like program). You can assume that no arguments will be passed to the commands to be executed.
8.	**Signal** 1. Write a C Program to register signal handler for SIGINT and when it receives the signal, the program should print some information about the origin of the signal. 2. Write a C program which illustrates sending signal from one process to another by using kill API. Also check if the program has permission to send the signal or not.
9.	Write a C Program to register signal handler for SIGSTOP.
10	**AWK scripts** Write a C Program to handle user-defined signals.
11	**AWK scripts** Write a C Program to create a Daemon process.
12	**Miscellaneous** Exercise of shell programs, C programs on processes and signals

Course Outcomes: At the end of the course student will be able to

1.	Interpret Unix commands to be familiarize with Unix operating system.
2.	Develop and implement shell script file using UNIX commands.
3.	Apply the concept of file attributes and filters to understand about the file permissions and pattern matching.
4.	Design and implement signal functions.
5.	Develop and implement processes in the Unix environment.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**	
↓ Course Outcomes													**1**	**2**
CC1552-1.1	3	-	-	-	3	-	-	-	-	-	-	1	-	1
CC1552-1.2	2	1	2	-	3	-	-	-	-	-	-	2	-	3
CC1552-1.3	2	1	2	-	3	-	-	-	-	-	-	2	-	3
CC1552-1.4	2	1	2	-	3	-	-	-	-	-	-	2	-	3
CC1552-1.5	2	1	2	-	3	-	-	-	-	-	-	2	-	3

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. "Unix and Shell Programming", M.G. Venkateshmurthy, Pearson Education, 2005.

2.	"UNIX and Shell Programming", Behrouz A. Forouzan and Richard F. Gilberg, Thomson 2005. (Chapters Appendix H,9).
E Resources	
1.	https://swayam.gov.in/nd2_aic20_sp05/preview

University Core Courses (UCC)

INTERNSHIP-II

Course Code:	**UC2001-1**	**Course Type:**	**UCC**
Teaching Hours/Week (L: T: P):	**-**	**Credits:**	**08**
Total Teaching Hours:	**-**	**CIE + SEE Marks:**	**50+50**

Course Objectives:

1.	This course is meant to provide students an avenue to understand the work environment, ethics and practices in an industry/organization and take up assignments/jobs in the future.

Course Outcomes: At the end of the course student will be able to

1.	Analyse and develop technical solutions for a specific problem that is assigned to them.
2.	Communicate ideas that are developed through brainstorming, presentation and prepare a report.
3.	Understand and inculcate industry practices in their professional career.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO ↓**		
↓ Course Outcomes													**1**	**2**	**3**
UC2001-1.1	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1
UC2001-1.2	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1
UC2001-1.3	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1

1: Low 2: Medium 3: High

MAJOR PROJECT

Course Code:	UC3001-1 &UC3002-1	Course Type:	UCC
Teaching Hours/Week (L: T: P):	24	Credits:	2+8
Total Teaching Hours:	-	CIE + SEE Marks:	(100+0) +100+100

Course Objectives:

1.	To perform effective literature survey, identification of research problem / project idea.
2.	To develop skills of planning to execute the project
3.	To assess the needs and necessity of a project.
4.	To learn time management and documentation.
5.	To expose the students to research aspects like literature review, executing experiments and analysis of results.
6.	To expose the students to research aspects like literature review, executing experiments and analysis of results.

A group of students (not more than 4) is assigned to a guide/projectsupervisor. The students must do a thorough literature review and come out with aproject plan. They are expected submit a project proposal (not more than 10 pages)including project idea, protocols, designs (if any), expected outcome, majorrequirements, and approximate budget. They shall present the same in a proposalseminar in front of the panel of internal examiners (involving guide) and shall get theirproposal approved. The presentation must involve projected timeline of the projectexecution.

Assessment Details (both CIE and SEE)

CIE procedure: Shall involve project proposal, proposal seminar, continuous evaluation of theproject progress by Guide and HOD. Monthly progress is evaluated.

Semester End Examination:

SEE procedure:
i)Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.
ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

SCHEME OF EVALUATION:
Project demonstration, Viva voce
Total marks: 100 Marks

The distribution of marks shall be proportioned based on the type of the project and it is based on fulfilling the following requisites.
The evaluation of students is proposed to be done by internal faculty with active involvement of industrial personnel. The evaluation may be based on following criteria:

- Punctuality and Attendance ¨ Interpersonal relations
- Sense of Responsibility
- Clarity of concepts, principles and procedures
- Self-expression/communication skills
- Report Writing Skills
- Creativity/conceiving new and unusual ideas

- Problem-solving skills

At the end of the project work course students are required to submit a working model of the equipment they have designed and developed or if it is a theoretical or experimental work, they are expected to study a detailed analysis and findings from their work.

Course Outcomes: At the end of the course student will be able to

1.	Use various methods or sources for finding literature and analyze data for relevance and appropriateness to the research projectundertaken.
2.	Identify and propose suitable methods of analysis and/or design or develop appropriate experiments to address the specific researchobjectives.
3.	Apply suitable standardized method/s for experimentaldesign.
4.	Analyze and interpret the research findings and compare with reported results to arrive at suitableconclusions.
5.	Adopt appropriate documentation protocol to organize research findings, learn good laboratory practices and work in ateam.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO↓**		
↓ Course Outcomes													**1**	**2**	**3**
UC3001-1/UC3002-1.1	-	1	-	-	2	2	3	1	-	-	-	1	1	2	2
UC3001-1/UC3002-1.2	-	1	2	1	1	-	1	2	1	-	1	1	1	2	2
UC3001-1/UC3002-1.3	-	1	2	2	1	-	1	1	1	1	1	1	1	2	2
UC3001-1/UC3002-1.4	1	3	2	2	1	2	2	3	3	3	3	2	1	2	2
UC3001-1/UC3002-1.5	-	1	1	-	1	2	2	3	3	3	3	1	1	2	2

1: Low 2: Medium 3: High

Open Elective Courses

LIST OF OPEN ELECTIVE COURSES			
Sl No.	Department	Course Codes	Open Elective Courses
1	BT	BT1501-1	Bio Fuel Engineering
2	BT	BT1502-1	Solid Waste Management
3	CS	CS2501-1	Fundamentals of AI and ML
4	CS	CS2502-1	Introduction to Data Structures
5	CV	CV2501-1	Disaster Management
6	CV	CV2502-1	Environmental Hygiene, Sanitation and Waste Management
7	CV	CV2503-1	Environmental Impact Assessment
8	CV	CV2504-1	Introduction to Geoinformatics
9	CV	CV2505-1	Sustainability Engineering
10	CY	CY2501-1	Corrosion Science (Only for CV and ME)
11	CY	CY2502-1	Natural Products Chemistry (Only For BT)
12	EC	EC1501-1	Artificial Neural Network Systems
13	EC	EC1502-1	Introduction to MATLAB Programming: A Hands-on Approach (only for CV and BT)
14	EC	EC1503-1	Robotics
15	EC	EC2501-1	Consumer Electronics
16	EC	EC2502-1	PCB Design and Fabrication
17	EC	EC2503-1	Space Technology and Applications
18	EE	EE2501-1	Battery Management System
19	EE	EE2502-1	Biomedical Instrumentation
20	EE	EE2503-1	Electric Vehicle Technology
21	EE	EE2504-1	Fundamentals of PLC and its applications
22	EE	EE2505-1	Motors and Motor Control Circuits
23	EE	EE2506-1	Non-Conventional Energy sources
24	HU	HU1501-1	Elements of Yoga
25	HU	HU1502-1	Intellectual Property Rights
26	HU	HU1503-1	Introduction to German Language
27	HU	HU1504-1	Introduction to Japanese Language
28	HU	HU1505-1	National Cadet Corps: Organization, Functions & Capabilities
29	HU	HU1506-1	Overview of Indian Culture
30	HU	HU1507-1	Philosophy
31	HU	HU1508-1	Principles of Physical Education
32	HU	HU1509-1	Introduction to Yakshagana
33	HU	HU1510-1	Indian Culture – Music *
34	HU	HU1511-1	Engineering Ethics *
35	HU	HU1512-1	Art of Communication and Interpersonal Skills*
36	HU	HU2501-1	Common sense and Critical Thinking
37	HU	HU2502-1	Linguistics & Language Technology
38	IS	IS2501-1	Introduction to Cyber Security (except EC, EE, AM, AD, CC, CS, IS)
39	IS	IS2502-1	Python Application Programming
40	IS	IS2503-1	Software Engineering Practices
41	IS	IS2504-1	Web technologies
42	MA	MA1501-1	Graph Theory (for BT, CV, EC, EE, ME and RI)
43	MA	MA1502-1	Number Theory
44	MA	MA3501-1	Linear Algebra (for BT, CV, EE, ME and RI)
45	ME	ME1501-1	Automotive Engineering
46	ME	ME1502-1	Industrial Pollution Control

47	ME	ME1503-1	Sustainable Development Goals
48	ME	ME1504-1	Technology Innovation
49	MG	MG1501-1	Human Resource Management
50	MG	MG1502-1	Management Accounting and Control Systems
51	MG	MG1503-1	Operations and Quality Management
52	MG	MG1504-1	Organizational Behaviour
53	MG	MG1505-1	Taxation for Engineers
54	ME	4ENGR05D2	Integrated Automotive Safety
55	MG	MG1506-1	Working Capital Management
56	PH	PH2501-1	Nanotechnology
57	PH	PH2502-1	Optoelectronic Devices (EC, EE, CSE, ISE, AM and CC branches)
58	RI	RI2501-1	Autonomous Mobile Robots
59	RI	RI2502-1	Medical Robotics (for all except AI)
60	RI	RI2503-1	PLC Control of Hydraulic and Pneumatic Circuits (for all except AI)

*** For students admitted under Twinning Program**

BIOFUEL ENGINEERING			
Course Code:	**BT1501-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.

2.To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT-I

Liquid Biofuels	**15 Hours**

Description and classification of Biofuels; Primary biomass: Plant Materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products- wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).

Production of biodiesel: Sources of Oils – edible and non-edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase m
ediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607). Algal Biodiesel production.

Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

UNIT-II

Biohydrogen and Microbial Fuel Cells	**15 Hours**

Enzymes involved in H_2 Production; Photobiological H_2 Production: Biophotolysis and Photo fermentation; H_2 Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H_2 production, Carbon sources, Detection and Quantification of H_2. Reactors for biohydrogen production.

Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness.

Advances in MFC.

UNIT-III

Recovery of Biological Conversion Products	**10 Hours**

Bio gasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

Course Outcomes: At the end of the course student will be able to

1.	Mark the significance of biofuels and raw materials and identify suitable feedstock for production of biofuels.
2.	Illustrate the production of liquid biofuels from various feed stocks.
3.	Demonstrate production of biohydrogen using microbial sources.
4.	Extend the concepts of microbial fuel cells towards development of specific application.
5.	Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1501-1.1	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.2	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.3	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.4	-	2	-	-	-	-	-	-	1	-	-	-
BT1501-1.5	-	2	-	-	-	-	-	-	1	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Drapcho, C. M., Nhuan, N. P. and Walker, T. H. , "Biofuels Engineering Process Technology", Mc Graw Hill Publishers, New York, 2008.
2.	Jonathan R.M, Biofuels, "Methods and Protocols (Methods in Molecular Biology Series)", Humana Press, New York, 2009.
3.	Olsson L. (Ed.), "Biofuels (Advances in Biochemical Engineering/Biotechnology Series", Springer-Verlag Publishers, Berlin, 2007.
4.	Glazer, A. and Nikaido, H., "Microbial Biotechnology – Fundamentals of Applied Microbiology", 2 Ed., Cambridge University Press, 2007.
5.	Godfrey Boyle (Ed). "Renewable Energy- Power for sustainable future", 3rd Ed. Oxford. 2012.
6.	Ramachandran, T. V., "Management of municipal solid waste", Environmental Engineering Series. Teri Press, 2016.

SOLID WASTE MANAGEMENT

Course Code:	**BT1502-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Biotechnology

Course Objectives:

1.	To learn types of solid wastes, collection, treatment and disposal methods.
2.	To understand various processing techniques and regulations of treatment and disposal.

UNIT-I

Introduction to Solid Wastes and its Segregation & Transportation	**15 Hours**

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.
Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.
Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

UNIT-II

Processing Techniques, Recovery of Resources and Waste Disposal	**15 Hours**

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.
Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.
Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

UNIT-III

Solid Waste Management Rules and Planning Issues	**10 Hours**

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2011.
Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

Course Outcomes: At the end of the course student will be able to	
1.	Identify the sources, classification, and characteristics of solid wastes
2.	Develop insight into the collection, transfer, and transport of solid waste.
3.	Apply waste processing techniques and recovery of resources from the waste.
4.	Select the alternatives of solid waste disposals and its impacts.
5.	Acquire knowledge about solid and hazardous waste management legislative rules.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
BT1502-1.1	1	-	-	-	-	-	-	-	1	-	-	-
BT1502-1.2	1	1	-	-	-	1	1	-	1	-	-	-
BT1502-1.3	-	2	-	-	-	-	-	-	1	-	-	-
BT1502-1.4	-	2	-	-	-	1	1	-	1	-	-	-
BT1502-1.5	1	-	-	-	-	-	-	-	1	-	-	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:	
1.	Tchobanaglous, G., Theisen, H. and Vigil, S. A. "Integrated Solid Waste Management", McGraw – Hill. 1993.
2.	Tchobanoglous, G., Thiesen, H., Ellasen, "Solid Waste Engineering Principles and Management", McGraw – Hill, 1997.
3.	Landrefh, R. E. and Sundaresan, B. B. "Solid Waste Management in Developing Countries", Indian National Scientific Documentation Centre. New Delhi, 2000.

FUNDAMENTALS OF AI AND ML

Course Code:	**CS2501-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50**
Prerequisite	**NIL**		

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Analyze the most fundamental knowledge to the students so that they can understand what the AI is.

2.	Gain a historical perspective of AI and its foundations
3.	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4.	Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
5.	Explore the current scope, potential, limitations, and implications of intelligent systems.

UNIT-I

Introduction	**15 Hours**

What is AI? Foundation of AI, Early History of AI, The Middle Ages and Dark Ages of AI, Renaissance, Future of AI.
Intelligence of AI
AI An Impossible Task, Animal Intelligence, Brain Size And Performance, Sensing And Movement, Subjective Intelligence, Iq Tests. Comparative Intelligence,
Chapter No 1: Introduction and Intelligence (Page No 11-37)

UNIT-II

Classical Artificial Intelligence	**15 Hours**

Introduction, Expert Systems, Conflict Resolution, Multiple Rules, Forward Chaining, Backward Chaining, Problems With Expert Systems, Fuzzy Logic, Fuzzification, Fuzzy Rules, Defuzzification, Fuzzy Expert System, Problem Solving. Chapter No 2: Classical AI (Page No 38-45)

UNIT-III

Foundations of Machine Learning	**10 Hours**

What is machine learning? Applications of Machine learning, Understand Data, Types of machine learning: Supervised, Unsupervised, Reinforcement Learning, Theory of learning: feasibility of learning, error and noise, training versus testing, theory of generalization, bias and variance, learning curve,.

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental understanding of the history of artificial intelligence (AI) and its foundation
2.	Interpret the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3.	Describe the awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks, and other machine learning models
4.	Identify and explain the proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5	Explain the fundamental concept and importance of machine learning.

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Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CS2501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.2	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.3	3	3	-	-	-	-	-	-	-	-	-	-
CS2501-1.4	3	3	2	-	-	-	-	-	-	-	-	-
CS2501-1.5	3	3	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Kevin Warwick, "Artificial Intelligence the basics", Typeset in Bembo by Wearset Ltd, Boldon, Tyne and Wear, Library of Congress Cataloging in Publication Data Warwick, K. ISBN: 978-0-415-56482-3 (hbk).

REFERENCE BOOKS:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson 3rd Edition , 2016.
2. Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson, 1st edition 2015.
3. Elaine Rich, "Artificial Intelligence", Mc Graw Hill 3rd Edition, 2017.

E Books / MOOCs/ NPTEL

1. Practical Artificial Intelligence Programming With Java, Third Edition ,Mark Watson
2. Artificial Intelligence -http://www.nptelvideos.in/2012/11/artificial-intelligence.html
3. http://nptel.ac.in/courses/106105077/
4. https://www.udemy.com/artificial-intelligence
5. https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

INTRODUCTION TO DATA STRUCTURES

Course Code:	**CS2502-1**	**Course Type:**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits:**	**03**
Total Teaching Hours:	**40+0+0**	**CIE + SEE Marks:**	**50**
Prerequisite	**CS1001-1**		

Teaching Department: Computer Science & Engineering

Course Objectives:

1.	Outline the concepts of data structures, types, operations, structures, pointers
2.	Implement linear data structures stacks, queues and usage of stacks in various applications.
3.	Implement the operations of singly linked lists
4.	Identify and differentiate different types of binary trees and binary search trees data structures
5.	Illustrate and classify threaded binary trees.

UNIT-I	
Introduction	**15 Hours**
Data Structure, Classification (Primitive and non-primitive), data structure operations, Arrays, Pointers and structures, Dynamic Memory Allocation Functions,	
Linear Data Structures – Stacks	
Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks,	
Applications of Stack	
Conversion of Expressions, Evaluation of expressions, Recursion: Implementation, Simulating Recursion, examples on Recursion.	
UNIT-II	
Linear Data Structures – Queues	**15 Hours**
Introduction and Definition Representation of Queue: Array and Structure, representation of Queue, Various queue structures: ordinary queue, circular Queue	
Linear Data Structures - Linked Lists	
Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List, Circular Linked List, Doubly Linked List: Representation and Operations, Circular doubly Link list: Representation and Operations.	
UNIT-III	
Nonlinear Data Structures- Tree Data Structures	**10 Hours**
Basic Terminologies, Binary Trees: Properties, Representation of Binary Tree: Linear representation, Linked representation, Operations on Binary Tree: Insertion, traversals. Introduction to Binary Search Tree	
Course Outcomes: At the end of the course student will be able to	

1.	Acquire the fundamental knowledge of various types of data structures and pointers.
2.	Apply the fundamental programming knowledge of data structures to design stack and use them for solving problems.
3.	Apply the fundamental programming knowledge of data structures to design queues and use them for solving problems.
4.	Design various functions for implementation of linked list.
5.	Implement and apply the concept of binary trees and binary search tree data structure.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CS2502-1.1	-	-	-	-	-	-	-	-	-	-	-	-
CS2502-1.2	3	1	2	-	-	-	-	1	-	-	-	1
CS2502-1.3	3	2	2	-	-	-	-	1	-	-	-	1
CS2502-1.4	3	2	-	-	-	-	-	1	-	-	-	1
CS2502-1.5	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Aaron M. Tenenbaum, YedidyahLangsam& Moshe J. Augenstein, "Data Structures using C", Pearson Education/PHI, 2009.
2.	Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2014.

REFERENCE BOOKS:

1.	Seymour Lipschutz, "Data Structures, Schaum's Outlines", Revised 1st edition, McGraw Hill, 2014.

E Books / MOOCs/ NPTEL

1.	Data Structures Using C, ISRD Group, Tata McGraw Hill, 2006.
2.	Data Structures Using C, Reema Thareja, 2nd edition, Oxford University Press, 2014
3.	Introduction to Data Structures by edx , URL: https://www.edx.org/course/
4.	Data structures by Berkley, URL: https://people.eecs.berkeley
5.	Advance Data Structures by MIT OCW , URL: https://www.mooclab.club/
6.	Data Structure by Harvard Extension School, URL: http://www.extension.harvard.

DISASTER MANAGEMENT

Course Code:	**CV2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Understand difference between Disaster, Hazard, Vulnerability, and Risk.
2.	Know the Types, Trends, Causes, Consequences and Control of Disasters
3.	Apprehend Disaster Management Cycle and Framework.
4.	Know the Disaster Management in India

5.	Appreciate Applications of Science and Technology for Disaster Management.

UNIT-I	
Understanding Disasters	**04 Hours**
Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.	
Types, Trends, Causes, Consequences and Control of Disasters	**10 Hours**
Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	
UNIT-II	
Disaster Management Cycle and Framework	**10 Hours**
Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.	
Disaster Management in India	**06 Hours**
Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies.	
UNIT-III	
Applications of Science and Technology for Disaster Management	**06 Hours**
Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India	
Case Studies	**04 Hours**
Study of Recent Disasters (at local, state and national level), Preparation of Disaster Risk Management Plan of an Area or Sector, Role of Engineers in Disaster Management	
Course Outcomes: At the end of the course student will be able to	

1.	Explain Concepts, Types, Trends, Causes of Disasters
2.	Describe Consequences and Control of Disasters
3.	Explain Disaster Management Cycle and Framework
4.	Explain the lesson learnt from the disasters in India and discuss the financial mechanism, roles and responsibilities of Non-Government and Inter-Governmental Agencies for Disaster management

5.	Describe the Applications of Science and Technology recent disasters, role of engineers for Disaster Management and prepare a report of Disaster Risk Management Plan.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CV2501-1.1	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.2	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.3	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.4	-	-	-	-	-	3	2	-	-	-	1	2
CV2501-1.5	-	-	-	-	-	3	2	-	-	-	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Noble, L. , "Introduction to environmental impact assessment. A Guide to Principles and Practice", 2nd edition, Oxford University Press, Don Mills, Ontario, 2010.
2.	Larry W. Canter, "Environmental Impact Assessment", McGraw Hill Inc. Singapore, 1996.

REFERENCE BOOKS:

1.	Morris and Therivel, "Methods of Environmental Impact Assessment", 3rd edition. New York, NY: Routledge, 2009.
2.	Hanna, K. S., "Environmental impact assessment", Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario, 2009.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/120108004/
2.	http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

ENVIRONMENTAL HYGIENE, SANITATION AND WASTE MANAGEMENT

Course Code:	**CV2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Creation of awareness among student’s health issues and Swachh Bharath mission and the consequent responsibilities.
2.	To understand the culture cleanliness, engineering applications in creation of ODF (Open defecation free) concept, Importance of legal & cultural issues related to Environmental Hygiene.
3.	To know the importance of sanitation, gender sensitive sanitation issues & use of engineering technology in construction of toilets.

4.	To know the importance of waste management system, wastewater audit and waste water treatment process.
5.	To study the role of student in Swachh Bharata Abhiyan, solid and waste water treatment process.

