B.S. Abdur Rahman ™
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2021
Curriculum and Syllabi
(Updated upto September 2024, as per 22nd Academic Council)

B.Tech.
(Electronics and Computer Engineering)

REGULATIONS 2021

CURRICULUMANDSYLLABI
(Updated upto September 2024 as per
22nd Academic Council)

B.TECH. ELECTRONICS AND COMPUTER ENGINEERING

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
VISION AND MISSION

VISION

Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering endeavours to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B.TECH. (ELECTRONICS AND COMPUTER ENGINEERING)

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Apply fundamental knowledge in electronics and computer engineering to develop innovative and effective solutions to real-world problems.

PEO 2: Demonstrate professional ethics to work and manage large, cross-functional teams while contributing to the growth of the organization.

PEO 3: Utilize modern engineering and IT tools effectively to provide appropriate engineering solutions for the betterment of society and the environment.

PEO 4: Interact effectively with the engineering community and society, and embrace lifelong learning and professional development in the context of technological advancements

PROGRAMME OUTCOMES

On successful completion of the programme,the graduates will be able to:

- **Engineering knowledge:** Apply the knowledge of Mathematics, Science and Electronics & communication Engineering fundamentals tosolve the complex engineering problems.
- **Problem analysis :** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principle of Mathematics, Electronics and Communication Engineering sciences.
- **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.
- **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.

- **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.
- **The Engineerand Society :** Apply reasoning informed by the contextual lknowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **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.
- **Ethics:** Apply ethicalprinciples and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and teamwork:** Function effectively as an individual, and as amember or leaderin diverseteams, and in multi disciplinarysettings.
- **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.
- **Project managementand finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply the setoone's own work, as a member and leader in a team,to manage projects and in multidisciplinary environments.
- **Life-long learning:** Recognize the need forand have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Acquire fundamental knowledge and skills to analyse, design and develop electronic devices and computing systems

PSO2: Develop automated solutions for contemporary applications using hardware-software proficiency

PSO3: Apply modern Electronics and Computer Engineering tools and techniques to find solutions for multi-disciplinary problems.

REGULATIONS - 2021

B.TECH. DEGREE PROGRAMMES

(Under Choice Based Credit System)

(Amendments Approved by the 19th Academic Council – September 2022)

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means theory / practical / laboratory integrated theory / seminar / internship / project and any other subject that is normally studied in a semester like English, Mathematics, Environmental Science, Engineering Graphics, Electronic Devices etc.,

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B. Tech. degree programme shall be required to have passed the Higher Secondary Examination of the 10+2 curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any University or authority accepted by the Institution as equivalent thereto.

2.1b) The student shall have studied at least any three of the following courses: Physics, Mathematics, Chemistry, Computer Science, Electronics, Information Technology, Biology, Informatics Practices, Biotechnology, Technical Vocational Subjects, Agriculture, Engineering Graphics, Business Studies, Entrepreneurship at 10+2 level. In case if the student has not studied any or all the courses viz., mathematics, physics and chemistry, he / she shall undergo bridge course(s) in the concerned course(s) at 10+2 level knowledge.

2.2 Notwithstanding the qualifying examination, the candidate might have passed at 10+2, the candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in the courses considered eligible for admission on the standards prescribed for 10+2 academic stream.

2.3 Candidates for admission to the third semester of the eight semester B.Tech. programme under lateral entry category shall be required to have passed minimum Three years / Two years (Lateral Entry) Diploma examination in any branch of Engineering / Technology or passed B.Sc. Degree from a recognized University as defined by UGC and passed 10+2 examination with Mathematics as a subject or Passed three year Diploma of Vocation Stream (D.Voc) in the same or allied sector or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.4 The Institution shall offer suitable bridge courses in Mathematics, Physics, Engineering drawing, etc., for the students of diverse backgrounds.

2.5 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution in adherence to the guidelines of regulatory authorities from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. Degree programmes in various branches of Engineering and Technology, each distributed over eight semesters, with two semesters per academic year.

1. Aeronautical Engineering
2. Artificial Intelligence and Data Science
3. Automobile Engineering
4. Biotechnology
5. Civil Engineering
6. Computer Science and Engineering
7. Computer Science and Engineering (Cyber Security)
8. Computer Science and Engineering (Internet of Things)
9. Electrical and Electronics Engineering
10. Electronics and Communication Engineering
11. Electronics and Instrumentation Engineering

12. Information Technology
13. Mechanical Engineering
14. Polymer Engineering

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every programme has a curriculum with syllabi consisting of theory and practical courses such as,

i) Basic Science Courses - BSC
ii) Humanities and Social Sciences including Management Courses - HSC
iii) Engineering Science Courses - ESC
iv) Professional Core Courses - PCC
v) Professional Elective Courses - PEC
vi) Open Elective Courses - OEC
vii) Laboratory Courses – LC
viii) Laboratory Integrated Theory Courses – LITC
ix) Mandatory Courses- MC
x) Project - PROJ (Project work, seminar and internship in industry or at appropriate workplace)

4.1.1 Mandatory Induction Programme for First year Students

The first year students upon admission shall undergo a mandatory three week induction programme consisting of physical activity, creative arts, universal human values, literary, proficiency modules, lectures by eminent people, visits to local areas, familiarization with departments / schools and centres, etc.,

4.1.2 Personality and Character Development

All students shall enroll, on admission, in any of the following personality and character development programmes:

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO)
- Youth Red Cross (YRC)
- Rotaract
- Crescent Indian Society Training Development (ISTD–C)
- Crescent Creative Strokes
- Crescent Technocrats club

The training activities / events / camp shall normally be organized during the weekends / vacation period.

4.1.3 Online Courses for Credit Transfer

Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean (Academic Affairs) during his / her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

4.1.4 Value Added Courses

The students are permitted to pursue department approved online courses (excluding courses registered for credit transfer) or courses offered / approved by the department as value added courses.

The details of the value added course viz., syllabus, schedule of classes and the course faculty shall be sent to the Dean (Academic Affairs) for approval. The students may also undergo the valued added courses offered by other departments with the consent of the Head of the Department offering the course.

These value added courses shall be specified in the consolidated mark sheet as additional courses pursued by the student over and above the curriculum during the period of study.

4.1.5 Industry Internship

The students shall undergo training for a period as specified in the curriculum during the summer vacation in any industry relevant to the field study.

The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period prescribed in the curriculum during the summer vacation, in lieu of Industrial training.

In any case, the student shall obtain necessary approval from the Head of the Department / Dean of School and the training has to be taken up at a stretch.

4.1.6 Industrial Visit

The student shall undergo at least one industrial visit every year from the second year of the programme. The Heads of Departments / Deans of Schools shall ensure the same.

4.2 Each course is normally assigned certain number of credits:

- one credit per lecture period per week
- one credit per tutorial period per week
- one credit for two to three periods and two credits for four periods of laboratory or practical sessions per week
- one credit for two periods of seminar / project work per week
- one credit for two weeks of industrial training or 80 hours per semester.

4.3 Each semester curriculum shall normally have a blend of lecture courses, laboratory courses, laboratory integrated theory courses, etc.

4.5 The medium of instruction, examinations and project report shall be in English, except for courses in languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is expected to complete the B.Tech. programme in eight semesters (six semesters in the case of lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry students).

5.2 Each semester shall consist of a minimum of 90 working days including the days of examinations.

5.3 The maximum duration for completion of the programme as mentioned in clause 5.1 shall also include period of break of study vide clause 7.1 so that the student may be eligible for the award of the degree.

6.0 REGISTRATION AND ENROLLMENT

6.1 The students of first semester shall register and enroll for courses at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

6.2 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

6.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.0 BREAK OF STUDY FROM PROGRAMME

7.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

7.1.1 Medical or other valid grounds

7.1.2 Award of ‘I’ grade in all the courses in a semester due to lack of attendance

7.1.3 Debarred due to any act of indiscipline

7.2 The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 5.1).

7.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

7.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

8.0 CLASS ADVISOR AND FACULTY ADVISOR

8.1 Class Advisor

A faculty member shall be nominated by the Head of the Department as class advisor for the class throughout the period of study except first year. The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

However, for the first and second semester, the class advisors (first year class advisors) are nominated by the first year coordinator.

8.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling, the Head of the Department of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

9.0 COURSE COMMITTEE

9.1 Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the course faculty teaching the common course with one of them nominated as a course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending on whether all the course faculty teaching the common course belong to a single department or from several departments. The course committee shall ensure preparation of a common question paper and scheme of evaluation for the tests and semester end examination.

10.0 CLASS COMMITTEE

A class committee is constituted branch wise and semester wise by the Head of the Department / Dean of the School shall normally comprise of faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman.

10.1 The composition of class committees for first and second semester is as follows:

i) The first year coordinator shall be the chairman of the class committee
ii) Faculty members of all individual courses of first / second semester
iii) Six student representatives (male and female) of each class nominated by the first year coordinator
iv) The class advisor and faculty advisors of the class

10.2 The composition of the class committee for each branch from 3rd to 8th semester is as follows:

i) One senior faculty member preferably not handling courses for the concerned semester appointed as chairman by the Head of the Department
ii) All the faculty members handling courses of the semester
iii) Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors
iv) All faculty advisors and the class advisors
v) Head of the Department

10.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the components of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

10.4 During these two meetings, the student members shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi, etc.

10.5 The third meeting of the class committee, excluding the student members, shall meet after the semester end examinations to analyse the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the course faculty concerned.

11.0 CREDIT LIMIT FOR ENROLLMENT & MOVEMENT TO HIGHER SEMESTER

11.1 A student can enroll for a maximum of 32 credits during a semester including Redo / Predo courses.

11.2 The minimum credits earned by the student to move to 7th semester shall not be less than 60 credits (40 credits for lateral entry students).

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 6	1.5 hours	25%
Assessment 2	7 to 12	1.5 hours	25%
Semester End Examination	Full course	3 hours	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 60% weightage for continuous assessments and 40% for semester end examination. However, a student shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

12.5 The components of continuous assessment for theory / practical / laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by the Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the viva voce examination.

12.8 Assessment of seminars and comprehension shall be carried out by a committee of faculty members constituted by the Head of the Department.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab components.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of the School for that purpose. There is no substitute examination for semester end examinations.

13.2 A student shall apply for a substitute exam in the prescribed form to the

Head of the Department / Dean of the School within a week from the date of assessment test. However, the substitute examination will be conducted only after the last instructional day of the semester.

14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

14.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded “I” grade in that course.

14.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

14.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

14.4 A student who has obtained an “I” grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat all the courses of the semester in the subsequent academic year.

14.5 The student awarded “I” grade, shall enroll and repeat the course when it is offered next. In case of “I” grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

14.6 A student who is awarded “U” grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains “U” grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

14.7 If a student with “U” grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier “U” grade and continuous assessment marks shall continue.

15.0 REDO COURSES

15.1 A student can register for a maximum of three redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the concerned department, based on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

15.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course shall be made on absolute marks basis. The class committee without the student members shall meet to analyse the performance of students in all assessments of a course and award letter grades following the relative grading system. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-

"W" - denotes withdrawal from the course

“I” - denotes inadequate attendance in the course and prevention from appearance of semester end examination

“U” - denotes unsuccessful performance in the course.

16.2 A student who earns a minimum of five grade points (‘E’ grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

16.3 Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further approve and declare the results.

16.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

16.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course,

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I” and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage equivalent of marks = CGPA X 10

16.6 After successful completion of the programme, the degree shall be awarded to the students with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semesters for all students (except lateral entry students) and 6 semesters for lateral entry students
First Class	6.50 and above and completing the programme within a maximum of 10 semesters for all students (except lateral entry students) and 8 semesters for lateral entry students
Second Class	Others

16.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the UG programme within the minimum prescribed period of study (except clause 7.1.1)

16.6.2 Eligibility for First Class

- A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 7.1.1)

16.6.3 The students who do not satisfy clause 16.6.1 and clause 16.6.2 shall be classified as second class.

16.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

17.0 SUPPLEMENTARY EXAMINATION

Final year students and passed out students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise, students with less credits in VI semester can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in the even semester.

18.0 DISCIPLINE

18.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

18.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Head of the Department / Dean of the School concerned shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action. This committee shall also address the grievances related to the conduct of online classes.

19.0 ELIGIBILITY FOR THE AWARD OF DEGREE

19.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

i) Successfully earned the required number of total credits as specified in the curriculum of the programme of study within a maximum period of 14 semesters (12 semesters for lateral entry) from the date of admission, including break of study.

ii) Successfully completed the requirements of the enrolled professional development activity.

iii) No dues to the Institution, Library, Hostel, etc.

iv) No disciplinary action pending against him/her.

19.2 The award of the degree must have been approved by the Institution.

20.0 MINOR DEGREE PROGRAMMES OFFERED FOR STUDENTS

20.1 The students admitted in the following B.Tech. programmes can graduate with a minor degree, which is optional, along with a major degree:

- Civil Engineering
- Mechanical Engineering
- Electronics and Communication Engineering
- Electrical and Electronics Engineering
- Automobile Engineering
- Aeronautical Engineering
- Polymer Engineering
- Biotechnology Engineering
- Electronics and Instrumentation Engineering
- Computer Science and Engineering
- Information Technology
- Artificial Intelligence and Data Science
- Computer Science and Engineering (IoT)
- Computer Science and Engineering(Cyber Security)

20.2 The eligibility for choosing the minor degree is given as below:

Sl. No.	Minor Degree	Eligible Major Degree Programmes (from other Departments)
1.	Artificial Intelligence and Machine Learning	Mechanical Engineering Aeronautical Engineering

<table>
<tr><td>2.</td><td>Block Chain</td><td rowspan="4">Polymer Engineering
Automobile Engineering
Civil Engineering
Biotechnology
Electrical and Electronics Engineering
Electronics and Instrumentation Engineering</td></tr>
<tr><td>3.</td><td>Cyber Security</td></tr>
<tr><td>4.</td><td>Data Science</td></tr>
<tr><td>5.</td><td>Internet of Things (IoT)</td></tr>
<tr><td>6.</td><td>Virtual and Augmented Reality</td><td>Mechanical Engineering
Aeronautical Engineering
Polymer Engineering
Automobile Engineering
Civil Engineering
Biotechnology
Electrical and Electronics Engineering
Electronics and Instrumentation Engineering
Electronics and Communication Engineering</td></tr>
<tr><td>7.</td><td>Sensor Technology</td><td>Mechanical Engineering
Aeronautical Engineering
Polymer Engineering
Automobile Engineering
Civil Engineering
Biotechnology
Electrical and Electronics Engineering</td></tr>
<tr><td>8.</td><td>Robotics</td><td>Artificial Intelligence and Data Science
Computer Science and Engineering (Cyber Security)
Computer Science and Engineering (IoT)
Computer Science and Engineering
Information and Technology
Civil Engineering
Biotechnology
Electrical and Electronics Engineering
Electronics and Instrumentation Engineering</td></tr>
<tr><td>9.</td><td>3D Printing</td><td>Artificial Intelligence and Data Science
Computer Science and Engineering (Cyber Security)
Computer Science and Engineering (IoT)
Computer Science and Engineering
Information and Technology
Biotechnology
Electrical and Electronics Engineering</td></tr>
</table>

		Electronics and Instrumentation Engineering Electronics and Communication Engineering
10.	Electric Vehicles	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology Electronics and Communication Engineering
11.	Industrial Automation	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electronics and Communication Engineering
12.	GIS and Remote Sensing	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
13.	Computational Biology	Artificial Intelligence and Data Science

		Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Electrical and Electronics EngineeringElectronics and Instrumentation Engineering Electronics and Communication Engineering

20.3 A student shall earn an additional 18 to 20 credits for the award of a minor degree.

20.4 A student shall be awarded a minor degree only when he / she completes the requirements for the award of major degree stipulated in the respective programme.

21.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY
B.TECH. ELECTRONICS AND COMPUTER ENGINEERING CURRICULUM & SYLLABI, REGULATIONS 2021

(Choice Based CreditSystem)

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BSC	PHD 1182	Engineering Physics *	3	0	2	4
2.	BSC	CHD 1182	Chemistry for Electrical and Electronic Engineering *	3	0	2	4
3.	BSC	MAD 1181	Algebra and Differential Calculus	3	1	0	4
4.	ESC	GED 1101	Engineering Graphics*	2	0	2	3
5.	ESC	GED 1102	Engineering Design	2	0	0	2
6.	ESC	GED 1103	Manufacturing Practices Laboratory	0	0	2	1
7.	ESC	GED 1104	Programming for Problem Solving **	1	0	2	2
			Credits				**20#**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	END 1281	English for Engineers	3	0	0	3
2.	BSC	MAD 1283	Partial Differential Equations and Transforms	3	1	0	4
3.	ESC	GED 1201	Engineering Mechanics	3	1	0	4
4.	ESC	GED 1204	Basic Electrical and Instrumentation Engineering*	3	0	2	4
5.	PCC	ESD 1201	Electron Devices	3	0	0	3
6.	PCC	ESD 1202	Object Oriented Programming	2	0	2	3
7.	PCC	ESD 1203	Electron Devices Laboratory**	0	0	2	1
8.	MC	GED 1206	Environmental Sciences	2	0	0	2
			Credits				**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC		Humanities Elective I	3	0	0	3
2.	BSC		Mathematics Elective	3	1	0	4
3.	PCC	ESD 2101	Analog Electronic Circuits	3	0	0	3
4.	PCC	ESD 2102	Digital Electronics	3	0	0	3
5.	PCC	ESD 2103	Operating Systems*	3	0	2	4
6.	PCC	ESD 2104	Data Structures and Algorithms	3	0	0	3
7.	PCC	ESD 2105	Analog and Digital Electronics Laboratory**	0	0	2	1
8.	PCC	ESD 2106	Data Structures Laboratory Using C++**	0	0	2	1
9.	HSC	GED 2101	Essential Skills and Aptitude for Engineers**	0	0	2	1
			Credits				**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	ESD 2201	Digital Signal Processing	3	1	0	4
2.	PCC	ESD 2202	Linear Integrated Circuits*	2	0	2	3
3.	PCC	ESD 2203	Microprocessor and Microcontroller	3	0	0	3
4.	PCC	ESD 2204	Computer Organization and Architecture	3	0	0	3
5.	PCC	ESD 2205	Database Management System	3	0	0	3
6.	PCC	ESD 2206	Microprocessor and Microcontroller Laboratory**	0	0	2	1
7.	PCC	ESD 2207	Database Management System Laboratory**	0	0	2	1
8.	PEC	-	Professional Elective Courses	3	0	0	3
9.	MC	GED 2202	Indian Constitution and Human Rights#	2	0	0	0
10.	HSC	GED 2201	Workplace Skills and Aptitude for Engineers **	0	0	2	1
			Credits				**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	ESD 3101	Analog and Digital Communication	3	1	0	4
2.	PCC	ESD 3102	VLSI Design	3	0	0	3
3.	PCC	ESD 3103	Compiler Design	3	0	0	3
4.	PCC	ESD 3104	Computer Networks	3	0	0	3
5.	PCC	ESD 3105	VLSI Design Laboratory**	0	0	2	1
6.	PCC	ESD 3106	Computer Networks Laboratory**	0	0	2	1
7.	PEC		Professional Elective Courses				6
8.	HSC	GED 3101	Communication Skills for Career Success **	0	0	2	1
9.	PROJ	ESD 3108	Internship I ##				1
			Credits				**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	MSD 3181	Fundamentals of Entrepreneurship	3	0	0	3
2.	BSC		Physics Elective	2	0	0	2
3.	HSC		Humanities Elective II	2	0	0	2
4.	OEC		Open Elective I	3	0	0	3
5.	PCC	ESD 3201	Embedded Systems Design	3	0	0	3
6.	PCC	ESD 3202	Embedded Systems Design Laboratory**	0	0	2	1
7.	PEC		Professional Elective Courses				6
8.	HSC	GED 3201	Reasoning and Aptitude for Engineers **	0	0	2	1
			Credits				**21**

SEMESTER VII

Sl. No	Course Group	Course Code	Course Title	L	T	P	C
1.	OEC		Open Elective II				3
2.	OEC		Open Elective III				3
3.	PCC	ESD 4101	IoT and Cloud Computing	3	0	0	3
4.	PEC		Professional Elective Courses				9
5.	PROJ	ESD 4102	Internship II ###				1
6.	HSC	GED 4101	Employability Skills	0	0	2	1
			Credits				**20**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PROJ	ESD 4201	Project Work				9
			Credits				**9**

Overall Total Credits – 162

* Laboratory Integrated Theory course
** Laboratory Course
# Three-Week Orientation Programme – Mandatory Non-Credit Course
15 days of Industrial training during the summer vacation of second year. The credit will be awarded in the 5th Semester.
15 days of Industrial training during the summer vacation of third year. The credit will be awarded in the 7th Semester.
$ Not a Mandatory Course - The student will take up this course during the Summer Holidays of III year as a comprehension of Soft Skills courses offered from semester III to VI. Upon successful completion, the course will be mentioned in grade sheet of VII semester.

Note:

- One value added course per year in the I, II and III year. (Foreign Language / Programming Skills / Skill based courses)
- All basic core courses can be accommodated in the II, III and IV semester to facilitate the award of diploma at the end of two years (if necessitates in the future as per NEP).

PROFESSIONAL ELECTIVES

Sub-Stream: Electronics Engineering

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PEC	ESDX 003	Electromagnetic Field Theory and Transmission Lines	3	0	0	3
2.	PEC	ESDX 004	Sensors and Instrumentation	3	0	0	3
3.	PEC	ESDX 011	Digital Image and Video Processing	3	0	0	3
4.	PEC	ESDX 012	Control Systems	3	0	0	3
5.	PEC	ESDX 013	Introduction to PCB design	3	0	0	3
6.	PEC	ESDX 014	Principles of Robotics	3	0	0	3
7.	PEC	ESDX 015	ARM architecture and Programming	3	0	0	3
8.	PEC	ESDX 016	Mechatronics	3	0	0	3
9.	PEC	ESDX 017	Automotive Networking and protocols	3	0	0	3
10.	PEC	ESDX 018	Wireless and Mobile Communication	3	0	0	3
11.	PEC	ESDX 019	Introduction to Embedded Linux	3	0	0	3
12.	PEC	ESDX 020	Introduction to RTOS	3	0	0	3
13.	PEC	ESDX 021	Nanoelectronics	3	0	0	3
14.	PEC	ESDX 022	Multicore Architecture and Parallel Programming	3	0	0	3
15.	PEC	ESDX 023	Autonomous Vehicle	3	0	0	3

Sub-Stream: Computer Engineering

1.	PEC	ESDX 001	Python Programming	3	0	0	3	IV
2.	PEC	ESDX 002	Analysis of Algorithms	3	0	0	3	IV
3.	PEC	ESDX 041	Machine Learning	3	0	0	3	V
4.	PEC	ESDX 042	Theory of Computation	3	0	0	3	V
5.	PEC	ESDX 043	Data Science	3	0	0	3	V
6.	PEC	ESDX 044	Web Technology	3	0	0	3	V
7.	PEC	ESDX 045	Introduction to Industry 4.0	3	0	0	3	V
8.	PEC	ESDX 046	Cryptography and Network Security	3	0	0	3	VI
9.	PEC	ESDX 047	Artificial Intelligence	3	0	0	3	VI
10.	PEC	ESDX 048	Edge Computing	3	0	0	3	VI
11.	PEC	ESDX 049	Computer Vision	3	0	0	3	VI
12.	PEC	ESDX 050	Deep Learning	3	0	0	3	VI
13.	PEC	ESDX 051	GPU architecture and Programming	3	0	0	3	VII
14.	PEC	ESDX 052	Software Engineering	3	0	0	3	VII
15.	PEC	ESDX 053	Pattern Recognition	3	0	0	3	VII
16.	PEC	ESDX 054	Natural Language Processing	3	0	0	3	VII
17.	PEC	ESDX 055	Prompt Engineering	3	0	0	3	VII
18.	PEC	ESDX 056	Block chain Technology	3	0	0	3	VII
19.	PEC	ESDX 057	Mobile Multimedia Systems	3	0	0	3	VII
20.	PEC	ESDX 058	Data Mining and Data Warehousing	3	0	0	3	VII
21.	PEC	ESDX 059	XML and Web services	3	0	0	3	VII
22.	PEC	ESDX 060	Multimedia Communication and Networking	3	0	0	3	VII
23.	PEC	ESDX 061	Augmented Reality and Virtual Reality	3	0	0	3	VII
24.	PEC	ESDX 062	Quantum Computing	3	0	0	3	VII

PHYSICS ELECTIVES – VI Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	PHDX 01	Non Destructive Testing of Materials	2	0	0	2
2	PHDX 02	Materials Science for Engineering	2	0	0	2
3	PHDX 03	Biomaterials	2	0	0	2
4	PHDX 04	Optical Fibre Communication	2	0	0	2
5	PHDX 05	Semiconductor Physics for Information Technology	2	0	0	2
6	PHDX 06	Sensors and Actuators	2	0	0	2
7	PHDX 07	Fundamentals of Nanotechnology and its Applications	2	0	0	2

MATHEMATICS ELECTIVES – III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	MADX 01	Transforms and Partial Differential Equations	3	1	0	4
2	MADX 02	Discrete Mathematics	3	1	0	4
3	MADX 03	Probablity and Statistics	3	1	0	4
4	MADX 04	Random Processes	3	1	0	4
5	MADX 05	Numerical Methods	3	1	0	4

HUMANITIES ELECTIVES – III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 01	Engineering Economics and Management	3	0	0	3
2	SSDX 02	Sociology of Science and Technology	3	0	0	3
3	SSDX 03	Industrial Economics and Management	3	0	0	3
4	SSDX 04	Dynamics of Indian Social Structure	3	0	0	3

HUMANITIES ELECTIVES – VI Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 11	Economics of Sustainable Development	2	0	0	2
2	SSDX 12	Sociology of Industrial Relations.	2	0	0	2
3	SSDX 13	Professional Ethics and Human Values	2	0	0	2
4	SSDX 14	Gender, Technology and Development	2	0	0	2

OPEN ELECTIVE COURSES FOR
B.TECH. PROGRAMMES R 2021 - VI SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1.	GEDX 201	Application of Fluid Mechanics in Everyday Life	3	0	0	3	Aero
2.	GEDX 202	Basics of Management and Organizational Behaviour	3	0	0	3	CSB
3.	GEDX 203	Big Data Analytics	3	0	0	3	CA
4.	GEDX 204	Biology for Engineers	3	0	0	3	SLS
5.	GEDX 205	Consumer Electronics	3	0	0	3	ECE
6.	GEDX 206	Creative Writing	2	1	0	3	English
7.	GEDX 207	Cyber Forensics	3	0	0	3	CSE
8.	GEDX 208	Cyber Security	3	0	0	3	IT
9.	GEDX 209	Disaster Management	3	0	0	3	Civil
10.	GEDX 210	English for Competitive Examination	2	1	0	3	English
11.	GEDX 211	Enterprise Risk Management	3	0	0	3	CSB
12.	GEDX 212	Fundamentals of Project Management	3	0	0	3	CSB
13.	GEDX 213	Industrial Robotics	2	0	2	3	Mech.
14.	GEDX 214	Internet of Things and its Applications	3	0	0	3	ECE
15.	GEDX 215	Introduction to Health Care Analytics	3	0	0	3	CA
16.	GEDX 216	IPR and Patent Laws	3	0	0	3	CSB
17.	GEDX 217	Logistics and Supply Chain Management	3	0	0	3	CSB
18.	GEDX 220	Optimization Techniques	3	0	0	3	Maths
19.	GEDX 221	Polymers for Different Transportation	3	0	0	3	Polymer
20.	GEDX 222	Programming Language Principles	3	0	0	3	CSE
21.	GEDX 223	Public Speaking and Rhetoric	2	1	0	3	English
22.	GEDX 224	Python Programming	2	0	2	3	IT
23.	GEDX 226	Smart Sensors for Healthcare Applications	3	0	0	3	EIE
24.	GEDX 227	Total Quality Management	3	0	0	3	Mech.
25.	GEDX 228	Value Education	3	0	0	3	Commerce
26.	GEDX 229	Waste Water Management	3	0	0	3	Civil
27.	GEDX 231	Electronics for Mechanical Systems	3	0	0	3	ECE
28.	GEDX 232	Renewable Energy Engineering					EEE
29.	GEDX 233	Nuclear Hazard and Disarmament	3	0	0	3	Physics

OPEN ELECTIVE COURSES FOR
B.TECH. PROGRAMMES R 2021 - VII SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1.	GEDX 101	Advanced Entrepreneurship	3	0	0	3	CSB
2.	GEDX 102	Artificial Intelligence and Machine Learning Applications	3	0	0	3	CSE
3.	GEDX 103	Automotive Technology	3	0	0	3	Automobile
4.	GEDX 105	Building Repair Solutions	3	0	0	3	Civil
5.	GEDX 106	Cloud Services and Management	3	0	0	3	CA
6.	GEDX 108	Cyber Law and Ethics	3	0	0	3	CSL
7.	GEDX 110	Deep Learning Essentials	3	0	0	3	CSE
8.	GEDX 111	Drone Technologies	2	0	2	3	Aero
9.	GEDX 112	Electric Vehicle	3	0	0	3	EEE
10.	GEDX 113	Emerging Technologies in Mobile Networks	3	0	0	3	ECE
11.	GEDX 114	Fundamentals of Data Science and Machine Learning	3	0	0	3	IT
12.	GEDX 115	Genetic Engineering	3	0	0	3	SLS
13.	GEDX 116	Green Design and Sustainability	3	0	0	3	Civil
14.	GEDX 117	Image Processing and its Applications	3	0	0	3	ECE
15.	GEDX 118	Industrial Automation and Control	3	0	0	3	EIE
16.	GEDX 119	Industrial Safety	3	0	0	3	Mech.
17.	GEDX 120	Industry 4.0	3	0	0	3	Mech.
18.	GEDX 121	Introduction to Artificial Intelligence	3	0	0	3	IT
19.	GEDX 122	Introduction to Artificial Intelligence and Evolutionary Computing	3	0	0	3	CSE
20.	GEDX 123	Motor Vehicle Act and Loss Assessment	3	0	0	3	Automobile
21.	GEDX 126	Personal Finance and Investment	3	0	0	3	Commerce
22.	GEDX 127	Soft Computing Techniques	3	0	0	3	CSE
23.	GEDX 128	Value Analysis and Engineering	3	0	0	3	Mech.
24.	GEDX 129	Vehicle Maintenance	3	0	0	3	Automobile
25.	GEDX 130	Graphical Programming Based System Design	3	0	0	3	ECE

SEMESTER I

		L	T	P	C
PHD 1182	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
SDG: 4		**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

COB1: To equip the students on the knowledge of electromagnetic waves.

COB2: To make the students in understanding the importance of mechanics.

COB3: To introduce the basics of oscillations, optics and lasers.

COB4: To acquire basic knowledge about the principle and theory of solids.

COB5: To understand the importance of physics behind semiconductor devices.

MODULE I ELECTROMAGNETIC WAVES 9

Gauss's law – Faraday's law - Ampere's law–Properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Reflection and transmission of electromagnetic waves from a non-conducting medium.

MODULE II QUANTUM MECHANICS 9

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh-Jean's law– Matter waves–Physical significance of wave function – Schrodinger wave equation – Time independent and time-dependent wave equation – Applications: Particle in one-dimensional box –Introduction to quantum computing.

MODULE III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - Anti-reflection coating - Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet-Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: Nd:YAG laser He-Ne laser and semiconductor laser - Applications : Laser Materials Processing - Holography.

MODULE IV INTRODUCTION TO SOLIDS 9

Free electron theory of metals- Expression for electrical conductivity of metal- Fermi level-Fermi distribution function-Effect of Fermi function with temperature-Density of energy states-carrier concentration in metals-Effect of temperature on Fermi energy- Energy distribution of electrons- Work function of a metal-Electron in a periodic potential (Kronig and Penny model)-Brillouin Zones-Fermi surface-Effective mass of electron and hole-Energy bands in solids.

MODULE V PHYSICS OF SEMICONDUCTORS 9

Elemental and compound semiconductors –Direct and Indirect band gap semiconductors- Drift and diffusion current – Intrinsic semiconductors: Intrinsic carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

PRACTICALS

List of Experiments

1. Determination of thickness of a thin wire / sheet using Air Wedge method.
2. Determination of wavelength of laser light using semiconductor laser diffraction.
3. Determination of angle of divergence of a laser beam using semiconductor diode laser and He-Ne laser.
4. Resistivity measurement of a semiconductor using four point probe method.
5. Determination of band gap of a semiconductor diode.
6. Determination of Hall coefficient of a given semiconductor material.
7. Determination of frequency of a tuning fork using Melde's string arrangement in transverse and longitudinal modes.
8. Determination of particle size of lycopodium powder using semiconductor laser.

L – 45; P – 30 ; Total Hours – 75

TEXT BOOKS:

1. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
2. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCES:

1. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015.
2. Serway R.A. and Jewett, J.W., Physics for Scientists and Engineers with Modern Physics, Brooks/cole Publishing Co., 2010.
3. Tipler P.A. and Mosca, G.P., Physics for Scientists and Engineers with Modern Physics, W.H. Freeman, 2007.
4. Markert J.T., Ohanian. H. and Ohanian, M., Physics for Engineers and Scientists, W.W. Norton & Co., 2007.
5. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.
6. Linear Integrated Circuits by D. Roy Choudhury and Shail Jain - New Age International (P) Ltd.(2003).
7. Integrated Electronics by J.Millman and C.Halkias, Tata McGraw Hill, New Delhi (2001).

COURSE OUTCOMES:

CO1: Express the knowledge of electromagnetic waves.

CO2: Comprehend the importance &principles of quantum mechanics and apply it to understand ideas of quantum computing.

CO3: Grasp ideas related to oscillations, interference phenomenon, apply it to understandoptical based devices and classify the different laser systems used forvarious applications.

CO4: Conceptualize the electron theory of metals and band structure of solids.

CO5: Understand the principles of physics behind semiconductors, Hall effectand apply the same to identify type of any semiconductor sample, evaluate no. of charge carriers.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	M	L	L	M	M	M	L	L	L	M	M	M	M	M
CO2	H	M	M	L	L	M	L	L	L	L	L	M	M	M	M
CO3	H	M	M	L	L	L	L	L	L	L	L	M	M	M	M
CO4	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M
CO5	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CHD 1182 SDG: 9	CHEMISTRY FOR ELECTRICAL AND ELECTRONIC ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

To make the students conversant with

COB1: preparation, properties and applications of polymers and moulding techniques.

COB2: synthesis, properties and applications of nanomaterials

COB3: classification and description of different types of batteries and their applications.

COB4: concepts of photochemistry related to photophysical processes, chemical reactions and its applications.

COB5: types of corrosion and its prevention.

MODULE I — POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS — 10

Classification: source, heat, composition – glass transition temperature – preparation, properties and applications of polyethene (LDPE, HDPE), poly(vinyl chloride), PMMA, polycarbonate, teflon, ABS, bakelite, urea-formaldehyde, epoxy resin - conducting polymers: polyaniline, polyacetylene and poly(phenylenevinylene), rubber- vulcanised rubber, ebonite, EPDM, polymer blends and alloys - moulding techniques: injection moulding, compression moulding.

MODULE II — NANOMATERIALS — 10

Introduction – classification based on dimension with examples – properties of nanomaterials (surface to volume ratio and size quantisation effect) - synthesis of nanomaterials (Top-down and Bottom-up)– role of capping & reducing agents - CVD (CNT), laser ablation (Ag, Ag_2O), electrodeposition (semiconductor materials), precipitation (Ag, Au), thermolysis: solvothermal (CuO, CeO_2) and hydrothermal (TiO_2, ZnO, carbon dots), microwave method (metal oxide), biogenic method – nanocomposite.

MODULE III — BATTERIES — 8

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cell, alkaline battery – secondary batteries: nickel cadmium cell – lead acid storage cell - lithium battery: primary and secondary type - PN junction solar cell, thin film solar cell.

MODULE IV PHOTOCHEMISTRY 9

Introduction: absorption and emission – laws of photochemistry: Grotthus-Draper law, Stark Einstein law – quantum efficiency – determination of quantum yield (problems) – Jablonski diagram: photo physical processes – IC, ISC, fluorescence and phosphorescence –(electronic states and transitions) – quenching – chemiluminescence – bioluminescence – photosensitization: principle and applications(photosynthesis and artificial photosynthesis) – photoelectrolysis.

MODULE V CORROSION AND ITS PREVENTION 8

Types of corrosion – dry and wet corrosion – galvanic corrosion – differential aeration corrosion – Prevention of corrosion: choice of materials, electroplating, electrolesss plating of PCB, coatings : paints: constituents and function – hot dipping – galvanizing, tinning – powder coating – anodising – special coatings: water repellent coatings, fire-retardant coatings, temperature indicating coatings.

PRACTICALS

1. Free radical polymerization of PMMA.
2. Preparation of phenol-formaldehyde.
3. Preparation of urea-formaldehyde.
4. Synthesis of epoxy resin.
5. Determination of molecular weight and degree of polymerisation of polyvinyl alcohol using viscometer
6. Electrochemical synthesis of graphene oxide
7. Synthesis of nano-ZnO by precipitation
8. Demonstration of Laser ablation techniques for nanomaterials
9. Construction of dry cell and alkaline battery
10. Measurement of EMF for different batteries.
11. Electroplating of copper
12. Determination of corrosion of mild steel in acidic, neutral and basic medium.

L –45 ; P – 30 ; TOTAL HOURS –75

TEXT BOOKS:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2016.

REFERENCES:

1. Gowarikar V.R., Viswanathan N.V and JayadevSreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1986.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.

3. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, Thomas Graham House, Cambridge, 2005.
4. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

COURSE OUTCOMES:

The students will be able to

CO1:summarise the preparation, properties and applications of plastics used in electrical and electronic applications

CO2: synthesize different types of nanomaterials based on its size and applications.

CO3: illustrate construction and working of various types of batteries with the aid of a diagram.

CO4: state laws of photochemistry and elaborate the various types of photophysical processes and concepts of photochemistry.

CO5: explain the different types of corrosion and elaborate the methods of various coating techniques.

Board of Studies (BoS) :

11thBoS of Chemistry held on 17.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		H		M					L						L
CO2		H		M					L						L
CO3		H													
CO4		M													
CO5		M	M			L	L								L

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Industry, Innovation & Infrastructure

Statement : The synthesis and use of polymers and nanomaterials supports the industrial growth and innovation activities of the nation. The aspects of corrosion and its prevention will lead to corrosion free environment in the industry and infrastructure.

		L	T	P	C
MAD 1181	**ALGEBRA AND DIFFERENTIAL CALCULUS**	**3**	**1**	**0**	**4**
SDG: 4					

COURSE OBJECTIVES:

COB1: To introduce matrix algebra techniques for engineers to apply in practical problems

COB2: To find the roots of polynomial equations using different techniques

COB3: To demonstrate the concepts of limits, continuity and application of differential calculus.

COB4: To familiarize the students with the functions of several variables

COB5: To develop the use of differential equations necessary for engineering applications

MODULE I MATRICES 9+3

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation

MODULE II THEORY OF EQUATIONS 9+3

Introduction - Surds and irrational roots – simple problems – Equations whose roots are in A.P,G.P and in H.P – Relations between the roots and coefficients – symmetric functions – Formation of equations – Decreasing and Increasing the roots – transformation of equation – Reciprocal equations

MODULE III DIFFERENTIAL CALCULUS 9+3

Limits of functions - one sided limits – Continuity - Curvature – Cartesian and polar coordinates – center and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

Laws of limits –Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method

MODULE V ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients- method of variation of parameters

L - 45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2010.
2. Grewal B.S., "Higher Engineering Mathematics" 44th edition, Khanna Publishers, New Delhi, 2017.
3. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Jain, R.K. &Iyengar, S. R. K., "Advanced Engineering Mathematics", Narosa Publishers, 5^{th} edition, 2016.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
5. James Stewart ," Calculus" 7th edition, Brooks/Cole Cengagelearning, UK

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:use the matrix algebra methods for finding eigenvalues, eigenvectors and diagonalization

CO2: solve equations using the relations between roots and coefficients

CO3: apply differential calculus in various engineering problems

CO4: use differential calculus on several variable functions

CO5:solve various types of differential equations that arise in many applications

Board of Studies (BoS) :
12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like matrices and calculus will lead to knowledge of applications in Communication Engineering

GED 1101	ENGINEERING GRAPHICS	L	T	P	C
SDG: 9		2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the basic concepts of engineering drawing, and familiarize with conic sections, special curves and orthographic projection of points and straight lines

COB2: To get practical exposure on projection of planes and solids

COB3: To be familiar with sectioning of solids, and development of surfaces

COB4: To conversant with 3D isometric projection, and perspective projection of simple solids

COB5: To introduce computerized drafting using CADD for draw ing the orthographic views of simple solids

MODULE I BASICS, ENGINEERING CURVES AND ORTHOGRAPHIC PROJECTION OF POINTS AND STRAIGHT LINES L: 7 P: 7

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola. Special curves: cycloid, epicycloid, hypocycloid and involutes.

Orthographic projection – first angle, second angle, third angle and fourth angle projections. Orthographic projection of points in all quadrants. Projection of straight lines in first quadrant – true length and true inclinations –traces of straight line.

MODULE II PROJECTION OF PLANES AND SOLIDS L: 7 P: 7

Projection of plane lamina in first quadrant and its traces

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, and cylinder – change of position method

MODULE III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES L:5 P:5

Section of solids: prism, pyramid, cone and cylinder– sectional view – true shape of section- cutting simple position solids - plane inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone and cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE IV THREE DIMENSIONAL PROJECTIONS L:4 P: 4

Isometric projection: Isometric scale – isometric axes- Isometric projection and view of prism, pyramid, cylinder, cone and frustums.
Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid by Visual ray method.

MODULE V ORTHOGRAPHIC PROJECTION USING CADD L:7 P:7

Introduction to CADD - Basic commands for sketching - Editing sketches - creating texts and tables - Basic dimensioning and editing dimensions - Sketching orthographic views of simple solids and machine parts as per first angle projection - Plotting drawings.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing",Charotar Publishing house, 53rdEdtion, 2014.
2. Venugopal. K, and V. Prabhu Raja, "Engineering Graphics", New Age International (P) Ltd., Publication, Chennai, Edition 15, 2017.

REFERENCES:

1. K.V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi publishers, Chennai, 31st Edition, 2018.
2. Agrawal B. & Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.
3. Jeyapoovan, T., "Engineering Graphics using AutoCAD", Vikas Publishing House Pvt. Ltd., New Delhi, 2015.
4. AutoCAD Software Theory and User Manuals
5. Engineering graphics You tube Lecture videos link: https://www.youtube.com/user/BSAUNIV/videos

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: identify the specifications and standards of technical drawing and draw conic sections, special curves and orthographic projection of points and straight lines

CO2: apply the concept of orthographic projection to draw the orthographic views of plane figures and simple solids

CO3:draw the sections of solids and development of solid surfaces

CO4:apply the concept of isometric and perspective projection to draw the 3-D views of simple solids
CO5: draw the orthographic views of simple objects using drafting software

Board of Studies (BoS):
18thBoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO2	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO3	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO4	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO5	M	L	L	-	M	-	-	-	-	L	-	-	-	-

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The various industrial standards of technical drawing and the application of orthographic projections to draw simple solids helps to innovate a new design for sustainable industrialization

GED 1102	**ENGINEERING DESIGN**	**L**	**T**	**P**	**C**
SDG:9		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To learn the basic concepts of design in engineering

COB2: To study the basic design thinking principles in problem solving

COB3: To encourage the students to develop a prototype using design concepts

COB4: To introduce the role of innovation in engineering

MODULE I INTRODUCTION TO DESIGN 08

Introduction to Engineering design – Design thinking – Problem identification - Design of Product, Process, System and Software – Case studies on Product, Process, Systems and Software design.