UNIT-I	
Prospective: Environmental Hygiene (EH), Sanitation, Solid Waste andWastewater	**06 Hours**
Introduction- Swachh Bharath Mission (SBM)-Mission Objectives-Duration- Components. Environmental Hygiene-Benefits-Sanitation-Waste Management. Work opportunities in Environmental Hygiene, Sanitation and Waste Management. Participatory Learning for Environmental Hygiene, Sanitation and Waste Management.	
Sociology of environmental hygiene management, solid waste and waste water and impacts	**08 Hours**
Open Defecation-Habits & attitude towards waste-Goals of SBA. Community Consciousness and Engagement on Sanitation Aspects, Roles & Responsibilities, Job Charts, Frequency, Schedules and Timelines in Swachhata Management, Culture of Cleanliness (Swachh Bharat Abhiyan), Behaviour Change Communication, Role of Habits and Attitudes in Environmental Hygiene Management, Waste and Wastewater Disposal; Change Management.	
UNIT-II	
Infrastructure for Sanitation	**08 Hours**
Containment-Preparation of toilets –Toilet Types Evaluation of Construction and Maintenance of Community, Public, Institutional and Individual Sanitation Infrastructure Toilets-Proportion and Number of toilets, Gender Sensitive Sanitation Facilities, Ramps for Differently Abled, Types – Indian and Western. Faecal Sludge treatment - Single / Twin pit, Eco San, Septic Tank and Formal Sewerage.	
Solid Waste Management	**08 Hours**
Swachh Survekshan- Solid Waste management- Steps- Waste Audit-Classification Methods of Solid Waste Disposal and Management-Composting-Different types of composting-Waste Minimization-Waste Management.	
UNIT-III	
Waste & Wastewater Audit	**06 Hours**
Waste Audit -Environmental Impact Assessment, Waste Characterization, Quantity Determination, Primary Collection Methods, Secondary Transportation. **Wastewater Audit**-Water Budget, Types of Wastewater, Survey of Distribution Network and Feasibility of Various Wastewater Treatment Methods.	
Swachh Bharath Mission and Inclusivity	**04 Hours**
Swacch Bharath Mission in rural & Urban Context-Gender Issues in sanitation. Role of women in Sanitation.	
Course Outcomes: At the end of the course student will be able to	

1	Creation of awareness among student's health issues and Swachh Bharath mission

.	and the consequent responsibilities.
2.	To understand the culture cleanliness, engineering applications in creation of ODF (Open defecation free) concept, Importance of legal & cultural issues related to Environmental Hygiene.
3.	To know the importance of sanitation, gender sensitive sanitation issues & use of engineering technology in construction of toilets.
4.	To know the importance of waste management system, wastewater audit and waste water treatment process.
5.	To study the role of student in Swachh Bharata Abhiyan, solid and waste water treatment process.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CV2502-1.1	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.2	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.3	1	1	-	-	-	2	3	2	-	-	-	-
CV2502-1.4	1	1	-	-	-	2	3	2	-	3	-	-
CV2502-1.5	1	1	-	3	-	2	3	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Joanne E. Drinan and Frank Spellman, "Water and Wastewater Treatment: A Guide for the Non-engineering Professional".
2.	M. S. Bhatt and AsherefIlliyan, "Solid Waste Management: An Indian Perspective".
3.	Jagbir Singh, "Solid Waste Management: Present and Future Challenges".
4.	M. S. Bhatt, "Solid Waste Management: An Indian Perspective".
5.	T. V. Ramachandra, "Management of Municipal Solid Waste".
6.	Syed R. Qasim, "Wastewater Treatment Plants: Planning, Design and Operation".

REFERENCE BOOKS:

1.	Swachhbharatmission.gov.in/
2.	https://www.india.gov.in//swachh-bharat-mission-gramin-portal
3.	https://www.swachhsurvekshan2018.org/
4.	https://zerowasteeurope,eu/
5.	www.zerowasteindia.in/

E Books / MOOCs/ NPTEL

1.	http://www.un.org/waterforlifedecade/pdf/award_south_africa_eng_for_web.pdf
2.	http://www.sulabhinternational.org
3.	http://swachhbharatmission.gov.in/sbmcms/writereaddata/images/pdf/Guidelines/Complete-set-guidelines.pdf

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code:	**CV2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Identify the need to assess and evaluate the impact of projects on environment.
2.	Explain major principles of environmental impact assessment.
3.	Understand the different steps within environmental impact assessment.
4.	Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT-I

Evolution of EIA	**16 Hours**

Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

UNIT-II

14 Hours

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

UNIT-III

10 Hours

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

Course Outcomes: At the end of the course student will be able to

1.	Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2.	Liaise with and list the importance of stakeholders in the EIA process.
3.	Know the role of public in EIA studies.
4.	Overview and assess risks posing threats to the environment.
5.	Assess different case studies/examples of EIA in practice.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CV2503-1.1	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.2	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.3	1	1	-	-	-	2	3	2	-	-	-	-
CV2503-1.4	1	1	-	-	-	2	3	2	-	3	-	-
CV2503-1.5	1	1	-	3	-	2	3	2	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Noble, L., "Introduction to environmental impact assessment. A Guide to Principles and Practice", 2nd edition, Oxford University Press, Don Mills, Ontario, 2010.
2.	Larry W. Canter, "Environmental Impact Assessment", McGraw Hill Inc. Singapore, 1996.

REFERENCE BOOKS:

1.	Morris and Therivel, "Methods of Environmental Impact Assessment", 3rd edition. New York, NY: Routledge, 2009.
2.	Hanna, K. S., "Environmental impact assessment. Practice and Participation". 2nd edition. Oxford, University Press, Don Mills, Ontario, 2009.

E Books / MOOCs/ NPTEL

1.	http://nptel.ac.in/courses/120108004/
2.	http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

INTRODUCTION TO GEOINFORMATICS

Course Code:	**CV2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T: P):	**3:0:0**	**Credits**	**03**

Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CV1001-1, CV1002-1**		

Teaching Department: Civil Engineering

Course Objectives:

1.	Explain the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS & GIS.
2.	Explain the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation.
3.	Explain and Appraise GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4.	Explain the GIS functionality and Appraise the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) in real world applications.

UNIT-I

16 Hours

Remote sensing and its Principles: Physics of remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.
Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products
Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.
Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

UNIT-II

15 Hours

Digital Image Processing and Analysis: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.
Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, vector and raster GIS, GIS Hardware and software, georeferencing, digitization, thematic maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

UNIT-III

09 Hours

Geoinformatics and Virtual GIS: Modern Surveying and Geoinformatics, GPS & GNSS, GIS Functionality: Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction, Virtual GIS and Real world applications.

Course Outcomes: At the end of the course student will be able to

1.	Define and explain the principles of Remote Sensing and list various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2.	Explain Photogrammetry, its basic principles, elements of photo interpretation, Visual & Digital Image interpretation techniques
3.	Explain different stages involved in Digital Image Processing, various image enhancement techniques, list and classify the digital image formats and the extracted information for various purposes.
4.	Explain and Appraise GIS - its components, data structures, process and operation, Map and its projections, components, preparation and Overlays.
5.	Explain the GIS functionality and appraise the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) and Virtual GIS in real world applications.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CV2504-1.1	2	2	-	-	-	2	-	-	-	-	-	-
CV2504-1.2	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.3	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.4	2	2	-	-	-	2	1	-	-	-	-	-
CV2504-1.5	2	2	-	-	-	2	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Anji Reddy, M, "Text Book of Remote Sensing and Geographical Information Systems", Fourth Edition, BS Publication, Hyderabad, 2012.
2. Bhatta, Basudeva, "Remote Sensing and GIS", 2nd edition, Oxford University Press, N. Delhi, 2011.
3. Lillesand, T.M., Kiefer, R.W and Chipman, J. W., "Remote sensing and Image Interpretations", 7th edition, John Wiley and sons, New Delhi, 2015.

REFERENCE BOOKS:

1. Anji Reddy, M. and Hari Shankar, Y., "Digital Image Processing", BS Pub., Hyd, 2006.
2. Bernhardsen, Tor, "Geographic Information Systems", 3rd Ed., Wiley India, Delhi, 2002.
3. Canada Centre for Remote Sensing, Fundamentals of Remote sensing-Tutorial, 2011.
4. Chang, Kang-tsung, "Introduction to Geographic Information Systems", 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
5. Korte, George B., "The GIS Book", Onword Press, Thomson Learning Inc., USA, 2001.
6. Kumar, S., "Basics of Remote sensing and GIS", Laxmi Publications (P) Ltd., Delhi,

	2008.
7.	Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., "Geographic Information Systems and Science", John Wiley & Sons Ltd., ESRI Press, 2004.
8.	Sabins, F. L., "Remote Sensing: Principles and Interpretation" 3rd edn. WH Freeman and Company, New York, 1997.
E Books / MOOCs/ NPTEL	
1.	https://www.youtube.com/user/edusat2004
2.	https://eclass.iirs.gov.in/login

CORROSION SCIENCE

Course Code	**CY2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CY1001-1**		

Teaching Department: Chemistry

Course Objectives:

1.	To provide fundamental understanding aspects of electrochemistry and material science related to corrosion. To understand the types of corrosion attacking on the metal and its preventions.
2.	To impart knowledge on corrosion science and its applications to the engineering materials.
3.	To identify practice for the prevention and remediation of the corrosion. To provide methodologies for measuring the corrosion performance of materials.

UNIT-I	
Fundamentals of Corrosion	**09 Hours**
Definition, cost of corrosion, Corrosion Damage and consequences, Classification of corrosion, Electrochemical Aspects of corrosion, Electrochemical reactions, Different Environmental aspects, polarization and passivity, Corrosion Rate Expression, Determination. Standard electrode potential, EMF and Galvanic series, Potential-pH (Roubaix Diagram).	
Forms of Corrosion	**08 Hours**
Galvanic corrosion, Crevices corrosion, Filiform corrosion, Pitting corrosion, Uniform corrosion and Atmospheric corrosion, Inter granular corrosion, Selective leaching, Erosion corrosion, Cavitation damage, Stress corrosion , Impingement attack, Inlet tube corrosion, Corrosion fatigue, Hydrogen blistering, Hydrogen embrittlement.	
UNIT-II	
Corrosion at Elevated Temperature	**08 Hours**
High temperature materials, Metal oxides, Pilling bed worth rule, oxide defect structure, Hot corrosion, Corrosion of mineral acids-corrosion of steel, stainless steel, Cu and Al.	

Corrosion Testing	**07 Hours**
Weight loss method, Tafel extrapolation test, linear polarization test and AC impedance method.	
UNIT-III	
Corrosion Prevention Methods	**08 Hours**
Materials Selections, Design, change of the environments: Atmospheric corrosion, Control of atmospheric corrosion, Changing medium, Inhibitors, Cathodic and Anodic protection, Protective coatings.	
Course Outcomes: At the end of the course student will be able to	

1.	Explain the fundamentals of difference in electrode potential across an interface in particular a metal/ electrolyte and the relationship between rates of electrochemical reactions and the potential drop across interfaces.
2.	Analyze the causes and mechanisms of various types of corrosion including uniform, galvanic, crevice, pitting, inter granular and various modes of environmentally cracking. Acquire knowledge of influence of a materials composition, the effect of an electrolyte's composition on the corrosion of metals and microstructure on its corrosion performance.
3.	Identify the materials that will exhibit adequate corrosion resistance in a particular environment and remedial action that will reduce corrosion to a acceptable level. Explain the concepts of different measuring techniques of corrosion.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CY2501-1.1	3	3	3	-	-	1	1	-	-	-	-	-
CY2501-1.2	3	3	3	-	-	1	1	-	-	-	-	-
CY2501-1.3	3	3	3	-	-	1	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Mars G Fontana, "Corrosion Engineering", 3rd Edition, Tata Mcgraw-Hill Edition.

REFERENCE BOOKS:

1.	Chamberlian and K. Trethway, "Corrosion", Longman scientific and technical, John Wiley and Sons.

NATURAL PRODUCTS CHEMISTRY

Course Code	**CY2502-1**	**Course Type**	**OEC**

Teaching Hours/Week (L:T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**CY1001-1**		

Teaching Department: Chemistry

Course Objectives:

1.	Identify the structure of terpenoids and their biosynthesis. Elucidate the structure of β-carotene, haemoglobin and chlorophyll.
2.	Understand the chemistry underlying steroids and sex hormones. Get introduced to the different types of prostaglandins as well as theory and chemistry behind natural dyes.
3.	Gain knowledge on general methods of structural determination of some of the important alkaloids.

UNIT-I

Terpenoids & Carotenoids	**08 Hours**

Introduction and classification, isoprene rules, general methods of determination of structure of terpenoids. Structure elucidation of the following terpenoids-geraniol, α-pinine, camphene and farnesol. Biosynthesis of terpenoids.
Introduction and classification of carotenes. Structural elucidation of β-carotene.

Porphyrins	**07 Hours**

Introduction to porphyrins, structure and degradation products of haemoglobin and chlorophyll.

UNIT-II

Steroids	**08 Hours**

Introduction, Dile's hydrogenation. Chemistry of cholesterol, Blanc's rule, Barbier-Wielman degradation, Oppenuer oxidation. Constitution of bile acids.
Sex hormones: Chemistry of oestrone, progesterone, androsterone and testosterone.

Prostaglandins & Natural Dyes	**08 Hours**

Introduction, nomenclature, classification, and biological role of prostagladins. Structure elucidation of PGE_1, Biosynthesis of PGE_2 and $PGF_{2\alpha.}$
Introduction, Witt's theory of colour, methods of dyeing, chemical constitution of alizarin.

UNIT-III

Alkaloids	**09 Hours**

Definition, Classification and isolation of alkaloids. General methods of structural determination of alkaloids. Detailed study of structure elucidation of the following alkaloids-papaverine, cinchonine andnicotine.

Course Outcomes: At the end of the course student will be able to

1	Elucidate the structure of terpenoids like geraniol, a-pinine, camphene and farnesol. Explain the structural chemistry of carotenoids and porphyrins.

2	State the basic reactions governing steroids and sex hormones. Explain the biological role and structure of prostaglandins and state the methods employed for dyeing.
3	Apply the general methods of structural determination to elucidate the structure of alkaloids like papaverine, cinchonine and nicotine.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CY2502-1.1	3	3	-	-	-	1	1	-	-	-	-	-
CY2502-1.2	3	3	-	-	-	1	1	-	-	-	-	-
CY2502-1.3	3	3	-	-	-	1	1	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Agarwal, "Organic Chemistry of Natural Products", Vol.-I & Vol.-II, O.P. Goel Publishing House, 2014.

REFERENCE BOOKS:

1.	K. Nakanishi, T. Goso, S. Ito, S. Natori and S.Nozoe, "Natural Products Chemistry", Vol. I & II, Academic Press, Ny, 1974.
2.	Gurudeep R. Chatwal, "Organic Chemistry ofNatural Products", Vol. I & II, Himalaya Publishing House, 2013.
3.	G.A. Swal, "An Introduction to Alkaloids", Backwell Scientific Publications, 1967.
4.	Hand book of naturally occurring Compounds, Vol. II, terpenes, T.K. Davon, A.I. Scott, Academic Press, Ny, 1974.

ARTIFICIAL NEURAL NETWORK SYSTEMS

Course Code	**EC1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To learn basic building blocks of ANNs and its terminology
2.	To understand the working of McCulloch-Pitts Neuron and different types of learning rules
3.	To understand decision regions, discriminant functions and training concept

4.	To understand the working of perceptron as classifier
5.	To understand the mathematics behind different types of single layer feedback networks

UNIT-I

Introduction to Artificial Neural networks	**16 Hours**
Introduction, Basic building blocks: network architecture, setting the weights, activation functions, ANN terminologies: weights, activation functions, bias, threshold, McCulloch-Pitts Neuron Model, Learning Rules	

UNIT-II

Single Layer Perceptron Classifiers	**15 Hours**
Classification Model, Features, and Decision Regions, Discriminant Functions, Linear Machine and Minimum Distance Classification, Nonparametric Training Concept, Training and Classification Using the Discrete Perceptron: Algorithm and Example, Single-Layer Continuous Perceptron Networks for Linearly Separable Classifications, Multicategory Single-Layer Perceptron Networks	

UNIT-III

Single-Layer Feedback Networks	**09 Hours**
Basic Concepts of Dynamical Systems, Mathematical Foundations of Discrete-Time Hopfield Networks, Mathematical Foundations of Gradient-Type Hopfield Networks. Transient Response of Continuous-Time Networks, Relaxation Modeling in Single-Layer Feedback Networks	

Course Outcomes: At the end of the course student will be able to

1.	Describe the building blocks of artificial neural and terminologies
2.	Describe the working of neural network and learning rules
3.	Describe training of Single layer perceptron and classification using it.
4.	Explain use of Single layer perceptron for linearly separable and multicategory problems
5.	Explain the mathematics behind different single-layer feedback networks

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC1501-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.2	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.4	3	-	-	-	-	-	-	-	-	-	-	-
EC1501-1.5	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Networks Using MATLAB 6.0", Tata McGraw-Hill Education, 2006

2	Jacek M. Zurada "Introduction to Artificial Neural Systems", 1st Edition, St. Paul West Publishers-USA, 1992.
3	Michael A Neilsen, "Neural Networks and Deep Learning", Determination Press, 2015

INTRODUCTION TO MATLAB PROGRAMMING: A HANDS-ON APPROACH

Course Code:	**EC1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**2:0:2**	**Credits**	**03**
Total Teaching Hours	**27+0+26**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering Offered to Civil & BT

Course Objectives:

1.	To demonstrate basic understanding of MATLAB programming
2.	To use and write functions
3.	To use MATLAB programming for image processing

Unit-I	**27 Hours**

Introduction to MATLAB: Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.

Matrices and Operators: defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.

Functions: creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.

Programmer's Toolbox: polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.

Selection Statement and Loops: how to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error, the for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.

Data Types: character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.

File Input/Output: reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.

Image Processing using MATLAB: pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image, histogram of

image, thresholding	
List of Experiments	
1	Starting MATLAB and familiarization with its user interface, syntax and semantics, ways in which MATLAB provides help, create plots in MATLAB.
2	Defining matrices, manipulation of matrices, extract parts of them and combine them to form new matrices, use of operators to add, subtract, multiply, and divide matrices, and we will learn that there are several different types of multiplication and division.
3	creating reusable functions, how the environment inside a function is separated from the outside via a well-defined interface through which it communicates with that outside world, define a function to allow input to it when it initiates its execution.
4	Polymorphism and how MATLAB exploits it to change a function's behavior on the basis of the number and type of its inputs, random number generator, how to get input from the keyboard, how to print to the Command Window
5	How to plot graphs in a Figure window, how to find programming errors with the help of the debugger, how to print to the Command Window, and how to plot graphs in a Figure window, how to find programming errors with the help of the debugger.
6	How to use the if-statement, how to use relational operators and logical operators, how to write polymorphic functions and how to make functions resistant to error.
7	The for-loop and the while-loop, how the break-statement works, nested loops, logical indexing and implicit loops.
8	Character arrays and how the characters in them are encoded as numbers, string and datetime datatype, how to produce heterogeneous collections of data via structs and cells.
9	Reading and writing files, how to create, read from, and write into MAT-files, Excel files, text files, and binary files, how to navigate among folders with MATLAB commands.
10	Reading an image, saving, basic manipulation of images, arithmetic operations
11	Pre-processing – conversion of color image to gray scale image, decomposition of color images to single color component image.
12	Histogram processing.
13	Thresholding operation.
Course Outcomes: At the end of the course student will be able to	

1.	Use matrices and operators in MATLAB programming
2.	Use and write functions; use MATLAB toolbox
3.	Use toolbox and selection statement in MATLAB programming

4.	Write MATLAB programs using loops and summarize data types
5.	Summarize file input/output methods using MATLAB commands and apply pre-processing and thresholding operations on images

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EC1502-1.1	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.2	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.3	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.4	1	-	-	-	3	-	-	-	-	-	-	-
EC1502-1.5	1	-	-	-	3	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Stormy Attaway, "Matlab: A Practical Introduction to Programming and Problem Solving", Second Edition, Butterworth-Heinemann, 2011
2.	Fitzpatrick and Ledeczi, "Computer Programming with MATLAB", eBook, 2013
3.	Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB, first edition, Dorling Kindersley Pvt Ltd, 2006.

REFERENCE BOOKS:

1.	Duane C. Hanselman, Bruce L. Littlefield, "Mastering MATLAB", first edition, Pearson, 2011

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/103/106/103106118/
2.	https://www.coursera.org/learn/matlab

ROBOTICS

Course Code:	**EC1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	Understand Anatomy of a robot.
2.	Analyse the robot motion using translation and rotational matrix.
3.	Discuss Robot trajectory planning and robot control.
4.	Categorise the various sensors used in robotics
5.	Understand the robot programming.

UNIT-I	
Introduction	**16 Hours**
Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical &non-mechanical grippers, methods of constraining parts in grippers.	
Motion analysis	
Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis.	
UNIT-II	
Control and trajectory planning	**15 Hours**
Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses, simple numerical problems on joint space trajectory planning.	
Sensors	
Classification, Types- Contact & Non-Contact sensors.	
Machine Vision	
Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual surveying and navigation.	
UNIT-III	
Programming	**09 Hours**
Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, robot programming languages, examples	
Course Outcomes: At the end of the course student will be able to	

1.	Explain the working principle, various performance parameters of robots and identify the types of robots employed in industry.
2.	Discuss the concept of direct and inverse kinematics. Determine the position and orientation of End-Effector subjected to transformations. Demonstrate the applications of Denavit-Hartenberg (DH) method for different robot configurations.
3.	Determine the technique of trajectory planning, control schemes for robot joints and understand the types of the sensors used in robotics.
4.	Apply engineering knowledge in robot visual surveying and navigation.
5.	Analyze and formulate different types of robot cell layouts and use modern tools to write robot programs for different tasks.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EC1503-1.1	3	2	2	1	-	-	-	-	-	-	-	1
EC1503-1.2	3	3	2	2	-	-	-	-	3	3	-	1
EC1503-1.3	3	2	2	2	-	-	-	-	3	3	-	1
EC1503-1.4	3	2	2	1	-	-	-	-	-	-	-	1
EC1503-1.5	3	3	3	2	2	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	R. K. Mittal and I. J. Nagrath, “Robotics and Control”, Tata-McGraw-Hill Publications, 2007.
2.	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel and Nicholas G. Odrey, “Industrial Robotics”, McGraw-Hill Publications, International Edition, 2008

REFERENCE BOOKS:

1.	Fu K. S., Gonzelez R. C., Lee C. S. G., "Robotics: Control, Sensing, Vision, Intelligence," , McGraw Hill Book Co., International edition, 2008.
2.	YoremKoren, "Robotics for Engineers", McGraw-Hill Publication, International edition, 1987.
3.	Craig, J. J., "Introduction to Robotics: Mechanics and Control", 3rd Edition, Pearson PrenticeHall Publications, 2005.
4.	Schilling R. J., "Fundamentals of Robotics, Analysis and Control", Prentice-Hall Publications, Eastern Economy edition, 2007.
5.	AppuKuttan K. K., "Robotics", I.K. International Publications, First Edition, 2007.
6.	James G. Keramas, "Robot Technology Fundamentals", Cengage Learning, 1999.
7.	Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, "Introduction to Unmanned Aircraft Systems", CRC Press, 2012.
8.	Ghosh, "Control in Robotics and Automation", Allied Publishers.
9.	Deb, "Robotics Technology", Wiley India.