MODULE II DESIGN THINKING PROCESS 08

Empathy – Ideate - Need analysis - Voice of customers - product specification - concept generation - Bench marking - Quality function deployment - Concept evaluation - Case studies

MODULE III PROTOTYPE DESIGN 07

Product form and function – High level design – Design detailing - Sketch models – Prototypes - 3D printing - Case studies.

MODULE IV INNOVATION 07

Creativity and innovation – Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – Intellectual property rights - case studies on innovative products.

L – 30; Total Hours – 30

TEXT BOOKS:

1. Clive L. Dym, Patrick Little, and Elizabeth J. Orwin, “Engineering Design: A Project Based Introduction”, 4th Edition, Wiley, 2014.
2. Eppinger, S. and Ulrich, K., “Product design and development”, McGraw-Hill Higher Education, 2015.

REFERENCES:

1. Nigel Cross, “Design Thinking”, Berg Publishers, 2011.
2. Tom Kelley, “The Art of Innovation”, Profile Books Ltd, London, 2016.

3. Tim Brown, “Change by Design”, HarperCollins e-books, 2009.
4. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: explain the basic concepts of design in engineering products / process /
Service

CO2:analyse the problems and perform design thinking process

CO3: correlate the basic principles of design thinking to solve engineering problems and develop prototypes

CO4: apply innovative approaches to engineering problems and provide design solutions

Board of Studies (BoS):
18thBoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	-	H	-	M	-	-	-	-	L	-	L	-	-
CO4	-	-	M	-	-	-	-	-	-	L	-	L	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of basic knowledge in Engineering design and its process in the development of prototypes results in satisfying industrial challenges.

GED 1103	**MANUFACTURING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
SDG: 9		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To learn the basics of pipe connections used in household and industrial systems

COB2: To educate the usage of welding equipment's and machining methods

COB3: To impart knowledge onsandmould preparation for simple components

COB4: To explorevarious tools, instruments and methods used in electrical wiring

COB5: To impart knowledge onDesign, assembly and testing of electronic circuits

PRACTICALS

List of Experiments:

CIVIL ENGINEERING PRACTICE:

1. Study of plumbing in general household and industrial systems: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
2. Making a small window frame with Lap and Mortise & Tenon Joints by sawing planing and cutting.
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints using Arc Welding - Gas cutting (Demo)
2. Machining of a component using simple turning and drilling practices.
3. Foundry operations such as sand mold preparation for simple component.
4. Plastic Component Manufacturing (Demo on Injection / Blow moulding)

ELECTRICAL ENGINEERING PRACTICE:

1. Comparison of incandescent, fluorescent, CFL and LED lamps.
2. Domestic, staircase and go down wiring.
3. Measurement of earth resistance.
4. Study of protection devices (small relay, fuse, MCB, HRC, MCCB, ECCB).
5. Familiarization of household electrical gadgets (Iron Box, Wet Grinder).
6. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE:

1. Identifications and symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Design and testing of electronic circuits using active and passive electronic components

P –30; TOTAL HOURS –30

TEXT BOOK:

1. S.Gowri and T.Jeyapoovan, "Engineering Practices Lab Manual – Civil, Mechanical, Electrical, Electronics included", Vikas Publishing, 5th Edition,2019.

REFERENCES:

1. SubhransuSekhar Dash &K.Vijayakumar, "Electrical Engineering Practice Lab Manual", Vijay Nicole Imprints Private Ltd., First Edition, 2013.
2. Raghbir Singh Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly", Tata McGraw-Hill Education, 2005.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: demonstrate Plumbing requirements of domestic buildings.

CO2: use welding equipment's to join the structures and to carry out machining operations

CO3: perform the task of making sand mould for simple components

CO4: execute simple electrical wiring and comprehend the construction and working of household appliances.

CO5: assemble and test simple electronic circuits used in day-to-day life

Board of Studies (BoS):

18thBoS of Mech held on 21.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	L	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of welding, moulding, machining, wiring and electronic circuit increases the access of small-scale industrial and other enterprises in developing countries.

GED 1104	**PROGRAMMING FOR PROBLEM SOLVING**	**L**	**T**	**P**	**C**
SDG: 8		**1**	**0**	**2**	**2**

COURSE OBJECTIVES:

COB1: To explore the hardware and software components of the computer

COB2: To learn the structured and procedural programming concepts using C.

COB3: To study the constructs of decision making in branching and iteration statements

COB4: To learn Functions for effective reusability and readability of the code.

COB5: To understand pointer and file operation concepts.

MODULE I INTRODUCTION TO C PROGRAMMING 05

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, system software, compilers, creating, compiling and executing a program, Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming - Structure of C - C Tokens – Data Types – Declaration of Variables and Storage class – Operators – Expressions - Type Conversion.

MODULE II DECISION MAKING AND ARRAY 05

Decision Making and Branching: Simple if Statements, The if..else statements, Nesting of if..else statements, else…if Ladder, switch Statements, goto Statements, Looping: while, do…while, for Statements, Array: One-Dimensional, Two-Dimensional and Multi-Dimensional operations.

MODULE III USER-DEFINED FUNCTIONS AND FILE OPERATIONS 05

Definition of Functions - Function Types – Nesting of Functions – Recursion – Structures and Unions – Pointers - File handing operations.

PRACTICALS

LIST OF PROGRAMS IN C:

1. Computer organization –Hardware in a typical computer Identification – Booting error messages and what it means
2. Structure of a basic program - Hello world program
3. Data types and Type conversions
4. Input / Output: Formatted functions – Unformatted functions – Library functions
5. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
6. Conditional Statements: If – if else- nested if else- goto- switch case – nested switch case
7. Iteration Statements: for loops – nested for loops – while loop – do-while loop – break and continue statement
8. I/O operations of one- and two-dimensional arrays
9. Bubble Sort and Linear Search using arrays.
10. Functions and its types, Recursion Function
11. Pointers File Operations

L – 15; P – 30; TOTAL HOURS – 45

TEXT BOOKS:

1. Richard L. Stegman, "Focus on Fundamentals of Programming with C", Ninth Edition, ISBN -170077395X, 9781700773951, 2019.
2. E.Balagurusamy, "Programming in ANSI C", McGraw Hill Education, Eighth Edition, ISBN-13: 978-93-5316-513-0, ISBN-10: 93-5316-513-X, 2019.

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
2. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd
   Edition, ISBN 13: 9788131704370, 2012.
3. Paul J. Deitel, Deitel& Associates, "C How to Program", Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: identify the hardware components and describe the software components of computer.

CO2: bring out the importance of structural and procedural programming

CO3: write C coding using conditional and iteration statements

CO4: develop programs using Functions, Pointers and Files

CO5: implement program to build a real time application.

Board of Studies (BoS) :
18thBoS of CSE held on 26.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	M	L	H	-	L	-	-	M	-	-	-	-	-
CO2	H	M	M	-	-	H	M	-	M	-	-	-	-	-
CO3	H	M	H	-	-	H	-	-	H	-	-	-	-	-
CO4	H	H	H	H	M	H	-	-	H	-	-	-	-	-
CO5	H	H	H	H	H	H	H	H	H	L	H	H	-	-

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning this computer fundamentals and programming course.

SEMESTER II

END 1281	ENGLISH FOR ENGINEERS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To train students to use appropriate vocabulary in academic and technical contexts

COB2: To facilitate students to speak effectively while exchanging ideas and making presentations

COB3: To develop students' listening skill for comprehending and analysing information

COB4: To develop their reading skill through sub skills like skimming, scanning and critical reading of a text

COB5: To sharpen their academic writing skills

COB6: To expose them to the correct usage of language and help them to apply that knowledge appropriately

MODULE I HUMAN RESOURCES 10

L: Listening to short texts – short formal & informal conversations.

S: Introducing one self – exchanging personal info.

R: Process of reading purposes, Reading comprehension, improving comprehension skills, Reading activities – short comprehension passages, practice in skimming & scanning.

W: Scientific & Technical Writing, Editing skills, Activities – completing sentences, developing hints - Paragraph Writing

Voc. development: Prefixes, Suffixes

Lang. development: Articles, Countable and Uncountable nouns, Present tense, Wh– Questions, Yes or No questions.

MODULE II TRANSPORT 10

L: Listening to long scientific talks

S: Sharing personal information – greeting, leave taking.

R: Comprehension passages with multiple choice questions / Wh–questions/ openended questions - Reading longer technical texts & completing exercises based on them.

W: Use of reference words & discourse markers on a text, jumbled sentences, describing a process – flow chart, use of sequence words.

Voc. development: Guessing meanings of words in context, vocabulary used in formal letters, e-mails & reports.

Lang. development: Preposition of Time, Place & Date, Past tense, Conjunctions, Impersonal passive voice, Question tags, Numerical Adjectives.

MODULE III ENERGY 9

L:Listening to talk on the topic & completing tasks.

S: Asking about routine actions & expressing opinions.

R: Locating Specific Information

W: Letter seeking permission for Industrial Visit / symposium – Letter of invitation

Voc. development: Sequence words, misspelt words.

Lang. development: Adverbs, Degrees of comparison, Future tense, Homophones

MODULE IV OUR LIVING ENVIRONMENT 8

L: Listening to scientific texts & making notes – Effective ways of making notes.

S: Speaking about one's friend.

R: Reading texts & magazines for detailed comprehension. (Students can be asked to read any book of their choice to encourage reading habit)

W: Argumentative writing.

Voc. Development: Synonyms, antonyms, phrasal verbs.

Lang. development: If clauses, Subject - Verb Agreement

MODULE V TECHNOLOGY 8

L: Listening to talks (General & Scientific).

S: Short group conversations.

R: Reading and understanding technical articles, Short narratives & articles from Newspaper including conversations.

W: Short essays, Dialogue writing.

Voc. Development: Idioms & Phrases.

Lang. development: Modal verbs.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad:2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1) Perry, Carol Rosenblum(2011). The Fine Art of Technical Writing, Create Space Independent Publishing Platform, New Delhi.
2) Dutt, P.K. Rajeevan G. andPrakash, C.L.N. (2007). A course in Communication Skills, Cambridge Univesity Press, India.
3) Sen, Leena(2004). Communication Skills, Prentice Hall, New Delhi.
4) Matt Firth, Chris Sowton et.al (2012). Academic English An Integrated Skills Course for EAP, Cambridge University Press, Cambridge.
5) Bailey,Stephen2011. Academic Writing: A practical guide for students, New York, Rutledge.
6) Redston, Chris&Gillies (2005). Cunningham Face2Face (Pre-intermediate Student's Book&Workbook) Cambridge University Press, New Delhi.
7) Dutt P. Kiranmai and RajeevanGeeta (2013). Basic Communication Skills, Foundation Books.

COURSE OUTCOMES:

CO1: Read articles of a general kind in magazines and newspapers

CO2: Participate effectively in conversations, introduce themselves and their friends and express opinions in English

CO3: Comprehend conversations and short talks delivered in English

CO4: Write short essays of a general kind and letters and emails in English

CO5: Express through speaking and writing using appropriate vocabulary and grammar

Board of Studies (BoS) :
13th BoS of Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	-	-	-	-	-	-	H	-	-
CO3	-	-	-	-	-	-	-	-	-	M	-	-
CO4	-	-	-	-	-	-	-	-	-	H	-	-
CO5	-	-	-	-	-	-	-	-	-	M	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG No. 4 : Give Quality Education to all the Engineers

Statement: In future, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

MAD 1283	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**L**	**T**	**P**	**C**
SDG: 4		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To formulate and solve partial differential equation of first, second and higher orders

COB2: To introduce basics and engineering applications of Fourier series

COB3: To develop Fourier transform techniques

COB4: To introduce techniques and engineering applications of Laplace Transforms

COB5: To acquaint with Z -Transform techniques for discrete time systems

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients

MODULE II FOURIER SERIES 9+3

Fourier Series and Dirichlet's conditions - General Fourier series – Even and Odd functions - Half range Fourier series - Parseval's identity - Harmonic Analysis

MODULE III FOURIER TRANSFORMS 9+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity

MODULE IV LAPLACE TRANSFORM 9+3

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

MODULE V Z – TRANSFORM 9+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Kreyszig .E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011.
2. Grewal B.S., "Higher Engineering Mathematics", 44th edition, Khanna Publishers, New Delhi, 2017.
3. Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2010.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics", 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: form and solve the partial differential equations

CO2: derive a Fourier series of a given periodic function by evaluating Fourier coefficients

CO3: apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms

CO4: solve ordinary differential equations using Laplace transforms

CO5: solve difference equations using Z-transform

Board of Studies (BoS) :	**Academic Council:**
12th BOS of Mathematics & AS held on 23.06.2021	17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	H	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	H	L	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like Partial differential equations and transform techniques will help to solve complicated engineering problems

GED 1201	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To impart knowledge about the basic laws of mechanics, resolution of forces, equilibrium of particles in 2D and 3D force systems.

COB2: To learn about supports, reactions and equilibrium of rigid bodies

COB3: To educate surface properties such as centroid and moment of inertia

COB4: To impart knowledge on friction and its applications

COB5: To study the laws of motion, impulse, momentum and elastic bodies

MODULE I VECTOR APPROACH AND EQUILIBRIUM OF PARTICLE L: 11 T: 3

Introduction - Vectors – Vectorial representation of forces and moments – Vector Algebra and its Physical relevance in Mechanics – Laws of Mechanics – Parallelogram and triangular Law of forces- Coplanar Forces Principle of transmissibility, Resolution and Composition of forces- Forces in plane and space - Lame's theorem - Equilibrium of a particle in 2D plane - Equilibrium of a particle in 3D space - Equivalent systems of forces – Single equivalent force

MODULE II EQUILIBRIUM OF RIGID BODY L: 7 T: 3

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Examples

MODULE III PROPERTIES OF SURFACES L:10 T:3

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section using standard formula – second and product moments of plane area – Physical relevance - Standard sections: Rectangle, triangle, circle- composite sections, Hollow section using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia

MODULE IV FRICTION **L:9**
T:3

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction –Block friction– Rolling resistance –ladder friction and wedge friction

MODULE V LAWS OF MOTION **L:8**
T:3

Review of laws of motion – Newton's second law – D'Alembert's principle and its applications in plane motion; Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers", McGraw Hill Education, 10th Edition, 2017.
2. R.K. Bansal., "A Text Book of Engineering Mechanics", Laxmi Publications, 6th Edition, 2015.

REFERENCES:

1. Russell C Hibbeler, "Engineering Mechanics: Statics & Dynamics", 14th Edition, Pearson, 2015.
2. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education India, 2005.
3. R.S. Khurmi., "A Text Book of Engineering Mechanics", S. Chand Publishing, 22nd Edition, 2018.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: resolve composite forces, apply concept of equilibrium to particles and solve problems

CO2: apply the concept of equilibrium to rigid bodies and solve problems

CO3: determine the properties of surfaces

CO4: analyse and evaluate the frictional forces between the bodies

CO5: apply the laws of motion in solving dynamics problems

Board of Studies (BoS):
18th BOS held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	M	-	-	-
CO3	-	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	L	-	-	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The understanding of force systems and its components leads to construction of robust engineeringsystems.

GED 1204	BASIC ELECTRICAL AND	L	T	P	C
SDG: 3, 5, 8, 12	INSTRUMENTATION ENGINEERING	3	0	2	4

COURSE OBJECTIVES:

COB1: To make the students understand the basic calculations and measurements in DC circuits.

COB2: To provide the basic knowledge on AC circuit calculations and measurements.

COB3: To familiarize with working and characteristics of different DC and AC machines.

COB4: To impart knowledge on the fundamentals of measuring electrical quantities.

COB5: To expose the students to various sensors and transducers to measure non-electrical quantities.

MODULE I DC CIRCUITS AND MEASUREMENTS 13

The concept of voltage and current-Electric circuit elements: R, L, C – Independent and dependent sources - Ohm's law- Kirchhoff's law- series and parallel resistive circuits – Voltage and current division – Star-delta transformation - Mesh and nodal analysis of resistive circuits – simple problems - Measurement ofvoltage, current and power in DC circuits.

MODULE II AC CIRCUITS AND MEASUREMENTS 17

Sinusoidal voltage - RMS, average, peak value, peak factor and form factor - single phase RL, RC and RLC circuits –phasor representation - complex power – power factor - simple problems - Resonance in RLC circuits – 3 phase balanced circuit calculations– star and delta connections - Principles of measurement of AC voltage, current, power and energy - Measurement of three phase power - Protection of AC circuits: Fuse and Miniature Circuit Breakers(MCB)

MODULE III ELECTRICAL MACHINES 18

Construction, principle of operation, basic equations, characteristics and applications of DC generators, DC motors, single phase transformers and three phase induction motors. Working principle of BLDC Motor and its applications in home appliances.

(Qualitative treatment only).

MODULE IV ELECTRICAL MEASUREMENTS 14

Functional blocks of a measurement system - types of measurements - Direct and indirect measurements – Classification of instruments – Induction type – dynamometer type wattmeters - Types of indicating Instruments Principles of Electrical Instruments – Multimeters, Oscilloscopes - Static and Dynamic characteristics of an instrumentation system – Errors in Measurement – Calibration and Standards.

MODULE V TRANSDUCERS AND SENSORS 13

Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect – electromagnetic flow transducers - Level transducers – Ultrasonic and fiber optic transducers – Smart transducers - Types of sensors – elastic sensors – viscosity – moisture and pH sensors – sensors based on semiconductor junctions - charge coupled and CMOS image sensors – Biosensors.

PRACTICALS

List of Experiments

1. Verification of KCL and KVL (ii) Measurement of voltage, current and power in DC circuits.
2. Resonance of RLC series circuit (ii) Measurement of voltage, current, power and power factor in single phase & three phase AC circuits.
3. Magnetization characteristics of DC generator (ii) Characteristics of DC shunt motor, single phase transformer and three phase induction motor.
    (i) Measurement of AC voltages and currents in CRO – magnitudes, time period, frequency and phasor difference
    (ii) Capturing the transients in RC / RL / RLC circuits in a storage oscilloscope.
4. Characteristics of resistive, inductive and capacitive transducers.

L – 45 ; P – 30 ; TOTAL HOURS – 75

REFERENCES:

1. D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering”, McGraw HillEducation(India) Private Limited, Third Reprint,2016.
2. Giorgio Rizzoni, “Principles and Applications of Electrical Engineering”, McGraw HillEducation(India) Private Limited, 2010.
3. S.K.Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson India, 2011.

4. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2015.
5. Leonard S Bobrow, “Foundations of Electrical Engineering”, Oxford University Press, 2013.
6. Rajendra Prasad, “Fundamentals of Electrical engineering”, Prentice Hall of India, 2006.
7. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, 24th reprint 2016.
8. Sawhney, A. K., and PuneetSawhney “A Course in Electrical and Electronic Measurements and Instrumentation” Dhanpat Rai & Company, 2016.

COURSE OUTCOMES:

At the end of this course, the student will be able to:

CO1:perform the basic calculations in DC circuits and measure the various quantities associated with DC circuits.

CO2:measure and compute the rms current and voltage, power, power factor and energy in AC circuits.

CO3:choose appropriate motor for specific applications based on the motor characteristics.

CO4:use the CRO and other measuring devices for measuring electrical quantities.

CO5:select appropriate transducer or sensor for applications involving non-electrical quantities.

Board of Studies (BoS) :

15th meeting of BoS of EEE held on 25.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H		H	L	M		M		L	L	M	L	-	-	-
CO2	H		H	L	M		M		L	L	M	L	-	-	-
CO3	H		H	L			M		L	L	M	L	-	-	-
CO4	H		H	L			M		L	L	M	L	-	-	-
CO5	H		H	L			M		L	L	M	L	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 3 : Good health and well-being.

Statement: Understanding of the fundamentals of electrical and instrumentation systems can help in designing systems to promote good health and well-being.

SDG 5: Gender equality

Statement: Acquiring the interdisciplinary knowledge help overcome the gender barriers in work place.

SDG 8: Descent work and economic

Statement: The learners of this course can get descent work and earn financial benefits and they can work in interdisciplinary areas.

SDG 12: Responsible consumption and production.

Statement: Use of right and energy efficient electric and instrumentation components and devices results is reasonable consumption and production.

ESD 1201	**ELECTRON DEVICES**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSEOBJECTIVES:

COB1: To describe fundamental concepts of semiconductors and electronic components

COB2 : To discuss about various semiconductor devices and its applications

COB3: To explain the process of PCB design

COB4: To use different types of power control devices in a appropriate applications

COB5 : To analyze the characteristics of optoelectronic and nano electronic devices

PREREQUISITES:

- Fundamentals of Semiconductor physics

MODULE I INTRODUCTION TO DIODES AND PCB DESIGN 9

Overview of Electronic components- Semiconductors – Construction, Characteristics and applications of PN junction diode: Rectifiers - Construction, Characteristics and applications of Special purpose diodes: Zener Diode ,Varactor Diode, Tunnel Diode, Schottky Diode -Process of PCB design: Schematic and Layout.

MODULE II BIPOLAR JUNCTION TRANSISTORS 9

Construction, Configurations and Characteristics of BJT - Current components - Hybrid Model - Biasing of BJT - Transistor switching times - Applications of BJT

MODULE III FIELD EFFECT TRANSISTORS 9

Construction, Configuration and Characteristics of JFET - JFET biasing - Applications of JFET. Construction, Configuration and Characteristics of MOSFET -MOSFET biasing –Types of FET - Applications of MOSFET

MODULE IV POWER CONTROL DEVICES 9

Construction, characteristics, and applications: UJT, SCR, TRIAC and DIAC - IGBT - Power MOSFET

MODULEV OPTOELECTRONIC AND NANOELECTRONICS DEVICES 9

Optoelectronic devices- Laser diodes, Photoresistors, Photo diodes, Solar cell, Display Devices: Liquid Crystal Display, LED, OLED,AMOLED – Nano electronic Devices.

L- 45: TOTAL HOURS – 45

TEXT BOOKS:

1. J.Millman, C.C.Halkias, and SatyabrathaJit, "Electronic Devices and Circuits" Tata McGraw Hill, 2nd Ed., 2010.
2. Thomas L. Floyd ,"Electronic Devices", Global Edition,Pearson Education, 2017
3. Pallab Bhattacharya, "Semiconductor Optoelectronic Devices", 2017, 2nd Edition, Pearson Education, India.
4. William Liu, "Fundamentals of III-V Devices: HBTs, MESFETs, andHFETs/HEMTs",Wiley-Interscience; 1st edition ,1999
5. Byung-Gook Park, Sung Woo Hwang, Young June Park,"Nanoelectronicdevices",Stanford publishing, 2012.

REFERENCES:

1. Donald A.Neaman, "Semiconductor Physics and Devices" 3rd Ed., Tata McGraw Hill 2003.
2. Nandita Das Gupta and Amitava Das Gupta, "Semiconductor Devices – Modeling and Technology", Prentice Hall of India, 2004.
3. David A Bell, 'Electronic Devices and Circuits' , 5th edition, Oxford University Press, 2008

COURSE OUTCOMES:

CO1:Recall the classification of electronic components and concepts of semiconductors

CO2: Identify the applications of PN junction diode and various special diodes

CO3 : Apply the process of PCB design

CO4 : Analyze the characteristics of Bipolar junction transistor and Field effect transistor

CO5 : Choose various power control devices, switches and nanoelectronic devices for different applications

CO6: Summarize the characteristics of optoelectronic and display devices

Board of Studies (BoS) :	**Academic Council:**
24th BoS of ECE department held on 08.02.2023	20th Academic council meeting held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	-	-	-	-	-	2	-	-	2	1	1	3
CO2	2	3	2	-	-	-	-	-	2	-	-	2	1	1	3
CO3	2	3	2	-	3	-	-	-	2	-	-	2	3	1	3
CO4	1	1	1	-	-	-	-	-	2	-	-	2	2	1	2
CO5	2	2	2	-	-	-	-	-	2	-	-	2	2	1	2
CO6	2	2	2	-	-	-	-	-	2	-	-	2	2	1	2

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the basic characteristics of electronic components, method of biasing, applications helps for lifelong learning of newer technologies and concepts related to the electronic devices.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the theoretical concepts of electronic devices for the various application of electronic sub domains.

ESD 1202	**OBJECT ORIENTED**	**L**	**T**	**P**	**C**
SDG: 8	**PROGRAMMING**	**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

COB 1	**:**	Describe the fundamentals of Object-Oriented Programming (OOP) and Java programming language.
COB 2	**:**	Explain the core principles governing packages, inheritance, and interfaces in Java.
COB 3	**:**	Construct Java applications that incorporate threaded programming
COB 4	**:**	Design and implement Java applications involving threads and generic classes, identifying areas for optimization and improvement.
COB 5	**:**	Assess the efficacy of exception handling techniques

PREREQUISITE: Data types, functions and loops

MODULE I INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING AND JAVA 8

Object oriented programming: Overview, paradigms and Features - Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- JavaDoc comments

MODULE II INHERITANCE, PACKAGES, AND INTERFACES 8

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

MODULE III EXCEPTION HANDLING 7

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java’s Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending – Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

MODULE IV I/O, GENERICS, STRING HANDLING 7

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods– Bounded Types –Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

PRACTICALS 30

1. Implement the concepts of Data Types, Variables, and Arrays in Java
2. Operators in Java
3. Implement Control Statements and Programming Structures in Java
4. Overloading and Passing Objects as Parameters
5. Work with Packages, Member Access, and Importing Packages.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Problem Solving

L–30; P-30; TOTAL HOURS–60

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.
2. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.

REFERENCES:

1. Amritendu De, "Spring 4 and Hibernate 4: Agile Java Design and Development", McGraw-Hill Education, 2015
2. Balagurusamy, "OOPS using C++ and JAVA", TataMcGraw-Hill Education, ISBN9781259051371, 2018.

COURSE OUTCOMES:

Students who complete this course will

CO1 : Apply the concepts of object-oriented programming (OOP) and its paradigms.

CO2 : Explore packages, member access, and importing packages.

CO3 : Implement thread synchronization and inter-thread communication.

CO4 : Perform basic input and output operations in Java, including console and file I/O.

CO5 : Create practical applications that involve packages, member access, and package importing.

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	H	H	M	M	L	-	-	L	M	L	M	L	H	L	H
CO2	H	H	H	M	L	-	-	L	M	L	M	L	H	L	H
CO3	H	H	H	M	L	-	-	L	M	L	M	L	H	L	H
CO4	H	H	L	L	L	-	-	L	M	H	H	L	M	L	M
CO5	H	H	M	L	L	-	-	L	M	H	H	L	H	L	H

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning the Object-Oriented Programming course.

ESD 1203	ELECTRON DEVICES LABORATRY	L	T	P	C
SDG: 4,9		0	0	2	1

COURSEOBJECTIVES:

COB 1: To identify various electronic components and devices
COB2 : To apply the PCB design process
COB3: To analyze the working characteristics and applications of various Semiconductor Devices

PRACTICALS
List of Experiments:
1. Study of Electronic Components, Data Sheet and Equipments
2. PCB Design Process - Schematic capture, Simulation, Schematic to layout transfer
3. PN junction diode characteristics and its application
4. Zener Diode characteristics and its applicatin
5. Bipolar Junction Transistor (BJT) characteristics and its application
6. Field Effect Transistor (FET) characteristics and its application
7. Silicon Controlled Rectifier (SCR) characteristics and its application
8. Light Dependent Resistor(LDR) characteristics and its application

P – 30; TOTAL HOURS– 30

TEXT BOOKS:

1. David Bell. Fundamentals of Electronic Devices and Circuits Lab Manual,Oxford University Press, 2009.
2. J.Millman, C.C.Halkias, and SatyabrathaJit, “Electronic Devices and Circuits” Tata McGraw Hill, 2nd Ed., 2010.
3. 3. Thomas L. Floyd ,”Electronic Devices”, Global Edition, Pearson Education, 2017.

REFERENCES:

1. Thomas L. Floyd ,”Electronic Devices”, Global Edition ,Pearson Education,2017
2. Pallab Bhattacharya, “Semiconductor Optoelectronic Devices”, 2017, 2ndEdition, Pearson Education, India.

COURSE OUTCOMES:

CO1 : Construct electronic circuits using simulation software and obtain their characteristics
CO2 : Apply the process of PCB design
CO3: Test and troubleshoot various semiconductor devices

CO4 : Apply various electronic components and devices in circuit design for practical applications.

CO5: Associate with a team and implement applications using electronic devices

CO6: Use device and components data sheet to select the appropriate components.

Board of Studies (BoS) :

24TH BoS of ECE department held on 08.02.2023

Academic Council:

20th Academic council meeting held on 13.04.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3
CO1	2	2	2						2			2	3	2	3
CO2	3	2	3						2			2	3	2	3
CO3	3	3	3						2			2	3	2	3
CO4	3	3	3						2			2	3	2	3
CO5	3	2	3						3			2	2	1	2
CO6	3	3	3	2	2				3			2	3	1	2

Note: L- Low Correlation M - Medium Correlation H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand practically the basic VI characteristics of electronic devices, method of biasing, applications and helps for lifelong learning of newer technologies and concepts related to the electronic devices.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the practical concepts of electronic devices and its applications in various fields of electronic sub domains.

		L	T	P	C
GED 1206	**ENVIRONMENTAL SCIENCES**	**L**	**T**	**P**	**C**
SDG: All		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

To make the student conversant with the

COB1: various natural resources, availability, utilisation and its current scenario.

COB2: diverse ecosystems and its function, importance of biodiversity, its values, threats and conservation.

COB3: types of pollutants and its impacts on the environment and the effects of natural disasters.

COB4: impacts of human population, human health, diseases and immunisation for a sustainable lifestyle.

MODULE I NATURAL RESOURCES 8

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems - (a) Land resources: Land degradation soil erosion and desertification - (b) Forest resources: Use and over-exploitation, deforestation (c) Water resources: Use and over-utilisation of surface and ground water, conflicts over water, dams: benefits and problems, effects on forest and tribal people - (d) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, mining (e) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture (f) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources.

MODULE II ECOSYSTEMS AND BIODIVERSITY 8

Concept of an ecosystem - Food chains, food webs, Energy flow in the ecosystem - ecological pyramids - Ecological succession - Characteristic features, structure and function of (a) Terrestrial Ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem (b) Aquatic fresh water ecosystems: Ponds and lakes, rivers and streams (c) Aquatic salt water ecosystems: oceans and estuaries

Biodiversity and its conservation - Types: genetic, species and ecosystem diversity - Values of biodiversity - India as a mega-diversity nation - Invasive, endangered, endemic and extinct species - Hot sports of biodiversity and Red Data book - Threats to biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 8

Sources, cause, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear pollution (h) ill-effects of fireworks and upkeep of clean environment, types of fire and fire extinguishers- Solid waste Management: types, collection, processing and disposal of urban waste, industrial waste, e-waste and biomedical wastes - Disaster management: flood, drought, cyclone, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES 6

Human Population - Population growth, Population explosion, population pyramid among nations - Family Welfare Programme - Human Rights - Value Education - Environment and human health: air-borne, water borne, infectious diseases, contagious diseases and immunisation (all types of vaccines from birth), risks due to chemicals in food and water, endocrine disrupting chemicals, cancer and environment - Sustainable development - Resettlement and rehabilitation of people - Environment Legislative laws- Women and Child Welfare, Public awareness.

Case studies related to current situation.

L – 30; Total Hours – 30

TEXT BOOKS:

1. ErachBharucha, “Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education for University Grants Commission”, Orient BlackswanPvt. Ltd., Hyderabad, India, 2013.
2. Benny Joseph, “Environmental Studies”, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, “Environmental Science and Engineering”, Sri Krishna Publications, Tamil Nadu, India, 2018.
4. Raman Sivakumar, “Introduction to Environmental Science and Engineering”, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, “Principles of Environmental Science and Engineering”, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., “Environmental Science and Engineering”, New Age International Pvt. Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., “Introduction to Environmental Engineering and Science”, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., “Environmental Science and Engineering”, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., “Environmental Science”, Wadsworth Publishing Co. Boston, USA, 2016.
4. “Waste to Resources: A Waste Management Handbook”, The Energy and Resources Institute, 2014.
5. https://www.teriin.org/article/e-waste-management-india-challenges-and-opportunities.
6. https://green.harvard.edu/tools-resources/how/6-ways-minimize-your-e-waste.
7. https://www.aiims.edu/en/departments-and-centers/central-facilities/265-biomedical/7346-bio-medical-waste-management.html.
8. https://tspcb.cgg.gov.in/Shared%20Documents/Guidelines%20for%20Management%20of%20Healthcare%20Waste%20Waste%20Management%20Rules,%202016%20by%20Health%20Care%20Facilities.pdf.

COURSE OUTCOMES:

The student will be able to

CO1:analyse the current scenario of various natural resources and their depletion and suggest remedies to curb the exploitation.

CO2: identify food chains and web and its function in the environment, assess the impacts on the biodiversity and propose solutions to conserve it.

CO3:analyse the types and impacts of pollutants in the environment and propose suitable methods to alleviate the pollutants and the natural disasters.

CO4: assess on the impact of human population and the health related issues and immunisation practices and sustainable developments for a healthy life

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Board of Studies (BoS) :

11thBoS of Chem held on 17.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	L	M	-	-	L	M	-	-	-	-	-	-	-	-
CO2	-	-	-	M	H	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	M	M	-	-	L	-	M	-	-
CO4	-	-	-	-	-	M	M	M	-	-	-	L	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SDG All: No Poverty, Zero Hunger, Good Health and Well-Being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable & Clean Energy, Decent Work and Economic Growth, Industry, Innovation & Infrastructure, Reduced Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace, Justice and Strong Institutions, Partnerships for the Goals.

Statement: This course discuss about the environment, all the natural resources available, sharing of resources, effective utilisation, effects of over utilisation, health and environmental issues pertained to that, global warming and related issues, climates, disasters, impact assessments, population, human rights, societal welfare, laws to conserve the environment and sustainability.

SEMESTER III

ESD 2101	**ANALOG ELECTRONIC**	**L**	**T**	**P**	**C**
SDG: 4,9	**CIRCUITS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1	**:**	To develop amplifier configurations using BJT and FET devices for specific gain and impedance requirements.
COB 2	**:**	To design and test the feedback amplifiers and oscillators
COB 3	**:**	To estimate the bandwidth and selectivity of tuned amplifiers through calculations and simulations.
COB 4	**:**	To apply and analyze the concepts of Multivibrator circuits.
COB 5	**:**	To analyze the blocking oscillator & Time base generating circuits.

PREREQUISITE: Circuit Analysis Techniques and Semiconductors

MODULEI SMALL SIGNAL ANALYSIS AND FREQUENCY RESPONSE OF AMPLIFIERS 9

Biasing -stabilization-Small signal models of BJT and FET- Small signal Analysis of amplifiers, Differential amplifier-.Frequency response of amplifiers.

MODULEII FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Basic feedback concepts - Four feedback topologies with amplifier circuit - Analysis of series - shunt feedback amplifiers. Oscillators: Barkhausen criteria for oscillator - Analysis of RC oscillators - LC oscillators.

MODULEIII POWER AMPLIFIERS AND TUNED AMPLIFIERS 9

Classification of large signal amplifiers – Class A amplifier– Class B amplifier – Class AB amplifier– Class C amplifier and Efficiency – Analysis of Single tuned amplifier - Double tuned amplifier.

MODULE IV MULTIVIBRATOR CIRCUITS 9

Collector coupled and Emitter coupled Astable multivibrator – Monostable multivibrator- Bistable multivibrator - Schmitt trigger circuit.

MODULE V BLOCKING OSCILLATORS AND TIME BASE GENERATORS 9

Pulse transformers - Monostable Blocking Oscillators using Emitter and base timing - Astable blocking oscillator - Voltage sweep generators -

Current sweep generators

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Boylested and Nashlesky, Electronic Devices and Circuit theory, 11th edition,Prentice Hall of India, 2015.
2. Donald.A.Neamen, Electronic Circuit Analysis and Design, 4th edition, Tata McGraw Hill, 2019.
3. Millman .J. and Halkias C.C, Integrated Electronics, McGraw Hill, 2nd Edition, 2017.
4. Robert Boylestad , Introductory Circuit Analysis, Pearson; 13th edition, 2015.

REFERENCES:

1. Adel.S.Sedra, Kenneth C. Smith, Micro Electronic circuits, 8th Edition, Oxford University Press, 2019.
2. David A. Bell, Electronic Devices and Circuits, Oxford Higher Education press, 6th Edition, 2019.
3. David A. Bell, "Solid State Pulse Circuits", 4th edition, Eastern economic edition, Prentice Hall of India, 2018.
4. Millman J. and Taub H., "Pulse Digital, Switching waveform", 3rd Edition, McGraw-Hill International, 2017

COURSEOUTCOMES:

Students who complete this course will be able to

CO1 : analyze small signal amplifiers

CO2 : design feedback amplifier circuits and oscillators.

CO3 : develop large signal amplifiers and tuned amplifiers

CO4 : implement multivibrators and schmitt trigger.

CO5 : analyze and design blocking oscillators and time base generators

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	2	2	1	1	1	1	2	1	2	3	1	2
CO2	1	3	1	1	2	1	1	1	1	2	1	2	1	3	2
CO3	1	1	1	1	1	1	1	1	1	1	3	2	2	1	3
CO4	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3
CO5	1	1	1	1	1	1	1	1	1	1	1	3	1	1	3

Note: L-Low Correlation, M-Medium Correlation, H-High Correlation

SDG 4: Quality Education - The course content, which includes small signal analysis, feedback amplifiers, power amplifiers, and multivibrator circuits, contributes to providing quality education in the field of electronics and electrical engineering.

SDG 9 : Industry, Innovation & Infrastructure Statement : The course content covering various amplifier types, oscillators and time base generators fosters knowledge and skills that are essential for the development and improvement of innovative technologies and infrastructure in the electronics industry.

ESD 2102	**DIGITAL ELECTRONICS**	**L**	**T**	**P**	**C**
SDG: 4,8,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1	**:**	To discuss the methods for simplifying Boolean expressions.
COB 2	**:**	To design and analyze combinational circuits.
COB 3	**:**	To design and test the performance of sequential circuits.
COB 4	**:**	To characterize and select the memories and programmable logic devices.
COB 5	**:**	To analyze the digital circuits using simulation tools.

PREREQUISITE: Fundamentals of Boolean Algebra and Knowledge on Number System

MODULE I DIGITAL FUNDAMENTALS 9

Number systems - Binary codes-Boolean algebra and theorems- Logic gates - Boolean functions - Karnaugh map and Quine - McCluskey Method Implementations of Logic functions using universal gates.

MODULE II DESIGN OF COMBINATIONAL CIRCUIT 9

Analysis and design procedures- Circuits for arithmetic operations – Magnitude comparator-Multiplexer- Demultiplexer- Encoder-decoder - Parity generator and checker- Code converters.

MODULE III SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 10

Analysis and Design of synchronous sequential circuits -Flip flops- SR, JK, T, D, Master slave FF-Counters-Shift registers –-Design of rolling display-Moore and Mealy circuits.

MODULE IV ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 8

Analysis and Design of Asynchronous sequential circuits- Fundamental mode sequential circuits- Pulse mode sequential circuits-cycles and races-Hazards - Design of Hazard free circuits.

MODULE V MEMORY DEVICES AND VERILOG HDL 9

Basic memory structure- Programmable Logic Devices — Programmable

Logic Array (PLA) — Programmable Array Logic (PAL) — Field Programmable Gate Arrays (FPGA) — Implementation of combinational logic circuits using PROM, PLA and PAL. Introduction to Verilog HDL-Types of Modeling.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, —Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog‖, Pearson Education, New Delhi, 6th edition, 2017.
2. 2. D. P. Kothari and J. S Dhillon, —Digital Circuits and Design‖, Pearson Education, New Delhi, 2016.

REFERENCES:

1. Charles H.Roth and J.S.Dhillon, —Fundamentals of logic design‖, Cengagei, 7th edition, 2019.
2. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, New Delhi, 2003.
3. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, New Delhi, 10th Edition 2008
4. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, New Delhi, 4th Edition, 2010.
5. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", Tata McGraw Hill, New Delhi, 6th Edition, 2009
6.

COURSEOUTCOMES:

Students who complete this course will be able to

CO1 : Apply the concepts and terminology of digital electronics

CO2 : Formulate and employ Karnaugh map and tabulation method to reduce Boolean expressions

CO3 : Analyze and design combinational circuits

CO4 : Design different types of sequential circuits.

CO5 : Implement combinational logic circuits using programmable logic devices.

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	L	L	L	L	L	L	M	M	M	L	M	M	H
CO2	H	H	H	H	M	L	L	L	M	M	M	L	M	M	H
CO3	H	H	H	H	M	L	L	L	M	M	M	L	M	M	H
CO4	H	H	H	H	M	L	L	L	M	M	M	L	M	M	H
CO5	M	M	H	L	M	L	L	L	M	M	M	L	M	M	H

Note: L- Low Correlation M - Medium Correlation H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: Understanding of the digital electronics course will bring a global impact on quality education.

SDG 8: Development of new technologies provides sustainable economic growth and productive employment.

Statement: Analysis and design of digital circuits promote sustained economic growth.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Able to apply the design concepts of digital circuits in IC based design.

ESD 2103	OPERATING SYSTEMS	L	T	P	C
SDG: 4,11		3	0	2	4

COURSE OBJECTIVES:

COB1: Apply the core principles and functions of operating systems

COB2: Analyze and compare different CPU scheduling algorithms

COB3: Examine the concepts of memory virtualization and apply various memory
management techniques to optimize resource utilization

COB4: Design and implement solutions for process synchronization

COB5: Evaluate security mechanisms and strategies in operating systems

PREREQUISITE:

Knowledge of Computer Organization and Architecture, Knowledge of “C” language

MODULE I INTRODUCTION TO OPERATING SYSTEMS 9

Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures ,Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

MODULE II PROCESS MANAGEMENT 9

Process Concept - Scheduling - Operations - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The critical-section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

MODULE III MEMORYMANAGEMENT 9

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

MODULE IV STORAGE MANAGEMENT 9

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface- Directory Structure - Directory organization - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

MODULE V VIRTUALMACHINESANDMOBILEOS 9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

PRACTICALS

1. Process Management using System Calls : Fork, Exec, Getpid, Exit, Wait, Close
2. Write C programs to implement the various CPU Scheduling Algorithms
3. Illustrate the inter process communication strategy
4. Implement mutual exclusion by Semaphores
5. Write a C program to avoid Deadlock using Banker's Algorithm
6. Write a C program to Implement Deadlock Detection Algorithm
7. Write C program to implement Threading
8. Implement the paging Technique using C program
9. Write C programs to implement the Memory Allocation Methods
10. Write C programs to implement the various Page Replacement Algorithms
11. Write C programs to Implement the various File Organization Techniques
12. Write C programs for the implementation of various disk scheduling algorithms

L – 45 ; P – 30 ; TOTAL HOURS – 75

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.

REFERENCES:

1. Pramod Chandra P.Bhatt, “An introduction to Operating Systems Concepts and Practice”, PHI Learning, 5th Edition, India, 2019. (ISBN : 9789387472884)
2. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
3. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Recall and list the main types of operating systems and characteristics

CO2: Demonstrate process management during multitasking.

CO3: Analyze a given CPU scheduling scenario and apply appropriate scheduling
algorithms.

CO4: Analyze a deadlock scenario involving multiple processes and resources and propose suitable methods to resolve or avoid deadlocks.

CO5: Evaluate the performance of different memory management scheme, and justify the best-fit approach for a given scenario.

Board of Studies (BoS) :
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	L	L	L	-	-	-	L	-		-		L	H	H
CO2	H	M	H	L	-	-	-	L	-	H	-		L	H	H
CO3	H	H	H	M	-	-	-	L	-	H	-		L	H	L
CO4	H	M	M	M	-	-	-	L	-		-		L	H	H
CO5	H	M	L	L	-	-	-	L	-		-		L	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Understanding operating systems is crucial for the development and maintenance of robust, efficient, and reliable computing infrastructures, which aligns with SDG 9's focus on promoting sustainable industry and innovation.

SDG11: Sustainable Cities and Communities
Operating systems play a role in the development of smart cities and sustainable communities by enabling efficient resource management and supporting interconnected devices and systems

ESD 2104	**DATA STRUCTURES AND**	**L**	**T**	**P**	**C**
SDG: 4,9	**ALGORITHMS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1 **:** To explain the role of data structures in organizing and manipulating data efficiently.

COB 2 **:** To explore various linear data structures, trees, graphs and hash tables.

COB 3 **:** To learn different searching and sorting algorithms and their efficiency in different scenarios

COB 4 **:** To apply data structures to solve real-world problems

COB 5 **:** To improve problem-solving skills.

PREREQUISITE: Basics of C language Program.

MODULE I FUNDAMENTALS OF DATA STRUCTURES 9

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – divide & conquer – recursion – analyzing recursive algorithms

MODULE II SEQUENTIAL DATA STRUCTURE 9

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – Stack ADT – Queue ADT – double ended queues – applications

MODULE III SEARCHING AND SORTING 9

Bubble sort – selection sort – insertion sort – merge sort – quick sort – analysis of sorting algorithms – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency.

MODULE IV TREE 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi- way search trees

7

MODULE V GRAPH 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – greedy algorithms – dynamic programming – shortest paths – minimum spanning trees – introduction to complexity classes and intractability

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C++ 4th Edition", Pearson Education Limited, 2013.
2. Yashavant Kanetkar, "Data Structures Through C++", BPB Publications; 4th edition, 2022.
3. Reema Thareja, "Data Structures Using C", Oxford Publisher, 2nd edition, ISBN-13: 978-0198099307,2014.

REFERENCES:

1. Narasimha Karumanchi," Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications, 5thEdition, ISBN-13: 978-8193245279, 2016.
2. G. A. V. Pai, "Data Structures and Algorithms: Concepts, Techniques and Applications", McGraw Hill Education, 1st edition, ISBN-10:0070667268,2017.
3. E.Horowitz, S.Sahni and Susan Anderson Freed , "Fundamentals of Data structures in C", 2nd Edition, Universities Press,1993
4. Michael T. Goodrich, Roberto Tamassia, and Michael H. Gold wasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021.

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Explain abstract data types

CO2 : Implement and manipulate various data structures, including linked lists, stack and queues.

CO3 : Analyze and execute tree operations and traversals to proficiently manipulate tree structures.

CO4 : Define and differentiate key terms and concepts related to graphs.

CO5 : Apply searching and sorting techniques to efficiently process and manage data.

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L	M	L	H	H	L	L	L	L	L	L	H	L	L	L
CO2	L	M	L	H	H	L	L	L	L	L	L	H	L	L	L
CO3	L	M	L	H	H	L	M	L	L	L	L	H	L	L	L
CO4	L	M	L	H	H	L	L	L	L	L	L	H	L	L	L
CO5	H	M	L	H	H	L	L	L	L	L	L	H	L	L	L

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG : 4 - Quality Education
This course will deliver the basic concepts Data structure

SDG : 9 - Industry, Innovation and Infrastructure
Data structure plays major roles in memory management of programming which modernize the industry operations.

		L	T	P	C
ESD 2105	**ANALOG AND DIGITAL**	**L**	**T**	**P**	**C**
SDG: 4, 8	**ELECTRONICS LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB 1 **:** Determine the Frequency response of single and double stage Amplifier

COB 2 **:** To design and analyze characteristics of feedback amplifiers and oscillators.

COB 3 **:** To perform the design of Combinational circuits.

COB 4 **:** To verify the functionalities of Flip-flops

COB 5 **:** To design and implement shift register & counters.

PREREQUISITE: Basics of electron devices and number systems

PRACTICALS

List of Experiments:

1. Frequency Response of BJT AND FET amplifiers.
2. Determination of frequency response, input impedance and output impedance of two stages RC Coupled Amplifier.
3. Design and Analysis of Feedback Amplifiers
4. Design and test the RC and LC Oscillator using BJT for the given frequency.
5. Determination of bandwidth of single stage and multistage amplifiers.
6. Design of combinational logic circuits using Boolean expressions optimized by K Map.
7. Design and implementation of binary Adder/ subtractor / 8 Bit magnitude Comparator.
8. Design and implementation of Multiplexer and Demultiplexer using logic gates.
9. Design and implementation of odd/even parity checker generators using Encoder and Decoder.
10. Verification of R-S flip-flop, J-K flip-flop, T Flip-Flop, D Flip-Flop Using logic gates.
11. Design and implementation of shift register/ counter.

P – 30 ; TOTAL HOURS- 30

REFERENCES:

1. Paul Horowitz and Thomas C. Hayes, ―Learning the Art of

Electronics: A Hands-On Lab Course Book‖, Cambridge university press, first edition, 2016.

2. M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog‖, Pearson Education, New Delhi, 6th edition, 2017.
3. K. A. Navas, Electronics Lab Manual, Volume II, PHI, 6 th Edition, 2015.
4. Charles H.Roth and J.S.Dhillon, - Fundamentals of logic design‖, Cengagei, 7th edition, 2019

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Differentiate between common emitter, common base, and common collector configurations.

CO2 : Design Cascode and cascade amplifiers.

CO3 : Implement state transition diagrams and timing diagrams for sequential circuit analysis.

CO4 : Design different sequential circuits.

CO5 : Apply appropriate design methodologies to solve problems, considering feasibility and functionality.

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

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CO 1	H	M	M	L	M								H	H	H
CO 2	H	M	M	L	M								H	H	H
CO 3	H	M	M	L	M								H	H	H
CO 4	H	M	M	L	M								H	H	H
CO 5	H	M	M	L	M								H	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Life long learning opportunities for all.
Statement: Understanding of the analog and digital electronics course will bring a global impact on quality education.

SDG 8: Development of new technologies provides sustainable economic growth and productive employment.
Statement: Analysis and design of analog and digital circuits promote sustained economic growth

ESD 2106	**DATA STRUCTURES**	**L**	**T**	**P**	**C**
SDG: 4,9	**LABORATORY USING C++**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB 1 **:** To understand and implement search algorithms.

COB 2 **:** To explore and compare various sorting algorithms.

COB 3 **:** To implement fundamental data structures.

COB 4 **:** To work with a dynamic data structure.

COB 5 **:** To understand and implement advanced sorting algorithms.

PREREQUISITE: Basics of C language

PRACTICALS

List of Experiments:

1. Write a C++ programs to implement recursive and non-recursive
   i) Linear search ii) Binary search.
2. Write a C++ programs to implement i) Bubble sort ii) Selection sort iii) quick sort iv) insertion sort.
3. Write a C++ programs to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C++ programs to implement list ADT to perform following operations
   a) Insert an element into a list.
   b) Delete an element from list
   c) Search for a key element in list
   d)count number of nodes in list
5. Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
6. Write a C++ program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.

7. Write C++ programs for implementing the following sorting methods: Merge sort and Heap sort

8. Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) inorder and c) postorder.

9. Write a C++ program to perform the following operations a) Insertion into a B-tree b) Deletion from a B-tree.

10. Write a C++ program to implement all the functions of a dictionary (ADT)

P – 30 ; TOTAL HOURS- 30

REFERENCES:

1. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Understand the differences between linear and binary search and their respective time complexities.

CO2 : Design efficient algorithms for searching, sorting, and other operations.

CO3 : Implementing data structure programs in C++ languages

CO4 : Will gain practical experience in working with dynamic data structures.

CO5 : Apply data structures in solving real-world problems.

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

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CO 2	H	H	L	L	-	-	-	L	H	M	H	L	M	H	H
CO 3	H	M	M	M	M	-	-	L	H	L	H	L	H	H	H
CO 4	M	M	H	H	-	-	-	L	L	-	L	L	H	H	H
CO 5	M	M	H	H	L	-	--	L	L	-	L	L	H	H	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG: 4 - Quality Education

This course will deliver the basic concepts Data structure

SDG : 9 - Industry, Innovation and Infrastructure

Data structure plays major roles in memory management of programming which modernize the industry operations.

GED 2101	**ESSENTIAL SKILLS AND APTITUDE FOR ENGINEERS**	**L**	**T**	**P**	**C**
SDG: 17		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1:To enable them to make effective business presentations

COB2:To train them to participate in group discussions

COB3: To enhance the problem-solving skills

COB4: To train students in solving analytical problems

MODULE I ORAL DISCOURSE 07

Importance of oral communication-verbal and non-verbal communication, Presentation Strategies- one minute presentation (using Audacity/vocaro) - Effective listening skills, listening for specific information

MODULE II VERBAL COMMUNICATION 08

Understanding negotiation, persuasion & marketing skills - Listening to short conversations & monologues - Group Discussion techniques - Role plays - Interview techniques

MODULE III BASIC NUMERACY 08

Simplification and Approximation – Competitive Examination Shortcut Techniques - Number Systems - Simple and Compound Interest-Progression

MODULE IV ANALYTICAL COMPETENCY 07

Blood Relations – Clocks and Calendars – Coding and Decoding – Analytical Reasoning(Linear Arrangement, Circular Arrangement, Cross Variable Relationship and Linear Relationship)– Directions .

L – 30; TOTAL HOURS 30

REFERENCES:

1. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK
2. Swan, Michael (2005). Practical English Usage, Oxford University Press
3. Bhattacharya. Indrajit (2008). An Approach to Communication Skills, DhanpatRai& Co., (Pvt.) Ltd. New Delhi.
4. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009

5. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017
6. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning , S. Chand Limited, 2010
7. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016
8. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
9. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019.

COURSE OUTCOMES:

CO1: Make effective business presentations

CO2: Speak English intelligibly, fluently and accurately in group discussions

CO3: To apply the various problem-solving techniques

CO4: Understand and solve aptitude problem

Board of Studies (BoS) :
13th BoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1										H					
CO2									M	H					
CO3					L	L									
CO4		M		L											
CO5															

Note: L- Low Correlation M - Medium Correlation H - High Correlation

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Statement: This course ensures capacity building and skills development requisite for implementing global partnership.

SEMESTER IV

		L	T	P	C
ESD 2201	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
SDG: 3,9		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB 1 **:** Recall mathematical representations of signals and their properties.

COB 2 **:** Explain the purpose and significance of analytical tools like Fourier transforms, Discrete Fourier transforms, Fast Fourier Transforms, and Z-Transforms in digital signal processing.

COB 3 **:** Apply analytical techniques such as Fourier transforms, Discrete Fourier transforms, Fast Fourier Transforms, and Z-Transforms to analyze and process digital signals.

COB 4 **:** Examine the components and functions of various digital filters used in digital signal processing.

COB 5 **:** Develop solutions for signal processing challenges in systems with multiple sampling frequencies.

PREREQUISITE: Basics of differential calculus and mathematical transforms

MODULE I INTRODUCTION TO SIGNALS AND SYSTEMS 9

Discrete and Continuous Signals. Standard elementary signals, Basic operations on signals. Energy and Power of signals. Continuous-Time and Discrete-Time Systems, Linear and Time Invariant (LTI) Systems and its Properties, Impulse Response, Discrete-time and Continuous time convolution. Applications of Digital signal processing.

MODULE II FOURIER ANALYSIS 9

Discrete Fourier Transforms: Properties of DFT, Circular Convolution of Sequences using DFT- Computation of DFT: Overlap Add Method and Overlap Save Method- Fast Fourier Transforms (FFT) – Radix-2 Decimation-in-Time and Decimation-in- Frequency, DCT and its applications- Sampling and Quantization

MODULE III IIR DIGITAL FILTERS 9

Analog Filter Approximations – Design of Analog filters, Design of IIR Digital filters from Analog Filters based on Impulse Invariant and Bilinear Transformation Method.

MODULE IV FIR DIGITAL FILTERS 9

Characteristics of FIR Digital Filters - Linear phase FIR filter. Design of FIR Filters: Fourier Method and Window Techniques (Rectangular Window, Hamming Window, Hanning Window), Comparison of IIR & FIR filters. Application of digital filters.

MODULE V MULTIRATE SIGNAL PROCESSING AND ITS APPLICATIONS 9

Introduction, Down-sampling, Decimation, Up-sampling, Interpolation, Sampling Rate Conversion, Applications of Multi-Rate Signal Processing.

L –45 ,T –15 ; TOTAL HOURS –60

TEXT BOOKS:

1. A. V. Oppenheim and R. W. Schafer. Discrete-Time Signal Processing (Prentice-Hall Signal Processing Series) 3rd Edition, 2021
2. John G Proakis, Dimtris G Manolakis, Digital Signal Processing Principles, Algorithms and Application, 4th Edition, Pearson Education India, 2007.

REFERENCES:

1. Sanjit K Mitra, “Digital Signal Processing, A Computer Based Approach”, 4th Edition, McGraw Hill Education, 2013
2. Dick Blandford, John Parr. Introduction to Digital Signal Processing. Pearson Education, Inc, 2013.

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Categorize different signal and system types based on their characteristics.

CO2 : Classify signals through the application of diverse time-domain operations.

CO3 : Employ digital transforms for analysis of digital signals

CO4 : Formulate both IIR and FIR digital filters as part of design processes.

CO5 : Describe Multirate signal processing principles.

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	H	H	M	L									H	H	H
CO 2	H	H	M	L									H	H	H
CO 3	H	H	M	L									H	H	H
CO 4	H	H	M	L									H	H	H
CO 5	H	H	M	L									H	H	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 3 : Good Health and Well-Being

Statement : Digital signal processing plays a major role in medical instrumentation. A sound knowledge in these could lead to a substantial research and development in health and well-being.

SDG 9 : Industry, Innovation & Infrastructure

Statement : Signals and its processing forms the basis of control systems and automation.

ESD 2202	**LINEAR INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**
SDG: 4, 9		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

COB 1 **:** To describe the characteristics and internal circuit of op-amps.

COB 2 **:** To design the various linear and non-linear applications of op-amps.

COB 3 **:** To design and characterize the data converters and active filters.

COB 4 **:** To explain and characterize the Timer IC and PLL.

COB 5 **:** To explain and characterize the special purpose ICs like voltage regulators, switched capacitor filters.

PREREQUISITE:

- Comprehensive knowledge in Network Analysis and Synthesis
- Basics of Electronic circuits

MODULE I — INTRODUCTION AND CIRCUIT CONFIGURATION OF LINEAR ICS — 5

OP-AMP fundamentals, ac and dc characteristics, basic building blocks of OPAMP. Op-Amp functionality: virtual ground, Inverting and non-inverting modes.

MODULE II — APPLICATIONS OF OPERATIONAL AMPLIFIERS — 8

Linear circuits: adder, subtractor, difference amplifier; Differentiator, Integrator, V to I converter and I to V converter, Instrumentation Amplifier, sine wave Oscillators. Non-linear circuits: Precision rectifier, Comparator, Schmitt trigger, Multivibrators, Triangular wave generator, Multiplier and phase detector.

MODULE III — CONVERTERS AND FILTERS — 9

Analog switches, High speed Sample and Hold circuit. DAC techniques: Weighted Resistor, R-2R ladder, Inverted R-2R ladder, ADC techniques: Flash type, Counter type, Successive approximation, Single slope and Dual slope.DAC and ADC specifications - Linearity, accuracy, Monotonicity, Settling time and stability. Active filters: First order and Second order LPF and HPF

MODULE IV — TIMER IC AND SPECIAL PURPOSE ICS — 8

555 timer IC, Applications: Astable and Monostable operation, Active filters, PLL and Closed loop analysis of PLL, Applications of PLL: IC Voltage regulators – General purpose, variable regulator Switched capacitor filter- IC MF10, Frequency to Voltage and Voltage to Frequency converters.

PRACTICALS

1. Inverting and Non-Inverting Amplifiers and Voltage follower – Application as Buffer/Isolator.
2. Adder, Subtractor, Difference amplifier, Integrator, Differentiator – Application of Analog computation.
3. Instrumentation Amplifier – Signal extraction from sensor and measurement of CMRR
4. Active Butterworth Filters – As distortion eliminators in Audio amplifiers
5. Multivibrators and Schmitt Trigger using operational amplifier – Function generator
6. Phase shift and Wien bridge oscillators using operational amplifier – Variable low frequency generator.
7. Design of Multivibrators using 555 timer – Clock Pulse generator.
8. PLL characteristics and its application as Frequency Multiplier.
9. DC power supply using LM317 and LM723.
10. Simulation using PSpice, Netlist of above experiments Mini project using above experiments

L –30 ;P –30 ; TOTAL HOURS –60

TEXT BOOKS:

1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 5th Edition, New Age International Pvt. Ltd., 2018.
2. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 4th Edition, Wiley International, 2009.
3. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, TMH. 2007.

REFERENCES:

1. Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', 4th Edition, Prentice Hall / Pearson Education,2015.
2. WilliamD.Stanely, 'Operational Amplifiers with LinearIntegrated Circuits'.4th Edition, Pearson Education, 2004.
3. Sedra & Smith, "Micro Electronic Circuits", 5th Edition, Oxford University Press, 2004.

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Determine the difference between ideal and practical AC & DC characteristics of an Operational Amplifier.

CO2 : Differentiate linear and non-linear applications of operational amplifiers

CO3 : Design a circuit to generate waveforms using Op-Amp.

CO4 : Apply IC 555 and PLL for different applications

CO5 : Identify the special purpose ICs

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	L	L	L	L	L	L	L	L	L	H	L	M
CO2	H	H	H	L	H	L	H	L	M	L	L	M	H	L	M
CO3	H	H	M	M	M	L	L	L	M	L	L	L	H	L	M
CO4	H	H	M	M	M	L	M	L	M	L	L	L	H	L	M
CO5	H	H	M	H	H	M	L	M	H	L	M	M	H	L	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: The holistic understanding of the course will bring global impact on quality education. Integrated circuit design and analysis can improve the quality of life style.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the design concepts of linear integrated circuit design in designing IC technology.

ESD 2203	MICROPROCESSOR AND	L	T	P	C
SDG: 4,9	MICROCONTROLLER	3	0	0	3

COURSE OBJECTIVES:

COB 1 **:** To analyze the internal organization, addressing modes and instruction sets of 8086 processor

COB 2 **:** To describe the programming concepts and interfacing techniques of 8086 microprocessor

COB 3 **:** To explain the basic concepts and programming of 8051 microcontroller

COB 4 **:** To analyze peripheral devices and interfacing with 8051 microcontroller

COB 5 **:** To describe ARM processor architecture and its instructions sets

PREREQUISITE: Digital Electronics

MODULE I 8086 MICROPROCESSOR 9

8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Timing Diagram, interrupts of 8086.

MODULE II PROGRAMMING in 8086 9

Addressing modes - Instruction set – Data transfer instructions, Arithmetic Instructions, Logical instructions, String manipulation instructions and control transfer instructions - Assembly language Programming- interfacing with 8255 PPI.

MODULE III 8051 MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers (SFRs) – I/O Ports and Memory organization – Instruction set – Addressing modes – Assembly language programming.

MODULE IV INTERFACING WITH 8051 MICROCONTROLLER 9

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing-External Memory Interface- Stepper Motor interface.

MODULE V ARM PROCESSOR 9

ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, conditional execution, Introduction to Thumb instructions

L –45 , TOTAL HOURS –45

TEXT BOOKS:

1. Barry B.Brey, ―The Intel Microprocessors: Architecture, Programming, and Interfacing‖, Pearson Education India; 8th edition, 2008.
2. Kenneth. J. Ayala, ―The 8051 Microcontroller Architecture Programming and Application‖, Cengage Learning, 3rd Ed, 2004.
3. Steve Furber, ―ARM System-on-Chip Architecture‖, 2nd Edition, University of Manchester, Addison-Wesley Professional, 2001.

REFERENCES:

1. Doughlas V. Hall, ―Microprocessors and Interfacing, Programming and Hardware‖, TMH, 2012.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education Asia, New Delhi, 2003.
3. Stephen Smith, ―Programming with 64-Bit ARM Assembly Language: Single Board Computer Development for Raspberry Pi and Mobile Devices, apress; 1st ed. Edition 2020.

COURSEOUTCOMES:

On completion of the course, the students will be able to

CO1 : Analyze the organization of registers and memory in microprocessors and microcontroller

CO2 : Prioritize interrupts for executing the respective ISR.

CO3 : Identify the addressing mode and calculate the number of T-states required for the execution of an instruction

CO4 : Develop assembly language programs suitable for real time applications using microprocessors / microcontroller

CO5 : Design and develop applications using Microcontroller boards

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12	PS O1	PSO2	PS O3
CO1	M	M	M	-	-	-	-	-	M	-	-	M	L	L	H
CO2	M	H	M	-	-	-	-	-	M	-	-	M	L	L	H
CO3	M	H	M	-	H	-	-	-	M	-	-	M	H	L	H
CO4	L	L	L	-	-	-	-	-	M	-	-	M	M	L	M
CO5	M	M	M	-	-	-	-	-	M	-	-	M	M	L	H

Note: L- Low Correlation M - Medium CorrelationH -High Correlation

SDG 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the assembly language programming concepts of microprocessor and microcontrollers helps for lifelong learning of newer technologies and concepts related to the microcontroller based system

SDG 9 - Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the programming concepts of microcontroller based systems for the various real time applications.

ESD 2204	**COMPUTER ORGANIZATION AND**	**L**	**T**	**P**	**C**
SDG: 4,9	**ARCHITECTURE**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1	**:**	To discuss the characteristics of functional units of computer system and its operations
COB 2	**:**	To apply the concept of memory interfacing and various I/O devices
COB 3	**:**	To select the specific hardware components and analyze its performance
COB 4	**:**	Apply the algorithms to implement arithmetic and logic operations
COB 5	**:**	To analyze the concepts of pipelining and the hierarchy of memory system

PREREQUISITE: Basic concepts in digital circuit design and microcontroller, Familiarity with a programming language like C or C++

MODULE I INSTRUCTION SET ARCHITECTURE 9

Function and structure of a computer, Functionality of computer hardwares, Instruction set architecture- CISC- architecture , Characteristics ,examples, advantages, RISC -architecture , Characteristics ,examples, advantages.

SMODULE II ARITHMETIC OPERATIONS 9

Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Subword parallelism, streaming SIMD Extensions and Advanced Vector Extensions in x86.

MODULE III PROCESSOR SUBSYSTEMS 9

Logic Design Conventions, Building a Datapath, A Simple Implementation Scheme, An Overview of Pipelining, Pipelined Datapath and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions, ARM Cortex-A8 and Intel Core Pipelines.

MODULE IV MEMORY ORGANIZATION 9

Memory Technologies, Basics of Caches, Measuring and Improving Cache Performance, Dependable Memory Hierarchy, Virtual Machines, Virtual

Memory, Parallelism and Memory Hierarchies: Cache Coherence.

MODULE V SUPER SCALAR ARCHITECTURE 9

Introduction to SuperScalar Architecture,Instruction-Level Parallelism, Superscalar Execution, SuperScalar Processor Architectures,Performance Evaluation and Benchmarking, Real-world Applications.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. C.Hamacher Z. Vranesic and S. Zaky, "Computer Organization", McGrawHill, 2002.
2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002

REFERENCES:

1. David A. Patterson and John L.Hennessy, "Computer Organization & Design, the hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002
2. 3. John P.Hayes, "Computer Architecture & Organization", 3rd Edition, McGrawHill, 1998

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 **:** Apply the basic knowledge of digital concept to the functional components of a Computer System.

CO2 **:** Analyze the addressing mode concepts and design the instruction set Architecture

CO3 **:** Identify the functions of various processing units within the CPU of a Computer System

CO4 **:** Analyze the function of the memory management unit and create suitable memory interface to the CPU.

CO5 **:** Recognize the need for recent Bus standards and I/O devices.

Board of Studies (BoS):

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M				M		L	L		M	H			H
CO2	M	M				M		L	L		M	H			H
CO3	M	M				M		L	L		M	H			H
CO4	M	M				M		L	L		M	H			H
CO5	M	M				M		L	L		M	H			H

Note: L-Low Correlation , M-Medium Correlation,H-High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Lifelong learning opportunities for all.

Statement: This course discusses about the basic electronics of computer system and its structure. This knowledge provides quality education and promotes lifelong learning opportunities for all.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: It proves the performance improvement in hardware and software of computer architecture.

ESD 2205	**DATABASE MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1 **:** Remember database systems, data models, E-R architecture, and relational algebra based on Bloom's taxonomy.

COB 2 **:** Construct SQL queries to retrieve and manipulate data as required

COB 3 **:** Describe functional dependencies, normalization principles

COB 4 **:** Develop a comprehensive understanding of transaction concepts, ACID properties.

COB 5 **:** Summarize advanced database security techniques and NoSQL databases

PREREQUISITE: Foundations of Software Development: and Basic understanding of mathematical concepts, particularly

MODULE I INTRODUCTION TO DATABASE MANAGEMENT 9

Purpose of Database System - Views of data - Data Models - Architecture - Entity - Relationship (E-R) model - Extended E-R Features - Design of E-R database schema - Structure of Relational data model - Fundamentals of relational algebra operations.

MODULE II STRUCTURED QUERY LANGUAGE 9

SQL: Basic structure - Query Processing Overview -Set operations - Aggregate functions - Null Values - Nested sub queries -Data Base Languages- Keys - Embedded SQL -Dynamic SQL. Domain Constraints - Assertions - Triggers – Views.

MODULE III DATABASE DESIGN 9

Functional Dependencies –Non-loss Decomposition- Normalization-First, Second, Third Normal Forms, Boyce/Code Normal Form - Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form.

MODULE IV TRANSACTIONS PROCESSING AND CONCURRENCY CONTROL 9

Transaction Concepts – ACID Properties – Schedules – Serializability –

Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.

MODULE V DATABASE SECURITY AND No-SQL 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – No-SQL MongoDB- Basic Structure – Commands – Data Base Connectivity- Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures, Blockchain in DBMS.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th/e, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th/e, Pearson, 2017.
3. Itzik Ben-Gan,"Microsoft SQL Server 2012 T-SQL Fundamentals", Microsoft Press 2nd/e, 2012.

REFERENCES:

1. Hector Garcia-Molina, Jeffrey Ullman, Jennifer Widom ," Database Systems: The Complete Book", Prentice Hall, September 2008.
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8/e, 2006.
3. Raghu Ramakrishnan, "Database Management Systems", McGrawHill, 4/e, 2010.
4. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Recall and describe the fundamental concepts of database systems.

CO2 : Outline the basics of SQL and methods to enhance queries.

CO3 : Apply the normalization rules for optimizing the database.

CO4 : Illustrate the transactions using T-SQL.

CO5 : Summarize the fundamental concepts of transaction, concurrency and recovery processing and various advanced Database technologies and database security.

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO2	M	M	H	L	H	-	-	-	H	L	M	H	-	-	H
CO3	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO4	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO5	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education:
The course provides students with a quality education in software engineering, which is essential for developing high-quality software products.

SDG 9: Industry, Innovation and Infrastructure:
The course addresses SDG 9 by focusing on software targeting industrial sectors, enhancing scientific research and innovation.

		L	T	P	C
ESD 2206	**MICROPROCESSOR AND MICROCONTROLLER LABORATORY**	**L**	**T**	**P**	**C**
SDG: 4,9		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB 1 **:** To apply the concept of Assembly Language Programming (ALP)

COB 2 **:** To develop skills in assembly language programming to program using 8086 instruction sets.

COB 3 **:** To analyze the microcontroller programming and interfacing of 8051 Microcontroller

COB 4 **:** To access and program on chip peripherals in 8051

COB 5 **:** To select and use the advanced microcontroller boards in appropriate electronic systems

PREREQUISITE: Knowledge on Digital Electronics and Instruction sets of 8086 Microprocessor & 8051 Microcontroller

PRACTICALS

List of Experiments:

1. Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations using 8086
2. Interfacing 8255 PPI with 8086
3. Arithmetic, Logical and bitwise operation using 8051
4. I/O Port programming in 8051
5. Programming 8051 Timers and Counters
6. Programming onchip UART
7. Sensor Interfacing with 8051
8. Interface 8279 with 8051
9. Stepper motor interfacing with 8051
10. Interfacing Traffic Light Control System with 8051
11. Study on Atmel AVR, PIC and ARM Processor boards.

P – 30; TOTAL HOURS – 30

REFERENCES:

1. Doughlas V.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH, 2012.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson

Education Asia, New Delhi, 2003.
3. Subrata Ghoshal, ―8051 Microcontroller: Internals, Instructions, Programming & Interfacing, Pearson Education,2010.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Develop the assembly language program for the basic arithmetic and logical operations of 8086 Microprocessor and 8051 Microcontroller.

CO2 : Interface different peripheral devices with Microprocessor / Microcontroller

CO3 : Interface Microcontroller and PC.

CO4 : Analyze the 16 bit and 32bit microcontroller boards

CO5 : Develop applications using Microprocessor/Microcontroller based systems.

Board of Studies (BoS)
25th BOS of ECE held on 20.09.2023

Academic Council
21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M	-	-	-	-	-	M	-	-	M	L	L	H
CO2	M	H	M	-	-	-	-	-	M	-	-	M	L	L	H
CO3	M	H	M	-	H	-	-	-	M	-	-	M	H	L	H
CO4	L	L	L	-	-	-	-	-	M	-	-	M	M	L	M
CO5	M	M	M	-	-	-	-	-	M	-	-	M	M	L	M

Note: L- Low Correlation, M-Medium Correlation ,H-High Correlation

SDG 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the architecture of microprocessor and microcontrollers, Instructions sets, Memory mapping, addressing modes, applications helps for lifelong learning of newer technologies and concepts related to the design of electronic products.

SDG 9 - Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the theoretical and programming concepts of different microcontrollers for the various real time applications.

ESD 2207 DATABASE MANAGEMENT SYSTEM LABORATORY
SDG: 4,9

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

COB 1 : To describe the basics of SQL.

COB 2 : To construct queries using SQL in database creation and interaction.

COB 3 : To analyze data using PL/SQL blocks.

COB 4 : To establish Java database connectivity using MONGODB

COB 5 : To implement real time applications of Database Management Systems

PREREQUISITE: Programming for Problem Solving

PRACTICALS

1. Practice of Database Languages using SQL Query
2. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands
3. Set operators and Join queries and nested queries
4. PL/SQL–(Cursors, Stored procedures, stored function, Triggers)
5. Front end Connectivity
6. Normalization (1NF, 2NF and 3NF)Auto Rollback - IF ELSE statement-SQL Transaction in TRY CATCH using T-SQL.

MONGODB

1. Installation of MySql and MONGO DB and practicing DDL commands.
2. Recursion
3. Java Database Connectivity

P – 30; TOTAL HOURS – 30

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 7th/e, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th/e, Pearson, 2017.
3. Itzik Ben-Gan,“Microsoft SQL Server 2012 T-SQL Fundamentals”, Microsoft Press 2nd/e, 2012.Meg Bernal, Tammie Dang, Acacio Ricardo Gomes Pessoa,” IBM DB2 12 for Z/OS Technical Overview”,

IBM Redbooks Publication, ISBN: 9780738442303, 2019.
4. Raghu Ramakrishnan, "Database Management Systems", McGrawHill, 4/e, 2010.
5. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Exhibit the structured query language (SQL) for database definition and database manipulation

CO2 : Apply the PL/SQL blocks using Cursors and Triggers.

CO3 : Analyze the normalization forms using SQL queries

CO4 : Solve the Transactions processing using T-SQL

CO5 : Compare and select the various advanced technologies of Databases and No-SQL.

Board of Studies (BoS)

25th BOS of ECE held on 20.09.2023

Academic Council:

21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO2	M	M	H	L	H	-	-	-	H	L	M	H	-	-	H
CO3	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO4	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H
CO5	H	H	H	H	H	-	-	-	H	L	M	H	-	-	H

Note: L-Low Correlation, M-Medium Correlation,H-High Correlation

SDG 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG 9 - Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation .

		L	T	P	C
GED 2201	**WORKPLACE SKILLS AND APTITUDE FOR ENGINEERS**	**L**	**T**	**P**	**C**
SDG: 8		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To expose them to reading for specific purposes, especially in professional contexts

COB2: To expose them to the process of different kinds of formal writing

COB3: To prepare the students to be successful in their career

COB4: To familiarize various problem-solving techniques in aptitude and puzzles.

MODULE I EXTENSIVE READING & WRITING 07

Reading for comprehension - inferring and note-making – Process of writing-paragraph development - elements of business writing: Email, memos.

MODULE II INTENSIVE READING & WRITING 08

Intensive reading and reviewing - Interpretation of charts, graphs - Résumé - Letter of enquiry, thanksgiving letters.

MODULE III QUANTITATIVE APTITUDE 08

Percentage - Ratio and Proportion - Profit and Loss – Averages, Allegations and Mixtures.

MODULE IV LOGICAL COMPETENCY 07

Syllogism – Blood Relations- Number, Alpha and Alpha numeric series - Puzzles – Cubes and Dice - Odd One Out-Coding and Decoding

L – 30; TOTAL HOURS - 30

REFERENCES:

1. Sharma, R.C. and Mohan, Krishna (2010). Business Correspondence and Report Writing. 4th edition. Tata McGraw Hill Education Private Limited, New Delhi
2. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK
3. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
4. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017

5. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning , S. Chand Limited, 2010
6. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016
7. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
8. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019.

COURSE OUTCOMES:

CO1: Demonstrate reading skills with reference to business related texts

CO2: Draft professional documents by using the three stages of writing

CO3: Apply various short cut techniques for solving complicated aptitude problems

CO4: To understand various problems and patterns of different ways to solve it

Board of Studies (BoS) :
13th BoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L		H						H					
CO2			L							H					
CO3			L				M								
CO4		H		M											
CO5															

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement:Demonstrating, Drafting and applying various techniques for sustainable growth to employment.

GED 2202 SDG: 16	INDIAN CONSTITUTION AND HUMAN RIGHTS	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES:

COB1: To explicate the emergence and evolution of Indian Constitution.

COB2: To have an insight into the philosophy of fundamental rights and duties, and Directive Principles.

COB3: To differentiate the structure of executive, legislature and judiciary.

COB4: To understand human rights and its implication - local and international and redressal mechanism.

MODULE I — INTRODUCTION AND BASIC INFORMATION ABOUT INDIAN CONSTITUTION — 8

Meaning of the constitution law and constitutionalism - Historical Background of the Constituent Assembly - Government of India Act of 1935 and Indian Independence Act of 1947 - The Constituent Assembly of India - Enforcement of the Constitution - Indian Constitution and its Salient Features - The Preamble of the Constitution. Citizenship.

MODULE II — FUNDAMENTAL RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES — 7

Fundamental Rights and its Restriction and limitations in different complex situations - Directive Principles of State Policy (DPSP) & its present relevance in our society with examples- Fundamental Duties and its Scope and significance in nation building - Right to Information Act 2005.

MODULE III — GOVERNANCE IN INDIA — 8

The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions. The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers and functions – Government of the State - The Governor – the Council of Ministers and the Chief Minister – Powers and Functions-Elections-Electoral Process and Election Commission of India - Indian judicial system.

MODULE IV — HUMAN RIGHTS AND INDIAN CONSTITUTION — 7

Human rights – meaning and significance - Covenant on civil and political rights - Covenant on Economic, Social and Cultural rights - UN mechanism and agencies - The Protection of Human Rights Act, 1993 – watch on human rights and enforcement - Roles of National Human Rights Commission of India -

Special Constitutional Provisions for SC & ST, OBC - Special Provision for Women, Children & Backward Classes.

L – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. B.K. Sharma, Introduction to the Constitution of India, 6th ed., PHI Learning Private Limited, New Delhi 2011
2. Durga Das Basu "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th / 20th Edn. 2008
3. M.P. Jain, Indian Constitutional Law, 7th ed., LexisNexis, Gurgaon. 2014.

REFERENCES:

1. Fadia B.L "Indian Government and Politics", Sahitya Bhavan Publications. 2010
2. Kashyap Subhash C "Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT. 2017
3. M.V.Pylee "An Introduction to Constitution of India", Vikas Publishing. 2002
4. Sharma Brij Kishore "Introduction to the Indian Constitution", 8th Edition, PHI Learning Pvt. Ltd. 2015
5. Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO1: describe the emergence and evolution of Indian Constitution.

CO2: realize the status and importance of fundamental rights, fundamental duties and directive principles of state policy and relation among them by understanding the articulation of its basic values under the Constitution of India.

CO3: compare the various structure of Indian government.

CO4: recognize the human rights, cultural, social and political rights and its relationship with Indian constitution. .

Board of Studies (BoS) :
4thBoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			M			H	M	L	M		M	
CO2			H			M	H	M			H	
CO3			M			H	M	L			L	
CO4			H			H	H	M	M			H

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Application of human, legal and political rights leading to empowerment in real-life situations for protection of fundamental freedoms and freedom from violence, abuse, trafficking and exploitation are at the core of human rights.

SEMESTER V

		L	T	P	C
ESD 3101	**ANALOG AND DIGITAL COMMUNICATION**	**L**	**T**	**P**	**C**
SDG 4 ,9		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB 1 **:** Identify different types of modulation used in communication systems.

COB 2 **:** Explain the theory behind analog and digital modulation techniques.

COB 3 **:** Apply knowledge of modulation techniques to compare different communication systems.

COB 4 **:** Analyze the principles of source encoding and error control coding in communication.

COB 5 **:** Evaluate the efficiency and effectiveness of various digital communication systems.

PREREQUISITE: Basic understanding of electronics and communication principles.

MODULE I ANALOG COMMUNICATION 9

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems.

MODULE II DATA AND PULSE COMMUNICATION 9

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System .Data Communication: History of Data Communication – Standards, Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces.

MODULE III DIGITAL MODULATION 9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System.

MODULE IV SOURCE AND ERROR CONTROL CODING 9

Entropy, Source Encoding Theorem, Shannon Fano Coding, Huffman Coding, Mutual Information, Channel Capacity, Error Control Coding, Linear Block Codes, Cyclic Codes – ARQ Techniques

MODULE V MULTI-USER RADIO COMMUNICATION 9

Global System for Mobile Communications (GSM) – Code Division Multiple Access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

L- 45, T- 15; Total Hours – 60

TEXT BOOKS:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2015.
2. B.P.Lathi,“Modern Analog and Digital Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Simon Haykin, “Communication Systems”, 5th Edition, John Wiley & Sons, 2022
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education,2014
3. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 4th Edition, Pearson Education, 2017.
4. B.Sklar,“ Digital Communication Fundamentals and Applications” 2nd Edition, Pearson Education, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Recall the types of modulation used in communication systems.

CO2 : Discuss the theory behind analog and digital modulation techniques.

CO3 : Apply knowledge of modulation techniques to compare different communication systems.

CO4 : Analyze the principles of source encoding and error control coding in communication.

CO5 : Evaluate the efficiency and effectiveness of various digital communication systems.

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	L	L	L	L	L	L	L	L	M	M	L
CO2	H	H	M	L	L	L	L	L	L	L	L	L	H	M	L
CO3	H	H	H	M	M	L	L	L	L	L	L	L	H	H	M
CO4	H	H	H	H	M	L	L	L	L	L	L	L	H	H	M
CO5	H	H	H	H	H	M	L	L	L	L	L	L	H	H	H

Note: L - Low Correlation M - Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: A fundamental concept of electronics properties and its characteristic provides a global impact on quality education.

SDG 9: Industry, Innovation and Infrastructure

Statement: This course is pivotal in advancing electronic sensing and analysis, revolutionizing industry operations through modernization.

ESD 3102	**VLSI DESIGN**	**L**	**T**	**P**	**C**
SDG: 4,9,12		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To discuss the characteristics of MOS transistors.

COB2 : To describe the fundamentals of CMOS fabrication methodologies

COB3 : To design combinational and sequential logic designs in CMOS logic style.

COB4 : To develop the basic building blocks of large-scale digital integrated circuits.

COB5 : To apply the concepts of modeling in digital system using Hardware Description Language.

PREREQUISITE : Basics of Digital Electronics

MODULE I INTRODUCTION OF VLSI DESIGN AND MOSFET 9

VLSI design methodology, MOS transistors – NMOS, PMOS, CMOS, MOSFET as a switch, Threshold Voltage of MOSFET, Current-Voltage characteristics, Transfer Characteristics, Second Order Effects, Static and Dynamic Power Dissipation.

MODULE II THE MANUFACTURING PROCESS 8

Fabrication of NMOS and PMOS, CMOS Process Technology N-well, P-well Process and twin-tub process, Stick Diagram for Boolean Functions using Euler Theorem, Layout Design Rule.

MODULE III DESIGN BASICS OF DIGITAL CMOS DESIGN 8

CMOS based basic logic gates, CMOS based combinational logic design, CMOS Sequential Logic Design – Latches and Flip Flops, Pipelining: An approach to optimize sequential circuits.

MODULE IV SUB SYSTEM DESIGN 9

Data path circuits, Architecture of fast Adders, Multipliers, Classification of ASICs, FPGA Architecture, IP cores – Hard core, Firm core and Soft core.

MODULE V MEMORY ARCHITECTURE AND FINITE STATE MACHINE 9

Logic Implementation using programmable Devices(ROM, PLA, FPGA), Memory Architecture and building blocks, Memory Core and Memory Peripherals Circuitry, Modelling Finite State Machine using Verilog.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Jan D Rabaey, AnanthaChandrakasan, “Digital Integrated Circuits: A Design Perspective”, PHI, 2016.
2. Weste, Neil HE, and David Harris. CMOS VLSI design: a circuits and systems perspective. Pearson Education India, 2015.
3. John P. Uyemura: Introduction to VLSI Circuits and Systems, J.Wiley, 2nd Edition, New York, 2009

REFERENCES:

1. Sung-Mo (Steve) Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis & Design 3rd Edition, McGraw-Hill 2003.
2. J.Adel S. Sedra, Kenneth C. Smith : Microelectronics Circuits, 5th Ed., Oxford University Press, 2004.
3. Essentials of VLSI circuits and systems – Kamran Eshraghian, EshraghianDougles and A. Pucknell, PHI, 2005.

COURSE OUTCOMES:

CO1 : Describe the working of MOS transistors and analyze its characteristics.

CO2 : Analyze the characteristics of VLSI circuits such as area, speed and power dissipation

CO3 : Implement CMOS circuits using processing technology and layouts.

CO4 : Develop design methodology of arithmetic building blocks and distinguish the types of ASICs

CO5 : Design and test digital circuits using HDL in gate, dataflow (RTL) and behavioral modeling.