E Books / MOOCs/ NPTEL

1.	https://nptel.ac.in/courses/112105249

CONSUMER ELECTRONICS

Course Code:	**EC2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Prerequisite	**EC1001-1**

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To provide basic knowledge on sound and transducers
2.	To provide basic knowledge on different display units and camera
3.	To understand the recording process and storage mechanism
4.	To provide basic knowledge on communication and broadcasting
5.	To understand the working of various electronic gadgets

UNIT-I

Sound & Vision	**15 Hours**

Sound: Definition and properties of sound, Transducers: Micro Phone – characteristics and types, and Loud Speakers – characteristics and types, Enclosures and baffles, mono-stereo, audio amplifiers-characteristics, Synthesizers.
Vision: Displays-LED, LCD, PLASMA, Camera: basic principle, CCTV Camera.

UNIT-II

Recording, Playback, Communication & Broadcasting Systems	**15 Hours**

Recording and Playback: Audio recording methods-magnetic recording, optical recording, digital recording, erasing methods, optical discs- recording and playback, Film projector, Theatre Sound, HiFi system.
Communications And Broadcasting: Modulation: AM, FM PCM, Radio transmitters, Radio receivers - Tuned radio frequency receiver and Superheterodyne receiver. Fiber optics, Radio and TV broadcasting. Cellular communication: digital cellular phone, establishing a call.

UNIT-III

Other Electronic Systems	**10 Hours**

Fax machine, Xerox machine, electronic Calculator, Microwave ovens, Washing Machines, A/C and refrigeration, ATM, Auto Electronics, Industrial Electronics and Robotics, Electronics in health / Medicine.

Course Outcomes: At the end of the course student will be able to

1.	Recall basics of sound and transducers.
2.	Understand the working principles of display units and CCTV camera.
3.	Explain basic working of Recording, storage devices
4.	Explain basics of communication and broadcasting
5.	Recall basic working of commonly used electronic gadgets

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2501-1.1	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.2	1	-	-	-	-	1	-	-	-	-	2	2

EC2501-1.3	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.4	1	-	-	-	-	1	-	-	-	-	2	2
EC2501-1.5	1	-	-	-	-	1	-	-	-	-	2	2

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	Anand, “Consumer Electronics”, Khanna publications, 2011.
2.	Bali S. P., “Consumer Electronics”, Pearson Education, 2005.
REFERENCE BOOKS:	
1.	Gulati R. R. "Modern Television Engineering", Wiley Eastern.

PCB DESIGN AND FABRICATION

Course Code	**EC2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**1:0:4**	**Credits**	**03**
Total Teaching Hours	**15+0+52**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2.	To expose students to complete PCB Design & manufacturing process

Unit-I

Circuit Schematic	**05 Hours**
Introduction to Kicad schematic design tool, features, node connections, labeling, creating new component.	

Unit-II

PCB Layout:	**05 Hours**
Introduction to Kicad layout editor, features, layer selections, manual and auto routing in Kicad, verification of footprint, creating footprint for a given component.	

Unit-III

PCB Fabrication	**05 Hours**
Generating and verifying the PCB Gerber file, preparing artwork for a single side PCB fabrication, preparing PCB artwork for double side PCB, Etching process, tin plating, legend printing, green masking and through hole plating	

List of Experiments

1	Exploring the Kicad Schematic and layout tool
2	Developing a schematic circuit for microphone preamplifier

3	Designing a single side PCB layout for microphone preamplifier
4	Developing a schematic circuit for a microcontroller development board
5	Designing a double side PCB layout for a microcontroller development board
6	Choosing a new sensor/display module and building a schematic circuit for the user level application
7	Building a layout using single or double side PCB for the sensor/display module
8	Preparing the film for the bottom copper, solder mask and top silk (legend) to fabricate a single side PCB using chemical process
9	Preparing the film for the top copper, bottom copper, top solder mask, bottom solder mask and legend to fabricate double side PCB using chemical process
10	PCB routing, etching, cutting and drilling using CNC machine

Course Outcomes: At the end of the course student will be able to

1.	Draw schematic circuit and create PCB layout for single or multilayer PCB
2.	Fabricate single and double-layer PCB

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EC2502-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EC2502-1.2	3	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Peter Dalmaris, "Kicad Like a Pro", Tech Exploration.

REFERENCE BOOKS:

1.	Peter Dalmaris, "Kicad Like a Pro", Tech Exploration.
2.	David L. Jones, "PCB Design Tutorials", Alternate zone, 2004.

E Books / MOOCs/ NPTEL

1.	www.alternatezone.com

SPACE TECHNOLOGY AND APPLICATIONS

Course Code:	**EC2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electronics & Communication Engineering

Course Objectives:

1.	Understand the general laws governing satellite orbits and its parameters.
2.	Discuss effect of space environment on satellite signal propagation.
3.	Illustrate various segments employed in satellite and ground station.

4.	Calculate the uplink / downlink subsystem characteristics.
5.	know the effects on the EM waves in propagation through space.
6.	Explain the satellite launch in the space and their applications in remote sensing.
7.	Discuss the different communication systems used for satellite access.
8.	Summarise Advanced space systems for mobile communication, VSAT, GPS.

UNIT-I

Satellite Technology	**15 Hours**

Satellite communications: Introduction, Kepler's laws, definitions, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits.
Space environment: Earth's Atmosphere, Ionosphere and Meteorological effects on space systems, propagation of signal, Transmission losses in space environment.
Satellite Technology: Space segment, Ground segment, Quality and Reliability, Satellite Communication systems.

UNIT-II

Space Applications	**15 Hours**

Launch Vehicles: Working, stages, Fuel, payload protection, Navigation, guidance and control, Reliability, launching into outer space and launch bases. Types of launch vehicles.
Space Applications: Digital DBS TV, DBS-TV System Design, Master Control Station and Uplink Antennas. Introduction, Radio and Satellite Navigation,
Remote Sensing: Introduction to Remote Sensing, Concepts and Applications of satellite Remote sensing.

UNIT-III

Advanced Space Systems	**10 Hours**

Satellite Access: Introduction, Single Access, Pre-assigned FDMA, Demand-Assigned FDMA, Spade system.
Advanced space systems: Satellite mobile services, VSAT, Radarsat, orbital communication**.** Global Positioning Satellite System (GPS).

Course Outcomes: At the end of the course student will be able to

1.	Discuss the fundamental principles of Satellite communication systems.
2.	Understand the Propagation impairments of satellite link.
3.	Explain various segments employed in satellite and ground station.
4.	Discuss the satellite launch mechanism and roll of those satellite in remote sensing.
5.	Understand the different communication systems used for satellite access and list the recent satellites that have been launched for mobile communication, GPS.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EC2503-1.1	3	2	2	-	1	-	-	-	-	-	-	-
EC2503-1.2	-	3	-	-	2	1	-	-	-	-	-	-
EC2503-1.3	3	-	-	1	-	1	1	-	-	-	-	-
EC2503-1.4	-	-	-	-	-	1	3	-	-	-	-	-
EC2503-1.5	-	-	-	-	-	3	3	2	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Dennis Roddy, "Satellite Communications", McGraw Hill ,1996.

2. Timothy Pratt, "Satellite Communications", Wiley India Ltd , 2006.

3. K Ramamurthy, "Rocket Propulsion", McMillan Publishers India Ltd, 2010.

REFERENCE BOOKS:

1. George Joseph, "Fundamentals of Remote Sensing", Universities press, India 2003.
2. B C Pande, "Remote sensing and Applications", VIVA Books pvt ltd, 2009.
3. Meynart Roland, "Sensors systems and next generation satellites", SPIE Publication.
4. Thyagarajan , "Space Environment", ISRO Hand Book Publication.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/101106046

ATTERY MANAGEMENT SYSTEM

Course Code:	**EE2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1	To familiarize various concepts of BMS
2	To understand functional blocks of BMS
3	To study design steps of BMS
4	To introduce hardware implementation of BMS

UNIT-I

Battery System	**08 Hours**

Introduction, Cells, Batteries, and Packs, Resistance, Li-Ion Cells, Formats, Chemistry, Safety, Safe Operating Area, Efficiency, Aging, Modeling, Unequal Voltages in Series Strings, Li-Ion

BMSs, BMS Definition, Li-Ion BMS Functions, Custom Versus Off-the-Shelf, Li-Ion Batteries, SOC, DOD, and Capacity, Balance and Balancing, SOH

BMS Options	**07 Hours**

Functionality, CCCV Chargers, Regulators, Meters, Monitors, Balancers, Protectors, Functionality Comparison, Technology, Simple (Analog), Sophisticated (Digital), Technology Comparison, Topology, Centralized, Modular Master-Slave, Distributed, Topology Comparison

UNIT-II

BMS Functions	**07 Hours**

Measurement, Voltage, Temperature, Current, Management, Protection, Thermal Management, Balancing, Redistribution, Distributed Charging, Evaluation, State of Charge and Depth of Discharge, Capacity, Resistance, State of Health (SOH), External Communications, Dedicated Analog Wire, Dedicated Digital Wire, Data Link, Logging and Telemetry, Off-the-Shelf BMSs, Cell Manufacturers' BMSs, Comparison

Custom BMS Design	**08 Hours**

Using BMS ASICs , BMS ASIC Comparison, Analog BMS Design, Analog Regulator, Analog Monitor, Analog Balancer, Analog Protector, Ready-Made, Digital BMS Designs, ATMEL's BMS Processor, Elithion's BMS Chip Set, National Semiconductors' Complete BMS, Peter Perkin's Open Source BMS, Texas Instruments' bq29330/bq20z90, Texas Instruments' bq78PL114/bq76PL102, Custom Digital BMS Design, Voltage and Temperature Measurement, Current Measurement, Evaluation, Communications, Optimization, Switching, Logging, Cell Interface, Non-distributed, Distributed, Distributed Charging

UNIT-III

Deploying a BMS	**10 Hours**

Installing, Battery Pack Design, BMS Connections to Pack, BMS Connections to System, Configuring, Cell Configuration, Pack Configuration, System Configuration, Testing, Troubleshooting, Grounding, Shielding, Filtering, Wire Routing

Course Outcomes: At the end of the course student will be able to

1	Identify process to implement BMS
2	Describe various communication protocol involved in BMS
3	Illustrate functionality of BMS
4	Apply concepts of BMS using application specific IC
5	Analyse the hardware implementation aspects of BMS

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2501-1.1	1	3	-	-	-	-	-	-	-	-	-	-
EE2501-1.2	1	3	-	-	-	-	-	-	-	-	-	-

EE2501-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2501-1.4	1	2	2	3	-	-	-	-	-	-	-	-
EE2501-1.5	1	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Davide Andrea, "Battery Management Systems for Large Lithium-Ion Battery Packs", ARTECH HOUSE 2010.

REFERENCE BOOKS:

1. Rui Xiong, "Battery Management Algorithm for Electric Vehicles", Springer 2019.
2. Nicolae Tudoroiu, "Battery Management Systems of Electric and Hybrid Electric Vehicles", MDPI 2021

BIOMEDICAL INSTRUMENTATION

Course Code:	**EE2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology.
2.	To introduce an fundamental of transducers as applicable to physiology
3.	To explore the human body parameter measurements setups
4.	To make the students understand the basic concepts of forensic techniques.
5.	To give basic ideas about Electrophysiological measurements, medical imaging

UNIT-I

Physiology and transducers	**08 Hours**

Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, neurons, synapse, transmitters and neural communication, Cardiovascular system, respiratory system, Basic components of a biomedical system, Transducers, selection criteria, Piezo-electric, ultrasonic transducers, Temperature measurements, Fiber optic sensors.

Electro – Physiological measurements	**09 Hours**

Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment.

UNIT-II

Non-electrical parameter measurements	**08 Hours**
Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers : pH of blood, measurement of blood pCO2, pO2, finger-tip oximeter, ESR, GSR measurements	
Medical Imaging	**07 Hours**
Radiographic and fluoroscopic techniques, X rays, Computer tomography, Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring	

UNIT-III

Assisting and therapeutic equipments:	**08 Hours**
Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, Heart Lung machine, Audio meters, Dialyzers, Lithotripsy	

Course Outcomes: At the end of the course student will be able to

1	Understand the physiology of biomedical system
2	Measure biomedical and physiological information
3	Discuss the application of Electronics in diagnostics and therapeutic area.
4	Analyze the images and do a prediction using image processing.
5	Understand the different equipment's used for various measurements of physiology

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2502-1.1	3	3	-	2	1	1	-	-	-	-	-	-
EE2502-1.2	2	2	2	2	-	-	-	-	-	-	-	-
EE2502-1.3	3	2	2	1	2	1	-	-	-	-	-	-
EE2502-1.4	2	3	-	-	1	-	-	-	-	-	1	-
EE2502-1.5	3	3	-	-	2	-	-	-	-	-	2	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, "Bio-Medical Instrumentation and Measurements", II edition, Pearson Education, 2002.
2.	R. S. Khandpur, "Handbook of Bio-Medical instrumentation", Tata McGraw Hill

	Publishing CoLtd., 2003.
3.	J. Webster, "Medical Instrumentation", John Wiley & Sons, 1995.
4.	L. A. Geddes and L. E. Baker, "Principles of Applied Bio-Medical Instrumentation", John Wiley & Sons, 1975.
5.	David. Cooney and Michel Deckker, "Bio- Medical Engineering Principles", INC.
REFERENCE BOOKS:	
1.	David Cooney, "Bio-Medical Engineering Principles", 2015, 1st Edition, Marcel Deckker Pub Co., New York.

ELECTRIC VEHICLE TECHNOLOGY

Course Code:	**EE2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1	To Understand the fundamental laws and vehicle mechanics.
2	To Understand working of Electric Vehicles and recent trends.
3	Ability to analyze different power converter topology used for electric vehicle application
4	Ability to develop the electric propulsion unit and its control for application of electric vehicles

UNIT-I

Vehicle Mechanics	**07 Hours**

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.

Electric and Hybrid Electric Vehicles	**07 Hours**

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive train).

UNIT-II

Energy storage for EV and HEV	**08 Hours**
Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.	
Electric Propulsion	**08 Hours**
EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.	

UNIT-III

Design of Electric and Hybrid Electric Vehicles	**10 Hours**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.	

Course Outcomes: At the end of the course student will be able to

1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design
2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3	Model batteries, Fuel cells, PEMFC and super capacitors.
4	Analyze DC and AC drive topologies used for electric vehicle application.
5	Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2503-1.1	2	3	-	-	-	-	-	-	-	-	-	-
EE2503-1.2	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2503-1.5	1	2	2	-	-	-	-	-	-	-	3	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
2.	M. Ehsani, Y. Gao, S.Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2005.

REFERENCE BOOKS:

1.	Sheldon S. Williamson, "Energy Management Strategies for Electric and

	Plug-in Hybrid Electric Vehicles", Springer, 2013.
2.	C.C. Chan and K.T. Chau, "Electric Vehicle Technology", OXFORD University, 2001
3.	Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications with Practical Perspectives", Wiley Publication, 2001
E Books / MOOCs/ NPTEL	
1.	Introduction to Mechanics | Coursera
2.	Electric Vehicles - Part 1 - Course (nptel.ac.in)
3.	NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
4.	Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
5.	Electric Cars: Technology | My MOOC (my-mooc.com)

FUNDAMENTALS OF PLC AND ITS APPLICATIONS

Course Code:	**EE2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To understand main parts and their functions, basic sequence of operation of PLC.
2.	To study the different programming languages and fundamental wiring diagrams.
3.	To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
4.	To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations
5.	To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes

UNIT-I

Programmable Logic Controllers	**02 Hours**
Introduction, Parts of a PLC, Principles of Operation, PLC Size and Application.	
PLC Hardware Components	**05Hours**
The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Human Machine Interface (HMIs).	
Basic Programming Language	**05Hours**
Ladder diagrams, Ladder conventions, Logic functions with timing diagram, latching, multiple outputs, entering programs, Functional blocks, Program examples, instruction list, branch codes,	

programming examples, Sequential functions charts, branching and convergence, actions, Structured Text, conditional and iteration statements	
Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs	**03Hours**
Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.	
UNIT-II	
Programming Timers	**02 Hours**
Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)	
Programming Counters	**04 Hours**
Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.	
Program Control Instructions	**05 Hours**
Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.	
Data Manipulation Instructions	**02 Hours**
Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.	
Math Instructions	**02 Hours**
Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations	
UNIT-III	
Sequencer and Shift Register Instructions	**05 Hours**
Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.	
Process Control, Network Systems, and SCADA	**05 Hours**
Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).	
Course Outcomes: At the end of the course student will be able to	

1.	Identify main parts, functions of PLC and describe basic circuitry for I/O modules to select PLC for desired application
2.	Apply suitable logic using various programming languages to achieve specific control mechanism for a given application
3.	Identify timer/counter resources of a PLC to design control logic for interfaced device.
4.	Interpret data manipulation and math instructions as they apply to a PLC program
5.	Develop programs that use shift registers and explain functions of control elements of a closed loop control system

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EE2504-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2504-1.2	1	3	-	-	-	-	-	-	-	-	-	-
EE2504-1.3	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.4	1	2	3	-	-	-	-	-	-	-	-	-
EE2504-1.5	1	2	3	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Frank Petruzella, "Programming Logic Controllers", Fifth Edition.
2.	W Bolton, "Programmable Logic controllers", 6th edition, Elsevier- newness, 2015.

REFERENCE BOOKS:

1.	John W Webb, Ronald A Reis, "Programmable logic controllers - principles and applications", 5th edition, 2nd impression, Pearson education, 2009
2.	L. A Bryan, E. A Bryan, "Programmable Controller Theory and Implementations", 2nd edition, 2003
3.	S. P. Sukhumi, J. K. Nayak, “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009.

E Books / MOOCs/ NPTEL

1.	https://library.automationdirect.com/category/product/programmable-control/
2.	https://www.coursera.org/lecture/intelligent-machining/programmable-logic-controllers-plc-fGz3r
3.	https://www.udemy.com/course/plc-programming-from-scratch/

MOTORS AND MOTOR CONTROL CIRCUITS

Course Code:	**EE2505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	Study architecture of induction motor and synchronous motor
2.	Understanding control of AC motor
3.	Study principle of operation of different dc motors
4.	Understand the different types of control techniques
5.	Study different sensors and their role in control of a motor

UNIT-I

AC Motor Designs	**08 Hours**

Introduction, Three phase AC motor architecture, Torque speed curve, wound rotor, Synchronous motors
Single phase AC motors, split phase motor, capacitor start and shaded pole motors, Universal and gear motors, AC Motor Specifications, Specifying an AC motor for an application.

AC Motor Control:	**07 Hours**

AC motor Enclosures, AC motor control components, Manual motor starting systems, Direct On Line Starter, semi-automatic star delta starter, fully automatic star delta starter, control circuit for sequence operation of two motors

UNIT-II

DC Motors	**07 Hours**

DC motor principle of operation, Brushed DC motors, shunt, series and compound wound motors, Brushless DC motors, driving a brushless DC motor, Commutation, Specifying a DC motor

DC Motor Control and Stepper Motors	**08 Hours**

Stepper motor principles of operation, Illustrative example of a stepper motor drive, stepper motor specification and operation, commercial stepper motor drive chips and packages, Direction Controller- H Bridge, Speed Controller: Pulse Width Modulation (PWM), Armature Controller: Variable resistance, DC vs.AC motors

UNIT-III

Sensors	**10 Hours**

Unipolar Hall Effect Switches, Omnipolar Hall Effect Switches, Latched Hall Effect Switches, Current Sensors: Shunt resistor, Current-sensing transformer, Hall effect current sensor, Speed/position sensors: Quadrature encoder, Hall effect tachometer, Back EMF/Sensorless control method, BLDC motor control with Hall sensor, Block diagram approach of BLDC Fan and Motor Control

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate an understanding of the general principles of AC Motor.
2.	Understand the basic principles of AC motor controls which includes starters, contactors, and control relays
3.	Demonstrate an understanding of the general principles of DC Motor.
4.	Understand the basic principles of DC motor controls which includes starters, contactors, and control relays

5.	Set up sensors in order to give feedback to a control circuit

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
EE2505-1.1	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.2	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.3	3	-	-	-	-	-	-	-	-	-	-	-
EE2505-1.4	2	3	3	-	-	2	-	-	-	-	-	-
EE2505-1.5	2	3	3	-	-	2	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. S. K. Bhattacharya Birjindersingh, "Control of electrical machines", New Age International.
2. Gary J. Rockis& Glen A. Mazura, "Electrical Motor Controls", 5th Edition, ISBN number is 9780826912268

REFERENCE BOOKS:

1. Stephen L. Herman, "Industrial Motor Control", Delmar Publishers, Inc., latest Edition.

E Books / MOOCs/ NPTEL

1. https://www.coursera.org/learn/motors-circuits-design
2. http://ww1.microchip.com/downloads/en/appnotes/00894a.pdf

NON-CONVENTIONAL ENERGY SOURCES

Course Code:	**EE2506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE1001-1**		

Teaching Department: Electrical & Electronics Engineering

Course Objectives:

1.	To understand the principle of extraction of energy from conventional, nonconventional sources
2.	To understand the working principle and applications of solar based thermal, electrical and PV systems.
3.	To justify the usage of energy storage techniques and understand the process of design and implement wind-based energy conversion systems.
4.	To understand the process of design and implement biomass-based energy conversion systems

UNIT-I

Energy Sources	**03 Hours**
Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources, Conventional Energy Resources- Availability and their Limitations, Non-Conventional Energy Resources- Classification, Advantages, Limitations, Comparison of Conventional and Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario	
Solar Energy Basics	**05 Hours**
Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems), Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer	
Solar Thermal Systems	**04Hours**
Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, Concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green House.	
Solar Electric Systems	**04Hours**
Solar Thermal Electric Power Generation, Solar Pond and Concentrating Solar Collector(Parabolic Trough, Parabolic Dish, Central Tower Collector), Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems- stand-alone and grid connected, Applications- Street lighting, Domestic lighting and Solar Water pumping systems.	
UNIT-II	
Energy Storage	**04 Hours**
Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)	
Wind Energy	**04 Hours**
Introduction, Wind and its Properties, History of Wind Energy Wind Energy Scenario – World and India. Basic principles of WECS, Classification, Parts of a WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS. Wind site selection consideration, Advantages and Disadvantages of WECS.	
Biomass Energy	**06 Hours**
Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, Factors affecting biogas generation, types of biogas plants- KVIC and Janata model, Biomass program in India	
UNIT-III	
Energy From Ocean	**05 Hours**
Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plant, Estimation of Energy – Single basin and Double basin type TPP (no derivations, Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle), Hybrid cycle, Site-selection criteria, Biofouling, Advantages & Limitation of OTEC	

Emerging Technologies	**05 Hours**
Fuel Cell, Small Hydro Resources, Hydrogen Energy and Wave Energy (Principle of Energy generation using block diagrams, advantages and limitations)	

Course Outcomes: At the end of the course student will be able to

1.	Describe non-conventional energy sources and solar radiation geometry to estimate and measure solar radiation.
2.	Apply the principle of solar radiation into heat to understand the operation of solar thermal and solar electric systems.
3.	Describe energy storage methods and wind–energy conversion systems to understand the factors influencing power generation.
4.	Review the biomass conversion technologies to design biomass-based energy systems.
5.	Describe tidal, ocean thermal and fuel cell energy conversion systems to understand emerging non-conventional energy technologies.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
EE2506-1.1	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.2	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.3	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.4	2	3	-	-	-	1	2	1	-	-	-	-
EE2506-1.5	2	3	-	-	-	1	2	1	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1	Rai G. D., “Non-Conventional Sources of Energy”, 4th Edition, Khanna Publishers, New Delhi, 2007.