Board of Studies (BoS):

26th BoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	H		H				M			M	M	M	H
CO2	M	L			H				M			M	M	M	H
CO3	M	L			H				M			M	M	M	H
CO4	M	L			H				M			M	M	M	H
CO5	M	L	H	M	H				M			M	M	M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the basic characteristics of MOS devices, design of combinational and sequential circuits.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the design concepts of VLSI system design in designing processor based design.

SDG 12: Responsible Consumption and Production Statement: Understand the market needs based on current technology trends in Integrated circuits market.

		L	T	P	C
ESD 3103	**COMPILER DESIGN**	**L**	**T**	**P**	**C**
SDG: 4, 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To recognize the role of lexical analyzer in compilation process.

COB2 : To utilize parser generators to generate parsers for given grammars.

COB3 : To implement syntax-directed translation for given grammars and generate intermediate code for simple programs.

COB4 : To understand the issues in code generation and target language translation.

COB5 : To analyze loops in flow graphs and apply region-based analysis.

PREREQUISITE: Discrete Mathematics, Theory of Computation.

MODULE I INTRODUCTION TO COMPILERS 8

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

MODULE II SYNTAX AND SEMANTIC ANALYSIS 9

Context-Free Grammars, Writing a Grammar, Top-Down Parsing ,Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Parser Generators, Semantic Analysis, attributes, Parse tree and dependency graph.

MODULE III SYNTAX – DIRECTED TRANSLATION AND INTERMEDIATE CODE GENERATION 10

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Applications of Syntax-Directed Translation, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control flow, Backpatching, Switch-statements, Intermediate Code for Procedures.

MODULE IV RUN-TIME ENVIRONMENT AND CODE GENERATION 10

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management, Issues in Code Generation, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator.

MODULE V CODE OPTIMIZATION 8

Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs, Region-Based Analysis, Symbolic Analysis

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. A.V. Aho, Monica, R.Sethi, J.D.Ullman, "Compilers, Principles, Techniques and Tools", Second Edition, Pearson Education Limited, 2014.
2. Des Watson, "A Practical Approach to Compiler Construction", Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017

REFERENCE BOOKS:

1. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1 : Use compiler construction tools and describe the functionality of each stage of compilation process

COB2: Apply different parsing algorithms to develop the parsers for a given grammar.

COB 3: Analyze different representations of intermediate code.

COB 4: Realize syntax-directed translation and run-time environment.

COB 5: Apply the code optimization algorithms and implement a simple code generator

Board of Studies (BoS):

26thBoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O 3
CO 1	H	M	L									M	H	H	
CO 2	M	H	M	M	L			L	M	M	M	M	H	H	
CO 3	M	H	M	M	L			L	M	M	M	M	H	H	
CO 4	M	H	M	M	L			L	M	M	M	M	H	H	
CO 5	M	H	M	M	M			L	L	L	L	M	H	H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Compiler design course involves ensuring equal access to quality education for all students, promoting inclusive learning environments, and encouraging lifelong learning opportunities to foster skill development and empowerment within the field.

SDG 9: Compiler design course involves emphasizing technological innovation and infrastructure development to enhance students' understanding of modern compiler design principles and practices, thereby contributing to sustainable industrial growth and fostering digital inclusivity.

		L	T	P	C
ESD 3104	**COMPUTER NETWORKS**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To define the flow of information from one node to another in the network.

COB2 : To Identify the component required to build different types of networks

COB3 : To analyze the different error coding schemes.

COB4 : To distinguish different protocols of network layer, transport layer and application layer.

COB5 : To apply contemporary knowledge in Cryptography and Security.

PREREQUISITES: Fundamentals of analog and digital Communications, Digital electronics, & Signals and Systems.

MODULE I DATA COMMUNICATION AND NETWORK MODELS 9

Data Communication, Networks-WAN, RAN, MAN, CAN, LAN, PAN, BAN, Protocols and Standards, Standards Organizations. Line Configuration, Topology, Transmission Modes, Transmission impairment, Categories of Networks - OSI and TCP/IP protocol suite: The Model, Functions of the layers-Modem - RS232 Interfacing sequences.

MODULE II DATA LINK LAYER 10

Error - detection and correction – Forward error correction- Block coding, Cyclic codes, Checksum, Backward error correction- stop and wait - go back N ARQ - selective repeat ARQ- sliding window techniques- Random access, Controlled access, Wired LAN: IEEE 802.3, IEEE 802.4 and IEEE 802.5, Wireless LAN: IEEE 802.11- IEEE 802.15 - Bluetooth, LoRa, IEEE 802.16 – WiMAX.

MODULE III NETWORK LAYER 8

Packet Switching – Network layer performance, Internet protocol, IPv4& IPv6 Addresses, IPsec, Mobile IP, Routing algorithms - Distance Vector Routing - Link State Routing – Path vector routing- Unicast routing protocols- Routing Information Protocol, Open Shortest Path First (OSPF) – Destination Sequenced Distance Vector Routing (DSDV) .

MODULE IV TRANSPORT LAYER & APPLICATION LAYER 8

Transport layer: Duties of transport layer-User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Stream Control Transmission Protocol (SCTP) – Socket-Quality of services (QOS).Application Layers: Client server programming- Iterative programming using UDP and TCP- WWW and HTTP, FTP, Electronic mail, TELNET, DNS,SIP,H.323.

MODULE V CRYPTOGRAPHY AND NETWORK SECURITY 10

Cryptography: Symmetric-Key Ciphers, Asymmetric-Key Ciphers, Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls. Cloud Computing - Cloud Security and its issues.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Behrouz A. Forouzan., "Data Communications and Networking", McGraw-Hill Publishers, 5th edition, 2017.
2. William Stallings., "Data and Computer Communications", Pearson Publishers, 10thEdition, 2017.

REFERENCES:

1. James F.Kurose, Keith W.Ross,"Computer Networking- A top-down approach",6th Edition, Pearson Education,2017.
2. Andrew S.Tanenbaum, Davis J.Whetherall,"Computer Networks",5th Edition, Pearson Education,2013.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2011.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Discuss data communication systems and its components.

CO2 : Classify the layer functionalities of OSI model and TCP/IP.

CO3 : Analyze the error detection and correction techniques in data communication& networks.

CO4 : Compare the operations and features of application layer protocol.

CO5 : Apply cryptography techniques in data communication and networks

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	H	H	M	H	L	M	L	L	L	M	M	L	H	M	M
CO2	H	H	M	H	L	M	L	L	L	M	M	L	H	H	M
CO3	H	H	M	H	L	M	L	L	L	M	M	L	H	M	M
CO4	H	H	M	H	L	M	L	L	L	M	M	L	H	H	M
CO5	H	H	M	H	L	M	L	L	L	M	M	L	H	M	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Quality education.

Statement: This course enables the student to understand basic network components, models and protocols and helps for lifelong learning of newer technologies and concepts related to data communication and networking.

SDG 9: Industry, Innovation and Infrastructure

Statement: Able to apply the theoretical concepts for the various application of computer networks

ESD 3105	**VLSI DESIGN LABORATORY**	**L**	**T**	**P**	**C**
SDG: 4,9,12		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To design the functionality of combinational and sequential circuits using Verilog HDL.

COB2: To simulate and synthesis on FPGA computing platform.

COB3: To develop digital design employing various modeling styles in Verilog HDL

COB4: To perform functional Verification CMOS circuits.

COB5: To estimate the characteristics of logic circuits in full custom design

PREREQUISITE: Basics of Digital circuits.

PRACTICALS :

1. Design, simulate and synthesis of adders using HDL.
2. Design, simulate and synthesis of Multiplexers &Demultiplexer using HDL.
3. Design, simulation and synthesis of multipliers using HDL.
4. Design, simulation and synthesis of flip flops and shift register using HDL.
5. Design, simulation and synthesis of Counters using HDL.
6. Design of Basic Cell structure (NMOS & PMOS) using conventional MOS using EDA tool
7. Design a CMOS inverter and perform the DC analysis using EDA tool.
8. Design a CMOS based logic gate and perform the transient analysis using EDA tool.
9. Design and Simulate basic Common Source amplifier.
10. Design and simulate simple 5 transistor differential amplifier.

P – 30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Reese, Robert B., and Mitchell A. Thornton. Introduction to logic synthesis using Verilog HDL. Springer Nature, 2022.
2. Samir Palnitkar, Verilog HDL, A guide to digital design and synthesis, PHI, 2010.
3. John P. Uyemura: Introduction to VLSI Circuits and Systems, J.Wiley, 2nd Edition, New York, 2009

REFERENCES:

1. Rabaey, Jan M., Anantha P. Chandrakasan, and BorivojeNikolić. Digital integrated circuits: a design perspective. Prentice Hall of India, 3rd edition,New Jersey, 2014.

2. Digital Design: With an Introduction to the Verilog HDL, 5th Edition by M Morris Mano and Michael Ciletti, Pearson publications, 2013.
3. Fundamentals of Digital Logic with Verilog Design, Third Edition, Stephen Brown, Mc, Graw Hill, 2014.

COURSE OUTCOMES:

CO1: Write Verilog code for combinational circuits and sequential circuits

CO2: Simulate the combinational circuits and sequential circuits using Xilinx ISE

CO3: Synthesize the designed digital circuits using Spartan FPGA kits.

CO4: Perform functional verification of digital designs with various test cases.

CO5: Analyze the characteristics of the digital circuit in EDA tools.

Board of Studies (BoS):
26thBoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	M	L	H		H				M			M	M	M	H
CO2	M	L			H				M			M	M	M	H
CO3	M	L			H				M			M	M	M	H
CO4	M	L			H				M			M	M	M	H
CO5	M	L	H	M	H				M			M	M	M	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the basic characteristics of MOS devices, design of combinational and sequential circuits.

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the design concepts of VLSI system design in designing processor based design.

SDG 12 : Responsible Consumption and Production

Statement: Understand the market needs based on current technology trends in Integrated circuits market.

		L	T	P	C
ESD 3106	**COMPUTER NETWORKS LABORATORY**	**L**	**T**	**P**	**C**
SDG: 4,9		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1 : To explain the components and devices in a computer network

COB2 : To evaluate the performance of different LAN protocols by using hardware and network simulator tools

COB3 : To analyze LAN configuration for wired and wireless networks

COB4 : To choose different algorithms for finding shortest path between any nodes

COB5 : To demonstrate the working of wireless sensor nodes

PREREQUISITES: Fundamentals of analog and digital Communications, Digital electronics,Signals and Systems.

PRACTICALS :

List of Experiments:

1. Study of Network devices and crimping of Ethernet cable.
2. Configure a Network topology using Packet tracer software.
3. Simulation of ALOHA protocol using C.
4. Performance analysis of CSMA/CSMA-CD and Token Bus/Token ring access method between nodes in a network.
5. Performance analysis of Stop & wait /Go-back N flow control protocols between nodes in a network
6. Establishment of wired LAN and transfer files in a LAN environment
7. Establishment of wireless LAN and its throughput measurement
8. Traffic Analysis using Packet Analyzer software
9. Implementation of Error Detection and Error Correction Techniques.
10. Simulation of shortest path using Distance Vector Routing Protocol and Link State Routing protocol using network simulator
11. Simulation of RSA algorithm using C
12. Configuration of Routers for Firewall settings
13. Case study: Interfacing of Wireless sensor node with Zigbee
14. Launching of Cloud server using AWS EC2 service

L – 30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Behrouz A. Forouzan., “Data Communications and Networking”, McGraw-Hill Publishers, 5th edition, 2017.
2. William Stallings., “Data and Computer Communications”, Pearson Publishers, 10thEdition, 2017.

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers Inc., 2011.
2. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill Publisher, 2011.
3. CCNA Security 2.0 Instructor Packet Tracer Manual, Cisco Systems,2015.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Explain the fundamental principles of computer networking Devices

CO2 : Apply different LAN protocols and test the performance

CO3 : Develop Wired & Wireless LAN network

CO4 : Select an appropriate simulator tools for networking protocols

CO5 : Adapt Wireless sensor node for different networking Applications

Board of Studies (BoS):
26thBoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	H	H	M	H	L	M	L	L	L	M	M	L	H	M	M
CO2	H	H	M	H	L	M	L	L	L	M	M	L	H	H	M
CO3	H	H	M	H	L	M	L	L	L	M	M	L	H	M	M
CO4	H	H	M	H	L	M	L	L	L	M	M	L	H	H	M
CO5	H	H	M	H	L	M	L	L	L	M	M	L	H	M	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand basic network components, models and protocols and helps for lifelong learning of newer technologies and concepts related to data communication and networking.\

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the theoretical concepts for the various application of computer networks

GED 3101 SDG: 4	COMMUNICATION SKILLS FOR CAREER SUCCESS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

COB1: To develop students' proficiency in English at CEFR B2 level (Business Vantage)

COB2: To develop students' receptive skills (Listening and Reading) in a wide range of situations

COB3: To develop students' productive skills (Speaking and Writing) in a wide range of situations

COB4: To expose students to the nuances of the English language, grammar and usage.

MODULE I BRIEF EXCHANGES OF COMMUNICATION 08

Listening to telephonic conversations - gap filling exercises- short conversations – Promoting a product-Reading short passages and answering matching tasks-Writing short notes and messages. - Framing questions

MODULE II WORKPLACE COMMUNICATION 07

Listening to monologues - gap filling exercises - Mini presentations- role play- Reading longer texts – gap filling- Writing memo , emails and Fax - Writing reports on conferences, seminars

MODULE III INTERPERSONAL COMMUNICATION 08

Listening to conversations – Collaborative discussion using prompts - Reading comprehension-multiple choice-texts - Writing enquiry letters & replies to customers

MODULE IV NEGOTIATING AND PERSUADING 07

Listening to interviews - Group Discussions - Multiple choice and gap filling- writing work reports- cause and effect - Complaint letter and sales letter

P – 30: TOTAL HOURS - 30

REFERENCES:

1. Guy Brook-Hart, 'Business Benchmark-Upper Intermediate, 2nd edition, Cambridge University Press, Shree Maitrey Printech Pvt. Ltd, Noida, 2016.

2. Leo Jones, ‘New International Business English’ Students book. Cambridge University Press, Cambridge, 2003.
3. Simon Sweeney, ‘Communicating in Business’ Teacher’s Book. Cambridge University Press, Cambridge, 2004.
4. Simon Sweeney, ‘Communicating in Business’ Student’s Book. Cambridge University Press, Cambridge, 2003.
5. Bill Mascull. ‘Business Vocabulary in Use’. Advanced. Cambridge University Press, Cambridge, 2004

COURSE OUTCOMES:

CO1: Use the LSRW skills effectively in business and general situations

CO2: Demonstrate receptive skills effectively in various formal and informal communication situations.

CO3: Demonstrate productive skills effectively in various formal and informal communication situations

CO4: Use appropriate grammar and vocabulary in any context.

Board of Studies (BoS) :
13th BoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O 3	PS O 4	PSO 5
CO1									M	H							H
CO2									M	H							H
CO3									M	H							H
CO4										H							M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

This course helps the students to enhance their communication skills, critical thinking, problem solving, conflict resolution, team building and public speaking. This course also helps them to achieve success in their professional and personal life.

ESD 3108	**INTERNSHIP I**	**L**	**T**	**P**	**C**
SDG 4 ,9		**0**	**0**	**0**	**1**

COURSE OBJECTIVES:

COB 1	**:**	To use relevant hardware and software to address industry/research problem
COB 2	**:**	To choose the components and devices during design of circuits
COB 3	**:**	To apply the design skills in prototype and modeling
COB 4	**:**	To develop the industry skill set of core industries
COB 5	**:**	Able to work in a team and manage projects in multidisciplinary environments

GUIDELINES:

1. The students shall be encouraged to do their internship in core industries to develop an experimental skill on any of the topics in electronics and computer engineering.
2. The students shall undergo training for a period of 15 days during the summer vacation of second year in any industry relevant to the field study.
3. The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period of 15 days during the summer vacation, in lieu of Industrial training.
4. The student shall also submit an internship completion certificate issued by the industry / research / academic organization.
5. In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department.
6. Department will constitute an Evaluation Committee to review the progress of internship periodically.
7. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively
8. This internship has to be taken up at a stretch.

COURSE OUTCOMES:

At the end of this course the student will be able to

CO1	**:**	Design and analyze an electronics / Computer systems
CO2	**:**	Develop a system / device for prototype and modeling

CO3 : Make use of the programming and designing skills to solve the industry use cases

CO4 : Develop working model and its demonstration

CO5 : Improve the presentation, documentation skills and team work

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	M	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	H
CO4	H	M	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L- Low Correlation M - Medium Correlation H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Lifelong learning opportunities for all.

Statement: Internship enables the student to implement the basic concepts of theory learnt, design process and applications helps for lifelong learning of newer technologies and concepts related to industrial/societal requirement.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Internship develops the professional aptitude promotes sustainable industrialization and foster innovation.

SEMESTER VI

MSD 3181	**FUNDAMENTALS OF**	**L**	**T**	**P**	**C**
SDG: All 1-17.	**ENTREPRENEURSHIP**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the fit between individual and their entrepreneurial ambitions.

COB2: To identify the customers and find a problem worth solving.

COB3: To create a business model for solving the problems of customer, forming solution and present the Business Model Canvas

COB4: To develop a solution for customers' problem and analyze the problem solution fit & product market fit.

COB5: To build and demonstrate a Minimum Viable Product (MVP) for startup

MODULE I PROBLEM IDENTIFICATION AND OPPORTUNITY DISCOVERY 9

Entrepreneurial Thinking, Business Opportunities, Problem Identification, Design Thinking, Potential solutions, Presentation of the problem- Case Study

MODULE II CUSTOMER, SOLUTION AND BUSINESS MODEL 10

Customers and Markets, Identification of Customer Segment, Niche Segment, Customers Jobs, Pain and Gain, Early Adopters, Value Proposition Canvas-Case Study, Basics of Business Model-Lean Canvas-Case Study.

MODULE III VALIDATION AND FINANCIALS 10

Blue Ocean Strategy, Solution Demo, Problem – Solution Fit, Minimum Viable Product- Product Market Fit, Prototype – Case Study. Cost, Revenues, Pricing, Profitability Checks, Bootstrapping, Initial Financing and Pitching.

MODULE IV GO TO MARKET 8

Positioning and Branding, Golden Circle model: Sinek's theory value proposition, Branding Elements, Market Penetration Strategy, Collaboration Tools and Techniques, Channels – Case Study

MODULE V MANAGING GROWTH AND FUNDING 8

Sales Planning, Customer Acquisition Strategy, Selling Skills, Identifying Funding Sources, Mapping Start-Up Cycle to Funding Options, Funding Plan, , Creating business valuation

L-45: TOTAL HOURS – 45

TEXT BOOKS:

1. Entrepreneurship Rajeev Roy oxford, 2012.
2. https://web.nen.wfglobal.org/en/home - Wadhwani Foundation
3. W. Chan Kim , Renée A. Mauborgne, "Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant", Harvard Business Press, 2015.

REFERENCES:

1. Anil Lamba , "Romancing the Balance Sheet: For Anyone Who Owns, Runs Or Manages a Business", HarperCollins Publishers India, 2016.
2. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.
3. "Anatomy of Business Plan" – Linda Pinson, OMIM publication , Seventh Edition, 2008.
4. Running Lean: Iterate From Plan A To a Plan That Works, Ash Maurya, "O'Reilly Media, Inc.", 28-Feb-2012.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Build an entrepreneurial mindset and reach out the customer to identify the problem using design thinking process

CO2: Craft solution to the problem through value proposition canvas and develop a business model using lean canvas

CO3: Provide product solution demo and deliver a minimum viable product

CO4: Work as a team and create brand strategy marketing for product/service

CO5: Prepare, make an outstanding sale pitch for startup

ESD 3201	**EMBEDDED SYSTEMS DESIGN**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1 : To explain the concepts of embedded systems

COB 2 : To build the software development skills

COB 3 : To demonstrate the key concepts of embedded systems

COB 4 : To elaborate the embedded networking system

COB 5 : To define the concepts of process and its communication

PREREQUISITE: C Programming and Digital Electronics

MODULE I EMBEDDED COMPUTING PLATFORM 9

Embedded computing – classification, characteristics and challenges –embedded system design process- overview of processors and hardware units in an embedded system- Embedded application.

MODULE II EMBEDDED SOFTWARE DEVELOPMENT TOOLS 9

Development and debugging - Host and target machines- Debugging Techniques and Challenges-Model of programs - Assembly, Linking and Loading - Program optimization - software performance optimization-Analysis and optimization of program size - Program validation and testing.

MODULE III EMBEDDED C 9

Basics of Embedded C - Introducing the 16/32 bit microcontroller family- simulation and debugging in IDE- I/O port programming- serial communication-Timer –Interrupt programming.

MODULE IV EMBEDDED NETWORKING 9

Multiprocessor systems-Distributed embedded system - I2C bus - CAN bus - Ethernet - Bluetooth- Zigbee, LoRa, Overview of IoT - IoT supported hardware platforms.

MODULE V REAL TIME OPERATING SYSTEMS (RTOS) 9

Overview of Operating Systems (OS) concepts – Real time systems –Types -Need for RTOS in Embedded Systems -Compare OS and RTOS- Multiple Tasks and Multiple Processes- Priority based scheduling- Real time scheduling algorithm – Inter process Communication Mechanisms- Case study.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Marilyn Wolf, "Computers as components", Elsevier 5th edition 2022.
2. Qing Li and Caroline,"Real Time Concepts for Embedded Systems", CRC PRESS, 2017.
3. Martin Schröder, "Embedded C Programming Design Patterns: Essential design patterns for clean, maintainable and robust firmware development', Kindle Edition, 2023.

REFERENCES:

1. Shibu KV, "Introduction To Embedded Systems", 2nd Edition, Tata McGraw-Hill, 2017.
2. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003 .

COURSE OUTCOMES:

Students who complete this course will be able to

CO1	:	Choose appropriate software and hardware components for embedded systems.
CO2	:	Apply code optimization and debugging techniques for host & target based embedded system.
CO3	:	Explain the basics of microcontroller architecture and programming the peripherals with C Language**.**
CO4	:	Develop the communication protocols in a distributed embedded system**.**
CO5	:	Design the application using RTOS

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22ND ACM held on 4.09.2024

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	M
CO4	H	H	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Life long learning opportunities for all.

Statement: This course enables the student to understand the basic concepts of embedded systems, classification, Design process and applications helps for lifelong learning of newer technologies and concepts related to the embedded systems.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Able to apply the theoretical and design concepts for the various applications in embedded domain.

ESD 3202	**EMBEDDED SYSTEMS DESIGN LABORATORY**	**L**	**T**	**P**	**C**
SDG 4,9		0	0	2	1

COURSE OBJECTIVES:

COB 1 **:** To develop a program, simulate and debug 16/32 bit Microcontrollers

COB 2 **:** To program on chip peripherals of 16/32 bit Controllers

COB 3 **:** To interface sensors and actuators with 16/32 bit Microcontrollers

COB 4 **:** To apply the principles of a real-time operating system in embedded system applications

COB 5 **:** To develop embedded applications using hardware and software components.

PREREQUISITE : Embedded System , C Programming

PRACTICALS

List of Experiments:

1. I/O Programming using 16/32 bit microcontroller
2. Programming on chip Timer / PWM /Interrupt using 16/32 microcontroller
3. Serial communication using 16/32 bit microcontroller
4. Interfacing Sensor with 16/32 bit microcontroller
5. Stepper/DC/BLDC motor interfacing with 16/32 bit microcontroller
6. Programming LCD / Keypad with 16/32 bit microcontroller
7. Design a Embedded network with 16/32 bit microcontroller
8. Implementation of multitasking using Real Time Operating Systems.
9. Implementation of scheduling algorithms using Real Time Operating Systems.
10. Design and implementation of embedded applications

P – 30 ; TOTAL HOURS –30

REFERENCES:

1. Yiu, Joseph, “Definitive Guide to Arm Cortex-M23 and Cortex-M33 Processors”, Newnes, 2020.
2. Stephen Oualline, “Bare Metal C: Embedded Programming for the Real World”, No Starch Press, 2022

3. Mazidi, Muhammad Ali, Rolin D. McKinlay, and Danny Causey, "PIC microcontroller and embedded systems: using Assembly and C for PIC18", Pearson, 2021.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Develop and debug the programs using Keil µ vision IDE

CO2 : Test programs for I/O ports, timers, serial ports using 16/32 bit microcontroller

CO3 : Demonstrate display interfacing with microcontroller

CO4 : Develop the application using on- chip peripherals of 16/32 bit microcontrollers

CO5 : Design a real time embedded applications

Board of Studies (BoS):
26^{th}BoS of ECE held on 13.05.2024

Academic Council:
22^{ND} ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	M	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	H
CO4	H	M	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Life long learning opportunities for all.

Statement: This course enables the student to understand the basic concepts of embedded systems, classification, Design process and applications helps for lifelong learning of newer technologies and concepts related to the embedded systems.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Able to apply the theoretical and design concepts for the various applications in embedded domain.

GED 3201	**REASONING AND APTITUDE FOR ENGINEERS**	**L**	**T**	**P**	**C**
SDG: 4		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To develop students' critical reading skills

COB2: To foster their writing skills

COB3: To enlighten the various methods of solving quantitative problems

COB4: To make students ready for clearing placement and competitive examination

MODULE I Objective English 07

Reading Comprehension - Sentence Rearrangement - Cloze Test – Error Spotting

MODULE II Vocabulary Development 08

Vocabulary (Synonyms and Antonyms, one word Substitutes, Spellings, Idioms and Phrases, etc) - Fill in the blanks - Paragraph Completion

MODULE III General Mental Ability 08

Time speed and Distance –Problems on Trains – Boats and Streams - Permutation and Combination - Probability

MODULE IV Quantitative Ability 07

Data Interpretation (charts, graphs, tables, data sufficiency, etc.) – Time and work- Pipes and Cisterns-Venn Diagrams-Mensuration

L –30 ; TOTAL HOURS 30

REFERENCES:

1. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.
2. Swan, Michael (2005). Practical English Usage, Oxford University Press.
3. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
4. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017
5. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand Limited, 2010
6. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016

7. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
8. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019

COURSE OUTCOMES:

CO1: Demonstrate their reading ability

CO2: Exhibit their vocabulary and writing skills

CO3: Apply the problem-solving techniques

CO4: Gain confidence mentally and be successful in their career

Board of Studies (BoS) :
13th BoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1										M		
CO2										H		
CO3										L		
CO4												M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG No. 4 : Give Quality Education to all the Engineers

Statement: In future, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

SEMESTER VII

ESD 4101	IOT AND CLOUD COMPUTING	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1: To equip students with a comprehensive understanding of IoT architecture,
components, and communication technologies

COB2: To gain practical skills in designing and implementing web connectivity for IoT systems

COB3: To learn the fundamentals of cloud computing and virtualization

COB4: To familiarize students with various cloud computing service platforms

COB5: To enable students to apply IoT and cloud technologies

PREREQUISITE: Computer network, Programming in embedded systems.

MODULE I INTERNET OF THINGS 9

Internet of Thing (IoT): Overview, conceptual framework, architecture, major components, common applications Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.

MODULE II DESIGN PRINCIPLES FOR WEB CONNECTIVITY 9

Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP. IoT privacy, security and vulnerabilities and their solutions.

MODULE III CLOUD COMPUTING 9

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.

Virtualization: Benefits & drawbacks of virtualization, server virtualization, virtualization of - operating system, platform, CPU, network, application, memory and I/O devices etc.

MODULE IV CLOUD COMPUTING SERVICE PLATFORMS 9

Compute services, storage services, database services, application services, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment & management services, identity & access management services and their case studies. Security in cloud computing: issues, threats, data security and information security.

MODULE V Application of IoT& Cloud 9

IoT and cloud integration - Getting Room Temperature and Sending the Data to the Cloud - Application development and cloud processing - Building Personal Cloud Storage Environment with Raspberry Pi and Nextcloud - Security and privacy for iot/cloud computing - securing the Raspberry Pi which holds our Nextcloud instance.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Internet of Things: Architecture and Design Principles, by Raj Kamal , McGraw Hill, 2017.
2. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill

REFERENCES:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013
3. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Explain IoT architecture and wireless communication technologies

CO2: To explain web communication protocolsin IoT systems.

CO3: To Implement cloud computing deployment models and service models

CO4: To identify and describe various cloud computing service platforms

CO5: To design and Implement IoT and Cloud Integration Solutions

Board of Studies (BoS) :	**Academic Council:**
23rd BoS of ECE held on 13.07.2022	22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No: 4 - Quality Education
Improving lives through the advancement of learning.

SDG No: 9 - Industry, Innovation and Infrastructure
To increase the performance by providing scalable computing and storage resources.

ESD 4102	INTERNSHIP II	L	T	P	C
SDG 4 ,9		0	0	0	1

COURSE OBJECTIVES:

COB 1	**:**	To use relevant hardware and software to address industry/research problem
COB 2	**:**	To choose the components and devices during design of circuits
COB 3	**:**	To apply the design skills in prototype and modeling
COB 4	**:**	To develop the industry skill set of core industries
COB 5	**:**	Able to work in a team and manage projects in multidisciplinary environments.

GUIDELINES:

- The students shall be encouraged to do their internship in core industries to develop an experimental skill on any of the topics in electronics and computer engineering.
- The students shall undergo training for a period of 15 days during the summer vacation of “Third year” in any industry relevant to the field study.
- The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period of 15 days during the summer vacation, in lieu of Industrial training.
- The student shall also submit an internship completion certificate issued by the industry / research / academic organization.
- In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department.
- Department will constitute an Evaluation Committee to review the progress of internship periodically.
- The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively
- The internship II has to be taken up at a stretch.

COURSE OUTCOMES:

At the end of this course the student will be able to

CO1	**:**	Design and analyze an electronics / Computer systems
CO2	**:**	Develop a system / device for prototype and modeling

CO3 : Make use of the programming and designing skills to solve the industry use cases

CO4 : Develop working model and its demonstration

CO5 : Improve the presentation, documentation skills and team work

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	M	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	H
CO4	H	M	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L- Low Correlation M-Medium Correlation H- High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Lifelong learning opportunities for all.

Statement: Internship enables the student to implement the basic concepts of theory learnt, design process and applications helps for lifelong learning of newer technologies and concepts related to industrial/societal requirement.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Internship develops the professional aptitude promotes sustainable industrialization and foster innovation.

SEMESTER VIII

ESD 4201	PROJECT WORK	L	T	P	C
SDG 4,9		0	0	0	9

COURSE OBJECTIVES:

COB 1	**:**	To improve the professional competency and research aptitude
COB 2	**:**	To apply the design skills in prototype and modeling
COB 3	**:**	To develop the skill set needed by the core industries
COB 4	**:**	To adapt the skills towards report/documentation preparation
COB 5	**:**	Able to work in a team and manage projects in multidisciplinary environments

GUIDELINES:

- Project work can be a design project/experimental project and/or computer simulation project on any of the topics of Electronics and computer Engineering.
- The project work is allotted individually or a group of students not more than 3.
- The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute.
- Department will constitute an Evaluation Committee to review the project work.
- The Evaluation committee consists of internal guide and experts in the specified area of the project.
- Project work consists of thesis work, two reviews of the work and the submission of project report with the viva voce.
- First review would highlight the topic, objectives, methodology and expected results.
- Second review evaluates the progress of the work, draft of the project report and demo of the prototype model.

COURSE OUTCOMES:

At the end of the project the student will be able to

CO1	**:**	Analyze the hardware and software required for the design of preliminary work.

CO2 : Select the specific devices for different application along with justification.

CO3 : Apply the practical knowledge while solving real time problems

CO4 : Implement the cost effective and efficient project models.

CO5 : Improve the presentation, documentation skills and team work

Board of Studies (BoS):
26thBoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	M	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	H
CO4	H	M	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L- Low Correlation M- Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote Lifelong learning opportunities for all.

Statement: The project work enables the student to implement the basic concepts of theory learnt, design process and applications helps for lifelong learning of newer technologies and concepts related to industrial/societal requirement.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The project work develops the professional aptitude promotes sustainable industrialization and foster innovation.

PROFESSIONAL ELECTIVES

ESDX 001	**PYTHON PROGRAMMING**	**L**	**T**	**P**	**C**
SDG: 4, 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- **COB 1** : Describe the core syntax and semantics of Python programming language.
- **COB 2** : Discover the need for working with the strings and functions.
- **COB 3** : Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- **COB 4** : Indicate the use of regular expressions and built-in functions to navigate the file system.
- **COB 5** : Infer the Object-oriented Programming concepts in Python.

PREREQUISITE: Basics of Computer Programming

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 9

Introduction to Python: Importance of Python, Installing and working with Python in Windows, Linux and Mac, Using Python as calculator, Comments, How to define main function in Python , concept of data types - Variables, Arithmetic Operators and Expressions String manipulations - Subscript Operator, Indexing, Slicing a string, Converting strings to numbers and vice versa, split function Control flow - if statements, for and while loops, nested loops, Short-circuit (lazy evaluation), range() function, break and continue statements, pass statements

MODULE II DATA STRUCTURES IN PYTHON DATA STRUCTURES 9

Lists - Basic list operations, Replacing, inserting, removing an element; Searching and sorting a list, Methods of list objects, Using lists as Stacks and Queues, How efficient lists are when used as stack or queue, List and nested list Comprehensions Tuple, Sets, Difference between list and tuple

Dictionary - adding and removing keys, accessing and replacing values, traversing dictionaries

MODULE III FILE AND EXCEPTION HANDLING IN PYTHON 9

File Handling - Reading keyboard input, opening and closing file, Read, Write and Append mode, Create and Read a text file, Looping over a file object, Writing on a file, with statements, splitting lines in a text file, Renaming and Deleting files. Exception Handling - Exceptions, Why use exceptions, Raising an exception, try and except, try, except and else clause; try and finally

MODULE IV REGULAR EXPRESSIONS IN PYTHON 9

Regular Expressions - re module, Searching a string (match and search), Finding a string (findall), Break string into substrings (split), Replace part of a string (sub)Examples of Regex - Return the first word of a given string, Extract all the words of a given string, Extract domain name from given e- mail id's, Extract date from given string, Return all the words of a string that starts with vowel, Split a string with multiple delimiters, Retrieve some information from HTMLor XML file

MODULE V PYTHON FUNCTIONS AND OOP CONCEPTS 9

Python functions and modules - OS and SYS modules, Defining python functions, calling a function, function arguments, Lambda and map function, Importing python module Useful Python Packages – Beautiful Soup, NumPy, iPython Classes and OOP - Class definition syntax, objects, class and instance variables, Inheritance and multiple inheritance, Polymorphism, Overloading, Overriding, Data Hiding.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Kenneth A. Lambert, “The Fundamentals of Python: First Programs”, Cengage Learning., 2011

REFERENCES:

1. Mark Lutz, “Learning Python”, Fifth Edition, O,Reilly, 2013
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Updated for Python Shroff/O'Reilly Publishers, 2016
3. Adnan Aziz, “Elements of Programming Interviews in Python” Amazon Digital Services-2016.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Describe the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.

CO2 : Explain what an algorithm is and its importance in computer programming.

CO3 : Recognize and construct common programming idioms: variables, loop, branch, subroutine, and input/output.

CO4 : Define and demonstrate the use of the built-in data structures 'list' and 'dictionary'

CO5 : Apply idioms to **common** problems such as text manipulation, web page building, and working with large sets of number

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

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CO1	H	H	M	M	L			L	L	-	L	L	H	M	M
CO2	M	H	M	M	L			L	L	-	L	L	H	M	M
CO3	M	H	M	L	L			L	L	-	L	L	H	M	M
CO4	M	H	H	L	L			L	L	M	L	L	H	L	M
CO5	M	H	H	H	L			L	L	M	M	L	H	M	M

Note: L-Low Correlation, M-Medium Correlation, H-High Correlation

SDG :4 - Quality Education This course delivers the basic programming concepts of “Python” language which is mostly used in Artificial Intelligence.

SDG :9 - Industry, Innovation and Infrastructure Python programming plays a major role in industry and modern infrastructures. Innovative ideas can be implemented by programming for automation

ESDX 002	ANALYSIS OF ALGORITHMS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB 1 : To Design and develop efficient algorithms for problem solving.

COB 2 : To acquire knowledge on principles of algorithm design.

COB 3 : To familiarize with divide and conquer techniques.

COB 4 : To Apply important algorithmic design paradigms and methods of analysis.

COB 5 : To Synthesize efficient algorithms in common engineering design situations.

PREREQUISITE: Discrete mathematics, Data structures and Probability.

MODULE I TIME COMPLEXITY ANALYSIS AND INCREMENTAL AND DECREMENTAL DESIGN 9

Algorithm - Fundamentals of Algorithmic Problem Solving – Analysis Framework –Asymptotic Notations. Solving recursive equations.

MODULE II BRUTE FORCE 9

Selection Sort and Bubble Sort – Sequential Search and Brute Force String matching – Closest pair and Convex Hull Problems by Brute Force – Exhaustive Search – Depth First Search and Breadth First Search Incremental design–Insertion Sort –Celebrity Problems. Include the algorithms relating to Incremental and Decremental Algorithms.

MODULE III DIVIDE AND CONQUER 9

Merge Sort – Recursive Binary Tree Traversals and Related Properties – Multiplication of Large Integers and Strassen's Matrix Multiplication – The Closest Pair and Convex Hull Problems by Divide and Conquer.

MODULE IV DYNAMIC PROGRAMMING AND GREEDY TECHNIQUES 9

Sorting by Counting – Input Enhancement in String Matching – Hashing – B-Trees – Knapsack Problems and Memory Functions – Optimal Binary Search Trees – Warshall's and Floyd's Algorithm.

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes and Real time applications.

MODULE V TRACTABILITY AND SOLVABILITY 9

NP-Hard and NP-Complete Problems: Basic concepts, Non deterministic algorithms, NP-Hard and NP Complete classes, NP-Hard problems, Cook's theorem.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithm", Pearson Education Limited,ThirdEdition,ISBN-10 : 9332585482, ISBN-13 : 978- 9332585485, 2017.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Third edition, Prentice Hall of India Private Limited, ISBN: 9780262533058, 0262533057, 2009.

REFERENCES:

1. Rajesh K.Shukla, "Analysis and Design of Algorithms", Wiley India Private Limited,ISBN : 978–81-265-5477-5,ISBN:978-81-265-8214-3, 2015.
2. Tim Roughgarden "Algorithm Illuminated: The Basic: 1 (Algorithms illuminated)",Sound like yourself Publishing, ISBN-10:0999282905, ISBN -13 978-0999282908, 2017.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1	:	Analyze worst-case running times of algorithms using asymptotic analysis.
CO2	:	Apply design principles and concepts to algorithm design.
CO3	:	Implement algorithms using the divide and conquer.
CO4	:	Compare between different data structures. Pick an appropriate data structure for a design situation.
CO5	:	Justify the appropriate algorithmic technique for solving real world problems.

Board of Studies (BoS):	**Academic Council:**
25th BOS of ECE held on 20.09.2023	21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	M	L			L	L	-	L	L	H	M	M
CO2	M	H	M	M	L			L	L	-	L	L	H	M	M
CO3	M	H	M	L	L			L	L	-	L	L	H	M	M
CO4	M	H	H	L	L			L	L	M	L	L	H	L	M
CO5	M	H	H	H	L			L	L	M	M	L	H	M	M

Note: L-Low Correlation,M-Medium Correlation,H-High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning “Analysis of Algorithm”, students can apply algorithms in order to take actions in complex decision-making environment, which in turn leads to sustainable economic growth and enormous employment opportunities.

ESDX 003	ELECTROMAGNETIC FIELD THEORY AND	L	T	P	C
SDG: 4,9	TRANSMISSION LINES	3	0	0	3

COURSE OBJECTIVES:

COB 1 : To explain the basics of Vector fields and coordinate systems.

COB 2 : To know the Maxell's equations, Faraday's law, Gauss's law and Ampere's law to solve field problems.

COB 3 : To apply divergence theorem and Stoke's theorem to solve field problems.

COB 4 : To understand about time varying fields and wave propagation.

COB 5 : To acquire the knowledge of transmission line from electromagnetic field point of view.

PREREQUISITE: Fundamentals of Mathematics and Fundamentals of Physics

MODULE I BASICS OF ELECTROMAGNETIC 9

Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems.

MODULE II STATIC ELECTRIC & MAGNETIC FIELDS 9

Coulomb's law, Electric field intensity Electric flux density, Gauss Law, Magneto-static fields, Biot – Savart's Law, Ampere's circuit law, Electric and Magnetic materials, Boundary conditions.

MODULE III MAXWELL'S EQUATION & PLANE WAVES 9

Maxwell's Equation, Differential and integral forms and their interpretation, Wave equation, Poynting vector, reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

MODULE IV TRANSMISSION LINES 9

Equivalent circuit of transmission lines, equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart.

MODULE V WAVEGUIDES 9

TE, TM and TEM modes of propagation, Wave propagation in Parallel plate wave guides, Rectangular waveguides and Circular Waveguides.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. M.N.O.Sadiku: "Elements of Engineering Electromagnetics", 6th Edition, Oxford University Press, 2016.
2. John D Ryder, "Networks, Lines and Fields", 2nd Edition, Pearson India, 2015.
3. William H.Hayt "Engineering Electromagnetics", 8th Edition, Tata McGraw - Hill, 2014.

REFERENCES:

1. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall Int., 2015.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", 5th Edition, Tata McGraw Hill, 2017.
3. David M.Pozar, "Microwave Engineering", 4th Edition, John Wiley, 2013.
4. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics", 3rd Edition, John Wiley & Sons, 2003.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 Apply the concepts of vector algebra and coordinate systems.

CO2 : Solve electrostatic and magnetostatic problems under different boundary conditions.

CO3 : Use Maxwell Equations for Electromagnetic wave propagation.

CO4 : Interpret wave propagation in different media.

CO5 : Illustrate impedance matching techniques using appropriate tool.

Board of Studies (BoS):	**Academic Council:**
25th BOS of ECE held on 20.09.2023	21st Academic Council held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	M									H	L	L
CO2	H	H	H	M		L	L						H	L	L
CO3	H	H	H	M		L	L						H	L	L
CO4	H	H	H	M		L	L						H	L	L
CO5	H	H	H	M	M	L	L						H	L	L

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education:

A fundamental concept of electromagnetic properties and its characteristic analysis provides a global impact on quality education in the area of RF & Communication.

SDG 9: Industry, Innovation and Infrastructure:

Build resilient Infrastructure; promote inclusive and sustainable industrialization through EM wave propagation within the industry.

ESDX 004	**SENSORS AND INSTRUMENTATION**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- **COB 1** **:** To classify sensing technologies according to their applications.
- **COB 2** **:** To discuss the significance of sensor characteristics in ensuring accurate and reliable measurements.
- **COB 3** **:** To define virtual instrumentation and its relevance in modern measurement and control systems.
- **COB 4** **:** To evaluate the impact of resolution, accuracy, and sampling rate on data acquisition quality.
- **COB 5** **:** To Design and analyze the measurement systems for various applications

PREREQUISITE: Fundamentals of Physics

MODULE I PRINCIPLES OF SENSING 8

Electric Charges, Fields, and Potentials-Capacitance-Magnetism-Induction-Resistance-Piezoelectric Effect-Pyroelectric Effect-Hall Effect-Thermoelectric Effects-Sound Waves-Temperature and Thermal Properties of Materials-Heat Transfer.

MODULE II SENSORS & TRANSDUCERS 10

Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor, Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

MODULE III VIRTUAL INSTRUMENTATION 9

Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, Need of software based instruments for industrial automation.

MODULE IV DATA ACQUISITION METHODS 9

Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

MODULE V INTELLIGENT SENSORS 9

General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.

L–45; TOTAL HOURS–45

TEXT BOOKS:

1. Jacob Fraden, Handbook of Modern Sensors: Physics, Design and Applications‖, 5th Edition, Springer, USA,2016.
2. Margolis, Michael, Brian Jepson, and Nicholas Robert Weldin, Arduino cookbook: recipes to begin, expand, and enhance your projects‖, O'Reilly Media, 2020.
3. Murthy, D. V. S. "Transducers and Instrumentation. PHI, 1995
4. John P. Bentley, Principles of Measurement Systems.", Pearson Education, 2005.

REFERENCES:

1. Joshi, M. G. "Compr. Transducers for Instrumentation" Firewall Media, 2005.
2. Sobh, Tarek, Khaled Elleithy, Ausif Mahmood, and Mohammad A. Karim, eds. "Novel algorithms and techniques in telecommunications, automation and industrial electronics" Springer Science & Business Media, 2008.
3. Gupta, Sanjay, and Jai P. Gupta, eds. PC Interfacing for data acquisition and process control. Instrument Society of America, 1994.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Describe the principles of sensors & Transducers

CO2 : Classify the sensors and choose the sensors based on the application

CO3 : Use the virtual instrumentation systems

CO4 : Design and analyse the data acquisition system

CO5 **:** Elaborate the applications of intelligent sensors in modern measurement systems.

Board of Studies (BoS):
25th BOS of ECE held on 20.09.2023

Academic Council:
21st Academic Council held on 20.12.2023

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CO1	H	H	H	M									H	M	
CO2	H	H	H	M		L	L						H	M	
CO3	H	H	H	M		L	L						H	M	
CO4	H	H	H	M		L	L						H	M	
CO5	H	H	H	M	M	L	L						H	M	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education Statement: A fundamental concept of electromagnetic properties and its characteristic analysis provides a global impact on quality education in the area of RF & Communication.

SDG 9: Industry, Innovation and Infrastructure Statement: Build resilient Infrastructure; promote inclusive and sustainable industrialization through EM wave propagation within the industry.

ESDX 011	DIGITAL IMAGE AND VIDEO PROCESSING	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1 : To apply the basic principles of digital image processing and its performance parameters.

COB2 : To implement algorithms to perform basic image processing and to analyze different image enhancement techniques.

COB3 : To analyze segmentation, restoration and compression techniques

COB4 : To apply the fundamental concepts and techniques used in video processing

COB5 : To list various practical applications of video processing in various domains using segmentation, restoration and compression techniques.

PREREQUISITES: Fundamentals of matrix algebra and mathematical transforms.

MODULE I DIGITAL IMAGE FUNDAMENTALS 9

Definition – Image Representation – Steps in DIP - Components of Image Processing System, Elements of Visual Perception - brightness adaptation, Mach-band effect. Image Sampling & Quantization, Spatial and Gray Level Resolution, Statistical Parameters - Mean, variance, PSNR, correlation. Fundamentals of color image processing: color models - RGB, CMY, HIS.

MODULE II IMAGE TRANSFORMS AND ENHANCEMENT 9

Significance of image transforms – Classifications-2D DFT, DCT, Hadamard, Haar transform, Hough, Wavelet transform - Image Enhancement techniques -Intensity transformation techniques – Histogram -Histogram equalization-Spatial and frequency domain-Low pass and High pass filters. Color Image Processing – Pseudo color Image Processing.

MODULE III IMAGE SEGMENTATION ,RESTORATION AND COMPRESSION 9

Segmentation: Point, line edge detection, boundary and thresholding, Segmentation types, Morphological Image Processing, Restoration: Image Degradation Model, Unconstrained and constrained restoration, Fundamentals of image compression.

MODULE IV INTRODUCTION TO VIDEO PROCESSING 9

Overview of Video Processing-Digital Video Formats and Standards-- Color Models for Video Processing-Video Compression Techniques: Lossy and Lossless Compression.

MODULE V VIDEO ENHANCEMENT AND SEGMENTATION 9

Video Enhancement- Video Denoising Techniques- Video Deinterlacing-Video Super-Resolution-Video Stabilization- Video Segmentation- Thresholding, Edge Detection -Video Compression Standards- MPEG, H.264/AVC, H.265/HEVC--Applications of Video Processing.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Victor Escorcia, Bernard Ghanem, and Juan Carlos Niebles,"Video Processing and Analysis", Springer, 2018.
3. Giovanni Ramponi and Fabio Marcoli, "Digital Video Processing" Springer, 2 018.

REFERENCES:

1. Alan C. Bovik, DimitrisAnastassiou, VivekNavalgund, and Qilian Liang ,"Introduction to Video and Image Processing Building Real Systems and Applications" , Cambridge University Press,2019.
2. Fabian CabaHeilbron, Victor Escorcia, Bernard Ghanem, and Juan Carlos Niebles"Video Processing and Analysis" Springer, 2018.
3. Jayaraman, S.Essakirajan and T.Veerakumar "Digital Image Processing", Tata McGraw Hill Education,5th edition,2015.
4. Giovanni Ramponi and Fabio Marcolin"Digital Video Processing" , Springer,2014.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Analyze the fundamental concepts and performance parameters of digital image processing.

CO2 : Apply transforms for image processing application and analyze various image enhancement techniques

CO3 : Apply the various techniques of image segmentation and restoration.

CO4 : Analyze the basics of video representation and digital video formats.

CO5 : Describe the principles behind video compression and evaluate different methods for video segmentation

Board of Studies (BoS) : **Academic Council:**

26th BoS of ECE held on 13.05.2024 22ND ACM held on 4.09.2024

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	H	H	H	L	M				M	M	M	M	H	L	M
CO3	H	H	H	H	H				H	M	L	L	H	H	H
CO4	H	H	H	H	L				H	H	M	L	H	M	H
CO5	H	H	H	H	H				H	H	H	L	M	L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Quality Education

Imparting students with a thorough grasp of digital image and video processing, this course actively promotes the attainment of inclusive and equitable quality education for every individual.

SDG 9: Industry, Innovation, and Infrastructure

Teaching digital image and video processing skills drives innovation and tech advancement in industries, fueling sustainable economic growth and infrastructure development.

		L	T	P	C
ESDX 012	**CONTROL SYSTEMS**	**L**	**T**	**P**	**C**
SDG: ,7,9,11		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To model various control systems using fundamental concepts

COB2 : To analyze the properties of control systems in time domain & frequency domain.

COB3 : To design feedback controllers and compensators

COB4 : To analyze the stability of the control system.

COB5 : To obtain state variable representation of physical systems and study the effect of state feedback.

PREREQUISITES: Basics of Calculus, Linear Algebra, Probability and Statistics.

MODULE I CONTROL SYSTEM MODELING 8

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph.

MODULE II TIME RESPONSE ANALYSIS 10

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB.

MODULE III FREQUENCY RESPONSE ANALYSIS 10

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol"s Chart - Use of Nichol"s Chart in Control System Analysis.

MODULE IV STABILITY ANALYSIS & COMPENSATORS 10

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators.

MODULE V STATE VARIABLE ANALYSIS 7

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. FaridGolnaraghi, Benjamin C. Kuo," Automatic Control Systems", McGraw Hill Professional, Tenth Edition , 2017.
2. Katsuhiko Ogata," Modern Control Engineering" Prentice Hall, 5e, 2010.
3. J. Nagrath, M. Gopal Control Systems Engineering, Anshan, 5e, 2008.

REFERENCES:

1. William S. Levine, "The Control Handbook, Second Edition: Control System Fundamentals "CRC Press, 2010.
2. Jesus C. De Sosa, "Control Systems: Analysis and Realization", Universe, 2010.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Develop mathematical models of control components and systems

CO2 : Design controllers for systems

CO3 : Analyze the system in time and frequency domain

CO4 : Apply the Root Locus method, Routh Hurwitz array and Nyquist stability criterion to find stability of a system.

CO5 : Obtain and manipulate state space representation of systems

Board of Studies (BoS) :
26th BoS of ECE held on 13.05.2024

Academic Council:
22ND ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Provide Quality education by understanding the fundamental concepts and promote research in the area of RF & Communication.

SDG 7: Basic Understanding and research in the area of RF & Communication, can promote affordable energy.

SDG 9: Build resilient Infrastructure; promote inclusive and sustainable industrialization Through EM wave propagation within the industry.

SDG 11: Build resilient Infrastructure; promote Communication through EM wave propagation within the Smart city.

ESDX 013	**INTRODUCTION TO PCB DESIGN**	**L**	**T**	**P**	**C**
SDG: 4,8,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To identify and understand the basics of PCB components.

COB2:. To design the schematic for PCB and understand the PCB design rules.

COB3: To make use of Pspice software for circuit analysis.

COB4: To evaluate Design rule check and prepare footprint.

COB5: To design layout and generate art files.

PREREQUISITE: Electronics Fundamentals and Basic Electronics Design

MODULE I BASICS OF PCB 9

History of Printed Circuit Boards. Various types of Printed Circuit Boards - Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards. Study of Packages of Electronic Components. Study of SMD Components. Process of PCB design and product development flow.

MODULE II SCHEMATIC DESIGN 9

PCB Design packages - OrCAD, PCB software for schematic capture,Rules for PCB Design, Standards for PCB Design.

MODULE III DESIGN OF SCHEMATIC SYMBOL and SIMULATION 9

PCB design: Placing, editing, and connecting parts and electrical symbols, Creating a net list, Exporting and importing schematic data, Basic Circuit simulation using EDA tool.

MODULE IV DESIGN OF FOOT PRINTS 9

Mechanical Design Consideration, Electrical Design Consideration Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components.

MODULE V PCB LAYOUT DESIGN 9

PCB layout design: Board outline design, Layer design, components placement, General layout - rules and parameters - PCB design rules for digital and analogue circuits, Art file Generation

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Walter C Bosshart, '' Printed Circuit Boards, Design and Technology" McGraw Hill.Inc., 2009.
2. Khandpur R.S, '' Printed Circuit Boards, Design, Fabrication and Assembly" McGraw Hill.Inc.

REFERENCES:

1. Kraig Mitzner "Complete PCB Design Using OrCAD Capture and PCB Editor" Newnes, 2009.
2. Clyde F.Coombs,Jr., and Happy T.Holden,"Printed Circuits Handbook"TataMc.Graw Hill Education, seventh Edition.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Categorize the SMD components and PTH components with different packages

CO2: Experiment the circuit design process and different machines used for designing.

CO3: Design pads and footprint for new symbols.

CO4: Place components and trouble shoot the errors.

CO5: Generate art files for fabrication.

Board of Studies (BoS) :
26th BoS of ECE held on 13.05.2024

Academic Council:
22ND ACM held on 4.09.2024

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	H	M	M	M				L	L		H	H	H
CO2	H	H	H	M	M	M				L	L		H	H	H
CO3	H	H	H	M	M	M				L	L		H	H	H
CO4	H	H	H	M	M	M				L	L		H	H	H
CO5	H	H	H	M	M	M				L	L		H	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: Understanding of the analog, digital electronics course will bring a global impact on quality education

SDG 8: Development of new technologies provides sustainable economic growth and productive employment.

Statement: Analysis and design of electronic circuits promote sustained economic growth

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the design concepts of analog, digital circuits in IC based design.

ESDX 014	PRINCIPLES OF ROBOTICS	L	T	P	C
SDG: 4, 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore the functional aspects of Robotics

COB2: To describe forward and inverse kinematics.

COB3: To Analyze the principles of actuator control and drive systems

COB4: To classify different types of sensors used in robotics.

COB5: To evaluate and optimize image processing techniques for robotic vision and sensing.

PREREQUISITE:

1. Knowledge on Electronics and programming skills.
2. Understanding of calculus and linear algebra.

MODULE I FUNDAMENTALS 8

Evolution of Robots – Types of Robots – History of Robotics – Advantages and disadvantages of Robots – Anatomy of Robots and degree of freedom – Robot coordinates – Robot characteristics and applications – Collaborative Robots.

MODULE II KINEMATICS OF ROBOTS 9

Mechanical structure – Links and Joints - Mathematical representation of Robots - Homogeneous transformation –– Representation of Transformation - verse of Transformation Matrice – Forward and inverse kinematics of Robots.

MODULE III ACTUATORS AND DRIVE SYSTEMS 9

Characteristics of Actuating Systems – Hydraulic actuators – Electric motors – Microprocessor control of electric motors – Magnetostrictive actuators – Shape-Memory type metals – Electroactive Polymer actuator (EAPs)

MODULE IV SENSORS 9

Sensor characteristics and utilization – Types of Sensors – Vision system – Voice recognition devices – Voice synthesizers.

MODULE V IMAGE PROCESSING AND ANALYSIS WITH VISION SYSTEMS 10

Basic concepts – Acquisition of images, Digital images, Resolution and Quantization, Sampling theorem - Image Processing Techniques – Noise reduction – Image analysis – Image data compression.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Saeed B. Niku, “Introduction to robotics analysis, control, applications”, John Wiley, USA, Third Edition, February 2020, ISBN - 9781119527626, 1119527627
2. R. K. Mittal and I. J. Nagrath, “Robotics and Control”, Tata McGraw Hill, 4th Edition, New Delhi, 2013.
3. Kevin M. Lynch, Frank C. Park, “Modern Robotics: Mechanics, Planning, and Control”, Cambridge University Press, 1st Edition, 2017, ISBN-13 - 978-1107156302.

REFERENCES:

1. Mark W. Spong, Seth Hutchinson and M. Vidyasagar, Robot Modeling and Control, 2nd Edition, Wiley Publication, February 2020, 608 Pages, ISBN: 978-1-119-52404-5
2. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Publication, 2018, 438 Pages.
3. AshitavaGhosal, Robotics: Fundamental Concepts and Analysis, Oxford, 2006, ISBN – 0195673913.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Describe the fundamental concepts of robotics.

CO2: Illustrate the mechanical structure and kinematic model in robotics.

CO3: Explain the function and types of actuators in robotics.

CO4: Design sensor fusion techniques for improved perception.

CO5: Analyze image processing techniques for robotic vision systems.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M				M		L	L		M	H			H
CO2	M	M				M		L	L		M	H			H
CO3	M	M				M		L	L		M	H			H
CO4	M	M				M		L	L		M	H			H
CO5	M	M				M		L	L		M	H			H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement:

- Improving lives through the advancement of learning.
- To increase industrial productivity and work safety by using automotive robots for performing repetitive actions or jobs considered too dangerous for humans.

ESDX 015	ARM ARCHITECTURE AND PROGRAMMING	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1 : To gain the fundamentals of an ARM processor architecture

COB2 : To explain the on-chip peripherals of an ARM processor.

COB3 : To Analyze the I/O ports, serial and parallel interfaces of an ARM processor.

COB4 : To apply the instruction sets of ARM processor.

COB5 : To design interrupt handling schemes and embedded operating systems.

PREREQUISITE : Basics of Computer Architecture and C Programming

MODULE I ARM PROCESSOR FUNDAMENTALS 9

RISC Design Philosophy, ARM Design Philosophy. Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families.

MODULE II LPC21XX ARM CPU 9

Introduction: - Architectural Overview - Memory Mapping -Block Diagram - System control block functions : PLL - Power Control - Reset - VPB Divider - Wakeup Timer - Memory Acceleration Module - Timer0 and Timer1- PWM - RTC - On Chip ADC - On Chip DAC- Interrupts- Vector Interrupt Controller.

MODULE III LPC 21XX - PERIPHERALS 9

General Purpose Input/Output Ports (GPIO) - Universal Asynchronous Receiver/Transmitter (UART) - I2C Interface - Multimaster and Multislave communication - SPI Interface - SSP Controller - USB 2.0 Device Controller.

MODULE IV ARM INSTRUCTIONS SET 9

ARM programmer’s model - Addressing modes- instruction set- Data processing instructions, Data transfer instructions, ARM Condition codes, Branches, Software interrupt (SWI), Multiply instructions-ARM Assembly Language programming.

MODULE V ARM APPLICATION DEVELOPMENT 9

Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Example: Standalone - Embedded Operating Systems – Fundamental Components - Example Simple little Operating System.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Muhammad Tahir,KashifJaved, "ARM Microprocessor Systems " CRC Press; 1st edition, 2020.
2. RenBeuchat,AndreaGuerrieri, SahandKashani, "Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers", Arm Education Media, 2021.
3. William Hohl, Christopher Hinds , “ARM Assembly Language Fundamentals and Techniques, 2nd Edition, CRC Press, 2015.

REFERENCES:

1. A.K.Ray& K.M Bhurchandi, ‘Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing’, Tata McGraw Hill, 3rd edition Paperback – 1 July 2017
2. Steve Furber, “ARM System On Chip Architecture, Second Edition, Addison Wesley, 2015.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Explain the ARM processor architecture and its family.

CO2 : Design and implement advanced embedded systems with diverse communication capabilities.

CO3 : Develop assembly language programs to perform specific tasks using ARM instructions

CO4 : Design ARM microcontroller applications using Embedded C Language.

CO5 : Analyze embedded operating systems and its components.

Board of Studies (BoS) :	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22ND ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PS O2	PSO 3
CO1	M	L	M	L	L	-	-	-	-	-	-	L	-	-	-
CO2	M	L	M	L	L	-	-	-	-	-	-	L	-	-	-
CO3	M	L	M	M	L	-	-	-	-	-	-	L	-	-	-
CO4	M	L	M	M	L	-	-	-	-	-	-	L	-	-	-
CO5	M	L	M	M	L	-	-	-	-	-	-	L	-	-	-

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Statement: This course enables the student to understand the fundamentals of ARM CPU, peripherals to interface with ARM processor, constraints in developing an ARM based systems for applications.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation
Statement : Statement: Able to apply the programming concepts of ARM for various applications practically.

		L	T	P	C
ESDX 016	**MECHATRONICS**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1	**:**	Identify the fundamental principles and concepts of mechatronics.
COB 2	**:**	Apply knowledge of sensors and actuators in the design of mechatronic systems .
COB 3	**:**	Analyze and design control systems for mechatronic applications.
COB 4	**:**	Demonstrate proficiency in programming and interfacing microcontrollers for mechatronic systems.
COB 5	**:**	Evaluate and integrate mechanical, electrical, and electronic components to design functional mechatronic systems.

PREREQUISITE: Basic knowledge of Mathematics, electronics

MODULE I INTRODUCTION TO MECHATRONICS 9

Overview of Mechatronics - Basics of Mechanical Systems - Basics of Electrical Systems - Basics of Electronic Systems - Interfacing between Mechanical, Electrical, and Electronic Systems

MODULE II SENSORS AND ACTUATORS 9

Types and Characteristics of Sensors - Principles of Actuators - Sensor Interfacing Techniques - Actuator Control Techniques - Applications of Sensors and Actuators in Mechatronic Systems

MODULE III CONTROL SYSTEMS 9

Introduction to Control Systems - Feedback Control Systems - PID Control - Digital Control Systems - Design and Implementation of Control Systems in Mechatronics.

MODULE IV MICROCONTROLLERS AND EMBEDDED SYSTEMS 9

Introduction to Microcontrollers - Programming Microcontrollers - Interfacing Sensors and Actuators with Microcontrollers - Embedded System Design Applications of Microcontrollers in Mechatronics.

MODULE V MECHATRONIC SYSTEM DESIGN AND INTEGRATION 9

System Design Methodologies - System Modeling and Simulation - Integration of Mechanical, Electrical, and Electronic Components - Testing and Validation of Mechatronic Systems

L- 45, Total Hours – 45

TEXT BOOKS:

1. Bolton, William, “Mechatronics: electronic control systems in mechanical and electrical engineering” Pearson Education, 7e, 2023.
2. Bishop, Robert H. "Mechatronic Systems: Sensors and Actuators. Fundamentals and Modeling” CRC Press. 2e, ebook, 2017.
3. De Silva, Clarence W., “Mechatronic systems: devices, design, control, operation and monitoring”. CRC press, 2007.

REFERENCES:

1. Janschek, Klaus. “Mechatronic systems design: methods, models, concepts” Springer Science & Business Media, 2011.
2. Onwubolu, Godfrey. “Mechatronics: principles and applications.” Elsevier, 2005.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Explain the basic principles and components of mechatronic systems

CO2 : Choose sensor and actuator systems for specific mechatronic applications

CO3 : Design and analyze control systems for mechatronic devices.

CO4 : develop and program microcontroller-based solutions for mechatronic problems

CO5 : Evaluate, test, and integrate various components to design functional mechatronic systems.

Board of Studies (BoS):
26thBoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	M	M	M		M	L	H				M		H
CO2	L	H	M	M	M			L	M	M	M		H	M	
CO3	M	M	H	M			M	L	H			M	M		H
CO4		M	M	H		M	M	L	M	H	H	M		H	
CO5			M	M	H	H		H	M	H	H	L	M	M	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: Through this course, students receive quality education in a multidisciplinary field, which is essential for preparing them to address complex societal challenges. By promoting hands-on learning and problem-solving skills, this course empowers students to contribute effectively to sustainable development efforts in various sectors.

SDG 9: Industry, Innovation and Infrastructure

Statement: Industry, Innovation, and Infrastructure - Mechatronics plays a crucial role in advancing innovation and infrastructure development. By equipping students with knowledge and skills in mechatronics, this course contributes to fostering innovation, improving industrial processes, and enhancing infrastructure through the development of intelligent systems.

ESDX 017	AUTOMOTIVE NETWORKING AND PROTOCOLS	L	T	P	C
SDG 4,9		3	0	0	3

COURSE OBJECTIVES:

COB 1 : Identify functions of electronic systems in modern automobiles.

COB 2 : Discuss Embedded networking protocols.

COB 3 : Describe Automotive networking protocols for internal communication.

COB 4 : Illustrate CAN, LIN, FlexRay, and MOST protocol frame format.

COB 5 : Apply AUTOSAR in the Automotive industry.

PREREQUISITE:

- Basic understanding of computer networks.
- Familiarity with embedded systems.

MODULE I INTRA-VEHICLE COMMUNICATIONS 9

Overview of vehicle electronic systems- Intra-Vehicle Communications and Functions-Systems and Sensors-Air Bag System, Air Conditioning and Climate Control System, Braking System, Crash Sensors, Engine Control Unit, Electronic Stability Control, Steering, Infotainment System, Integrated Starter Generator, Lighting System, Power Train, Seat Belt Sensors, Tire Pressure Monitoring System, Window and Door System.

MODULE II EMBEDDED NETWORKING 9

Introduction – Serial/Parallel Communication – Serial communication protocols - RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols - Firewire USB bus – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types – Enumeration – Descriptors.

MODULE III CONTROLLER AREA NETWORK (CAN) PROTOCOL 9

Overview- Evolution- CAN Versions-Types of Controllers- Layered Architecture CAN Bus-Signaling States, The Physical Layer, Data Transmission, Interoperability Issues, Bus Speed, Cable Length, Bus Termination, Cable and Cable Connectors-Message Frames-Data Frame, Remote Frame, Error Frame, Overload Frame-Error Handling.

MODULE IV AUTOMOTIVE NETWORKING PROTOCOLS 9

Overview- LIN Specification- Specification Components- Introduction, Key features and properties of Flex Ray - Overview of Flex Ray consortium – Flex Ray Physical Layer - Topologies- Flex Ray communication controller- Flex Ray bus transceiver, Rest bus simulation- Overview of MOST technology, key features, application examples- MOST frame structure, speed grades, transport mechanisms, synchronization.

MODULE V AUTOSAR 9

AUTOSAR Architecture- Basic concepts- Software components – Layered Architecture - Microcontroller Abstraction Layer – ECU Abstraction Layer - Service Layer – RTE - Application Layer- Diagnostics - Methodology - Tools in SW development using AUTOSAR.

L- 45; Total Hours –45

TEXT BOOKS:

1. Gilbert Held. “Inter- and Intra-Vehicle Communications”,AuerbachPublications; 1st Edition (2019).
2. Muhammad Ali Mazidi, Danny Causey and Janice Mazidi. “HCS12 Microcontrollers and Embedded Systems”, Prentice Hall, 2008.
3. Kevin Roebuck, “AUTOSAR – Automotive Open System Architecture:High-impact Strategies”, Emereo Publishing, 2011.

REFERENCES:

1. O.Pfeiffer, A.Ayre, C.Keyde, “Embedded Networking with CAN and CANopen””, Copperhill Media Corp. 2008.
2. Christophe Sommer, Falko Dressler, “Vehicular Networking”, Cambridge University Press, 2014
3. JorgSchauffele and Thomas Zurawka, “Automotive Software Engineering Principles, Processes Methods and Tools”, SAE International Publishers, 2005.
4. KonradReif, “Automotive Mechatronic: Automotive Networking, Driving Stability Systems, Electronics”, Springer, 2015.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Identify components and explain the significance of Embedded networking systems.

CO2 : Analyze data communication within the layers of the CAN protocol.

CO3 : Compare different automotive networking protocols and their characteristics.

CO4 : Implement CAN and LIN protocols effectively.

CO5 : Analyze the features of AUTOSAR

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PS O2	PSO 3
CO1	H		H	H			H			H			H		
CO2	H		H	H			H			H			H		
CO3					M	M		M	M		M	M			
CO4					M	M		M	M		M	M			
CO5					M	M		M	M		M	M			

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: This course enables the student to realize the need of communication protocols in automotive Industry and helps for lifelong learning of newer technologies and concepts related to Automotive Embedded systems.

SDG 9: Industry, Innovation and Infrastructure

Statement: Network protocols play a major role in the automotive Industry for interfacing sensors and automotive subsystems with microcontrollers.

ECDX 018	**WIRELESS AND MOBILE COMMUNICATION**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To introduce the concepts of wireless and mobile communication

COB2 : To comprehend the basic principles of cellular networks, such as frequency reuse and interference management.

COB3 : To gain the knowledge of radio wave propagation and its effects on wireless communication.

COB4 : To implement modulation techniques and equalization methods to enhance signal quality in wireless systems.

COB5 : To evaluate different multiple access techniques and wireless networking protocols for system optimization.

PREREQUISITE : Telecommunications Fundamentals

MODULE I INTRODUCTION TO WIRELESS COMMUNICATION 8

Evolution of mobile radio communications, paging system, cordless telephone system, cellular telephone system, Modern wireless communication systems: 4G networks,5G networks, Bluetooth and personal area networks.

MODULE II CELLULAR CONCEPT AND MOBILE RADIO PROPAGATION 10

Frequency Reuse Channel Assignment and Handoff Strategies Interference and System Capacity Radio Wave Propagation Mechanisms Outdoor and Indoor Propagation Models Small-Scale Multipath Propagation, Types of Small-Scale Fading and Models

MODULE III MODULATION TECHNIQUES AND EQUALIZATION 10

Amplitude and Angle Modulation Digital Modulation Schemes Spread Spectrum Modulation Techniques Modulation Performance in Fading Equalizers in Communication Receiver

MODULE IV MULTIPLE ACCESS TECHNIQUES AND WIRELESS NETWORKING 7

FDMA, TDMA, CDMA, and SDMA Techniques Packet Radio Capacity of Cellular Systems Traffic Routing in Wireless Networks Wireless Data Services SS7, PCS, UMTS, etc. AMPS and GSM system architecture overview. Call management and system operation. CDMA based cellular system. Wireless in Local Loop–DECT and CDMA WLL.

MODULE V ADVANCED WIRELESS COMMUNICATIONS SYSTEM 10

SISO, SIMO, MISO and MIMO communication channels, Capacity of MIMO channels , MIMO Diversity , MIMO spatial multiplexing , capacity of massive MIMO, Hardware technology for mmWave systems, SDR - Definition, hardware and software architecture, Cognitive Radio - Definitions, Cognitive theories, Cognitive radio as self controlling system, Terahertz

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Wireless Communications: Principles and Practice" by Theodore S. Rappaport,Pearson Education India,Second Edition,2010.
2. Mobile Communications" Jochen Schiller, Second Edition,Pearson education, 2003

REFERENCES:

1. Wireless Communication Networks and Systems", Cory Beard and William Stallings, Pearson, 2015

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Recollect the key milestones in the evolution of wireless communication systems

CO2 : Explain the principles underlying cellular network design and operation.

CO3 : Describe the impact of radio wave propagation on wireless communication system performance.

CO4 : Implement modulation techniques and equalization methods in practical scenarios to improve signal quality.

CO5 : Assess the effectiveness of various multiple access techniques and networking protocols for optimizing wireless communication systems.

Board of Studies (BoS) :
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Provide Quality education .

By understanding the fundamental concepts and promote research in the area of RF & Communication.

SDG 9 : Industry, Innovation, and Infrastructure.

The course on wireless and mobile communication contributes to SDG 9 by fostering collaboration for infrastructure development and technological innovation in the telecommunications industry.

		L	T	P	C
ESDX 019	**INTRODUCTION TO EMBEDDED LINUX**	**L**	**T**	**P**	**C**
SDG 9,11		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- **COB 1** : Introduce the fundamental concepts of Linux and its application in embedded systems.
- **COB 2** : Explore the Linux kernel architecture, boot sequence, and device management.
- **COB 3** : Cover various storage aspects, including flash memory, memory technology devices and file systems.
- **COB 4** : Prepare to write and integrate device drivers for peripherals such as serial communication, Ethernet, and USB.
- **COB 5** : Explore real-world applications, including consumer electronics, industrial automation, IoT, and communication devices.

PREREQUISITES: Basics of Embedded system, Operating system concepts

MODULE I INTRODUCTION TO LINUX 9

History of Linux, different versions and distributions, Linux File System - directory structure - file permissions and ownership - basic file manipulation commands, Linux Shell - text commands, Bash scripts.

MODULE II LINUX OPERATING SYSTEM AND ADMINISTRATION 9

Linux System Administration - Managing users and groups - system services -system performance, Network configuration, firewall setup, Linux Tools and Utilities – grep, sed, awk, Shell scripts, package management – apt, yum.

MODULE III FUNDAMENTALS OF EMBEDDED LINUX 9

Characteristics of Embedded Systems, Linux kernel and its role in embedded systems, Embedded Linux Kernel – configuring and building Linux kernel for embedded platform.

MODULE IV EMBEDDED LINUX ARCHITECTURE 9

Kernel modules – device drivers development, power management, Embedded Linux File systems, Flash memory management, Boot loaders and boot process.

MODULE V EMBEDDED LINUX APPLICATIONS 9

Application development basics, cross- compilations and deployment, building user-space applications. Networking and communications – TCP/IP and UDP, Interfacing with peripherals – GPIO, I2C, SPI, UART. Security – threars and vulnerability in embedded linux.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS :

1. Richard Blum; Christine Bresnahan, "Linux Command Line and Shell Scripting Bible", 4th Edition, Wiley (2021)
2. Christopher Hallinan, "Embedded Linux Primer: A Practical Real-World Approach", 2nd Edition Prentics Hall, 2010.
3. Mark G. Sobell, "A Practical Guide to Linux Commands, Editors, and Shell Programming", 4th Edition, Addison-Wesley (2018)

REFERENCES :

1. Craig Hollabaugh, "Embedded Linux: Hardware, Software, and Interfacing: Hardware, Software, and Interfacing", Addison-Wesley Professional, (2006)
2. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, "Building Embedded Linux Systems", O'Reilly, 2008
3. Frank Vasquez; Chris Simmonds, "Mastering Embedded Linux Programming", 3rd Edition, Packt Publishing, (2021)
4. P. Raghavan, Amol Lad, SriramNeelakandan, "Embedded Linux System Design and Development", Auerbach Publications, Taylor and Francis Group, 2006
5. Doug Abbott, "Linux for Embedded and Real-time Applications", 4th Edition, Newnes, (2017)
6. John Madieu, "Linux Device Drivers Development", Packt Publishing (2017)

COURSE OUTCOMES

At the end of the course student will able to:

CO 1	:	Create, Configure and modify Files and its permissions in Linux OS
CO 2	:	Write simple Bash and Shell scripts for automation
CO 3	:	Interpret the kernel, boot loaders and development of the kernel device driver
CO 4	:	Classify memory mapping, RAM disks, and journaling file systems.

CO 5 : Build embedded Linux applications for consumer electronics, industrial automation, and IoT.

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO2	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H
CO3	M	M	L	M	L	L	L	-	-	-	-	L	L	-	M
CO4	H	H	M	M	L	L	L	L	-	-	-	L	L	-	H
CO5	H	H	M	M	L	L	L	-	-	-	-	L	L	-	H

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 9: Industry, Innovation, and Infrastructure:

Justification: This course delves into the architecture of embedded Linux, including the Linux kernel, boot sequence, and device handling. By equipping students with knowledge in these areas, the course contributes to advancing industry innovation and building robust infrastructure for embedded systems

SDG 11: Sustainable Cities and Communities:

Justification: Embedded Linux plays a crucial role in creating sustainable urban environments. Understanding memory management, storage, and device drivers enables efficient resource utilization, contributing to sustainable development within communities

ESDX 020	INTRODUCTION TO RTOS	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1 : Describe the key aspects of Operating Systems and Real-time Operating Systems.

COB2 : Understand the concepts of scheduling and task management in OS.

COB3 : Explain resource management, time-constrained communication, and synchronization for real-time kernels.

COB4 : Familiarize with the features and services of free RTOS

COB5 : Develop the necessary skills to create real-time embedded system applications using RTOS.

PREREQUISITE: Programming and embedded systems.

MODULE I REAL TIME OPERATING SYSTEMS 9

Overview of Operating Systems concepts - Defining RTOS- Characteristics of RTOS Comparison with general purpose operating system- scheduler- schedulable entities, multitasking, context switching, dispatcher, scheduling algorithms- schedulability Analysis

MODULE II KERNEL OBJECTS AND RTOS SERVICES 9

Kernel Objects - Task, Tasks states and scheduling, Task Operations, Task structure, Synchronization, Communication and Concurrency - semaphores- state diagram, Types - Defining Message Queue, States, Pipes, Event Registers, Signals RTOS Services.

MODULE III EXCEPTIONS, INTERRUPTS AND MEMORY MANAGEMENT 9

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Dynamic memory allocation.

MODULE IV SYSTEM ARCHITECTURE OF FREE RTOS 9

Introduction to Free RTOS, TaskManagement, Synchronization, Inter Task Communication Mechanisms

MODULE V CASE STUDIES OF RTOS 9

RT Linux, MicroC/OS-II,Vx Works, Embedded Linux, Tiny OS, and Basic Concepts of Android OS, RTOS for Image Processing – RTOS for fault Tolerant Applications – RTOS for Control Systems.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Wang, K.C.Embedded and Real-Time Operating Systems-Springer 2018.
2. Jim Cooling, Real-time Operating Systems: Book 1 - The Theory (The engineering of real-time embedded systems) ISBN-13: 978-1549608940, Lindentree Associates 2017.
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating system concepts”, 9th edition, John Wiley and Sons Inc., 2012.
4. Qing Li, Elsevier , “Real Time Concepts for Embedded Systems”, 2011.
5. Karim Yaghmour, “Embedded Android: Porting, Extending, and Customizing”, O’Reilly March 2013.

REFERENCES:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH
2. Jean J. Labrosse, “MicroC/OS – II The Real Time Kernel”, CMP Books, 2002.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Explain the task assignment and scheduling methods utilized in operating systems and real-time operating systems.

CO2 : Identify exceptions, timers, and memory management mechanisms within operating systems.

CO3 : Evaluate synchronization techniques employed in real-time systems.

CO4 : Outline the practical applications of real-time operating systems.

CO5 : Assess the suitability of different types of real-time operating systems for specific applications.

Board of Studies (BoS) :

26th BoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	M	L	L							L	M	L	M
CO2	M	L	M	L	L							L	M	L	M
CO3	M	L	M	M	L							L	M	L	M
CO4	M	L	M	M	L							L	M	L	M
CO5	M	L	M	M	L							L	M	L	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement:

This course aims to provide a comprehensive understanding of real-time operating systems (RTOS). Topics covered include OS fundamentals, RTOS characteristics, scheduling, multitasking, and synchronization. By the end, students will be well-versed in RTOS concepts and their applications.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: This course focuses on RTOS concepts essential for industry advancement. Topics include kernel objects, task management, synchronization, and case studies of RTOS like RT Linux and VxWorks. Students will develop skills to design real-time embedded systems, contributing to innovation in industries.

ESDX 021	NANOELECTRONICS	L	T	P	C
SDG: 3,9		3	0	0	3

COURSE OBJECTIVES:

COB 1: Explore nanoscience fundamentals and their application in nanoelectronics.

COB 2: Evaluate fabrication techniques for nanoelectronics devices.

COB 3: Analyze electronic properties of semiconductor nanostructures.

COB 4: Explore applications and challenges of carbon nanostructures in nanoelectronics.

COB 5: Develop proficiency in nanoelectronics characterization techniques.

PREREQUISITE:

- Basic understanding of physics, particularly electromagnetism and solid-state physics.
- Familiarity with semiconductor devices and microfabrication processes.
-

MODULE I FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY 9

Overview of Nanoscience and Engineering - Development Milestones in Microfabrication and Electronic Industry - Moore's Law and Continued MiniaturizationClassification of Nanostructures - Electronic Properties of Atoms and Solids.

MODULE II CHARACTERIZATION TECHNIQUES IN NANOELECTRONICS 9

Classification of Characterization Techniques - Microscopic Techniques - Scanning Probe Techniques - Diffraction Techniques - Optical, Electrical, and Structural Characterization.

MODULE III INORGANIC SEMICONDUCTOR NANOSTRUCTURES 9

Overview of Semiconductor Physics - Quantum Confinement in Semiconductor Nanostructures - Band Offsets and Electronic Density of States - Fabrication Techniques for Semiconductor Nanostructures - Applications of Inorganic Semiconductor Nanostructures .

MODULE IV CARBON NANOSTRUCTURES AND THEIR APPLICATIONS 9

Types of Carbon Nanostructures - Properties - Fabrication Techniques - Challenges in Integration – Applications.

MODULE V NANOSENSORS AND FUTURE TRENDS 9

Introduction - Principles - Types - Applications - Future Trends in Nano sensor Technology

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Vladimir V. Mitin, Viatcheslav A. Kochelap, and Michael A. Stroscio, Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications, Cambridge University Press, 2018.
2. T. Pradeep, Nano: The Essentials - Understanding Nanoscience and Nanotechnology, McGraw Hill Education; 1st edition, 2017.
3. Charles P. Poole Jr. and Frank J. Owens, Introduction to Nanotechnology, John Wiley, Copyright 2006, Reprint 2011.

REFERENCES:

1. Robert Kelsall, Ian Hamley, and Mark Geoghegan, Nanoscale Science and Technology, (John Wiley, 2007.
2. William A. Goddard III, Donald W. Brenner, Sergey E. Lyshevski, and Gerald J. Iafrate, Handbook of Nanoscience Engineering and Technology, CRC Press, 2003.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1 **:** Demonstrate a comprehensive understanding of nanoscience principles in nanoelectronics.

CO2 **:** Select appropriate fabrication techniques for nano electronic devices effectively.

CO3 **:** Exhibit proficiency in analyzing semiconductor nanostructures for device optimization

CO4 **:** Explore the applications and integration challenges associated with carbon nanostructures.

CO5 **:** Demonstrateskills in characterization techniques for nanoelectronics materials and devices.

Board of Studies (BoS) :

26thBoS of ECE held on13. 05.2024 :

Academic Council:

22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	M	L	M	L	L							L	M	L	M
CO2	M	L	M	L	L							L	M	L	M
CO3	M	L	M	M	L							L	M	L	M
CO4	M	L	M	M	L							L	M	L	M
CO5	M	L	M	M	L							L	M	L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 3: Good Health and Well-being

Advancements in nano sensor technology for biomedical sensing, early disease detection, personalized medicine, and improved healthcare outcomes .

SDG 9: Industry, Innovation, and Infrastructure

Developing advanced nano electronic technologies, enhancing industry, fostering innovation, and building resilient infrastructure.

		L	T	P	C
ESDX 022	**MULTICORE ARCHITECTURE AND PARALLEL PROGRAMMING**	**L**	**T**	**P**	**C**
SDG: 4,9, 12		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To illustrate the need for multicore architecture.

COB2: To interpret the essentials of distributed and shared memory architecture in multicore architecture.

COB3: To develop the fundamentals of parallel programming to program the parallel hardware in multicore architecture.

COB4: To categorize the hierarchy of parallel hardware and software

COB5: To discuss the design issues related to parallel programming in multicore architecture.

PREREQUISITE: Microprocessors and Microcontrollers, Computer Architecture

MODULE I PARALLEL COMPUTER ARCHITECTURE 9

Processor Architecture and Technology Trends, Power and Energy Consumption of Processors, Memory access times, Flynn's Taxonomy of Parallel Architectures, Memory Organization of Parallel Computers, Thread-Level Parallelism, Interconnection Networks, Routing and Switching, Caches and Memory Hierarchy.

MODULE II PARALLEL PROGRAMMING MODELS 8

Models for parallel systems, Parallelization of programs, Levels of parallelism, SIMD Computations, Data distributions for arrays, Information exchange, Parallel matrix-vector product, Processes and Threads

MODULE III PERFORMANCE ANALYSIS OF PARALLEL PROGRAMS 8

Performance Evaluation of Computer Systems, Performance Metrics for Parallel Programs, Energy Measurement and Energy Metrics, Asymptotic Times for Global Communication, Analysis of Parallel Execution Times, Parallel Computational Models, Loop Scheduling and Loop Tiling

MODULE IV MESSAGE-PASSING PROGRAMMING 9

Introduction to MPI, Collective Communication Operations, Process Groups and Communicators, Advanced topics

MODULE V THREAD PROGRAMMING 9

Programming with Pthreads, Parallel programming patterns with Pthreads, Advanced Pthread features, Java Threads, OpenMP

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Rauber, T., and G. Rünger. "Parallel programming: For multicore and cluster systems, Springer science & business media, 2023.
2. Pacheco, Peter. An introduction to parallel programming. Elsevier, 2021.
3. Shameem Akhtar and Jason Roberts, “Multi-core Programming”, 2nd Edition, Intel Press, 2006.

REFERENCES:

1. Balaji, Pavan, ed. Programming models for parallel computing. MIT Press, 2015.
2. Ansorge, Richard. Programming in parallel with CUDA: a practical guide. Cambridge University Press, 2022.
3. Kirk, David B., and W. Hwu Wen-Mei. Programming massively parallel processors: a hands-on approach. Morgan kaufmann, 2022.

COURSE OUTCOMES:

CO1: Analyze the limitations of ILP and the need for multicore architectures

CO2: Develop parallel programming fundamentals and its design issues

CO3: Solve the issues related to multiprocessing and suggest solutions

CO4: Illustrate salient features of different multicore architectures and how they exploit parallelism

CO5: Develop the role of OpenMP and programming concept

Board of Studies (BoS):	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	M	L	H		H				M			M	M	M	H
CO2	M	L			H				M			M	M	M	H
CO3	M	L			H				M			M	M	M	H
CO4	M	L			H				M			M	M	M	H
CO5	M	L	H	M	H				M			M	M	M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand the basic features of multicore architecture.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the parallel programming concepts in multicore architecture.

SDG 12: Responsible Consumption and Production

Statement: Understand the market needs based on current technology trends in Integrated circuits market.

ESDX 023	AUTONOMOUS VEHICLE	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1: Comprehend the fundamentals of Connected, Automated, and Intelligent Cars.
COB2: Assess the role of sensor technology in detecting driver impairment and facilitating transfer of control in autonomous vehicles.
COB3: Apply concepts of simultaneous localization and mapping (SLAM) and multi-sensor data fusion in autonomous vehicle navigation.
COB4: Examine case studies of driver assistance system applications in various automotive contexts, including non-passenger vehicles.
COB5: Evaluate public acceptance and regulatory frameworks for highly automated and autonomous driving.