REFERENCE BOOKS:

1	Mukherjee D. and Chakrabarti, S., “Fundamentals of Renewable Energy Systems”, New Age International Publishers, 2005.
2	Khan, B. H., “Non-Conventional Energy Resources”, TMH, New Delhi, 2006.
3	S. P. Sukhumi, J. K. Nayak “Solar Energy: Principles Collection and Storage”, 3rd edition, McGraw-Hill Education (India) , 2009.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/108108078

ELEMENTS OF YOGA

Course Code:	**HU1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To give a brief history of the development of Yoga
2.	Identify names of different classical texts on Yoga
3.	To illustrate how Yoga is important for healthy living
4.	To explain the Asanas and other Yogic practices
5.	To explain, how Yoga practices can be applied for overall improvement

UNIT-I

Yoga	**09 Hours**
Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga. Yogic practices for healthy living. General guidelines for Yoga practices for the beginners: Asanas, Pranayama.	
Classification of Yoga and Yogic texts	**07 Hours**
Yogasutra of Patanjali, Hatha yogic practices- Asanas, Pranayama, Dharana, Mudras and bandhas.	

UNIT-II

Yoga and Health	**06 Hours**
Concept of health and Diseases-Yogic concept of body – pancakosaviveka, Concept of disease according to Yoga Vasistha.	
	04 Hours
Yogic concept of healthy living- rules & regulations, yogic diet, ahara, vihara. Yogic concept of holistic health.	
Applied Yoga for elementary education	**04 Hours**
Personality development- physical level, mental level, emotional level. Specific guidelines and Yoga practices for - Concentration development, Memory development	

UNIT-III

Yoga and physical development	**05 Hours**
Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.	
	05 Hours
Specific guidelines and Yoga practices for – Flexibility, Stamina, Endurance (Surya Namaskara)	

Course Outcomes: At the end of the course student will be able to

1.	Understand a brief history of the development of Yoga
2.	Know important practices and principles of Yoga
3.	Explain how Yoga is important for healthy living
4.	Practice meditation to improvement of concentration etc.
5.	Have knowledge about specific guidelines of yoga practices

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
HU1501-1.1	-	-	-	-	-	1	-	-	1	-	-	1
HU1501-1.2	-	-	-	-	-	1	-	-	1	-	-	3
HU1501-1.3	-	-	-	-	-	2	-	-	1	-	-	3
HU1501-1.4	-	-	-	-	-	3	-	-	2	-	-	3
HU1501-1.5	-	-	-	-	-	2	-	-	2	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. B. K. S. Iyengar, “Light on Yoga: The Classic Guide to Yoga by the World’s Foremost Authority”, Thorsons publisher 2016.
2. Makarand Madhukar Gore, “Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices”, Motilal Banarsidass Publishers; 6 edition (2016).
3. Swami Satyananda Saraswati, “Asana, Pranayama, Mudra and Bandha: 1”, Yoga Publications Trust.

REFERENCE BOOKS:

1. Ann Swanson, "Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice".
2. Dianne Bondy, "Yoga for Everyone : 50 Poses For Every Type of Body".

E Books / MOOCs/ NPTEL

1. https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2. https://youtu.be/FMf3bPS5wDs

INTELLECTUAL PROPERTY RIGHTS

Course Code	**HU1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.
2.	Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.

3.	Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.

UNIT - I	
Introduction to Intellectual Property	**08 Hours**
Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.	
Agreements and Treaties	**08 Hours**
History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017	
UNIT - II	
Basics of Patents and Concept of Prior Art	**08 Hours**
Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)	
Patent filing procedures	**08 Hours**
National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies.	
UNIT - III	
Case Studies	**08 Hours**
Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa).	
Course Outcomes: At the end of the course student will be able to	

1.	Have a General understanding of the Intellectual Property Rights.
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.
4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights
5.	Be aware and have a general understanding of patenting procedures and licensing.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1502-1.1	-	3	3	2	-	3	-	-	2	2	-	3
HU1502-1.2	2	2	3	-	-	3	-	3	1	1	2	2
HU1502-1.3	2	-	-	2	-	3	-	-	2	2	2	3
HU1502-1.4	-	-	1	1	-	3	-	-	1	2	-	3
HU1502-1.5	3	2	1	-	-	3	-	-	3	1	-	2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. BAREACT, "Indian Patent Act 1970 Acts & Rules", Universal Law Publishing Co. Pvt. Ltd., 2007.
2. Kankanala C., "Genetic Patent Law & Strategy", 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007.
3. Subbaram N.R., "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
4. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
5. Intellectual Property Today: Volume 8, No. 5, May 2001.
6. M B Rao, "WTO and International Trade", Vikas Publishing House Pvt. Ltd.
7. Correa, Carlos M. "Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options", Zed Books, New York 2000.
8. Wadehra, B. L. "Law relating to patents, trademarks, copyright designs & geographical indications", 2 ed. Universal Law Publishing 2000.
9. Sinha, Prabhas Chandra, "Encyclopedia of Intellectual Property Rights", 3 Vols. Eastern Book Corporation, 2006.
10. Rachna Singh Puri and Arvind Vishwanathan, “Practical Approach to Intellectual Property Rights”; I. K. International Publishing House Pvt. Ltd.

E-RESOURCES:

1. http://www.w3.org/IPR/
2. http://www.wipo.int/portal/index.html.en
3. http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4. www.patentoffice.nic.in
5. www.iprlawindia.org/

INTRODUCTION TO GERMAN LANGUAGE

Course Code	**HU1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical

Course Objectives:

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

UNIT – I	**15 Hours**

Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischen Karte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vier Jahreszeiten, die Jahre

Mir geht es gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings),

Wie schreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions

Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine)

articles:
the ʃ der/die/das; a/an ʃein/eine
Die vierFälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv (Not in level A-1)
Deklination des bestimmtenArtikels der/die/das
Deklination des unbestimmtenArtikelsein/eine
(Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified)
Deklination von Substantiven (Declension of nouns) (Singular and Plural)
(German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects).

Nominativ und Akkusativ(nominative and accusative cases)
The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive.
(Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs)

Negation „kein/e/er "(negation with „kein/e/er ")
(Singular und Plural)
The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k" at the beginning of the declined form of ein/eine/ein.
Peter siehtein Haus. ◊ Negation ◊ Peter siehtkein Haus.
(Peter sees a house. ◊ negation ◊ Peter does not see a house.)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

UNIT - II	14 Hours

Dativ (the dative)
(You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask "(To) whom?")

Der Plural (the plural)
There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular.

Das Personal pronomen (the personal pronoun) The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced.

Die Formen des Personal pronomenim Nominativ (The nominative forms of the personal pronoun):

Präpositionen (prepositions) German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But thereare also prepositions which can be followed by both. In this case, the question “Where(to)?” (◊ accusative) or “Where?” (◊ dative) determines the case of the object. PräpositionenmitAkkusativ und Dativ (Prepositions with accusative and dative) 1.Präpositionen mitAkkusativ (prepositions with accusative) 2.Präpositionen mitDativ (prepositions with dative) 3.Präpositionen mitAkkusativoderDativ (prepositions with accusative or dative) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	
UNIT - III	**11 Hours**
Konjugation von VerbenimPräsens (Conjugation of verbs in present tense) Verbs are conjugated by attaching certain endings, depending on the person and number ofthe subject. Trennbare und untrennbareVerben (separable and inseparable verbs) Verbs with prefixes are dinstinguished between separable and inseparable verbs. The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be-kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen 1.Trennbare Verben (separable verbs) 2.Untrennbare Verben (inseparable verbs) Konjugation von VerbenimPerfekt (Conjugation of verbs in present perfect) The present perfect (Perfekt) describes something which happened in the past and isespecially used in spoken German. It is formed with the present tense form of „haben“ or „sein“ and the past participle of the main verb. 1. Die Bildung des Partizips (the formation of the past participle) 2. Die Bildung des Perfektsmit „haben“ und „sein“ (the formation of the present perfect with „haben“ and „sein“) Modalverben (modal verbs) A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. Whilethe main verb remains in the infinitive, the modal verb is conjugated. In German, there are 7 modal verbs: können (can/be able), dürfen (may/be allowed), wollen (want), müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like)	

1. Konjugation der Modalverben
(Conjugation of the modal verbs)
2. Stellung des ModalverbsimSatz
(Position of the modal verb within a sentence)

(With examples, writing and hearing exercises, and German to English Glossary as applicable)

Course Outcomes: At the end of the course student will be able to

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1503-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1503-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, UnterrichtswerkfuerErwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989.
2. Paul Coggle and Heiner Schenke, Teach Yourself German (a complete course in understanding, speaking, and writing), Teach Yourself Books, Hodden& Stoughton Educational, UK, 2001
3. Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2011

REFERENCE MATERIALS:

1. Deutsche Sprachlehre für Ausländer.
2. Themen Aktuell (Text and workbook).
3. Deutsch alsFremdsprache 1A.
4. Tangram Aktuell 1A/1B (Text and workbook).
5. Wherever required the Videos/Audios are also played in the classroom sessions

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. Milind Brahme | IIT Madras
2. https://www.traingerman.com/en/powered by Sprachinstitut TREFFPUNKT Online

INTRODUCTION TO JAPANESE LANGUAGE

Course Code	**HU1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department:

Course Objectives:

1.	Have basic spoken communication skills
2.	Write Simple Sentences
3.	Listen and comprehend basic Japanese spoken Japanese
4.	Read and understand basic Japanese characters including Kanji

UNIT - I

(Lessons 1-6)	**15 Hours**

Grammar – Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense
Vocabulary – Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips

UNIT - II

(Lessons 7-13)	**14 Hours**

Communication skills – Time, Addective, Seasons, Conversation, Q&A, Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc**.**

UNIT - III

(Lessons 14-20)	**11 Hours**

Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji Characters, and sentence making, Video Clips

Course Outcomes: At the end of the course student will be able to

1.	Understand Simple words, expressions and sentences, spoken slowly and distinctly
2.	Speak slowly and distinctly to comprehend
3.	Read and Understand common words and sentences
4.	Ask Basic questions and speak in simple sentences
5.	Write Hiragana/Katakana and Kanji (120) characters.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1504-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1504-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES

Course Code	**HU1505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P)	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	To create evolved youth, who will be equipped to contribute in the development of the nation.
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of smart soldier and to inculcate the sense of authority by commanding the troop under him/her.
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.
4.	To understand and develop life skills, soft skills and to improve emotional quotient of the student.
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values

UNIT - I

NCC: Aims, Objectives and Organization	**07 Hours**
NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.	
Personality Development	**07 Hours**
Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.	
UNIT - II	
Naval Communication and Seamanship	**08 Hours**
Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work. Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.	
Disaster management and environmental awareness	**08 Hours**
Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities. Dos and Don'ts, Fire services and Firefighting, Environmental Awareness and Conservation.	
UNIT - III	
Naval Orientation	**10 Hours**
Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy. Border and Coastal areas: Security Challenges & role of cadets in Border management	
Course Outcomes: At the end of the course student will be able to	

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
HU1505-1.1	-	-	-	-	-	3	3	1	-	-	-	-	-	-
HU1505-1.2	-	-	-	-	-	3	3	-	-	-	-	-	-	-

HU1505-1.3	-	-	-	-	-	-	-	-	1	-	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.R.K. Guptha, "Cadets Handbook", Ramesh Publishing House, New Delhi.

OVERVIEW OF INDIAN CULTURE

Course Code	**HU1506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Objectives:

1.	To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.
2.	To understand the local culture and its vibrancies.
3.	To develop awareness about Indian Society, Culture and Arts under Western rule.
4.	To comprehend different dimension and aspects of the Indian culture and arts.
5.	To appreciate cultural performances in India.

UNIT - I

Knowing Culture	**08 Hours**
What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture	
Influence of Culture	**07 Hours**
Relationship of Culture with: Language, Religion and History, Gender	

UNIT - II

Media and Culture	**07 Hours**
Role of News Papers, Indian Cinema, Music, Advertisements	
Languages, Literature and Culture	**07 Hours**
Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature	

UNIT - III

Arts and Culture	**07 Hours**
Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.	
(Self-study Component) **Contribution of Indian History to Culture**	**04 Hours**

Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning. Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages. Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.
Course Outcomes: At the end of the course student will be able to

1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.
2.	Appreciate their own local culture from an academic perspective.
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1506-1.1	-	1	-	-	-	3	-	3	3	1	-	3
HU1506-1.2	-	-	-	2	-	3	-	2	3	3	-	3
HU1506-1.3	-	-	-	-	-	3	-	1	-	-	-	1
HU1506-1.4	-	-	-	-	-	3	-	2	1	2	-	3
HU1506-1.5	-	-	-	-	-	3	-	3	3	3	-	2

1: Low 2: Medium 3: High

PHILOSOPHY

Course Code	**HU1507-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Visiting

Course Objectives:

1.	To provide a new understanding based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.
2.	To introduce an orientation course for humanities courses in general and for philosophy courses in particular.
3.	To relate philosophy to literature, culture, society and lived experience.
4.	To train students in already available philosophical systems.
5.	To bridge the gap between theory and practice.

UNIT - I	
Knowledge (Vidya) and Ignorance (Avidya)	**14 Hours**
Upanishads Six systems orthodox and Heterodox schools of Indian philosophy Greek philosophy	
Origin of the universe	
NasidiyaSukta: "Who really knows?" Brhadaranyaka Upanishad; Chandogya Upanishad: Non-Self, real and unreal Taithriya Upanishad: SikshaValli Plato's Symposium: Lack as the source if desire and knowledge. Socratic method of knowledge as discovery Language: word as root of knowledge (Bhartrahari'sVakyapadiyam) Fourteen Knowledge basis as a source of Vidya: Four Vedas, six auxiliary sciences (vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.	
UNIT - II	
Knowledge as Power	**16 Hours**
Francis Bacon. Knowledge as both power and self- realization in Bhagavad Gita.	
Knowledge as Oppression	
M. Foucault. Discrimination between Ram and Satyam in Indian Philosophy.	
Knowledge as Invention	
Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.	
UNIT - III	
	10 Hours
Knowledge about the self, transcendental self; knowledge about society, polity and nature Knowledge about moral an ethics codes.	
Course Outcomes: At the end of the course student will be able to	

1.	To provide a new understanding based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.
2.	To introduce an orientation course for humanities courses in general and for philosophy courses in particular.
3.	To relate philosophy to literature, culture, society and lived experience.
4.	To train students in already available philosophical systems.
5.	To bridge the gap between theory and practice.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
HU1507-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1507-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. Copleston, Frederick, "History of Philosophy", Vol. 1. Great Britain: Continuum.
2. Hiriyanna, M. , "Outlines of Indian Philosophy", Motilal Banarsidass Publishers; Fifth Reprint edition, 2009.
3. Sathaye, Avinash, "Translation of NasadiyaSukta".
4. Raju, P. T. "Structural Depths of Indian Thought", Albany: State University of New York Press.
5. Plato, Symposium, Hamilton Press

PRINCIPLES OF PHYSICAL EDUCATION

Course Code	**HU1508-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Physical Education

Course Objectives:

1.	Express understanding of constitution of sports organizations
2.	Demonstrate considerate familiarity of various food practices
3.	Grasp understanding of first aid and physical education
4.	Awareness on the importance of exercise
5.	Leadership skills and the rules of different sports

UNIT - I

15 Hours

History of Physical Education - Olympic games, Modern Olympic games, Olympic Ideals & Objectives, Olympic Symbols, Olympic Flag, Olympic Emblem, Olympic Motto, Olympic Flame, Asian games International Olympic Committee (IOC), Indian Olympic Association (IOA)
Sports awards - Eligibility, Objectives & Criteria
Yoga - Meaning and Importance
World Health organization (WHO)

UNIT - II

14 Hours

Concept of Health - Meaning of Health, Health Definition, Factors Affecting Health, Qualities of Healthy Person. Health Hazards of College Students, Physical Fitness and Exercises.
Food and Nutrition - Food & Nutrition Defined, Nutrients and their Functions - i) Proteins ii) Carbohydrates iii) Fats iv) Vitamins
Balanced Diet & Malnutrition
Health Education - Meaning of Health Education, Health Education Defined, Scope of Health Education, Importance of Health Education.
Posture - Concept of Posture, Correct Postures, Common Postural Defects
First Aid - First Aid Defined, Need and importance of First Aid, The Requisites of First Aid, Scope of First Aid, Qualities of a First Aider, Fundamental Principles to be followed and the Duties to be performed by the First Aider, First Aid in Different Cases.
Physical Education - Concept of Physical Education, Physical Education Defined, Importance of Physical Education, Scope of Physical Education, Aims and Objectives of Physical Education.
Teaching Aid in Physical Education
Competition - Introduction, Types of competition, Knock out, League or Round Robin Tournament.

UNIT - III

11 Hours

Training in Sports – Meaning, Principles, Warming Up & Limbering Down
Importance of Anatomy and Physiology in Physical Education, Oxygen Debt and Second wind
Leadership and Supervision – Leadership, Qualities of a good leader in Physical Education, Types of Leadership in Physical Education - 1. Teacher Leadership 2. Student Leadership.
Measurement & specification of various playing fields – Cricket, Volley Ball, Basket Ball, Badminton, Ball Badminton, Foot Ball, Hand Ball & their basic playing skills.

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate knowledge of structure of the world sports organizations
2.	Display understanding of different type of food and nutrition for a healthy diet
3.	Comprehend awareness of first aid and physical education
4.	Elucidate about training and the importance of Physical Education
5.	Aware of leadership skills and the knowledge of various sports

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU1508-1.1	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.2	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.3	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.4	-	-	-	-	-	3	-	-	2	1	-	1
HU1508-1.5	-	-	-	-	-	3	-	-	2	1	-	1

1: Low 2: Medium 3: High

INTRODUCTION TO YAKSHAGANA

Course Code	**HU1509-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**2:0:2:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Chemistry

Course Objectives:

1.	Gain basic understanding of Thenku Thittu Yakshagana
2.	Perform basic movements.
3.	Understand speech/dialogue, rhythm, entry and improvisation skills.

UNIT - I

Introduction — **14 Hours**

Yakshagana: Meaning and features, Origin and development, Difference between Thenkuthittu and Badaguthittu yakshagana. A brief introduction to Thenkuthittu Yakshagana.
Thalas-Aadi thala, yeka thala, Kore thala and Asta Thala with biditha and mukthya- Practice, Dhigina – Practice.

UNIT - II

Thalas — **14 Hours**

Rupaka Thala, Trivide Thala, Jampe thala etc. with biditha and mukthaya. Dhigina Practice, Rangasthala Pravesha steps and Eripada ettugade steps., Revision of all Thalas.

UNIT – III	
Yakshagana Prasanga Practice	**12 Hours**
Abhinaya and presentation	

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate a comprehensive understanding of Yakshagana, including its cultural significance, historical evolution, and the distinctions between Thenkuthittu and Badaguthittu styles, thereby fostering a deeper appreciation for this traditional art form.
2.	Develop proficiency in executing traditional Yakshagana rhythms and expressions, empowering them to actively participate and contribute to the preservation and promotion of Yakshagana heritage.
3.	Attain proficiency in executing certain thalas with precision, enhancing their ability to interpret and convey the essence of traditional compositions.
4.	Develop agility, coordination, and stage presence, enabling them to perform with confidence and grace on various Yakshagana platforms, while the comprehensive revision of all thalas will consolidate their understanding and execution of Yakshagana rhythmic structures.
5.	Demonstrate refined proficiency in Yakshagana Prasanga Practice, exhibiting adeptness in abhinaya (expressive gestures) and captivating presentation skills, enriching their ability to convey narratives with authenticity and artistic flair.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1509-1.1	-	-	-	-	-	-	-	-	3	3	-	-	-	-
HU1509-1.2	-	-	-	-	-	-	-	-	3	3	-	-	-	-
HU1509-1.3	-	-	-	-	-	-	-	-	3	3	-	-	-	-
HU1509-1.4	-	-	-	-	-	-	-	-	3	3	-	-	-	-
HU1509-1.5	-	-	-	-	-	-	-	-	3	3	-	-	-	-

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Sathish Madivala, "Yaksha Naatyanjali Thenkuthittu- Sampadaka", Karkala.
2.	Yakshagna Shikshana Patya Pustaka- Prathamika vibhaga, Karnatka Patya pusthaka sangha- Bengaluru.
3.	Dr. Ramananda Banari, "Arthayana: Yakshagana Talamaddale Arthagarike: Ondu Vishleshane".
4.	Dr. M. Prabhakara Joshi, "Koralara: Yakshagana Vimarsha Sankalana".
5.	Vaagartha Gawrava: (Dr. Joshi Abhinandana Guchaha): Ga. Na. Bhat

LINGUISTICS & LANGUAGE TECHNOLOGY

Course Code	**HU2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1**		

Teaching Department: Humanities

Course Objectives:

1.	Introspect about the consciousness in one's language
2.	Learn pronunciation and how the process helps to communicate effectively.
3.	Build contextual speech and writing with the pedagogy in sentence structure.
4.	Improve skill of applying language to enunciate words.
5.	Progress on the speech aspects by understanding the acquisition of Second Language.

UNIT – I

Introduction to Linguistics	**08 Hours**
Broad understanding of Linguistics, Language and characteristic features, Scientific Language, Levels of Linguistic Analysis (Phonetics, Phonology, Morphology, Syntax and Semantics); Approach to Linguistics (Traditional, Structural and Cognitive).	
Phonology and Morphology	**08 Hours**
Perspectives in Linguistics, Phonemes, Allophones, Phonemic Analysis, Morphology and Morphemes, Word building process, Morphological Analysis.	

UNIT - II

Syntax	**16 Hours**
Constituent structure (Simple Sentence, Noun Phrase, Verb Phrase, Prepositional Phrase, Adjective Phrase, Adverb Phrase, Structure Rules), Tree Diagrams, Case	

UNIT - III

Sociolinguistics & Psycholinguistics, Artificial Intelligence	**08 Hours**
Notion of Language Variety, Languages in Contact, Language and Mind, Error Analysis.	