PREREQUISITE: Basics of linear algebra, probability, statistics, and Python programming.

MODULE I CONNECTED AND AUTOMATED CARS 9

Automotive Electronics Overview -, Basic Control System Theory Operation of ECUs, Basic Cyber-Physical System Theory - Advanced Driver Assistance Electronic Connected Car Technology- Connectivity Fundamentals, Navigation and Other Applications.

MODULE II SENSOR TECHNOLOGY 9

Sensor Technology for Advanced Driver Assistance Systems – Basicsof Radar Technology and Systems, Ultrasonic Sonar Systems, LidarSensor Technology and Systems, Camera Technology, Night VisionTechnology,

MODULE III SELF-DRIVING VEHICLE TECHNOLOGY 9

Fundamentals of state-of-the-art SLAM, multi-sensor data fusion, and other SDV algorithms. Robot Operating System (ROS) and Open Source Car Control (OSCC). Basicsof Computer Networking – the Internet of Things, Wireless NetworkingFundamentals, Integration of Wireless Networking and On-BoardVehicle Networks.

MODULE IV DRIVER ASSISTANCE SYSTEM TECHNOLOGY 9

Basics of Theory of Operation, Applications – Legacy, Applications – Integration of ADAS Technology into Vehicle Electronics, System Examples, Role of Sensor Data Fusion.

MODULE V ETHICS, POLICIES AND REGULATIONS 9

Ethics for Autonomous Driving, Opportunities and Risks Associated with Autonomous Driving. Regulatory bodies for highly automated and autonomous driving, Policies and policy making, standardization bodies and standards.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. George Dimitrakopoulos, AggelosTsakanikas, Elias Panagiotopoulos, “Autonomous Vehicles Technologies, Regulations, and Societal Impacts”, Elsevier Publications, 2021.
2. Dietmar P.F. Möller, Roland E. Haas, “Guide to Automotive Connectivity and Cybersecurity: Trends, Technologies”, Springer International, 2019,.
3. Hanky Sjafrie, “Introduction to Self-Driving Vehicle Technology”, 1st Edition, Chapman and Hall / CRC Press, 2019.

REFERENCES:

1. Tom Denton, “Automobile Electrical and Electronic Systems”, 5th Edition Routledge, 2018.
2. Dietmar P.F. Möller, Roland E. Haas – “Guide to Automotive Connectivity and Cybersecurity”, Springer International Publishing AG, 2017

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Recall and describe the components and functionalities of automotive electronics and advanced driver assistance systems.

CO2: Apply concepts of sensor technology to analyze and propose solutions for detecting driver impairment and facilitating autonomous vehicle control.

CO3: Analyze state-of-the-art algorithms for autonomous vehicle navigation and control, including SLAM and multi-sensor data fusion.

CO4: Evaluate recent developments in driver assistance systems, including their integration into vehicle electronics and their impact on automotive safety and efficiency.

CO5: Apply their understanding of regulatory frameworks and societal implications to assess the future adoption and acceptance of autonomous driving technology.

Board of Studies (BoS):	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22nd ACM held on 4.09.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	L	M	L	H	M	L	M	H	M	M
CO2	H	H	H	H	M	L	M	L	H	M	L	M	H	M	M
CO3	H	H	H	H	M	L	M	L	H	M	L	M	H	M	M
CO4	H	H	H	H	M	L	M	L	H	M	L	M	H	M	M
CO5	H	H	H	H	M	H	H	H	H	M	L	M	H	L	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The syllabus covers methods and techniques for building resilient infrastructure, such as sequential pattern classification and dimension reduction methods. These techniques enable the development of robust systems capable of adapting to changing conditions, aligning with the goal of building resilient infrastructure.

SDG 9: Industry, Innovation, and Infrastructure

Statement: Innovation in pattern recognition algorithms and technologies contributes to sustainable industrialization by enabling the development of more efficient manufacturing processes, as well as the optimization of energy and resource usage in industrial operations.

ESDX 041	**MACHINE LEARNING**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1	**:**	Describe machine learning basics and categorize different types.
COB2	**:**	Create and assess linear regression models effectively.
COB3	**:**	Apply decision tree and instance-based learning methods, including feature selection
COB4	**:**	Employ Bayes learning and Support Vector Machines to address practical issues.
COB5	**:**	To learn different aspects of unsupervised learning and reinforcement learning.

PREREQUISITE: Basics of Linear algebra, Probability and statistics, Calculus and Programming skills.

MODULE I INTRODUCTION AND MATHEMATICAL FOUNDATIONS 8

Introduction to Machine Learning. Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory.

MODULE II SUPERVISED LEARNING 12

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods – Random Forest - Evaluation of Classification Algorithms.

MODULE III UNSUPERVISED LEARNING 8

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Association Rule Learning - Anomaly Detection - Recent Advances and Applications.

MODULE IV SEMI-SUPERVISED AND REINFORCEMENT LEARNING 9

Introduction to Semi-Supervised Learning, Semi-Supervised Learning Algorithms - Self-training - Co-training - Generative models, Graph-Based Semi-Supervised Learning, Semi-Supervised Support Vector Machines (S3VM), Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning.

MODULE V LARGE SCALE MACHINE LEARNING 8

Learning With Large Datasets, Stochastic Gradient Descent, Mini-Batch Gradient Descent, Stochastic Gradient Descent Convergence, Online Learning, Map Reduce and Data Parallelism, applications.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 2017.

REFERENCES:

1. ShaiShalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2016

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Apply knowledge of different types of machine learning algorithms and their applications.

CO2 : Apply linear regression techniques to analyze and predict relationships between variables effectively.

CO3 : Design a Decision tree and Random forest for an application.

CO4 : Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.

CO5 : Use a tool to implement typical Clustering algorithms for different types of applications.

Board of Studies (BoS) :	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22ND ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education - By providing students with a comprehensive understanding of machine learning techniques and practical application, the course contributes to ensuring inclusive and equitable quality education for all.

SDG 9: Industry, Innovation, and Infrastructure - Equipping students with skills in artificial intelligence and data analytics addresses the need for innovation and technological advancement in various industries, contributing to sustainable economic growth and infrastructure development.

		L	T	P	C
ESDX 042	**THEORY OF COMPUTATION**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

COB 1 : To Interpret foundations of computation including automata theory

COB 2 : To model regular expressions and languages.

COB 3 : To design context free grammar and push down automata

COB 4 : To infer about the turing machines and their capability

COB 5 : To familiarize undecidability and NP class problems

PREREQUISITE: Basic Programming Language

MODULE I INTRODUCTION TO AUTOMATA AND COMPUTABILITY 9

Computability Theory - Mathematical Notions and Terminology - Definitions, Theorems, and Proofs - Regular languages and regular expressions - Finite automata and regular grammars - Pumping lemma for regular languages.

MODULE II SYNTAX AND SEMANTIC ANALYSIS 9

Regular expression - Regular Languages - Deterministic Finite Automaton (DFA) - Non-deterministic Finite Automaton (NFA), - Pumping lemma - Closure properties of regular languages.

MODULE III CONTEXT FREE LANGUAGES 9

Grammar types - Chomsky‘s hierarchy of languages - Context-Free Grammar (CFG) and Languages - Push Down Automata (PDA) - Context-free parsing - Pumping lemma for CFG - Closure properties of CFG. - Deterministic Pushdown Automata.

MODULE IV COMPUTABILITY THEORY 9

Turing Machines (TM),Variants of Turing Machines, Nondeterministic Turing machines - Algorithms, Hilbert’s problems , Types of TMs – Turing machine computability and decidability.

MODULE V DECIDABILITY AND REDUCIBILITY 9

Decidable problems for Regular Languages and CFG –Reduction Techniques – Rice Theorem - Computable functions - The Recursion Theorem, Time and space complexity - Polynomial-time algorithms and NP-completeness - Cook's theorem and NP-hardness..

L-45;Total Hours-45

TEXT BOOKS :

1. Michael Sipser, “ Introduction to the Theory of Computation”, 3rd Edition, Course Technology Inc.,2021.
2. A.A. Puntambekar, Theory of Computation, 1st Edition, Technical Publications, 2022.

REFERENCES :

1. Peter Linz (Author), Susan H. Rodger, An Introduction to Formal Languages and Automata, Jones and Bartlett Publishers, Inc; 7th edition ,2022.
2. John E.Hopcroft (Author), Rajeev Motwani, Jeffrey D.Ullman, Introduction To Automata Theory, Languages, And Computation, 3rd Edition, Rainbow Book Distributors, 2015.
3. Harry R Lewis and Christos H Papadimitriou, Elements of the Theory of Computation, 2nd Edition, Pearson Education India,2015.

COURSE OUTCOMES

At the end of the course the students will be able to

CO 1 : Use basic concepts of formal languages of finite automata techniques.

CO 2 : Developand generate regular and context-free languages.

CO 3 : Analyze the computational power and limitations of various models of computation, including Turing machines

CO 4 : Design Finite Automata for different Regular Expressions and Languages.

CO 5 : Implement computational theory, including decidability, reductions, and their applications in language and logical theories.

PO CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	M	L	H		H				M			M	M	M	H
CO2	M	L			H				M			M	M	M	H
CO3	M	L			H				M			M	M	M	H
CO4	M	L			H				M			M	M	M	H
CO5	M	L	H	M	H				M			M	M	M	H

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4 (Quality Education):
Understanding automata theory and formal languages contributes to quality education by enhancing students' computational thinking and problem-solving skills. Learning about regular expressions and their equivalence with finite automata fosters critical thinking and logical reasoning. Understanding context-free grammars and pushdown automata enhances students' ability to design compilers, parsers, and language processors. Studying unsolvable problems and computable functions deepens students' understanding of the limits of computation.

SDG 9 (Industry, Innovation, and Infrastructure):
Knowledge of automata theory is fundamental for designing efficient algorithms and building reliable software systems. Regular expressions play a crucial role in text processing, search engines, and data validation, contributing to technological innovation. Context-free grammars are essential for programming language design and software development. Turing machines serve as a theoretical foundation for understanding computation, which impacts technological advancements.

ESDX 043	**DATA SCIENCE**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1	**:**	Understand the fundamental concepts and importance of data science, including its applications across various industries.
COB 2	**:**	Gain proficiency in data preprocessing techniques, including data cleaning, transformation, and normalization using Python.
COB 3	**:**	Develop skills in exploratory data analysis (EDA) and data visualization to summarize and interpret datasets effectively.
COB 4	**:**	Acquire a foundational knowledge of statistical concepts such as probability distributions, hypothesis testing, and statistical inference.
COB 5	**:**	Explore machine learning basics, including supervised, unsupervised, and semi-supervised learning techniques, along with common algorithms and evaluation methods.

PREREQUISITE :

- Basic understanding of mathematics
- Familiarity with AI concepts

MODULE I INTRODUCTION TO DATA SCIENCE 9

Definition of data science- Importance and applications of data science-Overview of the data science workflow- Types of data- Pre-processing – Data sources and types (structured, semi-structured, unstructured)-Data collection methods-Data cleaning and preprocessing techniques (handling missing data, data transformation, normalization), Python codes for data loading, Preprocessing .

MODULE II EXPLORATORY DATA ANALYSIS AND DATA VISUALIZATION 9

Summary statistics (mean, median, mode, variance, standard deviation)-Data visualization techniques (histograms, box plots, scatter plots, etc.)-Identifying patterns and relationships in data. Principles of effective data visualization Tools for data visualization (matplotlib, seaborn, ggplot2, etc.) Creating various types of plots (line plots, bar plots, pie charts, etc.) Example python codes for data analysis and visualization.

MODULE III HYPOTHESIS TESTING AND STATISTICAL INFERENCE 9

Probability distributions (normal, binomial, Poisson, etc.)-Hypothesis testing-Statistical inference-Correlation vs. causation.

MODULE IV MACHINE LEARNING 9

Introduction to supervised, unsupervised, and semi-supervised learning- Common machine learning algorithms (linear regression, logistic regression, decision trees, k-nearest neighbors, clustering algorithms)-Model evaluation techniques (cross-validation, over fitting, under fitting, bias-variance tradeoff)

MODULE V ADVANCED TOPICS IN DATA SCIENCE: BIG DATA MANAGEMENT, ETHICS, AND REAL-WORLD APPLICATIONS 9

Challenges and opportunities of big data- Introduction to distributed computing frameworks (Hadoop, Spark)-Basics of working with big data tools and technologies. Data privacy and security-Ethical implications of data science-Regulatory compliance. Examples of data science applications across different domains (finance, healthcare, marketing, etc.)

L- 45, Total Hours -45

TEXT BOOKS:

1. Saltz, J. S., Stanton, J. M. (2024). An Introduction to Data Science With Python. United States: SAGE Publications.
2. Shah, C. (2020). A Hands-On Introduction to Data Science. United Kingdom: Cambridge University Press.
3. Patrishkoff, D., Hoyt, R. E. (2023). No-Code Data Science: Mastering Advanced Data Analytics, Machine Learning, and Artificial Intelligence. United States: Lulu Press, Incorporated.

REFERENCES:

1. Goodfellow, I., Bengio, Y., Courville, A. (2023). DeepLearning. Germany: Al anna Maldonado.
2. Geetha, T. V., Sendhilkumar, S. (2023). Machine Learning: Concepts, Techniques and Applications. United States: CRC Press.
3. Rogel-Salazar, J. (2020). Advanced Data Science and Analytics with Python. United Kingdom: CRC Press.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Demonstrate proficiency in handling various types of data, including structured, semi-structured, and unstructured data, through effective preprocessing techniques using Python.

CO2 : Analyze datasets using summary statistics and exploratory data analysis techniques and effectively communicate insights through data visualization using tools

CO3 : Apply statistical concepts such as probability distributions, hypothesis testing, and correlation vs. causation to draw meaningful conclusions from data and make data-driven decisions.

CO4 : Implement common machine learning algorithms for prediction and classification tasks.

CO5 : Develop an understanding of advanced topics in data science, including big data management, ethics, privacy, and real-world applications,

Board of Studies (BoS):
26thBoS of ECE held on 13.05.2024

Academic Council:
22ND ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H	H			H			H					
CO2	H		H	H			H			H					
CO3					M	M		M	M		M	M			
CO4					M	M		M	M		M	M			
CO5					M	M		M	M		M	M			

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: This course enables the student to realize the need of data science ,business and machine learning and helps for lifelong learning of newer technologies and concepts related to AI systems.

SDG 9: Industry, Innovation and Infrastructure

Statement: Data science plays a major role in industry, innovation and modern infrastructure.

ESDX 044	WEB TECHNOLOGY	L	T	P	C
SDG: 4,9		2	0	2	3

COURSE OBJECTIVES:

COB 1 : To introduce the fundamental concepts of web technologies

COB 2 : To develop skills in designing and implementing web applications.

COB 3 : To explore current trends and technologies in web development.

COB 4 : To analyze and apply industry-relevant practices in web technology.

COB 5 : To develop problem-solving abilities in the context of web development.

PREREQUISITE:

- Understanding of database concepts and SQL.
- Familiarity with statistics and probability theory.
- Basic programming skills in a high-level language such as Python or Java.

MODULE I INTRODUCTION TO WEB TECHNOLOG 9

Overview of web technologies, HTML, CSS, and JavaScript, Web development tools and frameworks.

MODULE II FRONT-END DEVELOPMENT 9

Responsive design, CSS frameworks (Bootstrap, Tailwind),JavaScript frameworks (React, Angular).

MODULE III BACK-END DEVELOPMENT 9

Server-side programming languages Node.js, Python, Database management systems: MySQL, MongoDB, Web application frameworks: Express.js, Django.

MODULE IV WEB APPLICATION AND SECURITY 9

Designing web applications, Web application architecture, Deployment and hosting.Web security, Web performance optimization, Web accessibility.

Practicals:

1. Designing static web pages using HTML
2. Designing dynamic web pages using different cascading style sheets

3. Designing XML Schemas
4. Programs using Java Script
5. Programs using Java servlets and JSP
6. Designing web applications using PHP
7. Designing web applications in Net Beans Environment
8. Database Connectivity with MySQL using Java Servlets, JSP, and PHP

L- 30; P-15; Total Hours – 45

TEXT BOOKS:

1. Web Development and Design Foundations: With HTML5 and CSS3" by Terry Felke-Morris and Diane S. Martinez, Pearson Education, 2022.
2. Responsive Web Design with HTML5 and CSS3" by Ben Frain, Packt Publishing, 2022.
3. Node.js: The Right Way: Practical, Server-Side JavaScript That Scales" by Jim R. Wilson and Ivo Balbaert, O'Reilly Media, 2022.
4. Designing Web Applications: A Guide to the Web Application Lifecycle" by Michael Amundsen, Addison-Wesley Professional, 2022.
5. Web Security: A Beginner's Guide" by Mark Stanislav, No Starch Press, 2022.

REFERENCES:

1. Head First HTML and CSS: A Learner's Guide to Creating Standards-Based Web Pages" by Elisabeth Robson and Eric Freeman, O'Reilly Media, 2022.
2. JavaScript: The Good Parts" by Douglas Crockford, O'Reilly Media, 2022.
3. Python Crash Course: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes, No Starch Press, 2022.
4. "MySQL: The Complete Reference" by Ron Hungate, McGraw-Hill Education, 2022.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1		Analyze the requirements of a web application and select appropriate tools and technologies for development.
CO2	**:**	Design and develop a web application using front-end and back-end technologies.
CO3	**:**	Evaluate the performance and security of a web application.
CO4	**:**	Collaborate with team members to develop a web application.

CO5 : Create a web application that meets the requirements and specifications of a given problem statement.

CO6 : Synthesize knowledge of web technologies to develop innovative solutions to real-world problems.

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22ND ACM held on 4.09.2024

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	M	L							L	H			
CO2	H	M	H	H	M	L						H			
CO3	L	M	H	H	M	L						L			
CO4	H		M	H	H	M						H			
CO5	L				M	H						L			

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education - The course promotes knowledge and skills in data mining and data warehousing, which are essential for decision-making in various industries.

SDG 9: Industry, Innovation, and Infrastructure - The course supports the development of advanced data management systems, which are crucial for modern industries and businesses.

		L	T	P	C
ESDX 045	**INTRODUCTION TO INDUSTRY 4.0**	**L**	**T**	**P**	**C**
SDG 4, 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

COB 1 : Explain key concepts and technologies in Industry 4.0.

COB 2 : Identify and assess cybersecurity challenges in Industry 4.0.

COB 3 : Implement IoT business models and architectures in industrial settings.

COB 4 : Assess big data and machine learning applications in industrial IoT.

COB 5 : Develop solutions for industrial applications using IoT technologies.

PREREQUISITE :

- Basic knowledge of computer and internet

MODULE I INTRODUCTION TO INDUSTRY 4.0 9

Introduction: Sensing & actuation, Communication, Networking, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

MODULE II CYBERSECURITY IN INDUSTRY 4.0 9

Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis,Cybersecurity in Industry 4.0, Basics of Industrial IoT, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.

MODULE III INTRODUCTION TO INTERNET OF THINGS 9

IIoT-Introduction, Industrial IoT: Business Model and ReferenceArchitecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers,IIoT Sensing-Part, IIoT Processing, IIoT Communication.

MODULE IV INDUSTRIAL IOT IN BIG DATA ANALYTICS 9

Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - R and Julia Programming, Data Management with Hadoop, Big Data Analytics and Software Defined Networks: SDN in IIoT ,Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT, Industrial IoT- Application Domains:

MODULE V CASE STUDIES IN INDUSTRIAL IOT 9

Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry. Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security Including AR and VR safety applications, Facility Management, Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries.

L- 45, Total Hours -45

TEXT BOOKS :

1. SudipMisra, Anandarup Mukherjee, "Introduction to IoT Solutions", Cambridge University Press; First Edition, Cambridge University Press, Splendour Forum, Jasola District Centre, New Delhi 110025,31 January 2022
2. SudipMisra, Anandarup Mukherjee," Introduction to Industrial Internet of Things and Industry 4.0".CRC Press; First Edition, Taylor & Francis Books India Pvt. Ltd.,New Delhi 110001, India,1 December 2020.

REFERENCES :

1. Alasdair Gilchrist ," Industry 4.0: the industrial Internet of Things", Apress ,first edition,1 January 2019
2. Kaliraj, P. Devi, T.,"Big Data Applications in Industry 4.0",P. Kaliraj,1st ed.. Auerbach Publications,2022.
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2015.

COURSE OUTCOMES

On completion of the course students will be able to

CO 1 : Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.

CO 2 : Classify various sensing devices and actuator types.

CO 3 : Demonstrate the processing in IoT.

CO 4 : Explain Associated IOT Technologies.

CO 5 : Illustrate architecture of IOT Applications

Board of Studies (BoS):	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22ND ACM held on 4.09.2024

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO 1	M	L			H				M			M	M	M	H
CO 2	M	L			H				M			M	M	M	H
CO 3	M	L			H				M			M	M	M	H
CO 4	M	L			H				M			M	M	M	H
CO 5	M	L			H				M			M	M	M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 (Quality Education):
Provides advanced educaton in Industry 4.0 technologies, preparing students with essential skills for modern industrial challenges.

SDG 9 (Industry, Innovation, and Infrastructure):
Promotes sustainable industrialization and innovation by teaching students about smart factories, IoT, and advanced analytics, driving technological advancements in industry.

ESDX 046 SDG: 4,9	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1 : To explore the concepts of symmetric cryptographic techniques.

COB2 : To know the fundamental asymmetric key concepts related to security.

COB3 : To impart concept of Hash and Message Authentication

COB4 : To identify authentication requirements for various applications.

COB5 : To reveal the basics of transport layer and web security

PREREQUISITE: Basics of Mathematics and Computer Networking

MODULE I **SYMMETRIC ENCRYPTION ALGORITHMS** **9**

Symmetric key cryptographic techniques: Introduction to Stream cipher. Block cipher: DES. AES.IDEA. Block Cipher Operation. Random Bit Generation and RC4.

MODULE II **ASYMMETRIC ENCRYPTION ALGORITHM AND KEY EXCHANGE** **10**

Asymmetric key cryptographic techniques: principles. RSA. EIGamal. Elliptic Curve cryptography. Homomorphic Encryption and Secret Sharing, Key distribution and Key exchange protocols, Diffie-Hellman Key Exchange, Marwi-the-Meddle Attack.

MODULE III **MESSAGE DIGEST AND HASH FUNCTIONS** **10**

Requirements for Hash Functions. Security of Hash Functions. Message Digest (MDS). Secure Hash Function (SHA).Birthday Attack. HMAC.

MODULE IV **DIGITAL SIGNATURE AND AUTHENTICATION PROTOCOLS** **7**

Authentication Requirements. Authentication Functions, Message Authentication Codes.Digital Signature Authentication. Authentication Protocols. Digital Signature Standards, RSA Digital Signature. Elgamal based Digital Signature. Authentication Applications: Kerberos.X.509 Authentication Service. Public Key Infrastructure (PK I).

MODULE V **TRANSPORT LAYER SECURITY AND IP SECURITY** **11**

Transport-Layer Security. Secure Socket Layer (SSL),TLS, IP Security: Overview: |P Security Architecture, Encapsulating Payload Security, Web and System Security:Electronic Mail Security. Pretty Good Privacy (PGP), S/MIME, Web Security: Web SecurityConsiderations, Secure Sectronic

Transaction Protocol.Intruders. Intrusion Detection, Password Management, Firewalls: Firewall Design Principles, Trusted Systems.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Cryptography and Network Security-Principles and Practice, by StallingsWilliam, published by pearson, 8thEdition, 2020.

REFERENCES:

1. Cryptography and Network Security, by Behrouz A Forouzan, DepdeepMukhopadhyayMcGrawHill, 3rd Edition, 2015.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 **:** Learn about the fundamental concepts related to security.

CO2 **:** Interpret the concept of various cryptographic techniques.

CO3 **:** Apprehend the authentication and integrity process of data for various applications

CO4 **:** Apply fundamentals of Transport layer security

CO5 **:** Build knowledge on web security. E-Mail- Security and IP

Board of Studies (BoS):
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Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Provide Quality education.
By understanding the fundamental concepts and promote research in the area of Cryptography and Network Security

SDG 9 : Industry, Innovation, and Infrastructure.

The course on Cryptography And Network Securitycontributes to SDG 9 by fostering collaboration for infrastructure development and technological innovation in the Network Security.

		L	T	P	C
ESDX 047	**ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1 **:** To discuss the concepts of AI terminologies

COB 2 **:** To choose the problem-solving methods and heuristic search algorithms

COB 3 **:** To identify suitable knowledge representation for solving problems

COB 4 **:** To Perform probabilistic reasoning

COB 5 **:** To explain AI Concepts for societal problems

PREREQUISITE: Basics of Mathematics, Programming and DataScience

MODULE I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Introduction- Foundation of AI-History of AI -State of Art -Different Types of Artificial Intelligence-Applications of AI-Subfields of AI- Agents and Environments – concept of rationality – nature of environments –structure of agents.

MODULE II PROBLEM SOLVING METHODS 9

Introduction to Problem Solving by searching Methods-Brute force- Depth First-Breadth first search techniques- Hill Climbing-Best first search- AND/OR graphs-A* algorithm-Constraint satisfaction- Game playing- mini-max algorithm, Alpha-Beta Pruning.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 9

First order predicate logic, Propositional logic- Tautology-Contradiction-Normal forms -Predicate logic -Rules of inference- Resolution Unification algorithm- Production rules – Semantic Networks-Frames – Scripts.

MODULE IV PROBABILISTIC REASONING AND PLANNING 9

Quantifying Uncertainty-– Bayesian inference – naïve Bayes models. Probabilistic reasoning -Bayesian networks - Classical planning, Planning as State-space search, Forward search, backward search, Planning graphs, Hierarchical Planning.

MODULE V ADVANCEMENTS IN AI 9

Natural Language Processing (NLP)- Machine Translation – Speech Recognition –Face recognition -AI for Cybersecurity- AI for Robotics- AI for Healthcare.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, FourthEdition,
Pearson Education, 2021.
2. K. R. Chowdhary, Fundamentals of Artificial Intelligence, First edition,Springer, 2020

REFERENCES:

1. Waymond Rodgers, " Artificial Intelligence in a Throughput Model ", 2ndEdition,CRC Press, 2020.
2. Ertel, Wolfgang Introduction to Artificial Intelligence, 2ndEdition, Springer, 2018.
3. Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3 rd Edition, McGraw Hill, Education, 2017

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Define the fundamentals of artificial intelligence and Explain intelligent agent frameworks

CO2 : Analyze the search algorithms for problem solving

CO3 : Demonstrate knowledge of reasoning, uncertainty, and knowledge representation for
solving real-world problems

CO4 : Perform probabilistic reasoning under uncertainty

CO5 : Apply Advancements in AI Concepts to societal problems

Board of Studies (BoS):
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Academic Council:
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PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG No: 4 -Quality Education This course will deliver the basic concepts of Artificial Intelligence.

SDG No: 9 - Industry, Innovation and Infrastructure Artificial intelligence plays major roles in industry and modern infrastructures. Innovative ideas can be implemented by programming.

		L	T	P	C
ESDX 048	**EDGE COMPUTING**	**L**	**T**	**P**	**C**
SDG 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1 : Develop a comprehensive understanding of the basic concepts, characteristics, and attributes of edge computing.

COB 2 : Gain knowledge of various edge computing architectures, including edge devices, edge server clusters, and cloud servers.

COB 3 : Learn about the architecture and implementation of edge data analytics.

COB 4 : Evaluate real-world use cases and assess the impact of edge computing on different industries.

COB 5 : Implement practical edge for demonstrating a holistic understanding of the technology and its applications.

PREREQUISITE :

1. Basic understanding data science
2. Familiarity with AI concepts

MODULE I INTRODUCTION TO EDGE COMPUTING 9

Edge computing concepts- basic characteristics and attributes-benefits of edge computing- “CROSS” value of edge computing-Fog and edge computing- use cases of edge computing-drawbacks of edge computing-blue print of edge computing.

MODULE II EDGE COMPUTING ARCHITECTURE 9

Edge devices- edge server cluster- cloud server- Background essentials: IOT devices- Network architecture- network management and control- Edge computing interfaces- Edge computing simulators.

MODULE III EDGE ANALYTICS 9

Introduction to big data analytics- phase of data analytics- types of data analytics- Edge data analytics- architecture of edge analytics.

MODULE IV EDGE DATA STORAGE SECURITY 9

Data security- data confidentiality- Authentication- privacy preserving schemes- Edge based attack detection and prevention.

MODULE V APPLICATIONS OF EDGE COMPUTING 9

Edge computing in autonomous vehicle- smart cities- industrial automation- network functions- augumented reality- health care sensors- Financial sectors.

L- 45: TOTAL HOURS – 45

TEXT BOOKS:

1. Singh, Ajit. Edge Computing: Simply In Depth. Australia, Amazon Digital Services LLC - Kdp, 2019.
2. Kumari, K. Anitha, et al. Edge Computing: Fundamentals, Advances and Applications. United States, CRC Press, 2021.

REFERENCES:

1. Cao, Jie, et al. Edge Computing: A Primer. Germany, Springer International Publishing, 2018.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1	:	Explain the fundamental concepts, characteristics, and benefits of edge computing, as well as identify its drawbacks and potential limitations.
CO2	:	Demonstrate the ability to describe and differentiate between various components of edge computing architectures, including edge devices, server clusters, and cloud servers, and understand their roles in IoT networks.
CO3	:	Gain proficiency in applying big data analytics techniques within edge computing environments, understanding different phases and types of data analytics, and designing edge analytics architectures.
CO4	:	Implement and evaluate data security measures, ensuring data confidentiality, authentication, and privacy in edge computing systems, and develop strategies to detect and prevent edge-based attacks.
CO5	:	Analyze and apply edge computing technologies in various practical use cases, such as autonomous vehicles, smart cities, industrial automation, augmented reality, healthcare, and financial sectors.

Board of Studies (BoS):

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Academic Council:

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PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H		H	H			H			H					
CO2	H		H	H			H			H					
CO3					M	M		M	M		M	M			
CO4					M	M		M	M		M	M			
CO5					M	M		M	M		M	M			

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: This course enables the student to realize the need of deep learning in AI and it helps for lifelong learning of newer technologies and concepts related to AI systems.

SDG 9: Industry, Innovation and Infrastructure

Statement: Deep learning plays a major role in industry, innovation and modern infrastructure.

ESDX 049	COMPUTER VISION	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB 1 : Identify fundamental image formation concepts and geometric transformations for computer vision applications.

COB 2 : Develop skills in image processing techniques such as filtering, segmentation, and color processing.

COB 3 : Learn various image descriptors and features including texture descriptors, edge detection, and interest point detectors.

COB 4 : Gain knowledge of statistical machine learning algorithms applicable to computer vision tasks.

COB 5 : Explore applications of computer vision in medical imaging, motion estimation, facial recognition, and gesture recognition.

PREREQUISITE :

- Knowledge of Matrix algebra and random process
- Digital image processing

MODULE I INTRODUCTION TO COMPUTER VISION 9

Basic Concepts of Image Formation: Image Formation and Radiometry, Geometric Transformation, Geometric Camera Models, Image Reconstruction from a Series of Projections, Stereo vision.

MODULE II IMAGE PROCESSING CONCEPTS 9

Fundamentals of Image Processing, Image Transforms. Image Filtering, Color Image Processing. Mathematical Morphology, Image Segmentation.

MODULE III IMAGE DESCRIPTORS AND FEATURES 9

Texture Descriptors, Color Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform,Speeded up Robust Features, Saliency.

MODULE IV MACHINE LEARNING ALGORITHMS FOR COMPUTER VISION 9

Statistical Machine Learning Algorithms for different Computer Vision applications, supervised and unsupervised learning. Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction. Artificial and Deep Networks for Computer Vision applications

MODULE V APPLICATIONS OF COMPUTER VISION 9

Medical Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Image Fusion, Gesture Recognition

L- 45; Total Hours –45

TEXT BOOKS:

1. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Fourth Edition, Academic Press, 2020.
2. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
3. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
4. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Verlag London Limited, 2011.

REFERENCES:

1. Jayaraman, S.Essakirajan and T.Veerakumar "Digital Image Processing", Tata McGraw Hill Education, 2nd edition, 2020.
2. A. K. Jain, Fundamentals of Digital Image processing, Pearson Education, 2015.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1	:	Demonstrate proficiency in analyzing images using geometric transformations and radiometry principles.
CO2	:	Apply image processing methods effectively for image enhancement and feature extraction.
CO3	:	Utilize diverse image descriptors and features for accurate object representation and feature extraction.
CO4	:	Implement machine learning algorithms for classification, clustering, and dimensionality reduction in computer vision tasks.
CO5	:	Design and develop computer vision systems for real-world applications such as medical imaging and human-computer interaction.

Board of Studies (BoS):	**Academic Council:**
26th BoS of ECE held on 13.05.2024	22nd ACM held on 4.09.2024

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H			M							H		H	
CO2	M				M							H		H	
CO3		H	H	M	M							H		M	
CO4	M	M			M							H		M	
CO5				M	M							H		H	

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Statement: This course enables the student to learn image processing concepts applied for computer vision

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation Statement: Apply the practical knowledge of computer vision concepts for developing computer vision related applications.

ESDX 050	DEEP LEARNING	L	T	P	C
SDG 4,9		3	0	0	3

COURSE OBJECTIVES:

COB 1 : Explore the functional units of ANN for pattern recognition tasks, focusing on feedforward neural networks and pattern classification using perceptrons.

COB 2 : Identify various regularization techniques for improving the generalization ability of deep learning models, including data augmentation, noise robustness, semi-supervised learning, and multi-task learning.

COB 3 : Learn about training algorithms of associative memory in deep learning

COB 4 : Gain proficiency in convolutional neural networks (CNNs), including their architecture, convolutional and pooling layers, and deep CNN architectures like LeNet, AlexNet, VGG, and PlacesNet.

COB 5 : Understand sequence modeling using recurrent neural networks concepts

PREREQUISITE :

- Basic understanding of mathematics
- Familiarity with AI concepts

MODULE I BASICS OF ARTIFICIAL NEURAL NETWORKS 9

Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks. Feed forward neural networks: Pattern classification using perceptron. Gradient descent algorithm- Back propagation of neural networks.

MODULE II REGULARIZATION FOR DEEP LEARNING MODELS 9

Introduction to Regularization Techniques- Types- Data Augmentation and Noise Robustness- Semi-Supervised Learning- Multi-Task Learning- Early Stopping and Parameter Tying- Parameter Sharing and Sparse Representations- Ensemble Methods.

MODULE III UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Autoassociative Memory Network Heteroassociative Memory Network- Bidirectional Associative Memory (BAM)- Iterative Autoassociative Memory Networks- Temporal Associative Memory Network- Kohonen Self-Organizing Feature Maps- Adaptive Resonance Theory Network- Auto encoders.

MODULE IV CONVOLUTION NEURAL NETWORKS (CNNs) 9

Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.

MODULE V RECURRENT NEURAL NETWORKS (RNNs) 9

Recurrent neural networks (RNNs): Sequence modeling using RNNs, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture-Introduction to generative AI.

L- 45, TOTAL HOURS – 45

TEXT BOOKS:

1. Goodfellow, I., Bengio, Y., Courville, A. DeepLearning. Germany: Alanna Maldonado.2023.
2. Roberts, Daniel A., et al. The Principles of Deep Learning Theory: An Effective Theory Approach to Understanding Neural Networks. India, Cambridge University Press, 2022.
3. Fundamentals Of Deep Learning: Theory And Applications. N.p., Academic Guru Publishing House, 2023.

REFERENCES:

1. Prince, Simon J.D.. Understanding Deep Learning. United States, MIT Press, 2023.
2. Gharehbaghi, Arash. Deep Learning in Time Series Analysis. United States, CRC Press, 2023.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1	:	Learn the inner workings of artificial neural networks, individual neurons function and network structure.
CO2	:	Apply regularization techniques to deep learning models and demonstrate a reduction in overfitting and validation loss.
CO3	:	Identify the unsupervised learning methods for classification and prediction task.
CO4	:	Gain advanced knowledge of convolutional neural networks (CNNs) and their applications in image classification.
CO5	:	Implement the recurrent neural networks concepts for sequential data modeling,

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG No: 4 -Quality Education This course will deliver the basic concepts of Artificial Intelligence.

SDG No: 9 - Industry, Innovation and Infrastructure Artificial intelligence plays major roles in industry and modern infrastructures. Innovative ideas can be implemented by programming.

ESDX 051	**GPU ARCHITECTURE AND PROGRAMMING**	**L**	**T**	**P**	**C**
SDG: 3,4		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To elaborate the basics of GPU architectures

COB2 : To develop code in GPU programming environment

COB3 : To analyze the programming issues and error handling in CUDA

COB4 : To understand the Open CL basics

COB5 : To explain the algorithms on GPU

PREREQUISITE: Programming and Data Structure, Digital Logic, Computer architecture

MODULE I GPU ARCHITECTURE 9

Review of Traditional Computer Architecture – Basic five stage RISC Pipeline, Cache Memory, Register File, SIMD instructions GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline

MODULE II GPU PROGRAMMING 9

Introduction to CUDA programming Multi-dimensional mapping of dataspace, Synchronization–Serial and Parallel code, Processing Datasets, Algorithm on Multiple GPUs, Single –Node Systems, Multiple-Node Systems and Optimizing CUDA Applications

MODULE III ERROR HANDLING 9

CUDA Error Handling, Kernel launching and bounds checking, Parallel Programming Issues- Race hazards, Synchronization, Algorithmic Issues Back-to-back testing, Memory leaks, Finding and Avoiding Errors.

MODULE IV ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster - CUDA Dynamic Parallelism.

MODULE V OPEN CL BASICS 9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Shane Cook, CUDA Programming: “A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)”, Morgan Kaufmann of Elsevier, First Edition, USA, 2013. (ISBN: 978-0-12- 415933-4)
2. David Kirk Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann of Elsevier ,3rd Edition, USA, 2016.
3. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, Heterogeneous computing with OpenCL, Morgan Kaufmann of Elsevier, 3rd Edition, USA, 2015.

REFERENCES:

1. Nicholas Wilt, “The CUDA Handbook: A Comprehensive Guide to GPU Programming”, Addison-Wesley Professional, Second edition, 2013.
2. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming”, Create Space Independent Publishing, USA, 2017.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1 : Elaborate the GPU Architecture

CO2 : Design and develop programs using CUDA

CO3 : Classify the Parallel Programming issues in CUDA

CO4 : Analyze the Open CL basics

CO5 : Apply efficient algorithms in GPUs for common application kernels.

Board of Studies (BoS) :
26th BOS of ECE held on 13.5.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	H	-	-	-	-	-	-	-	-	H	H	L
CO2	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO3	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO4	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO5	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG3: Ensure healthy lives and promote well-being for all.

Statement: The real understanding of this course on GPU will make the students to innovate better technologies. This leads to a healthcare organizations are digitally process and transforming massive amounts of data in real time.

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: The complete understanding of the course will bring global impact on quality education. Graphics Processing Units (GPU) is originally developed for graphics and video applications, but nowadays it is widely used in many applications beyond graphics. So, various GPU applications can improve the quality of life style.

ESDX 052	SOFTWARE ENGINEERING	L	T	P	C
SDG 4,9		3	0	0	3

COURSE OBJECTIVES

COB 1	:	To introduce the process involved in software development.
COB 2	:	To learn the importance of requirements gathering.
COB 3	:	To understand the need of design phase to build a software prototype.
COB 4	:	To provide knowledge to develop quality software in a systematic method
COB 5	:	To explore the various testing methodologies.

PREREQUISITE: Understanding software processes, design principles, quality management, testing strategies, and maintenance techniques.

MODULE I SOFTWARE PROCESS 8

Nature of Software – Software Engineering - Software Process – Models – Generic Process Model – Process Assessment - Prescriptive Process Model– Specialized Process Models – Unified Process – Personal and Team ,Process Models – Process Technology – Product and Process – Agile Model.

MODULE II REQUIREMENTS GATHERING 8

Requirements Engineering – Understanding Requirements – Requirements Modeling – Scenarios, Information and Analysis Classes, Flow, Behaviour, Patterns and Web Apps.

MODULE III DESIGN 8

Introduction – Design Process – Design Concepts – Design Model – Software Architecture – Component Based Development, Introduction – User Interface Design – Pattern Based Design – WebApp Design.

MODULE IV QUALITY MANAGEMENT 8

Software Quality – Achieving Software Quality – Review Techniques – SQA Goals and Metrics – Software Reliability.

MODULE V SOFTWARE TESTING AND MAINTENANCE 8

Software Testing – Strategic Approach – Issues – Test Strategies – Validation Testing – System Testing – Debugging – Testing Fundamentals: Path Testing, White Box and Black Box, Control Structure – Testing Applications. Software Maintenance – Supportability – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Risk Management.

TEXT BOOKS:

1. Roger S. Pressman & Bruce Maxim , "Software Engineering: A Practitioner's Approach", 9th Edition, McGraw Hill Education (India) Private Limited ,2023.
2. Ian Sommerville, "Engineering Software Products An Introduction to Modern Software Engineering", Pearson Education Limited, 2021.

REFERENCES:

1. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill, 2008.
2. Gopalaswamy Ramesh, Ramesh Bhattiprolu, "Software Maintenance", TataMcGraw Hill, 2003.
3. Shari LwarencePfleeger, Joanne M.Atlee "Software Engineering Theory and Practice", Third Edition, Pearson Education, 2006.
4. Hans Van Vliet, "Software Engineering: Principles and Practices" , Wiley; 3rd Edition, 2008.

COURSE OUTCOMES

By the end of this course, students will be able to:

CO 1 : Choose the appropriate process model for the software application to be developed.

CO 2 : Collect requirements based on the type of the application and its need.

CO 3 : Design frameworks for the application to be developed

CO 4 : Ensure that the software satisfies the quality standards

CO 5 : Apply the appropriate testing strategies to the developed products

Board of Studies (BoS) :
26th BOS of ECE held on 13.5.2024

Academic Council:
22nd ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	H	-	-	-	-	-	-	-	-	H	H	L
CO2	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO3	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO4	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO5	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Quality Education:

Statement: Software engineering education equips students with practical skills related to designing, developing, and testing software. By emphasizing quality education in this field, the course aligns with SDG 4's objective of ensuring inclusive and equitable education for all, fostering lifelong learning opportunities.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The field of software engineering plays a crucial role in adv industry innovation and building robust infrastructure. By imparting knowledge computer programming, web development, data structures, and management, this course contributes to SDG 9's goal of promoting susta industrialization and fostering innovation.

ESDX 053	**PATTERN RECOGNITION**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : Explain the principles of Bayesian Decision Theory and its application in pattern classification.

COB2 : Discuss Maximum Likelihood (ML) and Maximum a posteriori (MAP) estimation methods for parameter estimation.

COB3 : Explain linear discriminant function-based classifiers and their applications.

COB4 : Apply dimension reduction methods in practical pattern classification tasks.

COB5 : Evaluate clustering results using appropriate criterion functions.

PREREQUISITE:

- Knowledge of Linear algebra
- Knowledge of random process and probability

MODULE I PATTERN CLASSIFIER 9

Basics of Pattern Recognition-Bayesian Decision Theory-Minimum error rate classification, Classifiers, discriminant functions, decision surfaces -The normal density and discriminant functions for the Normal Density-Continuous and discrete valued Features-Bayesian Belief Networks

MODULE II PARAMETER ESTIMATION 9

Methods for parameter estimation - Maximum-Likelihood (ML) estimation-Maximum a posteriori (MAP) estimation - Bayesian estimation - Gaussian mixture model (Both unimodal and multimodal distribution) - Expectation - Maximization method

MODULE III NON-PARAMETRIC METHODS 9

Sequential Pattern Classification-Discrete hidden Markov model -Continuous density hidden Markov models - Non-parametric techniques for density estimation - Parzen-window method K-Nearest Neighbour method

MODULE IV DIMENSION REDUCTION METHODS 9

Dimension reduction methods - Principal component analysis - Fisher discriminant analysis - Linear discriminant function based classifiers -Perceptron - Minimum Mean

Squared Error (MME) method – The Ho-Kashyap method - Non-metric methods for pattern classification Decision trees-Classification and Regression Tree (CART).

MODULE V UNSUPERVISED CLASSIFICATION 9

Regression-Linear models for regression-Polynomial regression-Bayesian regression-Unsupervised learning and clustering-Criterion functions for clustering-Algorithms for clustering:-K-means, -Hierarchical clustering –Cluster validation.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Jürgen Beyerer, Raphael Hagmanns, Daniel Stadler, Pattern Recognition Introduction, Features, Classifiers and Principles, De Gruyter Publisher, 348 pages, April 2024, ISBN: 9783111339207, 3111339203
2. King-Sun Fu, Applications of Pattern Recognition, CRC Press, 284 pages, 22 July 2019, ISBN: 9781351086707, 1351086707
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2003.
4. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th edition, Academic Press, 2009.
5. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006

REFERENCES:

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. GonzalezandWoods,"Digital Image Processing",3rd Edition, Pearson Education, 2016.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1 : Explain the fundamental concepts of Bayesian Decision Theory and parameter estimation methods.

CO2 : Analyze the performance of various classification algorithms in real-world scenarios.

CO3 : Implement algorithms for sequential pattern classification and dimension reduction.

CO4 : Solve complex pattern recognition problems by selecting and applying appropriate techniques

CO5 : Evaluate the strengths and limitations of various pattern recognition techniques.

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H			M							H		H	L
CO2	M				M							H		H	L
CO3		H	H	M	M							H		M	L
CO4	M	M			M							H		M	L
CO5				M	M							H		H	L

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: The syllabus covers SDG 4 by fostering inclusive, equitable, and quality education. It provides opportunities for all learners, regardless of background, to engage with cutting-edge techniques of pattern recognition and its applications.

SDG 9: Industry, Innovation, and Infrastructure

Statement: Innovation in pattern recognition algorithms and technologies contributes to sustainable industrialization by enabling the development of more efficient manufacturing processes, as well as the optimization of energy and resource usage in industrial operations.

ESDX 054	NATURAL LANGUAGE PROCESSING	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1 : Depict the key concepts of regular expressions, text normalization, edit distance, and N-gram language models.

COB2 : Illustrate the application of Naive Bayes, logistic regression, and vector semantics in text classification and sentiment analysis

COB3 : Apply neural networks, including RNNs and LSTMs, to sequence labeling tasks for parts of speech and named entities in NLP.

COB4 : Evaluate the impact and challenges of transformers, large language models, and fine-tuning approaches

COB5 : Explore lexical semantics, including word sense disambiguation and semantic similarity.

PREREQUISITE: Probability, linear algebra and calculus

MODULE I INTRODUCTION 9

Regular Expressions - words, corpora, Text Normalization, Edit Distance N-gram Language Models- Evaluating Language Models, Sampling sentences from a language model, Generalization and Zeros, Smoothing, Huge Language Models and Stupid Backoff, Advanced: Kneser-Ney Smoothing, Advanced: Perplexity's Relation to Entropy

MODULE II TEXT CLASSIFICATION TECHNIQUES 9

Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes as a Language Model , Test sets and Cross-validation , Statistical Significance Testing, Logistic Regression- Classification with Logistic Regression, Multinomial logistic regression, Regularization, Vector Semantics and Embeddings

MODULE III NEURAL NETWORKS FOR NLP 9

Neural Networks and Neural Language Models - Feedforward Neural Networks,Training Neural Nets, Sequence Labeling for Parts of Speech and Named Entities, Recurrent Neural Networks (RNN)- RNNs as Language Models and LSTMs,The Encoder-Decoder Model with RNNs

MODULE IV TRANSFORMERS AND LARGE LANGUAGE MODELS 9

Transformers as Language Models, Pretraining Large Language Models , Language Models for Zero-shot Learning, Fine-Tuning and Masked Language Models- Bidirectional Transformer Encoders, Prompting, In-Context Learning ,and Instruct Tuning

MODULE V ANNOTATING LINGUISTIC STRUCTURE 9

Context-Free Grammars and Constituency Parsing, Dependency Parsing, Logical Representations of Sentence Meaning, Computational Semantics and Semantic Parsing, Time and Temporal Reasoning Lexical Semantics, NLP application

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Dan Jurafsky and James Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" Prentice Hall, Third Edition, 2024.
2. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019

REFERENCES:

1. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", MIT Press, Cambridge, MA: May 1999.
2. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Elaborate the key terms of natural language processing techniques

CO2 : Explain text classification principles using Naive Bayes, Logistic Regression, and Neural Networks for sentiment analysis.

CO3 : Implement RNNs and LSTMs for sequence labeling tasks

CO4 : Evaluate text classification methods and neural network architectures in NLP, assessing their effectiveness.

CO5 : Develop NLP solutions

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	M	M	M	L	L	L	M	M	M	L	M	L	M	L	L
CO2	H	H	H	H	L	M	M	M	M	L	M	L	L	H	H
CO3	M	H	H	M	L	H	M	L	L	L	L	L	L	L	M
CO4	M	H	H	M	L	M	H	L	M	L	L	L	L	M	H
CO5	M	H	H	H	L	H	H	H	H	H	H	L	L	H	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: Foundational knowledge in natural language processing (NLP), ensuring that learners have access to quality education.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Neural networks for NLP, including RNNs and LSTMs advanced techniques are at the forefront of innovation in NLP and are essential for building resilient infrastructure in this field.

ESDX 055	PROMPT ENGINEERING	L	T	P	C
SDG 9,17		3	0	0	3

COURSE OBJECTIVES:

COB 1 **:** To analyze the basics of prompt engineering
COB 2 **:** To explain the concepts of prompt design
COB 3 **:** To apply techniques for optimizing prompts.
COB 4 **:** To evaluate the responses of prompts.
COB 5 **:** To implement prompts for real time applications.

PREREQUISITE: Knowledge of CHATGPT, Familiarity with python programming.

MODULE I INTRODUCTION TO PROMPT **ENGINEERING WITH CHATGPT 9**

Overview of prompt engineering: Understanding the role of prompts in guiding AI models like ChatGPT. Introduction to ChatGPT: Explanation of the model architecture, capabilities, and use cases. The importance of prompt design in ChatGPT interactions: Clarity, contextuality, and engagement.

MODULE II CRAFTING EFFECTIVE PROMPTS FOR CHATGPT 9

Principles of prompt design: Crafting prompts that elicit desired responses from ChatGPT. Tailoring prompts for different conversational scenarios: Open-ended chats, specific queries, storytelling, etc. practice in crafting prompts and evaluating their effectiveness in guiding ChatGPT responses.

MODULE III OPTIMIZING PROMPTS FOR ENHANCED CONVERSATIONAL EXPERIENCES 9

Techniques for prompt optimization: Fine-tuning prompts for improved coherence and relevance. Leveraging ChatGPT's capabilities: Incorporating context, persona, and style into prompts. Implementing prompt optimization techniques and experimenting with different strategies.

MODULE IV EVALUATING AND ITERATING PROMPTED CONVERSATIONS 9

Evaluating ChatGPT responses: Metrics for assessing conversational quality, coherence, and relevance. Interpreting ChatGPT's responses: Analyzing prompt-response pairs to understand model behavior. Evaluation metrics and interpretability tools to assess and improve prompted conversations.

MODULE V ADVANCED STRATEGIES AND ETHICAL CONSIDERATIONS 9

Advanced prompt engineering strategies: Multi-turn prompting, context management, and dynamic prompts.Ethical considerations in prompt engineering: Addressing biases, safety concerns, and responsible AI usage.

L- 45, Total Hours – 45

TEXT BOOKS:

1. Philipp Dufter, Stefan Schneider, "Language Models for AI", Manning Publications, 2021.
2. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python", O'Reilly Media, 2009.

REFERENCES:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 2019.
3. Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson, 2011.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Understand the principles of AI and chatGPT
CO2 : Describe the techniques associated with prompt creation.
CO3 : Apply prompts for conversational experiences.
CO4 : Assess the metrics and tools for improving prompts.
CO5 : Understand the ethical consideration in prompt engineering.

Board of Studies (BoS):
26th BoS of ECE held on 13.05.2024

Academic Council:
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PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	L									H	H	L
CO2	M	H	H	M	L								H		
CO3	M	H	H	M	L								L	H	
CO4		M	H	H	M								H		
CO5				M	H								L	H	

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 9: Industry, Innovation and Infrastructure

Statement: This course is pivotal in advancing prompt creation, AI and machine learning techniques.

SDG 17: Partnerships for the Goals

Statement: The course can promote collaboration and automation, algorithm optimization, and creative AI applications to excel in technology-driven industries.

ESDX 056	BLOCKCHAIN TECHNOLOGY	L	T	P	C
SDG: 4, 9		3	0	0	3

COURSE OBJECTIVES:

COB1 : To apply the basics of Blockchain technology.

COB2 : To explain the importance of Bitcoin and cryptocurrency.

COB3 : To identify the future currencies and to create crypto tokens.

COB4 : To analyze the private and public Blockchain, and smart contracts.

COB5 : To discuss various aspects of Blockchain technology like application in various domains.

PREREQUISITE: Computer Network and security

MODULE I FUNDAMENTALS OF BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, TransactionsThe Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic - Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

MODULE II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

MODULE III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , BitcoinPoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

MODULE IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

MODULE V BLOCKCHAIN APPLICATIONS 9

Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

2. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.
3. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
4. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. Antonopoulos and G. Wood, “Mastering Ethereum: Building Smart Contracts and Dapps”, O’Reilly Publishing, 2018.
2. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017
3. Arvind Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” Princeton University Press, 2016
4. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1 : Compare emerging abstract models for Blockchain technology

CO2 : Analyze the working of Smart Contracts

CO3 : Describe the working of Hyperledger

CO4 : Discuss the modern currencies and its market usage

CO5 : Develop applications on Blockchain

Board of Studies (BoS):

26th BoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	H	-	-	-	-	-	-	-	-	H	H	L
CO2	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO3	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO4	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L
CO5	H	H	H	H	-	-	-	-	-	-	-	-	H	H	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Knowing the basic networking devices and protocol implementation makes the student equipped for lifelong learning in this field.

SDG 9: Intelligent use of blockchain concepts in real time applications can utilize the power of real time data to provide optimized solutions.

ESDX 057	MOBILE MULTIMEDIA SYSTEMS	L	T	P	C
SDG 4,9, 11		3	0	0	3

COURSE OBJECTIVES:

COB 1 : Understand the fundamentals of multimedia systems and their importance in mobile computing.

COB 2 : Gain experience in developing mobile multimedia applications for Android and iOS platforms.

COB 3 : Apply advanced principles of multimedia streaming and performance optimization

COB 4 : Evaluate emerging trends in mobile multimedia,

COB 5 : Examine the ethical, legal, and societal implications of mobile multimedia systems

PREREQUISITE: Basics of analog and digital communication

MODULE I — INTRODUCTION TO MOBILE MULTIMEDIA SYSTEMS — 9

Overview of multimedia systems - Evolution of mobile devices and multimedia - Challenges and opportunities in mobile multimedia - Basics of multimedia content creation (audio, video, images) - Multimedia file formats and codecs - Compression techniques for multimedia data.

MODULE II — MOBILE MULTIMEDIA APPLICATION DEVELOPMENT — 9

Overview of mobile operating systems - Multimedia frameworks and APIs - Multimedia resource management and optimization - Principles of mobile user interface design - Design considerations for multimedia-rich interfaces - Accessibility and usability in multimedia applications Mobile app development platforms and tools - Building multimedia applications for Android and iOS - Integrating multimedia features into mobile apps.

MODULE III — MULTIMEDIA STREAMING AND PERFORMANCE OPTIMIZATION IN MOBILE SYSTEMS — 9

Principles of multimedia streaming - Streaming protocols and architectures - Adaptive streaming techniques for mobile networks Metrics for evaluating multimedia applications - Performance optimization techniques - User feedback and analytics for multimedia apps.

MODULE IV EMERGING TRENDS IN MOBILE MULTIMEDIA 9

Overview of AR and VR technologies - Applications of AR and VR in mobile multimedia systems - Challenges and opportunities in AR and VR development for mobile platforms - Introduction to the Internet of Things (IoT) concept - Integration of multimedia technologies with IoT devices - Case studies and examples of multimedia-enabled IoT applications - Current trends and emerging technologies in mobile multimedia - Research challenges in immersive multimedia experiences - real-time multimedia communication - context-aware multimedia systems.

MODULE V ETHICAL, LEGAL, AND SOCIETAL ISSUES 9

Ethical considerations in mobile multimedia development and deployment - Legal issues related to multimedia content distribution, copyright, and intellectual property rights - Societal impact of mobile multimedia on communication, entertainment, education, and healthcare

L- 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Xiaoyi Jiang, Matthew Y. Ma, Chang Wen Chen, “Mobile Multimedia Processing Fundamentals, Methods, and Applications” Springer, 2010.
2. Rao, “Multimedia Communication Systems—Techniques, Standards and Networks” Prentice-Hall of India Pvt.Ltd, 2012

REFERENCES:

1. BorkoFurht, “Handbook of Multimedia for Digital Entertainment and Arts” Springer-Verlag, 2014
2. Ralf Steinmetz, “Multimedia: Computing, Communications & Applications, Pearson, 2012.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1 : Explain the principles of multimedia content creation and manipulation.

CO2 : Develop mobile multimedia applications that leverage multimedia frameworks

CO3 : implement multimedia streaming solutions for mobile platforms

CO4 : Apply advanced critical analysis to evaluate the implications of emerging trends in mobile multimedia

CO5 : critically analyze and articulate the ethical, legal, and societal implications of mobile multimedia systems

Board of Studies (BoS):

26th BoS of ECE held on 13.05.2024

Academic Council:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L								L	H	L	M
CO2	H	H	H	L								L	H	L	M
CO3	H	H	H	H								L	H	H	H
CO4	H	H	H	H								L	H	M	H
CO5	H	H	H	H								L	M	L	M

Note: L-Low Correlation M-Medium Correlation H-High Correlation

SDG 4: Quality Education

Statement: The course provides students with knowledge and skills related to mobile multimedia systems, contributing to quality education by fostering digital literacy and preparing students for careers in technology and innovation.

SDG 9: Industry, Innovation and Infrastructure

Statement: The course covers topics such as mobile application development, multimedia technologies, and emerging trends in mobile multimedia, promoting innovation and contributing to the development of robust digital infrastructure.

ESDX 058	DATA MINING AND DATA WAREHOUSING	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB 1 : To learn data warehousing and data mining.

COB 2 : To analyse dimensional modeling technique for designing a data warehouse.

COB 3 : To discuss data warehouse architectures, OLAP and the project planning aspects in building a data warehouse.

COB 4 : To explain the knowledge discovery process.

COB 5 : To describe the data mining tasks and study their well-known techniques.

PREREQUISITE:

- Familiarity with statistics, probability theory and database.
- Basic programming skills in a high-level language such as Python or Java.

MODULE I INTRODUCTION TO DATA WAREHOUSING 9

Definition and objectives of data warehousing, Data warehouse architectures, Data models and data structures, ETL (Extract, Transform, Load) process, OLAP (Online Analytical Processing),Data warehouse design and implementation.

MODULE II DATA WAREHOUSE PROJECT PLANNING 9

Project planning and management, Data warehouse project life cycle, Data warehouse project estimation and costing, Data warehouse project implementation, Data warehouse project maintenance and support.

MODULE III DATA MINING CONCEPTS 9

Introduction to data mining, Data mining techniques, Data mining algorithms, Data mining applications, Data mining tools and software.

MODULE IV DATA MINING TECHNIQUES 9

Association rule mining, Classification and regression, Clustering, Anomaly detection, Neural networks and deep learning.

MODULE V DATA MINING APPLICATIONS 9

Data mining in business, Data mining in healthcare, Data mining in finance, Data mining in social media, Data mining in security and fraud detection.

L –45 : TOTAL HOURS –45

TEXT BOOKS:

1. Data Warehousing: Concepts, Technology, and Applications" by Chris M. Jensen, J. Philip Moody, and William H. Inmon (John Wiley & Sons, 2018).
2. Data Warehouse Project Management: A Comprehensive Guide" by Tom Ward (John Wiley & Sons, 2016)

REFERENCES:

1. Data Mining: Concepts and Techniques" by Jiawei Han, MichelineKamber, and Jian Pei (Morgan Kaufmann, 2012).
2. Data Mining: Practical Machine Learning Tools and Techniques" by Ian H. Witten, Eibe Frank, and Mark A. Hall (Morgan Kaufmann, 2016).
3. Data Mining Applications in Business, Industry, and Government" by Usama Fayyad, Geoffrey I. Nigam, and Michael J. Ullman (Prentice Hall, 2002).

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO 1 : Analyze and design a data warehouse using dimensional modelling techniques.

CO 2 : Evaluate and select appropriate data mining techniques for various applications.

CO 3 : Apply data mining techniques to extract valuable insights from large data sets.

CO 4 : Develop a data mining system integrated with a data warehouse.

CO 5 : Evaluate and compare the performance of different data mining algorithms.

Board of Studies (BoS) :
26th BOS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	M	L							L	H				
CO2	M	H	H	M	L						H				
CO3	M	H	H	M	L						L	H			
CO4		M	H	H	M						H				
CO5				M	H						L	H			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Quality Education - The course promotes knowledge and skills in data mining and data warehousing, which are essential for decision-making in various industries.

SDG 9: Industry, Innovation, and Infrastructure - The course supports the development of advanced data management systems, which are crucial for modern industries and businesses.

ESDX 059	XML AND WEB SERVICES	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1	**:**	To understand the details of web services characteristics and architecture.
COB2	**:**	To learn the details of web services technologies.
COB3	**:**	To explore frameworks: SOAP, Java and axis
COB4	**:**	To understand the details of web services: WSDL, UDDI
COB5	**:**	To explore interoperability between different frameworks

MODULE I INTRODUCTION TO WEB SERVICES AND ARCHITECTURE 9

Definition of web services, operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web services Architecture and its characteristics, standards and technologies available for implementing web services, web services communication.

MODULE II EVOLUTION OF WEB SERVICES 9

Introduction: - computing technologies, client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA).

MODULE III FUNDAMENTALS OF SOAP 9

SOAP Message Structure, SOAP Encoding, Encoding of different data types, SOAP message exchange models, SOAP communication and messaging, Java and Axis, Limitations SOAP.

MODULE IV DESCRIBING AND DISCOVERING WEB SERVICES 9

WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, limitations of UDDI.

MODULE V INTEROPERABILITY OF WEB SERVICES & SERVICES SECURITY 9

Means of ensuring Interoperability, Overview of .NET, Creating a .NET Client for an Axis Web Services, Creating Java Client for a web service, Challenges in Web Services Interoperability.XML security frame work, Goals of cryptography, Digital Signature, Digital Certificate, XML encryption.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, 2008.
2. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education, 2008.

REFERENCES:

1. Building Web Services with Java, Second Edition, S. Graham and others, Pearson Education. 2008.
2. Web Services, G. Alonso, F. Casati and others, Springer, 2005.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Describe the characteristicsand architecture of web services.

CO2 : Familiarize the details of web services technologies.

CO3 : Exhibit the frameworks: SOAP, Java and axis.

CO4 : Develop the web services: WSDL, UDDI

CO5 : Understand the web services.

Board of Studies (BoS) :

26th BOS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2
CO1	H	H	M	H	-	-	-	-	-	-	-	-	H	H
CO2	H	H	H	H	-	-	-	-	-	-	-	-	H	H
CO3	H	H	H	H	-	-	-	-	-	-	-	-	H	H
CO4	H	H	H	H	-	-	-	-	-	-	-	-	H	H
CO5	H	H	H	H	-	-	-	-	-	-	-	-	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement:

Understanding of the course Natural Language Processing will bring a global impact on quality education.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply Natural Language Processing concepts in automation.

ESDX 060	**MULTIMEDIA COMMUNICATION AND NETWORKING**	**L**	**T**	**P**	**C**
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The aim of the course is to make the student

COB1 **:** Understand multimedia information representation including text, image, audio, and video.

COB2 **:** Explore network types, protocols, and performance metrics relevant to multimedia.

COB3 **:** Learn compression techniques for text and audio data.

COB4 **:** Study compression methods for image and video data.

COB5 **:** Investigate multimedia applications and emerging trends.

PREREQUISITE : Knowledge on digital communication

MODULE I INTRODUCTION TO MULTIMEDIA COMMUNICATION AND NETWORKING 9

Introduction to multimedia - information representation - Text representation - ASCII, Unicode character, encoding, Image representation - color models Audio representation - sampling rate, bit depth, audio formats (WAV, MP3) - Video representation - Multimedia networks - network types (LAN, WAN, internet), network protocols, network performance metrics.

MODULE II MULTIMEDIA NETWORKING PROTOCOLS 9

Network protocols - layered network architecture (OSI model), TCP/IP protocol suite Real-time Transport Protocol (RTP) - packet structure, jitter buffering Session Initiation Protocol (SIP) - Network QoS mechanisms - Content Delivery Networks (CDNs)

MODULE III TEXT AND AUDIO COMPRESSION 9

Text compression –Static and Dynamic Huffman coding – Shannon Fano coding Arithmetic coding –LempelZiv coding – Advanced Golomb coding, Audio Compression -Need for compression-Sampling and Quantization of Speech (PCM) – Adaptive differential PCM – Delta Modulation – Vector Quantization- Linear predictive coding (LPC) – Code excited Linear predictive Coding (CELP)

MODULE IV IMAGE AND VIDEO COMPRESSION 9

Graphics Interchange format- Tagged image file format-Digitized documents Digitized pictures-JPEG -Video Encoding-Motion estimation –Overview of H.263 and MPEG-2, compressed sensing.

MODULE V MULTIMEDIA APPLICATIONS AND TRENDS 9

Case studies - video conferencing, streaming services social media applications - virtual reality (VR), augmented reality (AR), interactive multimedia applications Network challenges for multimedia applications: bandwidth requirements, network congestion, latency issues

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Ralf Steinmetz, Multimedia: Computing, Communications & Applications, 8th Edition, Pearson Publication, 2022.
2. Simon Haykin, Introduction to Communication Systems, 6th Edition, Wiley Publication, 2020.
3. James Kurose and Keith Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 8th Edition, Pearson Publication, 2022.

REFERENCES:

1. William I. Grosky, The Handbook of Multimedia Information Management, 2nd Edition, Springer Publicfation, 2018.
2. Srinivasan Keshav, Quality of Service in IP Networks, 2nd Edition, Cambridge University Press, 2016.

COURSE OUTCOMES:

At the end of the courses, the students will be able to

CO1 : Gain knowledge of various representation formats and encoding techniques for multimedia data

CO2 : Understand the working of networks based on protocol and assess the quality of service.

CO3 : choose various compression algorithms to reduce the size of text and audio files

CO4 : Familiarize with image and video compression standards and techniques.

CO5 : Analyze case studies, understand challenges in multimedia applications.

Board of Studies (BoS) :

26thBoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO / CO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	M	L									H	L	M
CO2	H	H	H	L									H	L	M
CO3	H	H	H	H									H	H	H
CO4	H	H	H	H									H	M	H
CO5	H	H	H	H									M	L	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course enables the student to understand basic multimedia communication, multimedia compression and multimedia networking protocols and helps for lifelong learning of newer technologies and concepts related to communication and networking.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Able to apply the theoretical concepts for the various application of multimedia communication

		L	T	P	C
ESDX 061	**AUGMENTED REALITY AND VIRTUAL REALITY**	**L**	**T**	**P**	**C**
SDG: 4, 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: Todescribe the human machine interface system.

COB2: To explain the methods and tools of Augmented reality

COB3: To interpret physiological considerations in virtual reality.

COB4: To discuss virtual reality hardware.

COB5: To apply the concept of a synthetic environment system.

PREREQUISITE: Basic knowledge in image processing

MODULE I HUMAN SYSTEM INTERFACE 9

Introduction - Design, Control, and Evaluation of a Hyper-redundant Haptic Device-Man-Machine Interface Systems for operation and Interaction - Acquisition, Processing and Display for robotic Applications.

MODULE II AUGMENTED REALITY 10

Introduction- Definition-components of augmented reality-Differences between Augmented reality and virtual reality- Augmented reality methods- Abstraction and implementation- real time 3D design and modeling.

MODULE III VIRTUAL REALITY 9

Virtual reality: Overview – Physiological considerations-visual channel-Auditory channel-Haptic interfaces-Position tracking and mapping.

MODULE IV VIRTUAL REALITY HARDWARE 9

Motion Interfaces - Speech, Physiology and other interfaces - computer hardware and software for generation of virtual environments..

MODULE V APPLICATIONS OF AUGMENTED REALITY AND VIRTUAL REALITY 8

Augmented reality in education, sports, gaming, entertainment and medicine.-Synthetic Environment system –Virtual reality techniques in flight simulation-using virtual reality techniques in animation process.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Andrew YehChing Nee and SohKhim Ong, Springer Handbook of Augmented Reality, Springer International Publishing, 925 pages, 2023, ISBN: 9783030678227, 3030678229

2. Manuel Ferre, Martin Buss, Rafael Aracil, Claudio Melchiorri and Carlos Balaguer, Advances in Tele robotics, Springer, 2007.
3. Greg Kipper, Joseph Rampolla, Augmented Reality An Emerging Technologies Guide to AR, Elseiver, 2013
4. Steve Aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications, and Human factors for Augmented reality and Virtual reality, Pearson Education, 2017.
5. R.A. Earnshaw, M.A.Gigante, H.Jones, Virtual reality systems, Academic Press, 2014

REFERENCES:

1. Haller, Michael, Billinghurst, Mark, Thomas, Bruce, Emerging technologies of Augmented reality : Interfaces and design, Idea group publishing, 2007
2. Jason Jerald ,The VR Book: Human-Centered Design for Virtual Reality, ACM Books, 2015.
3. Bruno Siciliano, OussamaKhatib, Springer Handbook of Robotics, Springer 2016.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO 1 : Analyze the human-machine interface systems.

CO 2 : Explain the components and technologies for Augmented reality.

CO 3 : Compare the physiological considerations of visual and auditory channels in virtual reality systems.

CO 4 : Identify the hardware and software interfaces in virtual reality.

CO 5 : Discuss the applications of augmented reality and virtual reality.

Board of Studies (BoS) :

26th BoS of ECE held on 13.05.2024

Academic Council:

22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PS O2	PSO 3
CO1	H	H	H								M	M	H	H	L
CO2	H	H	H								M	M	H	H	L
CO3	H	H	H								M	M	H	H	L
CO4	H	H	H								M	M	H	H	L
CO5	H	H	H								M	M	H	H	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Statement: This course will deliver the basic concepts of Augmented & Virtual Reality which is mostly used in Real Time Applications.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation
Statement: Augmented & Virtual Reality plays major roles in industry and modern infrastructures. Innovative ideas can be implemented by various algorithms.

ESDX 062	**QUANTUM COMPUTING**	**L**	**T**	**P**	**C**
SDG: 4, 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To introduce the basic concepts of quantum mechanics.

COB2: To develop the knowledge on quantum computation and quantum information.

COB 3: To explore the basic hardware and mathematical models of quantum computation.

COB 4: To familiarize the quantum logical operations and algorithms.

COB 5: To analyze the behavior of basic quantum circuits and algorithms.

PREREQUISITE: Basic knowledge on Digital logic circuits& Linear Algebra

MODULE I INTRODUCTION TO QUANTUM MECHANICS 9

Introduction to quantum computing- Power of quantum computing- Quantum information-Quantum Computers. The Superposition probability rule- A Photon coincidence experiment- Quantum mechanics-Hilbert space- linear operators tensor and outer products- Quantum states- Quantum operators- spectral decomposition of a quantum operators.

MODULE II QUANTUM GATES 10

Qubits, blocks sphere representation- Rotation operation-the measurement of a single qubits- A pair of qubits-Qubits-physical implementation-Measurement of the spin-Qubit as polarized photon- Entanglement, Exchange of information-single qubit gates-two, three and multiple qubit gates- The Toffoli gates- Matrix representation of quantum gates and circuits.

MODULE III QUANTUM CIRCUITS 9

The No-Cloning theorem- Full adder circuits- Single and multiple qubit controlled operations-Universal quantum gate-State transformation-Quantum circuit for the Walsh-Hadamard transform- Mathematical models of quantum computer.

MODULE IV QUANTUM PROTOCOLS AND QUANTUM ALGORITHMS 9

Deutsch-Jozsa, Bernstein-Vazirani, Simon’s, Quantum Fourier transform, Shor’s and Grover’s algorithms.

MODULE V PROGRAMMING A QUANTUM COMPUTER 8

Coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press,Cambridge, 2020.
2. Quantum Computation and Quantum Information, Textbook by M. A. Nielsen and I. Chuang, Cambridge University Press ,2013.
3. Eleanor G. Rieffel and Wolfgang H. Polak “Quantum Computing: A Gentle Introduction”, The MIT Press Cambridge, Massachusetts London, England, 2014.
4. Riley Tipton Perry, “Quantum Computing from the Ground Up”, World Scientific Publishing Ltd (2012).

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO 1 : Define the basics of Quantum mechanics and explain the mathematical framework of quantum computing to solve computational problems.

CO 2 : Design and analyze the circuits using quantum computation.

CO 3 : Design and write simple algorithms for quantum machines.

CO 4 : Analyze quantum algorithms described in quantum circuit or measurement-based quantum computing models.

CO 5 : Simulate simple quantum algorithms and information channels in the quantum circuit model.

Board of Studies (BoS) :
26th BoS of ECE held on 13.05.2024

Academic Council:
22nd ACM held on 4.09.2024

PO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PSO 3
CO1	H	M		M									H	H	L
CO2	H	M		L	L								H	H	L
CO3	H	M	L	M	L								H	H	L
CO4	H	M	L	M	H								H	H	L
CO5	H	M	L	H	H								H	H	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Quality Education - Designing a quantum computing course to integrate emerging technologies into curricula, ensures inclusive access to resources, hands-on learning experiences, and lifelong learning opportunities for diverse learners, thus fostering a well-rounded education in quantum computing.

SDG 9: Building a quantum computing course that fosters innovation, promotes inclusive access to resilient infrastructure, and supports sustainable industrialization, thereby driving advancements in technology and contributing to global economic development.

PHYSICS ELECTIVE

		L	T	P	C
PHDX 01	**NON DESTRUCTIVE TESTING OF MATERIALS**				
SDG: 4		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1:To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

COB2:To study the working and instrumentation of thermography and eddy current testing methods and apply to interpret the results and investigate the possible defects.

COB3:To get full exposure about principle, instrumentation and standards of various radiographic NDT methods and improve the skill to identify the defects suitably.

COB4:To get deep insight into the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT methods.

COB5:To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

MODULE I SURFACE NDT METHODS 7

Liquid Penetrant Inspection – Principles, Types of dye and methods of application,developers, advantages and limitations of various methods, Interpretation of results. Magnetic Particle Inspection- Magnetic particle testing, Basic theory of magnetism, Magnetization methods, Interpretation of field indicators, Particle application, Inspection,Residual magnetism Principles and methods of demagnetization.

MODULE II THERMOGRAPHY AND EDDY CURRENT TESTING 7

Thermography- Principles, Contact and non contact inspection methods, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Applications, advantages, Limitations, Interpretation/Evaluation.

MODULE III RADIOGRAPHY 8

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square law, characteristics of films -graininess, density, speed, contrast, characteristic curves. Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography.

MODULE IV ULTRASONIC TESTING 8

Ultrasonic Testing: Basic principles of sound propagation, types of sound waves, Principle of UT, methods of UT, their advantages and limitations, Piezoelectric Material, Various types of transducers/probe, Calibration methods, use of standard blocks, technique for normal beam inspection.

L – 30;Total Hours –30

TEXT BOOKS:

1. ASM Metals Handbook,Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, 200, 2018.
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu Practical Non-Destructive Testing, Narosa Publishing House, 2014.

REFERENCES:

1. Ravi Prakash, Non-Destructive Testing Techniques, 1st revised edition, New Age International Publishers, 2010.
2. Paul E Mix, Introduction to Non-destructive testing: a training guide, Wiley, 2nd Edition New Jersey, 2005.
3. Charles, J. Hellier, Handbook of Nondestructive evaluation, McGraw Hill, New York 2001.
4. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).

COURSE OUTCOMES:

CO1: Demonstrate the importance, principle, concept and inspection methods of various surface NDT methods and apply the same to interpret the results effectively.

CO2:Comprehend the ideas behind working of thermography and eddy current testing methods and apply them to interpret the results of testing and analyse the defects and problem.

CO3:Grasp the fundamental principles and standards of various radiographic NDT methods and utilise them to identify the defects and defect location suitably.

CO4: Assimilate the ideas concerning the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT methods and identify the areas for their application.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 02	**MATERIALS SCIENCE FOR ENGINEERING**	**L**	**T**	**P**	**C**
SDG: 4		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To impart knowledge on the fundamentals of materials science and engineering.

COB2: To provide a basis for understanding properties and applications of dielectric materials.

COB3: To expose the students to different classes of materials, their properties, structures and imperfections

COB4:To aid the teaching learning process through relevant illustrations, animations, web content and practical examples

MODULE I CLASSIFICATION OF MATERIALS 6

Concept of amorphous, single crystals and polycrystalline materials, crystallinity and its effect on physical properties, metal, ceramic, polymers, classification of polymers, structure and properties, additives for polymer products, effect of environment on materials, composites

MODULE II PROPERTIES OF MATERIALS 10

Mechanical Properties: Stress-strain response of metallic, ceramic and polymer materials, yield strength, tensile strength and modulus of elasticity, toughness, plastic deformation, fatigue, creep and fracture- Electronic Properties:Free electron theory, Fermi energy, density of states, band theory of solids, semiconductors, Hall effect, dielectric behaviour, piezo, ferro, pyroelectric materials - Magnetic Properties: Origin of magnetism in metallic and ceramic materials, para-magnetism, diamagnetism, ferro and ferrimagnetism- Thermal Properties: Specific heat, thermal conductivity and thermal expansion, thermoelectricity- Optical Properties: Refractive index, absorption and transmission of electromagnetic radiation in solids, electro-optic and magneto-optic materials.

MODULE III CRYSTALLOGRAPHIC STRUCTURES AND IMPERFECTIONS 7

Crystal symmetry, point groups, space groups, indices of planes, close packing in solids, bonding in materials, coordination and radius ratio concepts, point defects, dislocations, grain boundaries, surface energy and equilibrium shapes of crystals.

MODULE IV THERMODYNAMICS AND KINETICS 7

Phase rule, phase diagrams, solid solutions, invariant reactions, lever rule, basic heat treatment of metals, solidification and phase transformations, Fick's laws of diffusion, mechanisms of diffusion, temperature dependence of diffusivity.

L – 30; Total Hours –30

TEXT BOOKS:

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

REFERENCES:

1. William D. Callister, Jr., David G. Rethwisch, Materials Science and Engineering, Edition 9, Wiley, 2014.
2. Michael F. Ashby, David R.H. Jones , Engineering Materials 1 An Introduction to Properties, Applications and Design · Volume 1, Elsevier Science, 2012
3. Michael F. Ashby, David R.H. Jones , Engineering Materials 2: An Introduction to Microstructures, Processing and Design · Volume 2, Elsevier Science, 2013
4. Reza Abbaschian, Robert E. Reed-Hill, Physical Metallurgy Principles - SI Version, Cengage Learning, NY, 2009
5. "Encyclopedia of Polymer Science and Technology" 3rd Edition, Vol.1-12, Wiley Interscience , 2003

COURSE OUTCOMES

At the end of the course, students will be able to

CO1:select suitable material for specific application.

CO2: analyse crystallographic structure of metals and their imperfections.

CO3: develop metal alloys with varying properties by selecting suitable heat treatment

CO4: correlate the various properties of material with their structure.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 03	**BIOMATERIALS**	**L**	**T**	**P**	**C**
SDG: 4		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1:To gain basic knowledge in classification of biomaterials and their properties.

COB2:To provide a basis for understanding properties of metallic implant materials.

COB3:To enable the students to correlate theoretical principles with practical applications.

COB4:To help students understand biocompatibility & toxicological screening of biomaterials

MODULE I INTRODUCTION TO BIOMATERIALS 8

Introduction: Definition of biomaterials, requirements & classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Surface properties of materials, physical properties of materials, mechanical properties - Materials for biophotonic applications.

MODULE II IMPLANT MATERIALS 10

Metallic implants: Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion-ceramic implants: bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics - Polymer implants: Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin.

MODULE III BIOCOMPATIBILITY AND TOXICOLOGICAL SCREENING OF BIOMATERIALS 6

Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ-implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

MODULE IV PRACTICAL ASPECTS OF BIOMATERIALS 6

Preparation of biomaterials - Microscopic study & analysis of different biomaterials- alginate – material preparation and characterization - Testing of various biomaterials- case studies on industrial and clinical applications of biomaterials.

L – 30; Total Hours –30

TEXT BOOKS:

1. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill, 2003
2. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and KratiJain. Implant biomaterials: A comprehensive review, World Journal of Clinical Cases, 2015.

REFERENCES:

1. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, Introduction to Biomedical Engineering, Elsevier, 2005.
2. Park J.B., Biomaterials Science and Engineering, Plenum Press, 2007.
3. A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran,Woodhead Medical Textiles and Biomaterials for Healthcare, Publishing Limited 2006.
4. D F Williams, Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume, VCH Publishers 1992.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: differentiate common use of biomaterials as metals, ceramics, polymers and apply them to classify its chemical structure, properties and morphology.

CO2: comprehend ideas involving general properties of implant materials and apply the same to identify the benefits of implant materials.

CO3: attain knowledge about the biocompatibility & toxicological screening of biomaterials and realize its usage in real life.

CO4: reflect upon the practical ideas of using biomaterials

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	M	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	L	L	M	M	M	L	L	L	M	-	-	-
CO3	M	L	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	M	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 04	OPTICAL FIBRE COMMUNICATION	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1:To facilitate the knowledge about optical fibres and its transmission characteristics.

COB2:To make the students to learn about LED and laser diodes.

COB3:To make the students understand the various types of optical receivers and sensors.

COB4:To enrich the knowledge on optical amplifiers and networks.

MODULE I INTRODUCTION TO OPTICAL FIBRES 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers.

MODULE II FIBER OPTICAL SOURCES 7

Light Emitting Diodes (LED) – power and efficiency - double hetero LED – LED structure - LED characteristics – Semiconductor Lasers diode, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers - applications.

MODULE III FIBER OPTICAL RECEIVERS AND SENSORS 8

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film solar cells, amorphous silicon solar cells - Fiber optic sensors: Intrinsic and Extrinsic sensors, amplitude, phase, wavelength and polarization modulation.

MODULE IV OPTICAL AMPLIFIERS AND NETWORKS 8

Optical amplifiers, Semiconductor optical amplifiers, Erbium-doped fiber amplifiers - Optical Networks: Basic networks, SONET/SDH, WDM Networks, Nonlinear effects on network performance, Performance of WDM + EDFA systems, Solitons, Optical CDMA, Ultrahigh capacity networks.

L – 30; Total Hours –30

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communication, 3rd Edition, McGraw-Hill International, Singapore, 2013.

REFERENCES:

1. Govind P. Agrawal, Fiber-Optic Communication Systems (Wiley Series in Microwave and Optical Engineering) , Wiley 4th Edition, 2010.
2. J. Senior, Optical Communication, Principles and Practice, Prentice Hall of India, 3rd Edition, 2010.
3. D. C. Agrawal, Fiber Optic Communication, S.Chand& Co Ltd., 2005.
4. Rajiv Ramaswami, KumarSivarajan, Galen Sasaki, Optical Networks: A Practical Perspective, 3rd Edition, Morgan Kaufmann, 2009.
5. B. Culshaw, Optical Fiber Sensing and Signal Processing, Peter Peregrinus Ltd, 2014.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1:realize basics of optical fiber and differentiate various modes and configurations.

CO2:understand and assimilate the working principle of LED and Diode Laser.

CO3:select suitable photodetectors/sensors for different types of applications.

CO4:analyze the mechanism of optical amplifiers and analyze optical networks.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 05	SEMICONDUCTOR PHYSICS FOR INFORMATION TECHNOLOGY	L	T	P	C
		2	0	0	2

SDG: 4

COURSE OBJECTIVES:

COB1: To study about electronic states of semiconductors.

COB2: To understand the physics of semiconductor devices

COB3: To gain knowledge on various methods involved in nanofabrication of semiconductor devices

COB4: To study the working principle of optoelectronic devices and various display devices

MODULE I ELECTRONIC STATES OF SEMICONDUCTORS 8

Energy bands in solids – Dynamics of electrons in periodic potential: Kronig – Penny model – Direct and Indirect Bandgaps – Brillouin Zone – Energy band structure in semiconductors (ZnO, GaAs) – concept of effective mass of electron and concept of holes.

MODULE II INTRODUCTION TO SEMICONDUCTOR DEVICES 6

Semiconductors: N and P type (Qualitative), PN junction diode under forward and reverse bias –– Zener diode, Schottky diode – Tunnel diode –bipolar junction transistor (BJT) - metal–oxide–semiconductor field-effect transistor (MOSFET), CMOS.

MODULE III DEPOSITION TECHNIQUES OF SEMICONDUCTING MATERIALS 6

Deposition of Semiconductor thin films – molecular beam epitaxy (MBE), chemical vapour deposition (CVD), pulsed laser deposition (PLD),magnetron sputtering, Types of lithography: Photo/ultraviolet /Electron-beam/Focused ion beam, Dip pen nanolithography, Etching process :Dry and Wet etching

MODULE IV OPTOELECTRONIC DEVICES 10

Light Emitting Diodes (LED) - double hetero LED structure - LED characteristics - White LED – Applications, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical detection – PIN and avalanche photodiodes, Luminescence, Cathode Luminescence, Electro Luminescence, Transparent Conductors, Liquid crystal displays – Dynamic scattering and Twisted nematic display, Charge-coupled devices (CCD)

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1) W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate(Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2) Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3) D. S. Dhaliwal et al., Prevail :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.

REFERENCES:

1. V.K. Mehta, Rohit Mehta, Principles of Electronics (Multicolour Edition) S. Chand Publishers, 10th Rev. Edn. 2006 Edition
2. Albert Malvino, David J. Bates Electronic Principles (SIE), McGraw Hill, 7th Edition, 2017
3. U. Mishra, J. Singh, Semiconductor Device Physics and Design, Springer, 2014
4. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley Publishers, 3ed 2008.
5. Bhattacharya Pallab, Semiconductor Optoelectronic Devices, Second Edition, By Pearson 2017
6. Joseph A. Castellano, Handbook of Display Technology, Springer, 1992
7. Yoshio Nishi, Advances in Non-volatile Memory and Storage Technology, Elsevier 2014

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: study about electronic states of semiconductors.