Course Outcomes: At the end of the course student will be able to

1.	Understand the importance of language and its facets.
2.	Demonstrate knowledge of sounds and competence in process of word building.
3.	Evolve to reason the constituent parts of a sentence.
4.	Understand the techniques of how 'meaning' is applied.
5.	Analyze errors in day-to-day-conversations and how language is related to society.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
HU2501-1.1	-	1	-	-	1	1	-	-	1	-	-	2
HU2501-1.2	-	-	2	-	-	-	-	-	2	2	-	-
HU2501-1.3	2	3	-	3	-	-	-	-	3	2	-	-
HU2501-1.4	-	-	-	-	2	-	-	-	1	2	-	-
HU2501-1.5	-	2	-	-	-	2	1	-	-	-	-	1

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. Akmaijan, A, R. A. Dimers and R. M. Harnish. "Linguistics: An Introduction to Language and Communication". London: MIT Press, 1979.
2. Chomsky, Noam. "Language in Mind". New York: Harcourt Brace Jovanovich, 1968.
3. Fabb, Nigel. "Sentence Structure". London: Routledge, 1994.
4. Hockett, C. "A Course in Modern Linguistics". New York: Macmillan, 1955.
5. O'Grady, W., O. M. Dobrovolsky and M. Aronoff. "Contemporary Linguistics: An Introduction". New York: St. Martin's Press, 1991.
6. Pride, J. B. and J. Holmes. "Sociolinguistics". Harmondsworth: Penguin, 1972.
7. Richards, J. C. "Error Analysis: Perspectives in Second Language Acquisition". London: Longman, 1974.
8. Salkie, R. "The Chomsky Update: Linguistics and Politics". London: Unwin Hyman Ltd., 1990.
9. Sinclair, J. M. C. H. and R. M. Coulthard. "Towards an Analysis of Discourse". Oxford: OUP, 1975.
10. Thomas, Linda. "Beginning Syntax". Oxford: Blackwell, 1993.
11. Verma, S. K. and N. Krishnaswamy. "Modern Linguistics: An Introduction". New Delhi: OUP, 1989.
12. Wekker, Herman and Liliane Haegeman. "A Modern Course in English Syntax". Kent: Croom Helm, 1985.

PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Course Code	**HU2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40+0+0**	**CIE + SEE Marks**	**50+50**
Pre-requisite	**HU1001-1 (Technical English)**		

Teaching Department: Humanities

Course Objectives:

1.	To Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

UNIT – I	**15 Hours**

Common sense and Emotional Intelligence

Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking; Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence

Etiquettes & Workplace

Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace

UNIT – II	**15 Hours**

Social Networking Sites and its Impacts

Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour

Gender and Body

Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA

UNIT – III	**10 Hours**

Writing

Types of Writing, Note Taking Methods, Plagiarism

Reading

Styles of Reading, Types of Reading, Scanning, Skimming

Course Outcomes: At the end of the course student will be able to

1.	Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
HU2502-1.1	-	3	-	-	-	-	-	-	3	3	-	3
HU2502-1.2	-	2	-	-	-	-	-	3	2	3	-	2
HU2502-1.3	-	3	-	-	-	-	-	-	2	2	-	3
HU2502-1.4	-	3	-	-	-	-	-	-	2	2	-	3
HU2502-1.5	-	2	-	-	-	-	-	-	3	3	-	2

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1. Geetha.V. Gender. Kolkatta: Web Impressions, 2009.
2. Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2013): 91-112.
3. Barry, Peter. "Beginning Theory". New Delhi: Viva Books, 2010.
4. Berger, John. "Ways of Seeing". London: Penguin Books, 1977.
5. Cranny-Francis, Anny, et al. "Gender Studies: Terms and Debates". New York: Palgrave Macmillan, 2003.
6. Gauntlett, David. "Media, Gender and Identity: An Introduction". London: Routledge, 2008
7. Pilcher, Jane, and Imelda Whelehan. "50 Key Concepts in Gender Studies". London: Sage, 2004. Print.
8. Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.
9. Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2004): 199-215.Web.

E-RESOURCES:

1. http://www.cyberpsychology.eu/view.php?cisloclanku=2009061501/ >.
2. http://www.surveillance-and-society.org/articles2(2)/webcams.pdf
3. http://eprints.rclis.org/19790/>.

INTRODUCTION TO CYBER SECURITY

Course Code:	**IS2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**IS1651-1**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Define the area of cybercrime and forensics and to understand the security threat
2.	Explain the motive and causes for cybercrime, detection, and handling.
3.	Investigate Areas affected by cybercrime.
4.	Illustrate tools used in cyber forensic

UNIT-I

Introduction to Cyber Security	**15 Hours**

Concepts of Cyber Security, Formal Methods of Security Validation, CIA framework-Confidentiality, Integrity and Authenticity, Threat modelling, Domains of cyber security, Security attacks, Security services, Security Mechanisms, Fundamental security design principles, Types of Cyber Threat.

UNIT-II

Tools and methods used in Cybercrime	**14 Hours**

Introduction, Proxy Servers and Anonymizers, Intruders and Hackers, Insider threats, Cybercrimes. Network Threats: Active/ Passive – Interference – Interception –Impersonation – Worms –Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels –Backdoors – Bots – IP, Spoofing - ARP spoofing - Session Hijacking, Introduction to Phishing, Identity Theft (ID Theft).

UNIT-III

Understanding Computer Forensics	**11 Hours**

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

Course Outcomes: At the end of the course student will be able to

1.	Comprehend the Cybercrime and its origin
2.	Analyse Security Threat Management and understand the security elements.
3.	Apply tools and methods used in Cyber crimes
4.	Analyse Phishing and ID Theft
5.	Comprehend Digital Forensics

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
IS2501-1.1	2	-	-	-	-	1	-	3	-	-	-	-
IS2501-1.2	-	3	-	1	-	2	-	-	2	-	-	-
IS2501-1.3	-	3	2	-	-	-	-	-	-	-	-	-
IS2501-1.4	2	-	-	-	-	2	-	-	-	-	-	-
IS2501-1.5	-	-	-	-	-	-	-	3	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 2006.
2. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
3. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1, 2014.
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials'', CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.
3. Santosh B. J., K. V. S. S. S. S. Sairam, Shubham Kumar, Chandu Jagan Sekhar M, "Information and Cyber Security", Scientific International Publishing House, ISBN- 978-93-5625-694-1.

PYTHON APPLICATION PROGRAMMING

Course Code:	**IS2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Construct Python programs using data types and looping.
2.	Design object-oriented Python programs using classes and objects.
3.	Design useful stand-alone and CGI applications in

UNIT-I

Functions, Classes and OOP	**15 Hours**

Functions: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions

Classes and OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block

UNIT-II

Lists, Tuples, and Dictionaries	**14 Hours**

Lists, tuples, and dictionaries: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing, and replacing values; traversing dictionaries.

File Handling: Reading From Text Files, Writing to Text Files, Working with Excel Sheets, CSV, PDF, Word,

UNIT-III

Essential Python Libraries	**11 Hours**

Working with SciPy, Numpy, Matplotlib, Pandas.

Graphical user interfaces: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form.

Course Outcomes: At the end of the course student will be able to

1.	Demonstrate the basics of Python programming like data types and looping
2.	Apply the basic data structures in solving the problems
3.	Experiment with usage of functions in a given problem
4.	Develop Objects by creating classes and apply object-oriented features
5.	Develop applications in Python using File Programming &User Interface

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
IS2502-1.1	2	-	-	-	2	-	-	-	-	-	-	3
IS2502-1.2	2	-	-	-	2	-	-	-	-	-	-	3
IS2502-1.3	2	-	-	-	2	-	-	-	-	-	1	3
IS2502-1.4	-	-	-	-	-	-	-	-	-	-	-	-
IS2502-1.5	-	-	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1Kenneth A. Lambert, "The Fundamentals of Python: First Programs", 2011, Cengage

Learning.

SOFTWARE ENGINEERING PRACTICES

Course Code:	**IS2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**NIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Outline software engineering principles and activities involved in building large software programs.
2.	Explain the importance of architectural decisions in designing the software.
3.	Describe the process of Agile project development.
4.	Recognize the importance of software testing and describe the intricacies involved in software evolution.
5.	Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT-I	
Introduction	**15 Hours**
Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.	
Software Processes	
Models: Waterfall Model, Incremental Model and Spiral Model; Process activities	
Requirements Engineering	
Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.	

UNIT-II	
System Models	**15 Hours**
Context models, Interaction models, Structural models, Behavioral models.	
T Architectural Design	
Architectural design decisions. Architectural Views and patterns, Application architectures.	
Design and implementation	
Object oriented Design using UML.	
Agile Software Development	

Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.

UNIT-III

Project Management	**10 Hours**
Risk management, Teamwork.	
Project Planning	
Software pricing, Plan-driven development, Project Scheduling.	
Quality Management	
Software quality, Reviews and inspections, Software measurement and metrics, Software standards.	

Course Outcomes: At the end of the course student will be able to

1.	Recognise the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility
2.	Describe the waterfall, incremental and iterative models, and architectural design in implementing the software
3.	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4.	Describe the methods for maintaining software system.
5.	Discuss project planning and management and illustrate the quality of software Products.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
IS2503-1.1	-	3	1	-	-	-	-	2	-	-	-	-
IS2503-1.2	1	3	1	-	-	-	-	-	-	-	-	-
IS2503-1.3	1	1	3	-	-	-	-	-	-	-	-	-
IS2503-1.4	1	3	2	-	-	-	-	-	-	-	-	-
IS2503-1.5	1	2	2	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Roger S. Pressman: “Software Engineering-A Practitioners approach”, 7th Edition, Tata McGraw Hill, 2017.
2. Pankaj Jalote: “An Integrated Approach to Software Engineering”, Wiley, India, 2010.

E Books / MOOCs/ NPTEL

1. http://agilemanifesto.org/
2. http://www.jamesshore.com/Agile-Book/
3. https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx
4. https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx

WEB TECHNOLOGIES

Course Code:	**IS2504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MIL**		

Teaching Department: Information Science & Engineering

Course Objectives:

1.	Illustrate the Semantic Structure of HTML and CSS
2.	Compose forms and tables using HTML and CSS
3.	Design Client-Side programs using JavaScript and Server-Side programs using PHP
4.	Illustrate the Database connectivity using PHP
5.	Examine JavaScript frameworks such as jQuery

UNIT-I

Introduction to HTML — **15 Hours**

HTML tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

UNIT-II

Client side Scripting — **15 Hours**

Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

UNIT-III

PHP Databases — **10 Hours**

Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

Course Outcomes: At the end of the course student will be able to

1.	Adapt HTML and CSS syntax and semantics to build web pages
2.	Construct and visually format tables and forms using HTML and CSS.
3.	Experiment with the usage of Event handling and Form validation using JavaScript.
4.	Understand the principles of object-oriented development using PHP and Database concepts.
5.	Inspect JavaScript frameworks like jQuery which facilitates developers to focus on core features.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
IS2504-1.1	1	2	-	2	-	-	-	-	-	-	-	1
IS2504-1.2	1	-	-	2	-	-	-	-	-	-	-	1
IS2504-1.3	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.4	1	2	-	2	3	-	-	-	-	-	-	1
IS2504-1.5	1	-	-	2	3	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271).

E Books / MOOCs/ NPTEL

1. nptel.ac.in/courses/106105084/11

GRAPH THEORY

Course Code:	**MA1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	Explain subgraphs, bipartite graphs, isomorphic graphs etc. Apply the concept of trees and its properties
2.	Distinguish between Hamilton and Eulerian graph. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.

3.	Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.
4.	Find the shortest path between two vertices in a graph. Find minimal spanning tree.

UNIT-I	
Introduction to graphs	**15 Hours**
Graphs and Graph Models, digraphs, Konigsberg bridge problem. Special Types of Graphs: Subgraphs-spanning and induced subgraphs, complete graph, Bipartite Graphs. Isomorphism of graphs. Complement of a graph and its properties. Connectivity-point and line connectivity. Trees and its properties. Euler and Hamilton graphs and their applications.	
UNIT-II	
Planar graphs	**09 Hours**
Euler's polyhedron formula, outer planar graphs, applications	
Colorability	**07 Hours**
Chromatic number, five color theorem, chromatic polynomial, Applications of graph coloring.	
Matrix representation of graphs	
Adjacency matrix, incidence matrix, circuit matrix, cut set matrix, Path matrix.	
UNIT-III	
Network Flows	**04 Hours**
Max -flow and Min-cut Theorem(statement), problems.	
Shortest paths in weighted graphs	
Dijkstra's algorithm to find shortest paths.	
Spanning trees	**05 Hours**
Algorithms to find a spanning tree, minimal spanning tree-Kruskal's & Prim's algorithm.	
Course Outcomes: At the end of the course student will be able to	

1.	Distinguish between bipartite and complete bipartite graphs, identify whether two graphs are isomorphic, find subgraphs of a graph etc.
2.	Distinguish between Eulerian and Hamiltonian graphs.
3.	Identify whether a graph is planar and to find the chromatic polynomial of a graph.
4.	Representing graphs in terms of Matrices.
5.	Apply algorithmic methods to find the shortest path between two given vertices. Use a suitable algorithm to find a minimal spanning tree.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12

MA1501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
MA1501-1.2	2	1	-	-	-	-	-	-	-	-	-	-
MA1501-1.3	2	3	-	-	-	-	-	-	-	-	-	-
MA1501-1.4	3	2	-	-	-	-	-	-	-	-	-	-
MA1501-1.5	3	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. F. Harary, "Graph theory", Narosa Publishing House, 1988.
2. Narsing Deo, "Graph Theory with applications to Engg. and Comp. Sciences", PHI,1974.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, V Edition-2003.

REFERENCE BOOKS:

1. D. B. West, "Introduction to Graph Theory", PHI,2001.
2. Chartrand and Zhang, "First Course in Graph Theory", 2012

E Books / MOOCs/ NPTEL

1. http://diestel-graph-theory.com.
2. https://nptel.ac.in/courses/111106102

NUMBER THEORY

Course Code:	**MA1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P) :	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mathematics

Course Objectives:

1.	Understand the divisibility of integers, study of prime numbers and basic properties of congruences.
2.	Study Fermat's little theorem and understand Euler's function.
3.	Study the existence of primitive roots and quadratic residues.
4.	Study the cryptographic applications in number theory.

UNIT-I

Divisibility and the theory of congruences	**15 Hours**

Division algorithm, Euclid's algorithm for the greatest common divisor. Linear Diophantine equations. Prime numbers, fundamental theorem of arithmetic. Basic properties of congruences, Linear congruences and Chinese reminder theorem.

UNIT-II

	07 Hours

Fermat's theorem, Wilson's theorem, Euler's Phi function, Euler's theorem.

Primitive roots and Quadratic congruences	**08 Hours**

Order of an integer modulo n, primitive roots for primes, Euler's criterion, Legendre symbol and its properties.

UNIT-III

Cryptography	**10 Hours**

Introduction to public key cryptography, RSA cryptosystem, an application of primitive roots to cryptography.

Course Outcomes: At the end of the course student will be able to

1.	Use divisibility and Greatest common divisor in Euclidean algorithm. Solve Diophantine equations. Identify prime factorization of an integers.
2.	Understand the properties of congruences. Use Chinese reminder theorem to find solution of system of linear congruences
3.	Use Fermat's Little Theorem and Wilson's Theorem. Use of Euler's Phi function.
4.	Identify primitive roots of an integers. Apply Euler's criterion and Legendre symbols.
5.	Code and decode numbers in the RSA cryptosystem.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA1502-1.1	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.2	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.3	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.4	2	3	-	-	-	-	-	-	-	-	-	-
MA1502-1.5	2	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. D. Burton, "Elementary Number Theory", McGraw-Hill, 2005.
2. Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley, 2000.

REFERENCE BOOKS:

1. H. Davenport, "The Higher Arithmetic", Cambridge University Press, 2008.
2. G. A. Jones & J. M. Jones, "Elementary Number Theory", Springer UTM, 2007.
3. Thomas Koshy, "Elementary Number Theory with Applications", 2nd edition, Elsevier, 2007.
4. William J. LeVeque, "Fundamentals of Number Theory".

E Books / MOOCs/ NPTEL

1. http://refkol.ro/matek/mathbooks/ro.math.wikia.com%2520wiki%2520Fisiere pdf_incarcate/
2. Elementary-Number-Theory.pdf
3. https://nptel.ac.in/courses/111104138
4. https://nptel.ac.in/courses/111103020

LINEAR ALGEBRA

Course Code:	**MA3501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**MA1001-1, MA2009-1**		

Teaching Department: Mathematics

Course Objectives:

1.	Understand the concepts of vectors, bases.
2.	Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3.	Find the canonical forms and appraise its importance in various fields.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis.
5.	Learn the concepts of singular value decomposition and PCA.

UNIT-I

Vector spaces	**08 Hours**
`	
Linear Transformations	**07 Hours**
Linear transformations, rank-nullity theorem, algebra of linear transformations, change of basis, linear operators, linear functionals, transpose of a linear transformation.	

UNIT-II

Canonical Forms	**08 Hours**
Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.	
Inner Product Spaces	**07 Hours**
Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization, Least-squares problems.	

UNIT-III

Symmetric Matrices and Quadratic Forms	**10 Hours**
Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.	

Course Outcomes: At the end of the course student will be able to

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MA3501-1.1	3	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.2	2	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.3	3	1	-	-	-	-	-	-	-	-	-	-
MA3501-1.4	3	2	-	-	-	-	-	-	-	-	-	-
MA3501-1.5	3	2	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2004.
2. David C. Lay, “Linear Algebra and its Applications”,3rd edition, Pearson Education (Asia) Pte. Ltd, 2005.

REFERENCE BOOKS:

1. M. Artin, "Algebra", Prentice Hall of India, 2004.
2. Gilbert Strang, “Linear Algebra and its Applications”, 4th edition, Thomson Learning Asia, 2003.
3. Bernard Kolman and David R. Hill, “Introductory Linear Algebra with Applications”, Pearson Education (Asia) Pte.Ltd, 7th edition ,2003.
4. Sheldon Axler, “Linear Algebra Done Right”, Springer International Publication, Third Edition, 2015.

AUTOMOTIVE ENGINEERING

Course Code:	**ME1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Get an idea on the different components of an engine and its types with lubrication system.
2.	Understand the fuel supply system and ignition systems used in automobiles.
3.	Demonstrate the working of transmission system.
4.	Explain the importance of suspension system, steering geometry and drives in automobiles
5.	Know the concept of braking system, tyres and emission control.

UNIT-I

Engine Components and Cooling & Lubrication Systems	**08 Hours**

SI & CI engines, Cylinderarrangements and their relative merits, Liners, Piston, connectingrod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Choiceof materials for different engine co mponents, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements, crankshaft/flywheel position sensor, accelerator pedal sensors, engine coolant watertemperature sensor.

Fuel Supply Systems for SI and CI Engines	**08 Hours**

Fuel mixture requirements for SI engines, types of carburetors, simplecarburetor, multi point and single point fuel injection systems, CRDI, fuel transfer pumps: AC Mechanical Pump, SU Electrical Pumps, injectors, Fuel gauge sensor, Throttle position sensor, Mass air flow sensors.
Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assisted contacts. Electronic Ignition, Automatic Ignition advance systems, Lighting systems, Rain/Light sensors, starting device (Bendix drive)
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

Power Trains	**07 Hours**

Clutches - Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, Constant m esh gear box, Synchromesh gear box, principle of automatic transmission, Vehicle Speed Sensors, calculation of gear ratios, Types of transmission systems. No numerical.

Drive to Wheels	**08 Hours**

Propeller shaft, universal joints, Hotchkiss. and torque tube drives, differential, rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, power steering, over steer, under steer & neutral steer, Steering angle sensors, numerical problems.
Suspension and Springs: Requirements, leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front Wheel, Air suspension system. Collective bargaining; Characteristics, Necessity, Forms Safety & Health; Industrial accidents, Safety Quality circle; Meaning, Structure
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

Brakes	**09 Hours**

Types of brakes, mechanical, compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes.
Tyres: Desirable tyre properties, Types of tyres.
Automotive Emission: Automotive exhaust emissions, sources and emission control method: EGR, SCR, Emission Standards, Exhaust sensors.
Electric Vehicles.
Pedagogy Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Describe and demonstrate the layout of an automobile and components of an automobile engine. Explain cooling and lubrication systems.
2.	Explain and demonstrate the fuel supply and Ignition systems for SI and CI engines.
3.	Describe and demonstrate the transmission system
4.	Explain and demonstrate the components of drive to wheel and suspension system, calculate the parameters of steering geometry.
5.	Describe and demonstrate automotive braking system. Explain types and construction of tyres and wheels. Explain the significance of automotive emissions and its controlling methods

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
ME1501-1.1	3	1	-	-	-	1	-	-	3	1	-	1
ME1501-1.2	3	1	-	-	-	1	-	-	3	1	-	1
ME1501-1.3	3	1	1	-	-	1	-	-	3	1	-	1
ME1501-1.4	2	3	1	-	-	1	-	-	3	1	-	1
ME1501-1.5	3	1	1	-	-	1	1	1	3	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. S. Srinivasan, "Automotive Mechanics", Tata McGraw Hill, 2003.
2. Kirpal Singh, "Automobile Engineering", Vol I and II, 2013.
3. A. K. Babu, "Automotive Electrical and Electronics", Khanna Publishers, 2nd edition, 2016.

REFERENCE BOOKS:

1. R. B. Gupta, "Automobile Engineering", Satya Prakashan, 4th Edn., 1984 .
2. Naran G, "Automobile Engineering", Khanna Publishers 2002

INDUSTRIAL POLLUTION CONTROL

Course Code:	**ME1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2.	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3.	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4.	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5.	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.

UNIT-I

Introduction to Pollution	**08 Hours**

Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.

Meteorology	**08 Hours**

Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems.
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

Separation techniques	**08 Hours**

Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber

Smoke and gaseous pollutants:	**08 Hours**

Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope&Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So2, Co, UBHC, Nox their ill effects and & control methods.
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

	08 Hours

Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards

Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
2.	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams
3.	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency
4.	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
5.	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
ME1502-1.1	1	-	-	1	-	3	3	2	1	2	-	3
ME1502-1.2	1	2	1	1	3	2	3	1	1	1	-	2
ME1502-1.3	1	2	2	1	1	2	3	1	1	1	-	1
ME1502-1.4	1	1	1	1	1	2	3	1	1	1	-	2
ME1502-1.5	1	-	-	1	-	2	3	1	1	1	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. "Environmental Pollution Control Engineering", Wiley Eastern Ltd.,
2. Gilbert M Masters, "Introduction to Environmental Engineering & Science", PHI,1995
3. C. S Rao, "Environmental Pollution Control Engineering", New Age Int.

REFERENCE BOOKS:

1. Henry C. Perkins, "Air Pollution", Mc-Graw Hill, 1974.
2. W. L. Faith, "Air Pollution control", John Wiley

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/courses/105106119/36

SUSTAINABLE DEVELOPMENT GOALS

Course Code:	**ME1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges
2.	Address the global challenges including poverty, inequality, climate change, environmental degradation, peace and justice.
3.	To learn more and take action.
4.	Addresses critical global challenges put forth by UN.
5.	Analyze how sustainable development can be achieved in practice.

UNIT-I

	08 Hours

The origin, development and idea of the SDGs History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals?

SDGs and Society	**08 Hours**

Ensuring resilience and primary needs in society In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-II

SDGs and Society	**14 Hours**

Strengthening Institutions for Sustainability In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions.

SDGs and the Economy: Shaping a Sustainable Economy In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption.

Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

SDGs and the Biosphere	**10 Hours**

Development within Planetary Boundaries In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land.

Realizing the SDGs: Implementation through Global Partnerships In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.

Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Summarize the UN‟s Sustainable Development Goals and how their aims, methodology and perspectives.
2.	Analyze the major issues affecting sustainable development and how sustainable

	development can be achieved in practice.
3.	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
4.	Evaluate the implications of overuse of resources, population growth and economic growth. sustainability & Explore the challenges the society faces in making transition to renewable resource use.
5.	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
ME1503-1.1	1	2	1	1	1	3	3	1	1	1	-	2
ME1503-1.2	2	2	1	1	1	3	3	2	1	1	-	1
ME1503-1.3	3	2	2	1	1	3	3	2	3	1	-	1
ME1503-1.4	3	2	3	1	1	3	3	2	1	1	-	1
ME1503-1.5	1	2	2	1	1	3	3	2	2	2	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Sachs, Jeffrey D. "The age of sustainable development" Columbia University Press, 2015
2. Gagnon, B., Leduc, R., and Savard, L., "Sustainable development in engineering: a review of principles and definition of a conceptual framework", Cahier de recherche / Working Paper 08-18, 2008.

REFERENCE BOOKS:

1. Elliott, Jennifer, "An introduction to sustainable development", Routledge, 2012.

E Books / MOOCs/ NPTEL

1. https://www.un.org/sustainabledevelopment/poverty/

TECHNOLOGICAL INNOVATION

Course Code:	**ME1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Understand basics of operations management and Quality.
2.	Define the concept of technological innovation.
3.	Discuss Innovation management and the difference between Invention and Innovation.
4.	Appreciate the importance of Innovation as a management process and Innovation management techniques.
5.	Discuss the Innovation system, Understand the importance of Technology management and Transfer and basics of Technological Forecasting.

UNIT-I	
Production and Operations Management and Introduction to Quality Concepts	**04 Hours**
Production and Operations Management: Introduction - Functions within business organizations - the operation management function - Classification of production systems. Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement - Key dimensions of Quality - Concept of cost of quality - Customers' perception of quality.	
Introduction to Technological Innovation	**09 Hours**
Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.	
Startup Idea Pitching	**03 Hours**
UNIT-II	
Introduction to Innovation Management andInnovation & Competitiveness	**07 Hours**
Introduction to Innovation Management: Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation. Innovation and Competitiveness: Case Study – Barriers for Innovation and Competitiveness	
Innovation as a Management Process	**08 Hours**
Activities to enhance companies' capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	
UNIT-III	
Innovation Systems andTechnology Management & Transfer	**04 Hours**
Innovation Systems: The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National. Technology Management and Transfer: Technology Transfer - Impacts of MNCs in technology transfer	
Introduction to Technological Forecasting	**05 Hours**
Introduction - Applications & Limitations of Technological Forecasting – Technology Forecasting Techniques – Exploratory Forecasting – Normative Forecasting – Delphi Technique – Problems of Technological Forecasting	

Course Outcomes: At the end of the course student will be able to

1.	Define operations management and quality.
2.	Describe technological innovation and its key features for business.
3.	Discuss innovation management and the difference between invention and innovation.
4.	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
5.	Explain innovation systems, technology management transfer and basics of technological forecasting.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
ME1504-1.1	3	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.2	3	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.3	2	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.4	2	2	-	-	-	1	1	-	1	-	-	1
ME1504-1.5	3	2	-	-	-	1	1	-	1	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., "Innovation and Entrepreneurship Theory, Policy and Practice", Springer, 2015.

REFERENCE BOOKS:

1. Dick Whittington, "Digital Innovation and Entrepreneurship", Cambridge University Press, 2018.

E Books / MOOCs/ NPTEL

1. https://krishi.icar.gov.in/jspui/bitstream/123456789/46063/1/21_Technological%20forecasting.pdf dtd 12/06/2022
2. http://www.oipec.eu/wp-content/uploads/2017/07/Introduction-to-Technology-Forecasting.pdf dtd 12/06/2022

INTEGRATED AUTOMOTIVE SAFETY

Course Code:	**ME1505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite			

Teaching Department: Mechanical Engineering	
Course Objectives:	
1.	To provide students with a foundational understanding of the critical need for enhanced road safety and to educate students on the integrated approach to automotive safety, focusing on accident-avoidance strategies and understanding the various factors that contribute to accidents.
2.	To introduce students to Advanced Driver Assistance Systems (ADAS), explaining their significance in the context of autonomous driving. Familiarize students with the terminologies, definitions, and the role of ADAS in enhancing vehicle safety and autonomy.
3.	To introduce students to the concepts of primary and secondary restraint systems, focusing on the mechanisms involved in mitigating injuries during accidents.
4.	To provide a comprehensive understanding of how primary and secondary restraint systems work to protect vehicle occupants.
5	To offer a global overview of automotive safety regulations, including NCAP and regulations specific to India. To educate students on the importance of safety ratings and the regulatory framework that governs automotive safety standards.

UNIT-I	
Introduction to Automotive Safety:	**05 Hours**
Introduction to Automotive Safety: Need for increased road safety, definitions involved in automotive safety, driving forces for increased road safety, regulations and consumer tests. Integrated Automotive safety: Accidence avoidance and factors associated, contributing factors of driver, Vehicle and environment. Introduction to Active safety systems/ADAS: What is ADAS? Role of ADAS towards Autonomous driving, terminologies, and definitions Sensors in ADAS: Automotive RADAR, Camera, Ultrasonic Sensor, LIDAR, GNSS-GPS-IMU	
Active safety systems:	**10 Hours**
ADAS and Safety systems 1: Adaptive cruise control, Rear cross traffic Alert, Vehicle exit Alert, front cross traffic alert, forward collision warning, Vehicle turn assistance, blind spot detection, parking assistance systems, Intelligent headlight control system, occupant protection system, pedestrian protection system, Evasive steering Support. ADAS and Safety systems 2: Traffic sign recognition system, speed limit assist, lane departure warning, 360-degree surrounding view system, driver monitoring system, driver drowsiness detection, emergency brake assist, ABS, cross wind assist. Testing of ADAS: Overview, Simulation-SIL, HIL, DIL, on track tests Role of Machine Learning and Deep Learning in ADAS: Overview, Sensors and sensor fusion, ML &DL in ADAS-processors	
UNIT-II	
Passive Safety Systems	**06 Hours**
Passive Safety: Mitigation of injuries: Introduction to Primary and secondary restraints systems, mechanisms involved. Anthropomorphic Test Devices: Historical background, evolution and current ATDs in use, biomechanics, injury assessments	
Crash Simulations:	**05 Hours**

Crash Simulations: component, sub-system, and system level simulations, optimizing restraint system function, future of Automotive safety.

Materials for Automotive safety and its testing:	**04 Hours**

Materials for Automotive safety and its testing: Metals, Resigns and fabrics: overview, requirements, applications, test methods.

UNIT-III

Regulations and Ratings Overview:	**05 Hours**

Regulations and Ratings Overview: Global overview, regulations in automotive safety, NCAP, Regulations and Ratings in India.

Automotive Functional safety & Cyber security for Road Vehicles	**05 Hours**

Automotive Functional safety ISO 26262: Functional safety, Hazard analysis and risk assessment, ASIL Rankings

Cyber security for Road Vehicles: Cyber security and Automotive context, adaptation of Automotive industry, threats, and vulnerabilities to a vehicle

Course Outcomes: At the end of the course student will be able to

1.	Summarise the foundational understanding of the critical need for enhanced road safety and able to explain the integrated approach to automotive safety, focusing on accident-avoidance strategies and understanding the various factors that contribute to accidents.
2.	Explain the Advanced Driver Assistance Systems (ADAS), explaining their significance in the context of autonomous driving. Explain the terminologies, definitions, and the role of ADAS in enhancing vehicle safety and autonomy.
3.	Describe the concepts of primary and secondary restraint systems, focusing on the mechanisms involved in mitigating injuries during accidents.
4.	Demonstrate how primary and secondary restraint systems work to protect vehicle occupants.
5.	Illustrate the automotive safety regulations, including NCAP and regulations specific to India. Explain the importance of safety ratings and the regulatory framework that governs automotive safety standards.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**		
↓ Course Outcomes													1	2	3
ME1505-1.1	3	3	1	3	3	3	1	3	1	3	-	3	1	1	2
ME1505-1.2	3	3	3	3	3	3	1	3	1	3	1	3	1	1	2
ME1505-1.3	3	3	3	3	3	3	1	3	1	3	1	3	1	1	2
ME1505-1.4	3	3	3	3	3	3	1	3	1	3	1	3	1	1	2
ME1505-1.5	1	1	1	1	1	1	1	3	1	3	1	3	1	1	2

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Mathew Huang, "Vehicle Crash Mechanics".

2.	Paul Du Bois Clifford C. Chou Bahig B. Fileta Tawfik B. Khalil Albert I. King Hikmat F. Mahmood Harold J. Mertz Jac Wismans, "Vehicle crashworthiness and occupant protection".
3.	S. Shladover, "Advanced Driver Assistance Systems and Autonomous Vehicles".
REFERENCE BOOKS:	
1.	Ulrich Seiffert, Mark Gonter, "Integrated Automotive Safety Handbook, SAE International".
2.	Daniel Watzenig and Martin Horn, "Automated Driving: Safer and More Efficient Future Driving".

HUMAN RESOURCE MANAGEMENT

Course Code:	**MG1501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	To develop a meaningful understanding of HRM theory, functions and practices.
2.	To understand concepts and skills recruitment.
3.	To understand the concepts of training and development.
4.	To deal with employees' grievances, safety and health types of organizations.
5.	To understand the concepts of e-HRM.

UNIT-I

Human Resource Management & HRP	**08 Hours**
Introduction, meaning, nature, scope of HRM. Major functions of HRM, Personnel Management vs Human Resource Management, job design, job evaluation, job analysis, job specification, job enlargement, job enrichment. Role of HR Manager.HR Planning. Process HRP.	
Recruitment	**08 Hours**
Definition, Sources and Methods of Recruitment Selection: Definition and Process of Selection. Cost benefit analysis of selection. Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation. Performance Appraisal methods. Pedagogy: Chalk and talk method, Power Point Presentation	

UNIT-II

Training and development	**07 Hours**
Training v/s development, stages in training, Training Methods, Executive Development,	

Methods and Development of Management Development, Career and Succession Planning.

Compensation	**08 Hours**

Employee remuneration, rewards, Wage and Salary Administration, Bonus, fringe benefits. Internal Mobility, External Mobility, Trade union Act (Amendment) 2001.
Employee Grievances: Employee Grievance procedure. Discipline procedure
Collective bargaining; Characteristics, Necessity, Forms Safety & Health; Industrial accidents, Safety Quality circle; Meaning, Structure
Pedagogy: Chalk and talk method, Power Point Presentation

UNIT-III

IHRM and e-HRM	**09 Hours**

Managing IHRM. e-HR Activities, Global recruitment, selection, expatriates. Industrial conflict –Causes, Types, Prevention and Settlement.
Aspects of e-HRM,e-Job design & Analysis, Ethical issues in employment
Pedagogy: Chalk and talk method, Power Point Presentation

Course Outcomes: At the end of the course student will be able to

1.	Describe the basic concepts of HRM & HRP.
2.	Elucidate the HRM functions of recruitment, selections, and appraisal.
3.	Apply the training, development and compensation methods in HRD.
4.	Identify the employee grievances to spell out the remedial measures.
5.	Infer the concepts of e-HRM and I-HRM.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1501-1-1.1	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.2	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.3	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.4	3	-	-	-	-	1	-	-	1	1	-	1
MG1501-1-1.5	3	-	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1.P Courseba Rao, "Essentials of Human Resource Management & Industrial Relations", Third Revised Edition.

REFERENCE BOOKS:

1. John M. Ivancevich, "Human Resource Management", 10/e, McGraw Hill.
2. Flippo, "Human Resource Management".

E Books / MOOCs/ NPTEL

1.http://edx.nimt.ac.in/courses/course-v1:nimtX+PGDM1212+2017_H1/about

MANAGEMENT ACCOUNTING AND CONTROL SYSTEM

Course Code:	**MG1502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Apply Cost Accounting concepts and techniques in the decision making process.
2.	Make decisions such as pricing, special order pricing, make-or-buy and elimination of a part of the company or replacement of equipment.
3.	Understand the relevance of different types of costs in the decision making process such as relevant costs, sunk costs or controllable costs.
4.	Understand fundamental concepts in Financial, Cost & Management Accounting.
5.	Develop analytical skills associated with the preparation and interpretation of Financial Statement

UNIT-I

Introduction to Cost and Management Accounting and Marginal Costing	**07 Hours**
Cost Accounting – Meaning, Objectives and Scope, Management Accounting – Meaning, Objectives and Scope, Tools and Techniques of Management Accounting, Relationship of Cost Accounting, Financial Accounting, Management Accounting and Financial Management, Conflicts in Profit versus Value Maximization Principle, Role of Management Accountant in Decision Making.	
Marginal Costing	**08 Hours**
Meaning, Advantages, Limitations and Applications. Breakeven Analysis, Cost Volume Profit Analysis, P/V Ratio and its Significance, Margin of Safety, Absorption Costing: System of Profit Reporting and Stock Valuation, Difference between Marginal Costing and Absorption Costing, Income Measurement under Marginal Costing and Absorption Costing. (Practical Problems)	

UNIT II

Standard Costing and Budgetary Control	**07 Hours**
Standard Costing – Definition, Significance and Applications, Various Types of Standards, Installation of Standard Costing System-for Material, Labour, and Overhead. Variance Analysis for Materials, Labour and Overheads, Accounting Treatment of Variances. Benchmarking for Setting of Standards, Variance Reporting to Management. (Practical Problems)	
Budgetary Control	**08 Hours**

Budget Concept, Manual, Fixed and Flexible Budgets, Preparation and Monitoring of Various Types of Budgets, Budgetary Control System- Advantages, Limitations and Installation. Zero Base Budgeting, Programme and Performance Budgeting. (Practical Problems)

UNIT III

Fund Flow and Cash Flow Statement	**05 Hours**
Fund Flow Statement Analysis – Definition, Features, Steps for Preparation of Fund Flow Statement.	
Cash Flow Statement Analysis	**05 Hours**
Classification, Preparation of Cash Flow Statement, Uses of Cash Flow statement, Difference between Cash Flow and Fund Flow Statement. (Practical Problems)	

Course Outcomes: At the end of the course student will be able to

1.	Describe the Cost Accounting concepts and techniques in the decision-making process.
2.	Elucidate the Make decisions such as pricing, special order pricing, make-or-buy and elimination of a part of the company or replacement of equipment.
3.	Apply the relevance of different types of costs in the decision-making process such as relevant costs, sunk costs or controllable costs.
4.	Identify fundamental concepts in Financial, Cost & Management Accounting.
5.	Infer the analytical skills associated with the preparation and interpretation of Financial Statement

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1502-1-1.1	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.2	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.3	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.4	3	-	-	-	-	1	-	-	1	1	-	1
MG1502-1-1.5	3	-	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. M.Y. Khan and P.K. Jain. “Management Accounting”, McGraw-Hill Education
2. Robert N. Anthony, “Management Accounting”, Richard Dirwin.
3. I.M. Pandey , “Management Accounting”, Vikas Publishing House.
4. Paresh shaw, “Management Accounting”, Oxford University Press.
5. Murthy and S. Gurusamy, “Management Accounting”, McGraw Hill.
6. NM Singhvi and Ruzbeh J. Bodhanwala, “Management Accounting”, PHI learning Pvt. Ltd.

OPERATIONS AND QUALITY MANAGEMENT

Course Code:	**MG1503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Define production/operations management. Differentiate between Production and service system and types of production systems Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
	Solve problems on fundamentals of statistics and normal distribution. Draw and Analyze variable process control charts and determine process capability.
	Discuss Total Quality Management tools and methods. Calculate reliability of series and parallel systems using the information on failure rate and time.
	Solve decision-making problems using break even analysis and decision tree methods. Apply the concepts of Design and System capacity. Solve problems on faculty location using break even analysis and transportation method. Solve problems related to product and process layouts.
	Use concepts of replacement theory to solve problems of replacing items that fail gradually and suddenly.

UNIT-I

Production and Operations Management	**06 Hours**
Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, Introduction to Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).	
Philosophy of statistical process controland modeling process quality	**11 Hours**
Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits) Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems, Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma. Pedagogy: Chalk and talk method, Power Point Presentation	

UNIT II

Quality Concepts and Reliability	**06 Hours**
Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality. TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.	

Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools.
Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.

Operations Management activities	**12 Hours**

Decision Making: The decision process, characteristics of operations decisions, use of models - decision making environments. Break even Analysis, Decision trees.
Capacity Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity. Design, System an actual capacity. System efficiency and utilization. Determination of Equipment requirement for a single stage production processes. Numerical problems on the above.
Facilities location planning: Need for location decisions, nature of locations decisions, general procedure for making locations decisions, Use of Breakeven analysis and Transportation algorithms for making location decisions.
Facilities layout planning: Need for layout decisions. Minimizing material handling cost in process ayout using Load distance analysis, Simple line balancing problems in product layout.

UNIT III

Replacement Theory	**05 Hours**

Replacement policy for equipment which deteriorates gradually. Replacement of items that fail suddenly.
Pedagogy: Chalk and talk method, Power Point

Course Outcomes: At the end of the course student will be able to

1.	Define production/operations management. Differentiate between Production and service system and types of production systems Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
2.	Solve problems on fundamentals of statistics and normal distribution. Draw and Analyze variable process control charts and determine process capability.
3.	Discuss Total Quality Management tools and methods. Calculate reliability of series and parallel systems using the information on failure rate and time.
4.	Solve decision-making problems using break even analysis and decision tree methods. Apply the concepts of Design and System capacity. Solve problems on faculty location using break even analysis and transportation method. Solve problems related to product and process layouts.
5.	Use concepts of replacement theory to solve problems of replacing items that fail gradually and suddenly.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	1 1	12

MG1503-1-1.1	2	1	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.2	2	2	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.3	1	1	-	-	-	-	-	-	-	-	2	-
MG1503-1-1.4	3	2	-	-	-	-	-	-	-	-	3	-
MG1503-1-1.5	1	1	-	-	-	-	-	-	-	-	1	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Joseph G Monks, "Production / Operations Management", McGraw Hill Books
2. William J Stevenson, "Production and Operations Management", Tata McGraw Hill, 8th Edition.
3. RC Gupta, "Statistical Quality Control", Khanna Publishers, New Delhi, 2005.
4. N.D. Vohra, "Quantitative Techniques in Management", Tata McGraw Hill, 2015

REFERENCE BOOKS:

1. E.L. Grant and R.S. Leavenworth, "Statistical Quality Control", 7th edition, McGraw- Hill publisher, 2004.
2. Prem Kumar Gupta, D S. Hira, "Operations Research", S Chand Publications, New Delhi, 2nd edition 2008, Prentice Hall.
3. W S Messina, "Statistical Quality Control for Manufacturing Managers", Wiley & Sons, Inc. New York, 1987
4. Montgomery, Douglas, "Statistical Quality Control", 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ.
5. Jerry Banks, "Principles of Quality Control", Wiley & Sons, Inc. New York.

ORGANIZATIONAL BEHAVIOUR

Course Code:	**MG1504-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	Describe the Nature and Characteristics, Determinants and Approaches of Organizational Behaviour. Describe the concepts of Perception, Attitudes and values and their implications.
2.	Describe the concepts of learning and motivation along with their managerial implications.
3.	Describe the concepts of Leadership along with their managerial implications.
4.	Discuss the concepts of group dynamics and conflict management along with their implications.
5.	Discuss the concepts of Organization culture and change and conflict management along with their implications.

UNIT-I	**15 Hours**

Introduction: Conceptual Foundation of Organisational Behaviour; Nature and Characteristics; Determinants; Contributing Disciplines; Challenges and Opportunities for Organisational Behaviour, Models and Approaches of Organizational Behaviour, OB and Emotional Intelligence.
Perception, Attitude, and Values: Nature, Process, Importance, Factors Influencing Perception; Attribution Theory of Perception; Issues Involved in Perception: Selective Perception, Halo Effect, Contrast Effect, Projection, Stereotyping; Concept of Pygmalion Effect; an overview of Emotions and feelings, Values, Beliefs and Attitudes with Managerial Implications.
Learning: Concept; Theories of Learning: Conditioning, Social Learning, Managerial Implication of Learning Theories. Reinforcement.
Motivation: Concept, Major Theories and Process of Motivation: Maslow's Need-Hierarchy Theory; Herzberg's Motivation-Hygiene Theory; McGregor's Theory X and Theory Y; Goal-Setting Theory; ERG Theory; Vroom's Expectancy Theory; Equity Theory; Managerial implications of Various Theories.
Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

UNIT II	**15 Hours**

Leadership: Concept and Functions; Style and Theories of Leadership: Traits, Behavioural and Situational/ Contingency Groups of Theories; Inspirational approaches to Leadership; Charismatic Leadership, Transformational Leadership, and Transactional Leadership, Contemporary Leadership Roles; Challenges to the Leadership Construct; Substitutes and Neutralizers to Leadership.
Group Behaviour: Groups: Concept and Classification; Stages of Group Development; Group Structure; Roles and Norms; Premise and Issues; Group Decision-Making: Group vs Individual;
Groupthink and Groups Shift; Group Decision Making Techniques and Process.
Conflict Management: Concept; Causes; Types; Stages; Effects; Management of Conflicts.
Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

UNIT III	**10 Hours**

Organizational Culture: Concept; Dominant Culture; Strong vs Weak Cultures; Creating and Sustaining Culture; Employees Learning of The Culture; Creating a Customer-Responsive Culture.
Organizational Changes: Concept and Forces for Change; Managing Planned Changes; Resistance to Change; Approaches to Manage Organizational Change; Organizational Development;
Culture-Boundedness of Managing the Change.
Pedagogy: Chalk and talk method, Power Point Presentation, Case studies

Course Outcomes: At the end of the course student will be able to

1.	Describe the Nature and Characteristics, Determinants and Approaches of Organizational Behaviour. Describe the concepts of Perception, Attitudes and values and their implications.

2.	Describe the concepts of learning and motivation along with their managerial implications.
3.	Describe the concepts of Leadership along with their managerial implications.
4.	Discuss the concepts of group dynamics and conflict management along with their implications.
5.	Discuss the concepts of Organization culture and change and conflict management along with their implications.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1504-1-1.1	2	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.2	2	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.3	1	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.4	3	-	-	-	-	-	-	-	3	1	-	-
MG1504-1-1.5	1	-	-	-	-	-	-	-	-	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Robbins, SP Stephen P, Timothy Judge and Nehasika Vohra, "Organisational Behaviour", 12th or 16th edition, Pearson Education, 2011.
2. Fred Luthans, "Organisational Behaviour", 11th edition, Mc Graw Hill, 2009.

REFERENCE BOOKS:

1. W. Newstrom, John, "Organisational Behaviour", 10th edition, Tata Mc Graw –Hill 2009.
2. Paul Heresy, Kenneth H. Blanchard, and Dewey E. Johnson, "Management of Organisational Behaviour", Leading Human Resources, 2008.
3. Dr S S Khanka, "Organisational Behaviour", S. Chand & Co, New Delhi, 2008.
4. Sanghi Seema, "Organisational Behaviour", Pearson, 2011.