CO2: understand the physics of semiconductor devices and identify its significance towards information technology (IT).

CO3: gain insight into various fabrication techniques towards the realization of nano-dimensional semiconductor devices.

CO4: attain knowledge on working principles of optoelectronic devices and display technologies and can recognize their importance in commercial applications.

Board of Studies (BoS) :

13th BoS of Physics held on 14.09.2023

Academic Council:

21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	M	M	M
CO2	M	L	M	H	L	M	H	M	L	L	L	M	M	M	M
CO3	L	M	H	H	L	H	M	M	L	H	L	M	M	M	M
CO4	M	L	H	M	L	M	M	H	L	M	L	M	M	M	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 : Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statemen t : The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 06 **SENSORS AND ACTUATORS** **L T P C**

SDG: 4 **2 0 0 2**

COURSE OBJECTIVES:

COB1:To understand the basic concept of measurements and sensors

COB2:To avail knowledge on variable resistance, capacitance and Inductance sensors.

COB3: To study about special sensors.

COB4: To get introduced towards MEMS technology and various actuators.

MODULE I INTRODUCTION TO MEASUREMENTS AND SENSORS 8

Sensors: functions – main technical requirement and trends, units and trends – calibration methods – classification of errors – error analysis – limiting error – probable error – propagation of error – odds and uncertainity – principle of transduction – classification: static and dynamic characteristics – mathematical model of transducers: zero, first and second order transducers.

MODULE II VARIABLE RESISTANCE, CAPACITANCE AND INDUCTANCE SENSORS 8

Characteristics and operation of resistive potentiometers – resistive pressure sensor – resistive position sensor - strain gauges: types, gauge factor calculation – resistive thermometer – thermistor Capacitive pressure sensor, Inductive sensor: Change in self-inductance with number of turns, change in self-inductance with change in permeability – inductive pressure transducer – inductive position transducer, LVDT – piezo resistive sensors.

MODULE III SPECIAL SENSORS 7

Photoconductors – optical detectors -photodiodes, phototransistors – charge coupled device (CCD) – Fabry Perot sensor - Hall effect – magneto resistive, magneto strictive sensors – microphones: resistive, capacitive, Fiber optic – thermocouple.

MODULE IV MICROSYSTEMS AND ACTUATORS 7

Microelectro-mechanical systems (MEMS), Micro fabrication and Applications, micro actuators– actuation principle, shape memory actuator: one way, two way and pseudo elasticity – types of micro actuators – electrostatic, inverse piezoelectric effect – Solid-state switches, relays Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Jacob Fraden, Hand Book of Modern Sensors: physics, Designs and Applications, 3rd edition, Springer, New York, 2015.
2. Jon. S. Wilson, Sensor Technology Hand Book, 1st edition, Elsevier, Netherland, 2011.
3. John G Webster, Measurement, Instrumentation and sensor Handbook, 2nd edition, CRC Press, Florida, 2014.

REFERENCES:

1. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate (Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2. Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3. D. S. Dhaliwal et al., PREVAIL :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.
4. Tai-Ran Hsu, MEMS & Microsystem, Design and Manufacture, 1st ed., McGraw Hill India, New Delhi, 2017.
5. MassoodTabibArar, Microactuators – Electrical, Magnetic Thermal, Optical, Mechanical, Chemical and Smart structures, 1st ed., Kluwer Academic publishers, New York, 2014.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: get exposed to the basics of measurements and sensors

CO2: familiarize towards variable inductance, capacitance and resistance sensors and recognize their importance in commercial applications.

CO3: gain knowledge about special sensors and their applications.

CO4:apply the ideas to conceptualize MEMS technology and different actuators in engineering field

Board of Studies (BoS) :	**Academic Council:**
13th BoS of Physics held on 14.09.2023	21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L	L	M	L	M	M	M	L	L	L	M	M	M	M
CO2	M	L	M	L	L	M	M	M	L	L	L	M	M	M	M
CO3	M	L	H	H	L	H	M	M	L	H	L	M	M	M	M
CO4	M	L	H	M	L	M	M	M	L	M	L	M	M	M	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 07 **FUNDAMENTALS OF NANOTECHNOLOGY AND ITS APPLICATIONS**

SDG: 4

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

COB1:To introduce the basic concepts of Nanoscience through quantum mechanical theories and solid state physics.

COB2: To provide knowledge about the various synthesis methods applicable to different nano materials

COB3: To enrich the knowledge of students in various characterisation techniques.

COB4:To provide knowledge on applications of polymer based nano materials in various fields.

MODULE I BASICS OF NANO SCIENCE 7

Introduction to Nanoscience & Nanotechnology : Review of classical mechanics – overview Quantum Mechanics. Background to nanoscience and nanotechnology - scientific revolutions - nanosized effects – surface to volume ratio – atomic structure – molecular and atomic size - quantum effects - formation of nano sized particles – energy at the nanoscale.

MODULE II SYNTHESIS OF NANOMATERIALS 8

Nanomaterial Fabrication: Bottom-up vs. top-down - Preparations of Nanomaterials by mechanical and physical methods : – High energy ball milling – melt quenching and annealing – vapour deposition – Pulsed laser deposition – Magnetron sputtering - Microwave plasma evaporation. Chemical Methods of Preparation : Sol-gel method –Electrodeposition – Electrospinning. Arc method for carbon nanotubes – nanofibres and rods – synthesis of Graphene- Handling of nano particles - Health hazards – Precautions.

MODULE III CHARACTERIZATION OF NANOMATERIALS 8

Characterisation of Nanomaterials: XRD – particle size determination - SEM - FESEM - TEM – AFM – Nanoindentor – UV-VIS spectroscopy – FTIR, FT-Raman, Photoluminescence, NMR, ESR - Dielectric characterization – Magnetic characterization.

MODULE IV APPLICATION OF NANO MATERIALS 7

Applications of Carbon based nanomaterials (CNT, CNF, Graphene) - Biosensor (principle, component, types, applications) - agriculture (nano-fertilizers, herbicides, nano-seed science, nano-pesticides) and food Systems (encapsulation of functional foods, nano-packaging) – Nano - electronics, Nano-optics.

L – 30; Total Hours –30

TEXT BOOKS:

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

REFERENCES:

1. Nanotechnology: basic science and emerging technologies by Mick Wilson, Kamali Kannangara, Geoff Smith, and Michelle Simmons, Chapman & Hall/CRC; I edition, 2002.
2. Handbook of NanoScience, Engineering and Technology by Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., CRC Press, 2012.
3. Nanocomposite Science and Technology by P. M. Ajayan, L. S. Schadler, P. V. Braun, WILEY-VCH Verlag GmbH, 2003.
4. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1:understand basic principles of nanomaterials and apply them todifferentiate the significance of nanomaterials compared to bulk materials.

CO2:familiarize the various synthesis methods of nanomaterials andcompare them with the preparation of materials in bulk form.

CO3:get useful ideas about characterization techniques and differentiatedifferent techniques.

CO4: understand the various applications of nanomaterilas and realize the role of nanomaterials in various fields

Board of Studies (BoS) :

BOS of Physics was held on 21.6.21

Academic Council:

17^{th} AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

HUMANITIES ELECTIVE – I
(SEMESTER III)

SSDX 01	**ENGINEERING ECONOMICS AND**	**L**	**T**	**P**	**C**
SDG: 4, 8, 9,12	**MANAGEMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To present the major concepts and techniques of engineering economic analysis that is needed in the decision making process by providing insights to the basic microeconomic concepts of demand, supply and equilibrium.

COB2: To generate theoretical knowledge and understanding of macroeconomic aggregates such as national income and inflation and the major challenges associated with the measurement of these aggregates.

COB3: To develop analytical and critical thinking skills on money, banking and public finance and use them to judge the appropriateness of economic development and policy options.

COB 4: To introduce the basic concepts of management and planning and highlight the contribution of planning to the attainment of organization's objectives.

COB 5: To apprise the students about important management concepts and create awareness about the corporate social responsibilities and ethical aspects.

MODULE I DEMAND AND SUPPLY ANALYSIS 9

Introduction to Engineering Economics – Engineering efficiency – Economic efficiency - Scope of Engineering Economics, Engineers' contributions to economic growth- Problem solving and decision making - Laws of Demand and Supply - Difference between Microeconomics and Macroeconomics - Equilibrium between Demand and Supply, Elasticity of Demand - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 8

Concepts of National Income and measurement – GDP Growth Rate - Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – Meaning of Inflation, its types causes and preventive measures.

MODULE III MONEY, BANKING AND PUBLIC FINANCE 10

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary Policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) – Economic Reforms in India – LPG Policy.

MODULE IV PRINCIPLES OF MANAGEMENT AND PLANNING 8

Nature of management and its process - Importance of Management-Functions and Principles of Management - Nature, Purpose and Kinds of Planning.

MODULE V ENGINEERING MANAGEMENT 10

Strategic Management-Manager and Environment - Globalization and Technology Intermediation, Corporate Social Responsibility of business - meaning, importance, arguments for and against Corporate Social Responsibility - Business Ethics- Role of Ethics in Engineering Practice-meaning, importance - State intervention in business - Pros and Cons of intervention.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Krugman, P, Wells, R, and Graddy, K., “Essentials of Economics”, Worth Publishers, 4th Edition, New York, 2016.
2. Hussain, Moon Moon, “Economics for Engineers”, Himalaya Publishing House, 1st Edition, New Delhi, India, 2015.

REFERENCES:

9. Andrew Gillespie, “Foundations of Economics”, OUP Oxford, England, 2007.
10. Acemoglu, D., Laibson, D., & List, J., “Microeconomics”, Pearson Education, 2nd Edition, Boston, 2017.
11. Brinkman John , “Unlocking the Business Environment”, Routledge, 1st Edition, London, United Kingdom, 2010.(ISBN 9780340942079)
12. Cleaver Tony, “Economics: The Basics”, Routledge, 3rd Edition, London, United Kingdom, 2014.
13. H. L. Ahuja, “Macroeconomics”, S Chand Publishing; Twenty Edition, New Delhi, India, 2019.

14. Koutsoyiannis A, “Modern Microeconomics”, Palgrave Macmillan, 2nd Edition, U.K, 2003.
15. R.A. Musgrave and P.B. Musgrave, “Public Finance in Theory and Practice” , McGraw Hill Education India, Fifth Edition, India, 2017.
16. Mell Andrew and Walker Oliver, “The Rough Guide to Economics”, Rough Guide Ltd, 1st Edition, London, 2014.
17. R. Paneerselvam, “Engineering Economics”, PHI Publication, 2nd Edition, New Delhi, India, 2014.
18. Robbins S.P. Decenzo David A and Coulter, “Fundamentals of Management: Essential Concepts and Applications”, Pearson Education, 9th Edition, London, England, 2014.

COURSE OUTCOMES: On successful completion of this course, students will be able to

CO1: Interpret the forces driving demand and supply and their impact on market conditions.

CO2: Demonstrate various dimensions of macroeconomic variables like national income, money supply, employment, etc. in analyzing the effects on business.

CO3: Explicate the different aspect of Governmental activities and their rationality and describe how they can be pursued through fiscal and monetary policy.

CO4: Develop skills to plan, organize, direct and control the resources of the organization for obtaining common objectives or goals.

CO5: Augment managerial skills and adopt ethical practices in various functional areas and engineering practices.

Board of Studies (BOS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic Council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1	H	H	M		H	H				H	H	H
CO2	H	M			M					H	H	H
CO3		M	M		H	H		H			H	
CO4					M	H	H	M		M	H	
CO5					M	H	H	M		M	H	

Note: L- Low Correlation   M - Medium Correlation   H - High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all.
SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.
SDG 12: Ensure sustainable consumption and production patterns.

Inclusive and equitable quality education can make a critical difference to production patterns, consumer understanding of more sustainably produced goods, promote inclusive and sustainable economic growth along with productive employment and decent work for all.

SSDX 02	**SOCIOLOGY OF SCIENCE AND TECHNOLOGY**	**L**	**T**	**P**	**C**
SDG: 17		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To recognize and define the basic concepts of society and the ways in which sociologists use these concepts in constructing explanations for individual and group problems.

COB2: To illustrate the convergence and divergence of sociology with engineering subjects in terms of the subject matter, nature and scope of the discipline and its approach.

COB3: To demonstrate the relationship between science, technology and society.

COB4: To understand the issues relating to science, technology and change in India both in the historical and globalization contexts.

COB5: To appraise the impact of science and technology on different socio-cultural institutions and processes.

MODULE I INTRODUCTION 8

Sociology - Definition, scope and importance, relationship with other social sciences - Major theoretical perspectives: Functionalism, Conflict Theorizing and Interactionism - Elements of social formation - Society, Community, Groups and Association - Institutions, family and kinship, religion, education, politics - Social process - Associative Social Process - Co-operation, Accommodation and Assimilation - Dissociative Social Process - Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 9

Culture - characteristics, functions, types, cultural lag and civilization - Socialization – process, stages, agencies and anticipatory socialization - Social Control - characteristics, importance, types and agencies - Social stratification. - Meaning, forms - caste and class.

MODULE III SCIENCE, TECHNOLOGY AND SOCIETY 9

Relationship between society and science and vice-versa - Science as a social system - Norms of science - Relationship between science and technology - History of modern science in India – colonial–independence and post-independence science - Science education in contemporary India – primary level to research level - Performance of universities in the development of technology - Interrelationship between industry and universities.

MODULE IV SCIENCE, TECHNOLOGY AND SOCIAL ISSUES 10

Technology, media, identity and global society - Conformity and deviance and role of science and technology - Technology and development issue - S&T and sustainable development - Role of science and technology in the creation of environmental crisis - Social inequality, social exclusion and digital divide - Science, technology and ethical issues -Gender and technology.

MODULE V GLOBALIZATION, SCIENCE, TECHNOLOGY AND CHANGE 9

Social Change - nature, direction, forms - Technology and rate of social change – Globalization - characteristics, historical and social context- Social consequences of science and technology on civil society - Globalization - Liberalization - Their impact on Indian science and technology - WTO and issues related to intellectual property rights - MNCs and Indian industry.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Giddens A. “Sociology” Wiley India Pvt. Ltd 2017.
2. Heald Haralambos, R.M “Sociology Themes and Perspectives”, Oxford, New Delhi-92. 2014
3. Sergio Sismondo. An Introduction to Science and Technology Studies Malden: Wiley Blackwell.2010
4. R.K. Merton, Sociology of Science, Theoretical and Empirical Investigations, University of Chicago Press, 1973.

REFERENCES:

1. Atal Yogesh, “Changing Indian Society” Rawat Publications, Jaipur, 2006.
2. Bilton, T. et al “Introductory Sociology”, Palgrave, New York. 2002
3. Das Gupta, Samir and ‘‘An Introduction to Sociology”, Pearson, Delhi. 2012.
4. Francis Abraham M. “Contemporary Sociology: An Introduction to Concepts and Theories”**,** New Delhi, Oxford University Press. 2014
5. Inkless, A, “What is Sociology”, Prentice Hall, New Delhi. 1987
6. Tumin, Melvin M “Social Stratification”, Prentice Hall, New Delhi. 1969.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO1: Recognize the fundamental tenets of Sociology.

CO2: Interpret the relationship between individual and society in a sociological perspective.

CO3: Categorize and constructively identify their own assumptions about the relationships among society, science and technology

CO4: Appraise the dynamics of human society with special reference to the science, technology and contemporary trends of globalization.

CO5: Able to link and reflect on current and ongoing sociological debates on development and role of technology.

Board of Studies (BOS) :
5th BoS of SSSH held on 29.12.2021

Academic Council:
18th Academic Council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			H			H	H	M	L	H	L	
CO2			M			H	H	M	H	H	M	L
CO3			H	M	H	H	M		M	H	H	M
CO4			M			H	H	L	L	M	H	H
CO5			M			H				M		L

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

To inculcate knowledge and socialize youth in building participation, institutions and partnership for inclusive development for the implementation of sustainable development goals.

		L	T	P	C
SSDX 03	**INDUSTRIAL ECONOMICS AND MANAGEMENT**	**L**	**T**	**P**	**C**
SDG: 8 and 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide a wholesome idea about the concept of industrial economics and identify the classifications of firms based on ownership and control.

COB2: To impart theoretical and analytical knowledge on the different market structures, pricing practices and government policies.

COB3: To equip the students with the framework that will be useful for applying economic models in business strategy, competition policy and regulations.

COB4: To understand the importance of Industrial Policy in the development of Industries in India.

COB5: To elucidate industrial growth in India by examining its performance and problems in industrial sector.

MODULE I INTRODUCTION TO INDUSTRIAL ECONOMICS 9

Definition and scope of industrial economics - Concept and importance of industry; Concept and organization of a firm - Classification of firms based on ownership - sector (industries, formal vs. Informal) - size and use - based classification - Separation of ownership and control - Localization of industries .

MODULE II MARKET STRUCTURE 9

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot Kinked Demand and Price Leadership – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing.

MODULE III PRODUCTION ECONOMICS AND THEORY OF FIRM 9

Production and Production function – Types, Factor Inputs – Input-Output Analysis**,** Undifferentiated Products - Cournot, Stackelberg, Dominant firm model, Bertrand-Heterogeneous products - Chamberlin’s small and large number case - Kinked demand curve theory - Bain’s limit pricing – Production Possibility Frontier.

9

MODULE IV INDUSTRIAL POLICY

Industrial Policy: Industrial Policy in India -1948, 1956, 1977, 1980, 1990, 1991 - Industrial Performance after Independence.

MODULE V INDUSTRIAL GROWTH IN INDIA 9

Trends and prospects - Public enterprises; efficiency - Productivity and performance constrain - Small scale industries: definition, role - Policy issues and performance - Capacity utilization - Industrial sickness and Exit - Technology transfer - Privatization.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Barthwal R R “Industrial Economics: An Introductory Textbook”, New Age International Pvt. Ltd Publishers, 2017
2. P.J. Devine, N. Lee, R.M. Jones, W.J. Tyson, “An Introduction to Industrial Economics”, Routledge.2019.

REFERENCES:

1. Ferguson, Paul R. and Glenys J. Ferguson, “Industrial Economics - Issues and Perspectives”, Macmillan, London. 1994
2. Gregory Mankiw “Principles of Microeconomics”, Havcourt Asia Publishers, 2001.
3. Mohanty Binode Ed. “Economic Development Perspectives”, Vol. 3, Public Enterprises and Performance, Common Wealth Publishers, New Delhi, 1991
4. Mote and Paul “Managerial Economics, Tata McGraw Hill, 2001
5. Peterson and Lewis “Managerial Economics”, 4th Ed., Prentice Hall, 2004.

COURSE OUTCOMES:

CO1: Develop knowledge on the concept and organization of firms and the implications of the separation of ownership and control.

CO2: Acquire familiarity with various market structures and formulate appropriate pricing strategies.

CO3: Think analytically using various economic models concerning market structures and apply them to the real world of industry.

CO4: To compare the various Industrial Policies introduced in India and recognize the role of these policies in making required industrial development in India.

CO5: Clearly diagnose and illustrate the challenges in industrial economy in India and develop effective and comprehensive solution on them.

Board of Studies (BoS) :

5thBoS of SSSH held on 29.12.2021

Academic Council:

18th Academic Council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			H	M			H		M		M	L
CO2			H		M		H		M		M	L
CO3			H				H		M		M	M
CO4			H				H		M		H	M
CO5			H				H		M		H	M

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.

A comprehensive and holistic approach towards the way for sustainable development and economic growth through the inclusive economic strategy and thereby to reduce the poverty, hunger among people by familiarizing them industry and its importance as survival strategy for earning decent standard of living.

SSDX 04	**DYNAMICS OF INDIAN SOCIAL STRUCTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

SDG: 10, 16

COURSE OBJECTIVES:

COB1: To provide knowledge on the components of the Indian social structure.

COB2: To learn the nature and contemporary structure of Indian social institutions.

COB3: To sensitize students about social stratification in Indian Society.

COB4: To create awareness about the social problems occurring in contemporary India.

COB5: To explicate the changing institutions, the processes, the agents and the interventions that brings about change in the Indian society.

MODULE I INDIAN SOCIAL STRUCTURE 9

Demographic composition - Racial, religious, ethnic and linguistic -Types of communities - rural, urban, agrarian and tribal - Social backwardness - OBC, SC, ST and EWS - Indian minorities- religious, ethnic, linguistic and LGBT.

MODULE II INDIAN SOCIAL INSTITUTIONS 9

Family - types, characteristics, functions of family - Joint Family- definition features, functions of joint family , dysfunctions of joint family, disintegration of joint family – Marriage - definition, characteristics, marriage as sacrament or contract.

MODULE III SOCIAL STRATIFICATION IN INDIA 9

Social stratification - Concept of hierarchy - inequality, meaning and characteristics - Social Stratification and Social Mobility - Functions of Social Stratification - Caste, definition, principles, contemporary changes, dominant caste, caste - Class interface - Religious minorities.

MODULE IV SOCIAL PATHOLOGY 9

Social Problem - nature, social disorganization - Population explosion- causes, effects, relationship with development - Child Labour- causes, magnitude and consequences – Unemployment - nature, types, causes and effects - Gender issues - social status of women, violence against women and women in work place - Contemporary issues - communalism, terrorism and corruption.

MODULE V SOCIAL CHANGE IN INDIA 9

Socio-cultural change - Sanskritization – Westernization - Secularization, Modernization - Processes of Social change - Industrialization – Urbanization – Globalization - Social movement - concept, characteristics, functions - New social movement-Women and Environment movement.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Sharma,K.L., "Indian Social Structure and Change", Jaipur: Rawat Publications, 2008.
2. Ahuja Ram., "Social Problems in India", Rawat Publication: New Delhi, 2014.
3. Ahuja Ram., "Society in India", Rawat Publication: New Delhi, 2014.

REFERENCES:

1. Atal Yogesh, "Changing Indian Society" Rawat Publications, Jaipur, 2006.
2. Dube S.C., "India's Changing Villages: Human Factors in Community Development", London, Routledge and Kegan Paul, 2003.
3. Hasnain N., "Indian Society: Themes and Social Issues", Mc Graw Hill, 2019.
4. Jayapalan, N., "Indian Society and Social Institutions" Atlantic Publishers, 2001.
5. Pandey Vinita., "Indian Society and Culture", Rawat Publications, New Delhi, 2016
6. Rao Sankar., "Sociology of Indian Society", S.Chand Publisher, New Delhi, 2004.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO1: explain about the social structure and social institutions that constitute society in India.

CO2: differentiate the various categories of inequalities and their challenges.

CO3: describe the social stratification and its impact in society.

CO4: analyze the social problems encountered in contemporary India.

CO5: Correlate the various forms and trends of the social change in Indian society and realize the relevance of their role in bringing about development.

Board of Studies (BoS) :

5th BoS of SSSH held on 29.12.2021

Academic Council:

18th Academic Council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			H			H	M			M		
CO2			M			M	H	L				H
CO3			M			M	H	L				H
CO4			H			H	H		M			M
CO5			H		H	M	H	M		H		H

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 10: Reduce inequality within and among countries.

SDG16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

To sensitize and impart pertinent knowledge to youths to combat the contemporary issues and challenges facing Indian society in order to remedy its social pathos and injustices in the path of achieving sustainable development in India.

Humanities Elective – II
(To be offered in VI Semester)

SSDX 11	ECONOMICS OF SUSTAINABLE DEVELOPMENT	L	T	P	C
		2	0	0	2

SDG: 1-17

COURSE OBJECTIVES:

COB1: To inculcate the knowledge base on sustainable development with a view to balance our economic, environmental and social needs, allowing prosperity for now and future generations.
COB2: To develop a capacity to undertake a theoretically grounded analysis of environment issues and identify and describe what the United Nations and other governing bodies are doing to assist in a more sustainable world.
COB3: To have an insight of the emerging debate about reconciling ecological sustainability with poverty alleviation in the context of globalization and development.
COB4: To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 8

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components – Sustainable Development Goals – Quality education, Gender equality, innovation and infrastructure, peace and justice - Sustainable engineering practices.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 6

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.
International responses to environmental challenges - Global policy such as Kyoto Protocol, Paris Agreement, Montreal Protocol, Basel Convention.
Community Participation in Sustainable Development, Common Property Resource Management, Innovation, Industry and Sustainable Development.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 7

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability - Globalization and Global Governance.

Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 9

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.

Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L –30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, "An Introduction to Sustainable Development", Glen Educational Foundation, 1st Edition, England, UK, 2008.

2. Sayer, J. and Campbell, B, "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.

REFERENCES:

1. Anderson, David A, "Environmental Economics and Natural Resource Management", Routledge, 3rd edition, England, UK, 2010.
2. Berck, P., "The Economics of the Environment", New Delhi: Pearson India, 2015.
3. Karpagam M, "Environmental Economics: A Textbook.pdf", Sterling Publishers Pvt. Ltd, New Delhi, 2021.
4. Kumar, Pushpam, "Economics of the Environment and Development",Ane Book Publication, New Delhi, India, 2009.
5. Karpagam M and Jaikumar Geetha, "Green Management Theory and Applications", Ane Books Pvt. Ltd, New Delhi, India, 2010.
6. Sengupta Ramprasad, "Ecology and Economics: An Approach to Sustainable Development", Oxford University Press, New Delhi, 2004.

7. Muthukrishna, S, “Economics of Environment”, PHI Learning Pvt. Ltd., New Delhi, India, 2010.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO1: Develop awareness of the ethical, economic, social and political dimensions that influence sustainable development.

CO2: Clearly articulate their views and beliefs with regards to environmental issues.

CO3: Identify and describe the major economic forces that shape our approach to the environment issues and demonstrate responsible globalization through global governance.

CO4: Account for strategies, international agreements and major policy instruments for a sustainable use of resources and ecosystem services.

Board of Studies (BoS) :
4th BoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1		H	H		H	H	H		H		H	H
CO2			H			H	H		H		H	H
CO3	M	M	H			H	H		H		H	H
CO4			H			H	H	H	H		H	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 1: End poverty in all forms and everywhere.

SDG 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

SDG 3: Ensure healthy lives and promote well-being for all at all ages

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 5: Achieve gender equality and empower all women and girls

SDG 6: Ensure availability and sustainable management of water and sanitation for all.

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

SDG 10: Reduce income inequality within and among countries

SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.

SDG 12: Ensure sustainable consumption and production patterns

SDG 13: Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.

SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The holistic understanding of all the 17 SDGs aims to end poverty, ensure prosperity, and protect the planet.

SSDX 12	SOCIOLOGY OF INDUSTRIAL RELATION	L	T	P	C
		2	0	0	2

SDG: 8, 9

COURSE OBJECTIVES:

COB1: To familiarize sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.

COB2: To highlight the structure and functions of industrial organizations

COB3: To explicate the dynamics of organizational behavior, leadership and communication.

COB4: To provide an overview in labour legislation and labour welfare

MODULE I INTRODUCTION 7

Sociology of Industrial relation - definition, scope and importance - Theoretical approaches- scientific management, human relations approach, theory of bureaucracy- Fordism and post-fordism - Production system- concept and characteristics of factory system - automation and rationalization -The Industrial Employment (Standing Orders) Act, 1946 Industrial conflict-strike, lockout and trade unions- Emerging role of trade unions in India.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility - Informal organization- definition, characteristics, types and relevance - Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction- Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 7

Group dynamics- Definition, Group behaviour model - Group decision making process, group cohesiveness - Leadership- definitions, style and effective supervision- Communication- concepts, types, model barriers - Job satisfaction- nature, employee compensation and job satisfaction. Grievance Handling and Disciplinary Action, Code of Conduct, Industrial Relations in changing scenario, Employers' organisations.

MODULE IV LABOUR LEGISLATION AND LABOUR WELFARE 9

Labour Legislation-Objectives, Principles, Classification and Evolution. International Labour Organisation. Social Justice and Labour Legislation, Indian Constitution and Labour Laws- The Factories Act, 1948, The Inter-state Migrant Workmen Act, 1979, The Contract Labour (Regulation and Abolition) Act, 1970, The Child Labour (Prohibition and Regulation) Act, 1986. Labour welfare-Concept, Scope, Types, and Principles, Industrial Health and Hygiene, Industrial Accidents and safety, Occupational Diseases. Social Security-Concept and Scope, Social Assistance and Social assurance.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Mamoria ,Gankar., “Dynamics of Industrial relations”, Himalaya Publishing House,Mumbai, 2007.
2. Narender Singh ., “Industrial Sociology”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
   Kumar., “Industrial Sociology”, Lakshmi Narain Agrawal Publishers, Agra, 2019.
3. SharmisthaBhattacharjee, “Industrial Sociology”, Aavishkar Publishers, Jaipur, 2016.

REFERENCES:

1. Bhatnagar M., “Industrial Sociology”,S. Chand Publications, New Delhi, 2012.
2. MisraRajan., “Industrial Sociology”, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.), New Delhi, 2013.
3. Newstorm W John, “Organizational Behavior”, Mc. Graw Hill Publishing Co., New Delhi, 2006.
4. Nina, Bandlej (ed)., “Economic Sociology of Work”, Bingley: Emerald Group Publishing Ltd, 2009.
5. Richard Brown, John Child, S.R. Parker, “The Sociology of Industry”, Routledge Publisher, 2015.
6. Sushil Kumar Saxena, Satish Mittal, “Industrial Sociology”,Common Wealth Publishers, 2012.
7. Watson, Tony, “Sociology, Work and Industry (5th edition), Oxon: Routledge, 2008.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the sociological perspectives for dealing with social relationships in production and service organizations.
CO2: Have deeper knowledge in structure of authority, roles and responsibility in organizational settings.
CO3: Assess the role of leadership, communication and behavioral acumen to govern the organization.
CO4: Describe the importance of labour legislation and labour welfare

Board of Studies (BoS) :
4th BoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H						M	H		M
CO2						M	L	M	M		H	M
CO3			M			M		M	H	H	H	M
CO4						H						H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

The holistic understanding of industrial relations leads to equal access to opportunity, and equal pay for work of equal value for male and female contributions is necessary for gender equality as well as for inclusive economic growth. Explore work opportunities, understand career processes and appreciate the meaning and purpose of work in people’s lives which leads to decent work and safe working practices.

SSDX 13	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		2	0	0	2

SDG: 8

COURSE OBJECTIVES:

COB1: To render basic insights and inputs to the students to inculcate human values to grow as responsible human beings with a proper personality.

COB2: To create awareness on senses of engineering ethics.

COB3: To inculcate knowledge and exposure on safety and risk, risks benefit analysis and professional rights.

COB4: To instill social values and loyalty and to appreciate the rights of others.

MODULE I HUMAN VALUES 7

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

MODULE II ENGINEERING ETHICS 7

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - Theories about right action - Self-interest - Customs and Religion - Uses of ethical theories - Valuing Time – Co-operation – Commitment.

MODULE III SAFETY, RESPONSIBILITIES AND RIGHTS 8

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

MODULE IV CONTEMPORARY ISSUES 8

Globalisation-Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Ethics-Ethics and codes of business conduct in MNC.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S., “Engineering Ethics”, Prentice Hall of India, New Delhi, 2019.
2. Kiran. D R, “Professional Ethics and Human Values”, Mc Graw Hill Publishers,New Delhi, 2013.
3. Naagarazan R.S., “Professional Ethics and Human Values”, New Age International Publishers, New Delhi, 2006.
4. R Sangal, RR Gaur and G P Bagaria, “Foundational Course in Human Values & Professional Ethics”, Excel Books, India, 2010.

REFERENCES:

1. Charles D. Fleddermann , “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S.Protchard and Michael J Rabins., “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000.
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
6. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York, 2010.
7. Subramanian. R,“Professional Ethics - Includes Human Values”, Oxford HED Publishers, 2017.\

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Apply moral and ethical values scrupulously that ought to guide the engineering profession.

CO2: Understand the ethical issues related to engineering aspects.

CO3: Assess safety and risk and execute risk benefit analysis.

CO4: Become responsible engineers, experimenters, researchers or businessmen.

Board of Studies (BoS) :
4^{th}BoS of SSSH held on 28.06.2021

Academic Council:
17^{th} AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H				H	H				M
CO2			M			M		H		H	M	
CO3			M		M	H		H				H
CO4			L				H	H	H		M	M

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Holistic understanding of professional ethics explores work opportunities, understand career processes and appreciate the meaning and purpose of work in people's lives leading to a decent work and safe working practices and environments.

SSDX 14	GENDER, TECHNOLOGY AND DEVELOPMENT	L	T	P	C
		2	0	0	2

SDG: 8

COURSE OBJECTIVES:

COB1: To conceptualize what is gender and sex and draw a line of distinction between the two.

COB2: To develop students' sensibility to the difference in gender roles, responsibilities, rights and injustice.

COB3: To reflect critically on the ways in which new technologies have sharpened and/or blurred gender difference.

COB4: To develop an insight to the gender and development with the paradigm shift from time to time.

MODULE I UNDERSTANDING GENDER 7

Basic Concepts: Sex/Gender, Gender roles, Gender socialization, - Construction of Gender- Making Women, Making Men Gender stereotyping, Femininity and Masculinity, Patriarchy, Heteronormativity, LGBTIQ - Theoretical Background to gender and feminist thinking: Liberal, Radical, Marxist, Socialist, Post-modern Feminism.

MODULE II GENDER ROLES AND GENDER INJUSTICE 7

Gender Roles and Relations-Types of Gender Roles Gender Roles and Relationships Matrix. Health conditions, Sex Ratio, Education: Literacy & Gender Bias - Work Related Issues: Existing Prejudices, gender Related Violence, Gender Discrimination - Political participation: Lack of women's representation - Economic Conditions- Social Conditions: divorce, rape, domestic violence.

MODULE III GENDER, TECHNOLOGY AND CHANGE 8

A historical perspective – Technology as masculine culture – Household technology – medical technology: New Reproductive technologies – Impact of Technological Change on Women. The Digital Divide: Unequal Access, Unequal Effects – Outcome and impact of ICT's Policies and projects for women. How gender influences technologies and the social organization of scientific and technical workspaces.

MODULE IV GENDER AND DEVELOPMENT 8

Gender, Governance and Sustainable Development - Women's role in Development - Women in Development (WID), Women and Development

(WAD) - Gender and Development (GAD); Gender Mainstreaming and Gender Budgeting - Gender and Human Rights.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Bhasin, Kamala., "Understanding Gender", New Delhi: Kali for Women, 2000.
2. John, Mary E., "Gender and Development in India, 1970-90's: Some reflections on the constitutive role of context' Chaudhuri, Maitrayee. (ed.) Feminism in India", New Delhi: Kali for women. pp. 246-258, 2004.
3. Menon, Nivedita, "Embodying the Self: Feminism, Sexual Violence and the Law" in Partha Chatterjee and Pradeep Jeganathan (ed)- Subaltern Studies XI: Community, Gender and Violence", Permanent Black and Ravi Dayal, 2000.
4. Gender and Technology: A reader ., Edited by Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, John Hopkins University Press, Baltimore , 2003.

REFERENCES:

1. Lourdes Beneria , GünseliBerik , Maria Floro .,"Gender, Development and Globalization: Economics as if All People Mattered", 2nd edition , Routledge, 2015.
2. Moser, Caroline, "Gender Planning and Development: Theory, Practice and Training", Routledge, 1993.
3. Rege, Sharmila., "Sociology of Gender: The Challenge of Feminist Sociological Knowledge", Sage publications: New Delhi, 2003.
4. Jain S.C., Women and Technology, Rawat Publication, Jaipur Begh, 1985.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Distinguish important concepts related to gender in contemporary society.

CO2: Interpret the gender discrimination works in our society and how to counter it.

CO3: Illustrate how the intersection of gender and technology involves gender shaping technology and technology shaping gender.

CO4: Apply gender sensitive perspective on development and human rights.

Board of Studies (BoS) :
4th BoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H			H	H		H		H	L
CO2			H			H	M			H		L
CO3			H			H	H	H			M	H
CO4			H			H	H		H			H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 5: Achieve gender equality and empower all women and girls

To imbibe gender concern and gender perspective in the invention, and application of technology, planning and designing production and innovating strategies for engendering gender equality.

MATHEMATICS ELECTIVE
(SEMESTER III)

		L	T	P	C
MADX 01	**TRANSFORMS AND PARTIAL**	**L**	**T**	**P**	**C**
SDG: 4	**DIFFERENTIAL EQUATIONS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To formulate and solve partial differential equations of first, second and higher orders

COB2: To introduce basics and engineering applications of Fourier series

COB3: To develop Fourier transform techniques

COB4: To introduce analytic solutions of PDEs by using Fourier series

COB5: To acquaint with Z -Transform techniques for discrete time systems

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 9+3

Fourier Series and Dirichlet's conditions - General Fourier series – Even and Odd functions - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 9+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES 9+3

Applications of Fourier series to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete and point Spectrum and Single pulse.

MODULE V Z – TRANSFORM 9+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution

Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1 Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011.
2. Grewal B.S., “Higher Engineering Mathematics”, 44th edition, Khanna Publishers, New Delhi, 2017.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2010.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: form and solve the partial differential equations using different methods

CO2: derive a Fourier series of a given periodic function by evaluating Fourier coefficients

CO3: apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms

CO4: solve partial differential equations by using Fourier series

CO5: solve difference equations using Z-transform

Board of Studies (BoS) :

12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	M														
CO 2	M														
CO 3	H														
CO 4	M														
CO 5	M														

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like matrices and calculus will lead to knowledge of applications in Computer Science

MADX 02	DISCRETE MATHEMATICS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To introduce logical and mathematical ability to deal with abstraction

COB2: To acquaint with the concepts of predicate calculus.

COB3: To introduce the notations and concepts used in set theory

COB4: To apply and use the terms function, domain, codomain, range, image, inverse image and composition

COB5: To introduce basic concepts from abstract algebra, especially the essential concepts in group theory

MODULE I PROPOSITIONAL CALCULUS 9+3

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 9+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III SET THEORY 9+3

Basic concepts –Notations-Subset –Algebra of sets –The power set – Ordered pairs and Cartesian product- Relations on sets – Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations –Partial ordering –Poset – Hasse diagram – Lattices and their properties– Boolean algebra – Homomorphism.

MODULE IV FUNCTIONS 9+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE V ALGEBRAIC SYSTEMS 9+3

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

L – 45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.
2. Kenneth H.Rosen, "Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

REFERENCES:

1. Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. C.L.Liu, D.P.Mohapatra, "Elements of Discrete Mathematics", 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: Form truth tables and write principal normal forms

CO2: Write the negation of a quantified statement involving either one or two quantifiers.

CO3: Prove that a proposed statement involving sets is true, or give a counterexample to show that it is false.

CO4: Compute the connection between bijective functions and inverses. Be able to find the inverse of an invertible function.

CO5: Give intrinsic structure of groups both abstract and specific examples illustrating the mathematical concepts involved.

Board of Studies (BoS) :

12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	M														
CO 2	M														
CO 3	H														
CO 4	M														
CO 5	M														

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques will lead to knowledge of applications in Communication Engineering

MADX 03	PROBABLITY AND STATISTICS	L	T	P	C
SDG:4		3	1	0	4

COURSE OBJECTIVES:

COB1: To impart knowledge on the basic concepts of probability

COB2: To understand random variables and distribution functions

COB3: To acquaint with joint density function and generating functions

COB4: To introduce sampling techniques and estimation

COB5: To perform hypothesis testing and draw inference

MODULE I PROBABILITY 9+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II RANDOM VARIABLE AND DISTRIBUTION FUNCTIONS 9+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables- Generating functions.

MODULE IV SAMPLING AND ESTIMATION 9+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 9+3

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. T.Veerarajan, "Probability and Statistics", Tata McGraw-Hill New Delhi, 2008.

2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, New Jersey 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons 2015

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier 2016
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons New Delhi 2012
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, New Delhi 2007

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: Do problems on probability, Baye’s theorem and descriptive statistics.

CO2: Evaluate moment generating functions and calculate probabilities using distributions.

CO3: Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables

CO4: Classify random samplings and calculate point and interval estimates

CO5: : Make an informed decision, based on the results of inferential procedures

Board of Studies (BoS) :

12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	M	L													
CO 2	M	L													
CO 3	M	L													
CO 4	M	L		M											
CO 5	H	L		M											

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all

Learning of various statistical methods will lead to knowledge of applications in Electronics and communication Engineering

MADX 04 **RANDOM PROCESSES** **L T P C**

SDG: 9 **3 1 0 4**

COURSE OBJECTIVES:

COB1: To acquire knowledge of the theory of probability, Baye's theorem and Tchebechev inequality

COB2: To understand random variables and discrete and continuous probability distributions

COB3: To demonstrate the techniques of two dimensional random variables and its distributions

COB4: To introduce the random process, stationary, Markov process and the study of correlation functions

COB5: To study spectral analysis and Weiner-Khinchine theorem

MODULE I PROBABILITY 9+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II RANDOM VARIABLES AND ROBABILITY DISTRIBUTIONS 9+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 9+3

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities-Autocorrelation function and its properties - Cross Correlation function and its properties.

MODULE V SPECTRAL DENSITY 9+3

Linear system with random inputs – Ergodicity-Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse

Response of the System – Weiner-Khinchine Theorem - Cross Power Density Spectrum.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, New Delhi, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, New Delhi,2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, John Wiley & Sons, New Jersey 2007

REFERENCES:

1. Scott L. Miller, Donald G. Childers, Probability and Random Processes, Academic Press, London,2009.
2. Trivedi K S, “Probability and Statistics with reliability, Queueing and Computer Science Applications”, Prentice Hall of India, 2nd edition, New Delhi, 200

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: evaluate probability, apply Baye’s theorem and calculate bounds using Tchebechev inequality

CO2: calculate probabilities and expected values for distributions

CO3: calculate probabilities and derive the marginal and conditional distributions of bivariate random variables

CO4: evaluate stationary process, compute correlation functions and related identities

CO5: compute power spectral density functions and apply Weiner-Khinchine theorem

Board of Studies (BoS) :

12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	H	L													
CO 2	M	L													
CO 3	M	L													
CO 4	H	M													
CO 5	H	M													

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 9 : Sustainable Industry, innovation and Infrastructure

Learning of various techniques in Random Processes will lead to knowledge required for applying in many projects.

MADX 05	NUMERICAL METHODS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To familiarize with the methods of solving equations numerically

COB2: To introduce interpolation techniques and finite difference concepts

COB3: To acquire knowledge on Numerical differentiation and integration

COB4: To solve ordinary differential equations numerically

COB5: To solve partial differential equations numerically

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 9+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 9+3

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods.

MODULE V BOUNDARY VALUE PROBLEMS FOR PDE 9+3

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation

L – 45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers, New Delhi, 2007.
2. Gerald C.F., P.O.Wheatley, “Applied Numerical Analysis”, Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, New York, 2006.
2. Jain M.K., S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003
3. Sastry.S.S,”Introductory Methods of Numerical Analysis”,Fifth Edition,PHI Learning Private Ltd., New Delhi, 2012

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: solve algebraic, transcendental and system of equations by numerical methods

CO2: apply various interpolation techniques and finite difference concepts

CO3: carry out numerical differentiation and integration using different methods whenever regular methods are not applicable

CO4: solve first order ODE using single and multi step methods

CO5: solve the boundary value problems in PDE by finite differences

Board of Studies (BoS) :

12th BOS of Mathematics and AS department held 23.06.2021

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L													
CO2	M														
CO3	M	L													
CO4	M	L													
CO5	M	L													

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all

Learning of various methods in numerical analysis will lead to use of applications in many projects in Engineering.