TAXATION FOR ENGINEERS

Course Code:	**MG1505-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Management

Course Objectives:

1.	To make students understand the overview of Income Tax Law in India.
2.	To make students understand the basic concepts of income tax such as residential status, tax incidence.

3.	To make students understand the income tax provisions involved in determination of income from salary, House property, business and profession, capital gain and other sources.
4.	To help students understand the determination of tax liability Individual assessees.
5.	To make students understand the deductions u/s 80.

UNIT-I	
Basic concepts and Explanation under various Heads of Income	**15 Hours**
Basic concepts: Assessment Year, Previous Year, Person, Assessee, Income, Charges on Income, Gross Total Income, Capital and Revenue Receipts, Residential status, Connotation of income, Deemed to accrue or arise in India, Incidence of tax, Tax Planning, Tax Evasion, Tax Management. (Problems on Residential Status of Individual assessee) Explanation under various Heads of Income: Income from Salary (theory, basic and full-fledged problems on allowances, perquisites and retirement benefits)	
UNIT II	
Income under the head Profit and gains of Business or Professions and Income under Capital Gain	**15 Hours**
Income under the head Profit and gains of Business or Professions and its computation - basis - Method of accounting - Scheme of business deductions/ allowance - Deemed profits - maintenance of books, (Problems on computation of Income from Business/ Profession of Individual assessee) Income under Capital Gain: Basis of charge, Transfer of capital asset, inclusion & exclusion from Capital Asset, Capital Gain, Computation of Capital Gains (theory & problems), Exemptions/deductions from capital gains	
UNIT III	
Income from House Property and Other Sources	**10 Hours**
Income from House Property - Basic problems on House Property Income from Other Sources (theory only) Deductions under section 80C to 80U (No problems - Provisions only)	

Course Outcomes: At the end of the course student will be able to

1.	Exhibit an understanding of the Income Tax Law in India.
2.	Identify the nature of Incomes and their tax incidence.
3.	Demonstrate how to determine the income from salary, house property, business and profession, capital gain.
4.	Demonstrate the determination of tax liability of Individual assessees.
5.	Exhibit a clear understanding of various provisions of deductions u/s 80.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
MG1505-1-1.1	2	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.2	2	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.3	3	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.4	3	-	-	-	-	1	-	-	1	-	2	1
MG1505-1-1.5	3	-	-	-	-	1	-	-	1	-	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Vinod Singhania, "Students Guide to Income Tax", Taxman Publications.
2. Mehrotra & Goyal, "Direct Tax", Sahitya Bhavan.
3. Lal &Vashisht, "Direct Tax", Pearson Ed. 28E.
4. V S Datey, "Indirect Taxes", Taxman Publications.
5. Vinod Singhania, "Direct Taxes", Taxman Publications.
6. T N Manoharan, "Students Guide to Income Tax", Snow White.
7. Kul Bushan, "How to deal with VAT", Pearson Education/PHI, 1/e.
8. Mahesh Chandra &Shukla , "Income Tax Law & Practice", Pragathi Publications.
9. Dr.Pillai, "VAT", Jaico Publications.

WORKING CAPITAL MANAGEMENT

Course Code:	**MG1506-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Need of the Course: The course will enable the student to manage activities in the area of working capital in an enterprise and help the students to do advance study in the field of financial management through detailed analysis of financial statements, liquidity crises, cash optimization, credit analysis etc. The student will learn how to apply sound techniques for managing inventory.

Description of the Course: Every business needs adequate liquid resources in order to maintain day-to-day cash flow. It needs enough cash to pay wages and salaries as they fall due and to pay creditors if it is to keep its workforce and ensure its supplies. Maintaining adequate working capital is not just important in the short-term. Sufficient liquidity must be maintained in order to ensure the survival of the business in the long-term as well. Even a profitable business may fail if it doesn't have adequate cash flow to meet its liabilities as they fall due.

Teaching Department: Management

Course Objectives:

1.	Discuss the importance of working capital management.
2.	Evaluate working capital requirement.
3.	Assess the challenges faced in managing working capital in domestic and international operations.
4.	Plan for financing working capital requirement.

UNIT-I

Working Capital Decisions, Working Capital Management and Sources of Working Capital	**15 Hours**

Working Capital Decisions: Meaning, Concepts, components Importance & types of working Capital.
Working Capital Management: Meaning, objectives, Principles, Importance of adequate working capital & consequences of inadequate working capital, Dangers of excessive working capital, determinants of working capital - operating cycle and Cash cycle. Approaches to determine an appropriate financing mix, Estimation of working capital requirements (problems) important working capital ratios.
Sources of Working Capital: Financing of long term working capital & short term working capital. Factoring - Meaning mechanism, Functions, types, merits & demerits.

UNIT II

Liquidity Management and Receivable Management	**15 Hours**

Liquidity Management: Cash Management - Meaning - Objectives of Cash Management - Nature of Cash - Motives of holding cash - Cash Management planning aspects - Cash Budgets (Problems), Cash Management control aspects - Concentration banking - Lock box system - Playing the float - Cash Management models - William J Baumol Model - Miller-Orr Model (Problems using these models)

Receivable Management: Definition, Objectives, cost and benefits of receivable. Credit policy & its variables. Types of Credit policy & their merits & demerits, Factors influencing the size of investment in receivables. Control of receivables. Framing optimum credit policy & Average collection period (Problems)

UNIT III

Inventory Management	**10 Hours**

Meaning of Inventory - Need/Purpose of holding inventory - Benefits of holding inventory - Risk and cost of holding inventory - Management of Inventory - Objectives of Inventory Management - Techniques of Inventory Management - Economic Order Quantity (EOQ) -

Determination of Stock levels - ABC analysis - Just in Time (JIT).

Course Outcomes: At the end of the course student will be able to

1.	Understand the meaning of working capital
2.	Realize the importance of management of working capital in an organization
3.	Learn about some key liquidity ratios used to understand more about a business' working capital position
4.	Understand various techniques used to manage working capital.
5.	Be aware of the techniques of cash, inventory and receivables management.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1506-1-1.1	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.2	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.3	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.4	2	-	-	-	-	1	-	-	-	1	2	1
MG1506-1-1.5	2	-	-	-	-	1	-	-	-	1	2	1

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Sekhar Satya G.V., "Working Capital Management", 1/e; New Delhi: Wiley, 2014.
2. Bhalla V. K., "Working Capital Management", 1/e; New Delhi: S. Chand Publishing, 2014.
3. Sagner James S., "Working Capital Management, Applications and Cases", 1/e, New Delhi: Wiley, 2015.

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT

Course Code:	**MG1507-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Objectives:

1.	Analyse the time value of money.
	Evaluate the worth of creations, by comparing the alternatives visa, vis the cost (cost-benefit analysis).
	Take decisions with the limited resources, the relevant course of action, with the help of suitable tools.
	Determine the depreciated values of assets and also cost involved in each operation, a product should undergo with an aim to fix suitable selling price for the products.
	Know the fundamentals of Financial Management.

UNIT-I

Fundamental economic concepts	**07 Hours**
Consumer goods, Producer goods, Factors of production, Economy of organization, Demand theory, Law of demand, Exceptions to law of demand, Law of supply, Determinants of supply, Law of increasing returns and law of diminishing returns(No exercises)	
Interest	**07 Hours**
Rate of interest, Determining rate of interest, Time value of money, Simple interest, Compound interest, Nominal and effective interest rate, Equivalence involving interest, Interest formulae [single payment, uniform series and arithmetic gradient only], problems using interest formulae [discrete compounding only].	

UNIT II

Economic Analysis of Alternatives	**09 Hours**
Analysis based on: Present Worth [equal life and unequal life situations], Future Worth, Equivalent Annual Worth, Exercises. Analysis based on Rate of Return, Exercises.	
Depreciation	**04 Hours**
Causes of depreciation, Depletion, Methods of depreciation [Straight line, Declining balance, Double declining balance] Exercises.	
Estimating and Costing	**03 Hours**
Components of cost [Material cost, Labour cost, Overhead expenses, Prime cost, Factory cost, Total cost], Determination of selling price of a product, Exercises.	

UNIT III

Financial management	**05 Hours**
Terminologies used in accounting, Journal and ledger, Profit and loss statement, Balance sheet, Understanding basic financial ratios, Simple exercises.	
Working Capital Management	**05 Hours**
Factors influencing working capital requirement, determination of operating cycle and working capital. **Capital Budgeting:** Risk analysis in Capital Budgeting	

Course Outcomes: At the end of the course student will be able to

1.	Explain the fundamental economic concepts.
2.	Use simple interest and compound interest to determine compounded and discounted amount.
3.	Compare the alternatives using Present Worth, Equivalent Annual Worth, Future Worth and IRR methods.
4.	Calculate the depreciated amount of a given assets using Straight line, Declining balance, Double declining g balance method. Estimate the selling price of given product.
5.	Prepare Balance Sheet & Profit and Loss account for given data of a firm. Estimate working capital. Explain capital budgeting.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
MG1507-1.1	3	1	-	-	-	1	-	-	1	1	-	1
MG1507-1.2	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.3	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.4	2	3	-	-	-	1	-	-	1	1	-	1
MG1507-1.5	2	3	-	-	-	1	-	-	1	1	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Riggs J.L., "Engineering Economics", 4th edition, Tata McGraw-Hill, 2004.
2. Banga and Sharma, "Mechanical Estimating and Costing", 16^{th} edition, Khanna Publishers, 2012.
3. I M Pandey, "Financial Management", Vikas Publishing House, 2002.

REFERENCE BOOKS:

1. E Paul Degarmo, "Engineering Economy", Macmillan Publishing, 2001.
2. Gerald J Thuesen & W J Fabrycky, "Engineering Economy", Prentice Hall of India, 9th ed.
3. Tarachand, "Engineering Economics", Nemchand& Bros, 1996.

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/courses/112107209/

NANOTECHNOLOGY

Course Code:	**PH2501 -1**	**Course Type**	**OEC**

Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH1001 -1**		

Teaching Department: PHYSICS

Course Objectives:

1.	To understand the basic scientific concepts of nanoscience, properties of nano materials, synthesis and fabrication of nano materials.
2.	To understand the various characterization techniques of nano materials.
3.	Study of carbon nano technology and its characterizations.
4.	To understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

Properties of Materials	**07 Hours**

Introduction: History of nano science, definition of nano meter, nanomaterials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes, Band structure.
Properties Of Materials: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

Synthesis and Fabrication	**08 Hours**

Synthesis of bulk polycrystalline samples, growth of single crystals, Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography, Requirements for realizing semiconductor nano structure, growth techniques for nano structures.

UNIT-II

Characterization Techniques	**15 Hours**

X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy (TEM), scanning probe microscopy (SEM), atomic force microscopy (AFM), piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, UV-VIS-IR Spectrophotometers, Magnetic and electrical measurements, and Infrared/ Raman, EPR and NMR

UNIT-III

Carbon Nano Technology	**05 Hours**

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, and applications of carbon nano tubes.

Applications of Nano Technology	**05 Hours**
Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.	

Course Outcomes: At the end of the course student will be able to

1.	Ability to choose the appropriate nano material to meet the requirerment of a particular application.
2.	Identify the essential concepts used in nanotechnology.
3.	Identify the materials, properties, synthesis, and fabrication of nanomaterials.
4.	Understand the various characterization techniques of nano materials.
5.	Applications of nanomaterials in various fields

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
PH2501-1.1	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.2	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.3	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.4	3	3	-	-	-	-	-	-	-	-	-	-
PH2501-1.5	3	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1.M.S. Ramachandra Rao, Shubra Singh, "Nano science and nano technology", Wiley publishers.

REFERENCE BOOKS:

1. Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nano Technology", Wiley publishers.
2. Jermy J Ramsden, "Nanotechnology", Elsevier publishers.
3. A.K. Bandyopadhyay, "Nano Materials", New Age publishers.
4. T. Pradeep, "Nano Essentials", TMH.
5. M. A. Shah, "Nanotechnology the Science of Small", Wiley publishers.
6. Phani Kumar, "Principles of Nanotechnology", Scitech.

E Books / MOOCs/ NPTEL

1. https://youtu.be/ebO38bbq0_4
2. https://youtu.be/0MzIh7wkgMs

OPTOELECTRONIC DEVICES

Course Code:	**PH2502-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH1001 -1**		

Teaching Department: PHYSICS

Course Objectives:

1.	To understand the basic principles of construction, working and applications of various optoelectronic devices.
2.	Study of sources of radiation like lasers and LED, their specific properties and hence their use for applications.
3.	Study of radiation detectors like semiconductor detector, diode as detector and photo multiplier.
4.	Understanding the fabrication and applications of optical fibers, optical modulators and waveguides for optical communication

UNIT-I

Optical processes in Semiconductor, Display devices & Optical fibers	**15 Hours**

Elements of optical phenomena in Semiconductors- fundamentals of Fermi-Dirac distribution, band structure, direct and indirect band gap semiconductors, generation-recombination mechanisms, absorption and emission processes.
Display devices- cathode ray tube, liquid crystal display, charge coupled devices, plasma display.
Optical fibers- types of fibers, modes of propagation, attenuation and losses, optical fiber communication system, advantages.

UNIT-II

Optical Sources and Detectors	**15 Hours**

Lasers- basic principles, optical resonator-types, modes and quality factor, practical lasers- Nd-YAG, CO2, Excimer laser, Semiconductor laser- basic structure, laser action, heterojunction laser, quantum well laser, applications.
Light emitting diode- electroluminescence in p-n junction, LED characteristics, efficiency and responsivity, Heterojunction LED, Surface-Emitting LED and Edge emitting LED.
Photo detectors- photo conductor detector, junction photo diode, p-i-n photo diode, avalanche photo diode. Photo multiplier tube.

UNIT-III

Integrated Optics and Modulators	**10 Hours**

Modulation of light- Analog and digital modulation, Direct modulation - using LED and Semiconductor diode laser (SDL). External modulation - Electro-optic modulators (Pockels effect), Electro-absorption modulators. Acousto-optic modulation. Waveguides- device structure, waveguide devices – waveguide lenses, light bending devices, optical power dividers, directional couplers, waveguide polarizer, wavelength multiplexers and demultiplexers. Waveguide coupling. Optoelectronic integrated circuit

Course Outcomes: At the end of the course student will be able to

1.	Ability to choose the appropriate device to meet the requirement of a particular application.
2.	Making modifications to device structures by understanding the factors affecting their performance.
3.	Attempting better efficiency and utility through an understanding of the principles of performance.
4.	Use the technical knowledge acquired to troubleshoot and rectify devices and circuits.
5.	Explore the possibility of designing devices with better characteristics.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
PH2502-1.1	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.2	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.3	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.4	3	3	-	-	-	-	-	-	-	-	-	-
PH2502-1.5	3	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. P.R.Sasikumar, "Photonics – an introduction", PHI Learning Pvt.Ltd.,New Delhi, 2012 edition.
2. Pallab Bhattacharya, "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 2006.

REFERENCE BOOKS:

1. J.Wilson and J.Haukes, "Opto electronics- an introduction", Prentice Hall of India, New Delhi.
2. Jasprit Singh, '"Opto electronics- an introduction to Materials and Devices", McGraw Hill international ed., 1998.
3. A.Ghatak and Thyagarajan, "Introduction to opto electronics", New Age International Publication.

E Books / MOOCs/ NPTEL

1. http://nptel.ac.in/courses/115102026/

AUTONOMOUS MOBILE ROBOTS

Course Code:	**RI2501-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EC 1001-1, ME 1003-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	Explain different types of locomotion in mobile robots to obtain a required task.
2.	Understand the different types of kinematics and dynamics involved in a mobile robot.
3.	Study the different types of sensors used in an autonomous mobile robot.
4.	Understand the different types of algorithms to identify the position of the mobile robot.
5.	Understand the various algorithms for planning and navigation of the mobile robot.

UNIT-I

Robot locomotion	**07 Hours**
Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, and controllability.	
Mobile robot kinematics and dynamics	**09 Hours**
Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots.	

UNIT-II

Perception	**07 Hours**
Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-based sensors, vision-based sensors, uncertainty in sensing, filtering.	
Localization	**07 Hours**
Odometric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, and positioning beacon systems.	

UNIT-III

Introduction to planning and navigation	**10 Hours**
Path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP).	

Course Outcomes: At the end of the course student will be able to

1.	Explain different types of locomotion in mobile robots to obtain a required task.
2.	Identify the different types of kinematics and dynamics involved in a mobile robot.
3.	Apply the different types of sensors used in an autonomous mobile robot.
4.	Apply the different types of algorithms to identify the position of the mobile robot.
5.	Apply the various algorithms for planning and navigation of the mobile robot to reach the destination.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
RI2501-1.1	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.2	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.3	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.4	3	3	3	3	2	1	-	-	-	-	-	3
RI2501-1.5	3	3	3	3	2	1	-	-	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. R. Siegwart, I. R. Nourbakhsh, “Introduction to Autonomous Mobile Robots”, The MIT Press, 2011.
2. Peter Corke, "Robotics, Vision and Control: Fundamental Algorithms in MATLAB", Springer Tracts in Advanced Robotics, 2011.
3. S. M. LaValle, “Planning Algorithms”, Cambridge University Press, 2006. (Available online http://planning.cs.uiuc.edu/)

REFERENCE BOOKS:

1. Thrun, S., Burgard, W., and Fox, D., "Probabilistic Robotics". MIT Press, Cambridge, MA, 2005.
2. Melgar, E. R., Diez, C. C., "Arduino, and Kinect Projects: Design, Build, Blow Their Minds", 2012.
3. H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, "Principles of Robot Motion: Theory, Algorithms, and Implementations", PHI Ltd., 2005.

E Books / MOOCs/ NPTEL

1. https://archive.nptel.ac.in/courses/112/106/112106298/
2. https://www.edx.org/course/autonomous-mobile-robots

MEDICAL ROBOTICS

(For All except AI)

Course Code:	**RI2502-1**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**PH 1001-1, IS 1001-1, CY 1001-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	Understand the types of medical robots used in the field of healthcare.
2.	Explain the various localization and tracking sensors
3.	Understand the applications of surgical robots with the help of few case studies
4.	Understand Rehabilitation of limbs and brain machine interface with the help of few case studies
5.	Understand the design methodology of medical robots.

UNIT-I

Introduction	**07 Hours**
Types of medical robots - Navigation - Motion Replication - Imaging - Rehabilitation and Prosthetics - State of art of robotics in the field of healthcare. Localization And Tracking	
Position sensors requirements	**09 Hours**
Tracking - Mechanical linkages - Optical - Sound-based - Electromagnetic -Impedance-based - In-bore MRI tracking - Video matching - Fiber optic tracking	

UNIT-II

Control Modes Radiosurgery	**07 Hours**
Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery – Neurosurgery – case studies.	
Rehabilitation	**07 Hours**
Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles – case studies.	

UNIT-III

Design of Medical Robots	**10 Hours**
Characterization of gestures to the design of robots- Design methodologies- Technological choices - Security	

Course Outcomes: At the end of the course student will be able to

1.	Describe the types of medical robots and the concepts of navigation and motion replication.
2.	Describe about the sensors used for localization and tracking
3.	Explain the applications of surgical robots
4.	Explain the concepts in Rehabilitation of limbs and brain machine interface
5.	Classify the types of assistive robots and analyze the design characteristics, methodology and technological choices for medical robots.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
RI2502-1.1	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.2	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.3	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.4	3	-	1	-	-	-	-	-	-	-	-	1
RI2502-1.5	3	-	3	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, "Robot Modeling and Control", Wiley Publishers, 2006.
2. Paula Gomes, "Medical robotics- Minimally, Invasive surgery", Woodhead, 2012.
3. Achim Schweikard, Floris Ernst, "Medical Robotics", Springer, 2015.

REFERENCE BOOKS:

1. Jocelyne Troccaz, "Medical Robotics", Wiley-ISTE, 2012.
2. Vanja Bonzovic, "Medical Robotics", I-tech Education publishing Austria, 2008.
3. Daniel Faust, "Medical Robotics", Rosen Publishers, 2016.
4. Jocelyne Troccaz, "Medical Robotics", Wiley, 2013.

E Books / MOOCs/ NPTEL

1. https://www.futurelearn.com/courses/medtech-ai-and-medical-robots
2. https://web.stanford.edu/class/me328/

PLC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS

(For All except AI)

Course Code:	**RI2503-1**	**Course Type**	**OEC**
Teaching Hours/Week (L: T: P):	**3:0:0**	**Credits**	**03**
Total Teaching Hours	**40**	**CIE + SEE Marks**	**50+50**
Prerequisite	**EE 1001-1, EC 1001-1**		

Teaching Department: Robotics and Artificial Intelligence

Course Objectives:

1.	To understand the fundamentals of fluid power transmission systems
2.	To design various hydraulic system components.
3.	To design various pneumatic system components.
4.	Learn various types of hydraulic and pneumatic power circuits.
5.	Learn various types of applications in fluid power circuits using PLC.

UNIT-I

Fluid power systems and fundamentals	**06 Hours**
Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, General types of fluids - Properties of hydraulic fluids -Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law	
Hydraulic system components	**05 Hours**
Sources of Hydraulic Power: Pumping theory - Pump classification - construction and working of pumps - Variable displacement pumps, pump performance. Actuators: Linear hydraulic actuators-Single acting and double acting cylinders, Rotary actuators - Fluid motors.	
Control Components	**04 Hours**
Direction control valve - Valve terminology - Various center positions. Shuttle valve - check valve - pressure control valve - pressure reducing valve, sequence valve. Flow control valves - Fixed and adjustable Safety valves.	

UNIT-II

Pneumatic system components	**07 Hours**
Pneumatic Components: Properties of air. Compressors. FRL Unit -Air control valves, Quick exhaust valves and pneumatic actuators- cylinders, air motors. Basics of low-cost automation	
Fluidics & Pneumatic circuit design	**08 Hours**
Fluidics - Introduction to fluidic devices, simple circuits. Introduction to Electrohydraulic Pneumatic logic circuits, PLC applications in fluid power control, Sequential circuit design for simple applications using classic, cascade, logic with Karnaugh- Veitch Mapping and combinational circuit design methods.	

UNIT-III

Fluid power circuits	**10 Hours**
Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram	

for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

Course Outcomes: At the end of the course student will be able to

1.	Compare the basics of hydraulics to the performance of fluid power systems
2.	Explain the working principle of hydraulic systems including pumps and control components.
3.	Explain the working principle of pneumatic systems and their components.
4.	Design various types of Electrohydraulic and electro pneumatic circuits
5.	Design various types of applications in fluid power circuits using PLC.

Course Outcomes Mapping with Program Outcomes

Program Outcomes→ **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
RI2503-1.1	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.2	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.3	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.4	3	2	3	2	3	-	-	-	-	-	-	3
RI2503-1.5	3	2	3	2	3	-	-	-	-	-	-	3

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Majumdar S.R., "Pneumatic systems - Principles and maintenance", Tata McGraw Hill, 2008.
2. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2009.

REFERENCE BOOKS:

1. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.
2. Harry L. Stevart D. B, "Practical guide to fluid power", Taraoeala sons and Port Ltd.Broadey, 2010.
3. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 2011.
4. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 2011.

E Books / MOOCs/ NPTEL

1. https://nptel.ac.in/courses/108/105/108105088/
2. https://plc-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering
3. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/COEP_KNOWLEDGE_SEEKERS/labs/exp1/theory.html

Value Added Courses

PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON			
Course Code	**noc25-cs59**	**Course Type**	**NPTEL**
Total Teaching Hours	**8 Weeks**	**Credits**	**0**
Prerequisite	**NIL**		

Week 1	Informal introduction to programming, algorithms and data structures via gcd Downloading and installing Python, gcd in Python: variables, operations, control flow - assignments, conditionals, loops, functions
Week 2	Python: types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values, List operations: slices etc, Binary search, Inductive function denitions: numerical and structural induction, Elementary inductive sorting: selection and insertion sort, In-place sorting
Week 3	Basic algorithmic analysis: input size, asymptotic complexity, O() notation, Arrays vs lists, Merge sort, Quicksort, Stable sorting
Week 4	Dictionaries, More on Python functions: optional arguments, default values, Passing functions as arguments, Higher order functions on lists: map, lter, list comprehension
Week 5	Exception handling, Basic input/output, Handling files, String processing
Week 6	Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested functions, Data structures: stack, queue, Heaps
Week 7	Abstract datatypes, Classes and objects in Python, "Linked" lists: find, insert, delete, Binary search trees: find, insert, delete, Height-balanced binary search trees
Week 8	Effcient evaluation of recursive definitions: memorization, Dynamic programming: examples, Other programming languages: C and manual memory management, Other programming paradigms: functional programming

TECHNOLOGY BUSINESS - INTERACTIONS			
Course Code		**Course Type**	**VAC**
Total Teaching Hours	**15 Hours**	**Credits**	**0**
Prerequisite	**NIL**		

1 Preamble

Why this course on business and technology interactions? What is the focus of our CS and IS program and what should it be? For whom this course is intended? Why is this topic important? Are both business and technology aligned? Will technology help in scaling up a business? Are business directions Clear, easy and explicit or complicated? Are future directions definable? Why is Digital Transformation important? It is a tsunami in 21st century. It affects all sections - people, business, society, government, ngo, and all sectors - with many new ones like education, health, agriculture, local governments, urban problems, smart city, security, transport. It has changed media - tv to ott. Youtube , social media . Changed markets. It changed totally from 20th century practices to 21st century practices, a highly opposite set of changes. Changes were fast - mobile, AI, That is difficult to understand and adjust to its philosophy. The next or even the current ongoing stage is AI inclusive transformations.

2 Introduction - scenario setting

Business scenario: What was business yesterday? What is business today? Why do businesses die? What is disruption? How do we prevent the decay of a business? What is a business model? - goals, objectives of business, success constraints, values or differentiation, overview of relationships with stakeholders, growth aspects, What are the types of businesses- manufacturing, logistics, metallurgy, services, finance, regulation etc? What are business objectives, value proposition? Why is a strategy important for business? What is an enterprise?

3. Technology scenarios introduction

What is technology, and What is engineering? What are the characteristics of technology today? How do we build convergence? How do we make technology borderless? Is it complex? How do we build technology culture in a business? How do we customise technology? How do we architect various subsystems ? How do we re-engineer the overall business technology system? How do we integrate?

4. Transformation scenarios

Early tech injections into manufacturing. Stages of transformations, What is IT? Why have IT services become very important for the survival of businesses? What is the role of data ? How do we manage and use data? Transformation approaches - top down, bottom up- admin to functions, user end to back end, decomposition, sequencing, Transformations in 20th century vs 21st century- changes seen.

5. IT applications in business

Social media, SMAC Information management Data and functions management Remote and online Customer connect and services Business intelligence Systems engineering New products and services New hypotheses- innovations – Netflix Features of Enterprise IT - scalability, millions of concurrent processes, millions of connections, growing every year, smooth changes, seamless integration, business continuity- high reliability-, Enterprise data, user friendly, online fast responses - high throughputs , high response time , user interactions, explanatory software Activities, Hype cycle of tech adoption. Each year, Gartner creates more than 90 Hype Cycles in various domains as a way for clients to track technology maturity and future potential. The five phases in the Hype Cycle are Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity. This year, Gartner organized the 17 technologies into five major trends: Democratized artificial intelligence (AI), digitalized ecosystems, do-it-yourself biohacking, transparently immersive experiences and ubiquitous infrastructure.

6. Components of an IT in a large organization like a bank

Servers- production, Test servers, Application software, Loan management, Workflow, Branch automation, Comm interface, Mobile apps interface, MIS and data analytics, Reports generator, CRM, Data management and storage units SAN, Multiple networking, Wide area network, Network routers, switches, Multiple communications for redundancy - two operators, 4G, VSAT, NOS, Interbank and RBI networks, ATM switch, Security devices, SOC, Internet LAN, Client PCs in a LAN, Support infra power, DG, UPS, AC, Data centre, DR centre, Near Data, centre, Data loss minimization, Fast recovery through dumps and audit trail, Business process continuity measures, Dashboards for different people

7. Role of a transformation engineer

Initial period - implementation and maintenance , testing, - basic technology skills, Next level - execution engineer- transformation skills, communications skills, business skills, Next level- Platform and vendor selection - market skills , domain and tech skills, Next level - modeling and design- application skills , multi tech knowledge , domain skills, Next level - architect - multi dimensional skills , coordination skills, Next level - integration planning and design - deep knowledge of techs and business processes, Next level - project leader - tech, business , communications and leadership skills, To grow - inside view or tech view is not enough. We need out in and in out views , domain knowledge, application understanding, communications. Ownership and leadership skills.

8. What is digital transformation?

Definition, Digital first. 20th century principles vs 21 st century principles. Basic characteristics of digital-The cornerstone of digital economy is digital technologies, which include big data (as resource), cloud (as platform), Internet of things (as transmission), block chain (for reliance) and artificial intelligence (for intelligence). Data focus, customer focus, people focus Global Scale "Swiggy is now partnered with close to 3,00,000 restaurants across the country," Digital economy is user-oriented economy. Internet becomes closest to user with zero distance in space and real time information transfer, which derives many new modes of economy—user economy, platform economy, sharing economy, service economy and value economy are served to users, around to users, enhancing user experience and taking the needs of the users as priority. Digital economy is positioned in C2B, which has created and attained maximized value for users all along. Internet and web dependent, chatbots, AI focus Interactive, connected, online High potentials for new products or services Automation orientation - simplifies operations, reduces errors and costs, gives a fast response, Scale - go global Agility- incremental additions Continuous changes and adaptation Integrated People oriented- front-end is important. Customer needs matched Feedbacks and fast response Asset reductions Collaborative, outsourcing Digital economy is essentially an innovation oriented economy, which is talent oriented and placing the creativity of talents at the first place, emphasizing self-motivation and self-development of human being. New economy calls for new leadership which is based on value, and the key of its value lies on cognition. The level of cognition is shown in two aspects: (i)The cognition of space—as the iceberg can see 1/8 above the water and actually it possesses 7/8 below the water surface; and (ii) The cognition of time and future. The potentiality of future may be far more meaningful than the reality existing nowadays. Therefore cognition ability is new leadership. The essence of digitization is not technology, but new thinking, which is the source of fortune and innovate new value, and digitization will open a complete new era of digital economy. Use SMART principle - is the abbreviation of English by specific, measurable, achievable, relevant and traceable. Ex. Vendor qualification criteria - How - change mindset, . Participation.build a process Have Clarity on-Is transformation necessary? what is to be transformed? What are the objectives? What is the scope? Can we achieve the goal , is it feasible or complicated? what are the outcomes and benefits?, what is the effort required? What is to be done inhouse and what are to be outsourced?

9. Major steps in transformation

Strategy planning: Define the purpose, scope of work, get the interests and commitments from the top to middle management, understand the existing gaps - power failures and it's effect on online activities ,databases, Search and discover , no business as usual. Change processes both business and engineering Localize solutions . Adapt.

10. Problems of success-

People oriented digital succeeded fast- email, ecommerce, social media, whatsapp, skype, smart phones, mobileapps, upi, Reasons - Direct to people , simple to use, no learning curve, there was no major business alignment needed, mindset changes were easy. Opened many channels, many options . Ease of communications, . Cost effectiveness- zero cost, Millennials adapted to it fast, met felt needs of people

11. Why is DT not easy? - alignment,

Complexity of components and their interconnections as well as their connections - three way architecture. People, process, technology understanding, correct application, proper development, strategy, planning , futuristic look, mindset changes, participation and responsibility, implementation , reviews, testing, user responses, adjustments , alignments , schedules for upgrades, introduction of new concepts and channels, ?

12.What are the critical success factors?

Iterate solutions Have a clear workable acceptable shared vision Conduct many pilots Learn from experiments Involve users , stakeholders, people in pilots Decentralise Establish feasibility, Plan the transformation - without a good plan, it may not succeed. Do a detailed engineering - you have a problem . Invariably you focus on the problem and create steps to implement it. That is one aspect of detailing. The second aspect is anticipate the problems you will encounter and how to solve it. Do a dry run . Third learn from past experience and failures, make changes. Fourth is to go backwards. What are other things needed for business and tech - like power, ac, ups, battery, dg sets, broadband, internet, server rooms, understand existing situations - teachers not digital literate in mahithisindhu program, Engineers did a detailing in building urban drainage- start with data of rainfall , do leveling, then go for drainage network design. Detailing many times Is context and location dependent. Good committed passionate focused leadership- DOS on PSLV and GSLV

developments, Chandrayan, my role plus Satyamurthys sustained commitment over years and the commissioner's support in mahithisindhu. Build trust in stakeholders Capable integrators - TCS, Wipro, HP, Mahindra, Good support infra- power, ac, data centres, communications outlets, Fast decision making , quick corrections- Good advisors help and guidance - mine in core banking , Good, clear and realistic strategy and plan - core banking, loan management by PNBHFL- expected outcomes are clear. Is it too ambitious? , is there a checklist of dos and don'ts , a well defined series of milestones and timelines. Transparency and good communications. Proper , appropriate selection of technology, business processes , vendors Proper integration, infrastructure, automation - Deccan airlines Good and fast decision making Collaborative approaches with vendors, developers, integrators, Alignment between business and technology- culture and structure changes, training Well defined implementation Progress reviews Course corrections
A good process for acceptance - mahithisindhu by engineering colleges faculties Acceptance and participation by employees, customers

13. Success stories
Airbnb, Uber, Google, Facebook, Zoom, Amazon AWS, Microsoft, ChatGPT, Indian Air Deccan Aadhaar Fintech - banks, jan dhan , NEFT, RTGS, DBT, mobileapps, Insurance UPI, wallets , payment systems, Vaccination- covid Ecommerce -flipkart, jio mart, zomato , swiggy, bigbasket,blinkit , and hundreds more Quick commerce Bangalore one - sakaala Most industries Passport, IT, company affairs Mahithisindhu Steel automation

14.Some Causes of failures
Early adoption without understanding - A320 Failure Lack of faith - digital control of power grids in india - Tatas succeeded in 1980s , but most EBs struggled. No water supply boards use digital for control and operations. Medical uses devices but not data, not integrated, not patient centric, not current, Poor integration Refusal to change business processes – ERP Complex operations No commitment from top management Poor project leader Improper selection of vendors Poor user friendly approaches- Indian airlines didn't anticipate problems of checkin - operator's inability to type fast, Poor understanding of support infra - power- Indian airlines database recovery time - not expected or scheduled - led to DG sets and UPS as standard. Lack of follow ups. DG shipping Lack of synergy

15.Phases for DT
Initial strategy and planning phase Modeling and structuring phase Architecting and design phase Integration phase Project implementation phase Acceptance Operations phase

16.What is a process for technology based transformation ?
Strategy Gap analysis and preparation for transformation - mahithisindhu - power, building Approach to transformation Discovery of technology Benefits, capabilities, maturity of technology Risk assessment, deliverables Culture building Architecting Designing Discovery of vendors Selection methodology and criteria Implementation steps Integration of all systems - business, people, society , other businesses, economy Integration of subsystems - computers, data, network, applications, user interfaces, etc Transformation Is a multistep process - is this a problem solving approach? - context dependent, business dependent, user dependent, market sensitive, Is there a standard process for all businesses or all societies? Or processes needed to be customised?

17. Essential aspects of transformation
What are the essential parameters to be looked at?- performance, growth, reliability, ease of use, completeness, correctness , adaptability and flexibility, modularity and partitioning, interconnections,

integration, interoperability, security, platforms and uniformity, sizing of hardware, network, routers, message queues etc, business continuity, disaster recovery, data loss minimisation or avoidance, standardization . ? Major policy aspects:What can be done inhouse and what cannot be done inhouse? What is the culture and readiness of the organization to go for transformation? How do you build the culture - start using mobiles, social networks, messaging, email, online administration, digital office, training, motivation, creating a new department, encouraging employees to use online facilities? Automation - what aspects should be automated , what should be the level of automation, roadmap and staging? What is the role of humans in an automated system ? System design - what functions to be distributed and what should be centralised , Levels of client server Data centres or cloud?- security considerations, network stability, growth issues, service aspects etc Data centres in house or rented. Outsourcing - what should be outsourced, what should be in house , what should be the criteria for outsourcing? How do you control and review outsourced operations? What are the operational policies, procedures, methods , NOC, SOC, operations planning, operations control, recovery procedures, BCP procedures, ? What are the modification procedures - separate Servers and software for modifications and testing and separate server for operations., modifications by vendors, operations by an outside agency, checks and balances? Knowledge about customers and their behaviours- How do you measure customer satisfaction, customer needs, - feedbacks , response times, rejections, customer walking away, new customers, prioritization, - banks looked at industries initially, later consumer loans, now jandhan, dbt, upi etc.?

18. the stages and steps in project implementation

i) problem discovery
ii) strategy planning
iii) feasibility
iv) assess capabilities of your organization , technology
v) problem definition - scope , description of functions,specs Rfp, selection methodology,
vi) vendor discovery and selection
vii) assessment of vendor solutions - technical evaluation
viii) financial evaluation
ix) project execution, reviews, user feedbacks
x) acceptance
xi) integration and operations

19. selections and discoveries

How do we identify problems in the business suitable for technology support - problem analysis and discovery ? Vendor selectiion processes How does one write specs and rfp? How do we reengineer software? Should you buy a standard package, customize, build your own?

20. Integration EAI, SOA- middleware

How has software design changed? From functional to performance - throughput and response Then to user friendlyness. Adapt to client server approach Create a front end and a backend Create a service based model Create messengers and agents upto AI agent. Build large capacities - queues , concurrent processes, no of messengers, agents Create a link with OS Make it flexible - multiple thousands of modules interconnected through loose coupling - no central control , blockchain,

21. General

How do we select ERP? My experiences with steel, construction, government offices , etc.? What should be the level of customisation? Is there an ERP plus? How do you build trust in business and technology? What is the role of AI?

22. Case studies - schools, exams, apmc, government, banks, fintech, and many more

NPTEL Courses

ADVANCED COMPUTER NETWORKS			
Course Code	**noc25-cs02**	**Course Type**	**NPTEL**
Total Teaching Hours	**12 Weeks**	**Credits**	**03**
Prerequisite	**CC2001-1**		

Week 1	High Performance Switching and Routing: Introduction, performance considerations, IP address lookup
Week 2	Algorithms for IP address lookup and optimization, hardware implementation of address lookup
Week 3	Packet Classification: Need for packet classification and methods for packet classification
Week 4	Differentiated Service, Quality of Service, Traffic Polishing, Traffic Shaping
Week 5	Network Softwarization – Introduction
Week 6	Software Defined Networking (SDN) - Deep Dive (Northbound and Southbound interface), Working with Mininet + Lab Exercises with Mininet
Week 7	Network Function Virtualization (NFV) - Architecture and Concepts

Week 8	Programmable Networks - Introduction to P4, SmartNICS and P4 switches. + Lab Exercise with Mininet and BMV2 switches
Week 9	Data Center Networking (DCN) – Introduction
Week 10	DCN - Deep Dive (Network topologies, Container Network Interfaces)
Week 11	Content Distribution on the Internet, Architectures for Information Centric Networking
Week 12	Content Naming, Routing and Caching, Security in Named Data Networking

Books and references:

1. High Performance Switches and Routers, H. Jonathan Chao, Bin Liu, 2007, John Wiley & Sons, Inc. ISBN-10: 0-470-05367-4
2. Information-Centric Networks: A New Paradigm for the Internet (Focus Series in Networks and Telecommunications), Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE; 1st edition, 2013, ISBN: 9781848214491
3. Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology, B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran and C. Tschudin, RFC 8793, June 2020
4. Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Online Free Reference Book available at https://sdn.systemsapproach.org/index.html
5. Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Lee (Author), Morgan Kaufmann (Publisher), 2014, ISBN-139780128007280

CLOUD COMPUTING			
Course Code	**noc25-cs11**	**Course Type**	**NPTEL**
Total Teaching Hours	**12 Weeks**	**Credits**	**03**
Prerequisite	**CC2001-1**		

Week 1	Introduction to Cloud Computing
Week 2	Cloud Computing Architecture
Week 3	Service Management in Cloud Computing
Week 4	Data Management in Cloud Computing
Week 5	Resource Management in Cloud
Week 6	Cloud Security
Week 7	Open Source and Commercial Clouds, Cloud Simulator
Week 8	Research trend in Cloud Computing, Fog Computing

Week 9	VM Resource Allocation, Management and Monitoring
Week 10	Cloud-Fog-Edge enabled Analytics
Week 11	Serverless Computing and FaaS Model
Week 12	Case Studies and Recent Advancements

Books and references:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010

BUSINESS INTELLIGENCE AND ANALYTICS			
Course Code	**noc25-cs09**	**Course Type**	**NPTEL**
Total Teaching Hours	**12 Weeks**	**Credits**	**03**
Prerequisite	**NIL**		

Week 1	Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources Reference: Text 1: Han et al. (2023) Chapter 1, Introduction
Week 2	Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases Reference: Text 1: Han et al. (2023) Chapter 4, Data Warehouse and Online Analytical Processing (pp. 85-108)
Week 3	Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube Reference: Tutorial: SQL tutorial on MySQL (https://www.mysqltutorial.org)
Week 4	Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study Reference: a. Knowing When to Worry: Using Survival Analysis to Understand Customers: https://learning.oreilly.com/library/view/data-mining-techniques/9780470650936/9780470650936c 10.xhtml#c10_level1_1 b. Customer Lifetime Value (CLV): A Critical Metric for Building Strong Customer Relationships, https://www.gartner.com/en/digital-markets/insights/what-is-customer-lifetime-value
Week 5	Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis Reference: a. Text 2: James et al. (2013) Chapter 1, Statistical learning, ISL b. Text 2: James et al. (2013) Chapter 2, Linear regression, ISL

Week 6	Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves Reference: Text 1: Han et al. (2023) Chapter 6, Classification: Basic concepts and methods
Week 7	Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods Reference: Text 2: James et al. (2013) Chapter 8, Tree- based models
Week 8	Tree implementation in Python: problem of targeted mailing Reference: a. https://scikit-learn.org/stable/modules/model_evaluation.html#roc-metrics b. https://scikit-learn.org/stable/visualizations.html
Week 9	Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, cluster quality Reference: Text 2: James et al. (2013) Chapter 10, Unsupervised learning (pp. 385-400)
Week 10	A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub- segmentation for customer loyalty Reference: What Is Recency, Frequency, Monetary Value (RFM) in Marketing?: https://www.investopedia.com/terms/r/rfm-recency-frequency-monetary-value.asp
Week 11	Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN, implementation in Python Reference: Kaastra & Boyd (1996) Designing a neural network for forecasting financial and economic time series, JNC.
Week 12	Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary Reference: Text 1: Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi: Elsevier. Text 2: James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer

Books and references:

1. Text 1: Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi, Elsevier.
2. Text 2: James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY

DEEP LEARNING FOR NATURAL LANGUAGE PROCESSING			
Course Code	**noc25-cs22**	**Course Type**	**NPTEL**
Total Teaching Hours	**12 Weeks**	**Credits**	**03**
Prerequisite	**CC2001-1**		

Week 1	Introduction to NLP: What is Natural Language Processing? A brief primer on word and sentence level tasks and n-gram language Model

Week 2	Introduction to Deep Learning, Shallow and Deep Neural Networks, Representation Learning
Week 3	Word Representations, Word2Vec, Glove. fastText,, Multilingual representations with emphasis on Indian Languages
Week 4	Recurrent Neural Networks: RNN LMs, GRUs, LSTMs, Bi-LSTMs, LSTMs for Sequence Labeling, LSTMs for Sequence to Sequence
Week 5	Attention Mechanism, Sequence to Sequence with Attention, Transformers: Attention is all you need
Week 6	Self-supervised learning (SSL), Pretraining, Designing SSL objectives, Pretrained Bi-LSTMs: ELMO, Pretrained Transformers: BERT, GPT, T5, BART
Week 7	Applications: Question Answering, Dialog Modeling, TextSummarization, Multilingual extension with application to Indian languages
Week 8	Instruction Fine-tuning, FLAN-T5, Reinforcement Learningthrough Human Feedback (RLHF)
Week 9	In-context learning, chain-of-thought prompting. ScalingLaws. Various Large Language Models and unique architectural differences
Week 10	Parameter Efficient Fine-tuning (PEFT) - LoRA, QLoRA
Week 11	Handling Long Context, Retrieval Augmented Generation (RAG)
Week 12	Analysis and Interpretability, ethical considerations

Books and references:

1. Daniel Jurafsky and James H. Martin. 2024. Speech and Language Processing. 3rd Edition. https://web.stanford.edu/~jurafsky/slp3/

QUANTUM ALGORITHMS AND CRYPTOGRAPHY			
Course Code	**noc25-cs61**	**Course Type**	**NPTEL**
Total Teaching Hours	**12 Weeks**	**Credits**	**03**
Prerequisite	**CC3101-1**		

Week 1	Basics of Quantum Information
Week 2	Entanglement, No Cloning, Quantum Parallelism
Week 3	Quantum Algorithms: Deutsch-Jozsa, Simons, Bernstein-Vazirani
Week 4	Introduction to Cryptography, principles of cryptographic design, building cryptography from RSA, Discrete Log
Week 5	Key exchange, Symmetric and public key encryption, Random Oracle Model, RSA and Elgamal encryption
Week 6	Boolean Fourier Analysis, Grover's Algorithm, Quantum Foruier Transform
Week 7	Shor's Algorithm, Hidden subgroup problem
Week 8	Post Quantum Crypto: Introduction to lattices, Useful Lattice Problems. Learning with Errors and Short Integer Solution problem. Connection to dihedral hidden subgroup

	problem
Week 9	Public key encryption and fully homomorphic encryption
Week 10	Quantum key distribution, Quantum one time pad
Week 11	Quantum public key encryption
Week 12	Quantum fully homomorphic encryption