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 (I - IV Semesters)
(Amendments updated upto February 2022)

B.Tech. Electronics and Instrumentation Engineering

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 (I - IV Semesters)

(Amendments updated upto February 2022)

B.TECH. ELECTRONICS AND INSTRUMENTATION 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 INSTRUMENTATION ENGINEERING

VISION

The Department aspires to excel in, providing quality education, trainingand research in the area of Electronics and Instrumentation Engineering tomeet the industrial and societal needs

MISSION

- To provide quality education in the field of Electronics andInstrumentation Engineering by offering Under Graduate, Post Graduateand Doctoral Programs
- To impart technical knowledge and hands on experience, leadership andmanagerial skills to meet the current industrial and societal needs.
- To enhance problem solving capabilities through design projects, internship and industrial projects
- To maintain active linkages with industries and research institutions
- To develop analytical skills, leadership quality and team spirit throughbalanced curriculum and a judicial mix of co-curricular, extra-curricular andprofessional society activities
- To enrich the knowledge and skills of faculty through continuouslearning and active research

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

B.TECH. (ELECTRONICS & INSTRUMENTATION ENGINEERING)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge of Mathematics and Science to enable thestudent understand the basic concepts of Electronics and InstrumentationEngineering.

- To impart sound theoretical and practical knowledge in the broad areas ofElectrical and Electronic Measurements, Transducers, Industrial Instruments, Analytical Instruments Biomedical instruments, Microelectronics and ProcessControl.

- To provide knowledge and skill in the design, installation, maintenance, andcalibration of different types of instruments used in process industries.

- To develop skills for devising solutions in the design of conventional andadvanced Control Systems required for Industrial Automation.

- To inculcate sustained interest in the process of life- long learning to keepabreast of state-of-art technologies in the fields of Electronics andInstrumentation.

- To impart necessary managerial and soft skills required to face the challengesin the process industries and software companies.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

- 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.

- 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

- 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.

- apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- understand the impact of the professional engineering solutions in societal and environmental contexts, and

demonstrate the knowledge of, and need for sustainable development.

- apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- 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.

- demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

- recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

- test, Calibrate and Select measuring Instruments and analyzers for differentIndustrial applications.

- design & fabricate signal conditioning circuits for measurement systems.

- design, simulate and implement conventional, multi loop, intelligent andmodel based controllers for Industrial Automation.

REGULATIONS - 2021
B.TECH. DEGREE PROGRAMMES
(Under Choice Based Credit System)

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 20% 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 7^{th} 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	Mechanical Engineering

	Machine Learning	Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering
2.	Block Chain	
3.	Cyber Security	
4.	Data Science	
5.	Internet of Things (IoT)	
6.	Virtual and Augmented Reality	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering
8.	Robotics	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

9.	3D Printing	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 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 Engineering Electronics 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 & INSTRUMENTATION ENGINEERING CURRICULUM FRAME WORK, REGULATIONS 2021

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 1181	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 1203	Basic Electrical Engineering *	3	0	2	4
5.	PCC	EID 1201	Network Analysis and Synthesis	3	0	0	3
6.	PCC	EID 1202	Electron Devices	2	0	0	2
7.	PCC	EID 1203	Electron Devices and Network Synthesis Laboratory**	0	0	2	1
8.	MC	GED 1206	Environmental Sciences	2	0	0	2
			Credits				**23**

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	EID 2101	Digital Electronics	3	1	0	4
4.	PCC	EID 2102	Linear Integrated Circuits	3	0	2	4
5.	PCC	EID 2103	Transducer Engineering	3	0	0	3
6.	PCC	EID 2104	Electrical, Electronics and Physical Measurements	3	0	0	3
7.	PCC	EID 2105	Digital Electronics Laboratory**	0	0	2	1
8.	PCC	EID 2106	Transducers and Measurements Laboratory**	0	0	2	1
9.	HSC	GED 2101	Essential Skills and Aptitude for Engineers **	0	0	2	1
			Credits				**24**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	EID 2201	Industrial Instrumentation I	3	0	0	3
2.	PCC	EID 2202	Control Systems	3	1	0	4
3.	PCC	EID 2203	Microprocessor and Microcontroller	3	0	0	3
4.	PCC	EID 2204	Python for Instrumentation Engineers	3	0	0	3
5.	PCC	MED 2281	Thermodynamics and Fluid Mechanics	3	0	0	3
6.	PCC	EID 2205	Industrial Instrumentation I Laboratory **	0	0	2	1
7.	PCC	EID 2206	Microprocessor and Microcontroller Laboratory **	0	0	2	1
8.	PEC		Professional Elective I	3	0	0	3
9.	HSC	GED 2201	Workplace Skills and Aptitude for Engineers **	0	0	2	1
10.	MC	GED 2202	Indian Constitution and Human Rights	2	0	0	0
			Credits				**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	EID 3101	Process Control	3	0	0	3
2.	PCC	EID 3102	Industrial Instrumentation II	3	0	0	3
3.	PCC	ECD 3181	Communication Engineering	3	0	0	3
4.	PCC	EID 3103	Digital Signal Processing	3	1	0	4
5.	PCC	EID 3104	Process Control Laboratory**	0	0	2	1
6.	PCC	EID 3105	Industrial instrumentation II Laboratory **	0	0	2	1
7.	PEC		Professional Elective II	3	0	0	3
8.	PEC		Professional Elective III	3	0	0	3
9.	HSC	GED 3101	Communication Skills for Career Success	0	0	2	1
10.	PROJ	EID 3106	Internship I ##	0	0	0	1
			Credits				**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	MSD 3281	Entrepreneurship	3	0	0	3
2.	HSC		Humanities Elective II	2	0	0	2
3.	OEC		Open Elective I	3	0	0	3
4.	BSC		Chemistry Elective	2	0	0	2
5.	BSC		Physics Elective	2	0	0	2
6.	PCC	EID 3201	Embedded System and RTOS*	2	0	2	3
7.	PEC		Professional Elective IV	3	0	0	3
8.	PEC		Professional Elective V	3	0	0	3
9.	HSC	GED 3201	Reasoning and Aptitude for Engineers **	0	0	2	1
			Credits				**22**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	OEC		Open Elective II	3	0	0	3
2.	OEC		Open Elective III	3	0	0	3
3.	PCC	EID 4101	Industrial Automation *	3	0	2	4
4.	PCC	EID 4102	Biomedical Instrumentation	3	0	0	3
5.	PEC		Professional Elective VI	3	0	0	3
6.	PEC		Professional Elective VII	3	0	0	3
7.	PEC		Professional Elective VIII	3	0	0	3
8.	PROJ	EID 4103	Internship II ###	0	0	0	1
9.	HSC	GED 4101	Employability Skills $	0	0	2	1
			Credits				**23**

SEMESTER VIII

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

Overall Total Credits – 166

* 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.

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PROFESSIONAL ELECTIVE COURSES

SPECIALIZATION I - INSTRUMENTATION ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Semester offered
1.	PEC	EIDX 01	Fiber Optic and Laser Instrumentation	3	0	0	3	IV
2.	PEC	EIDX 02	Advanced Sensors	3	0	0	3	V
3.	PEC	EIDX 03	Ultrasonic Instrumentation	3	0	0	3	V
4.	PEC	EIDX 04	Analytical Instrumentation	3	0	0	3	VI
5.	PEC	EIDX 05	Instrumentation System Design	3	0	0	3	VI
6.	PEC	EIDX 06	Advanced Instrumentation Systems	3	0	0	3	VII
7.	PEC	EIDX 07	Virtual Instrumentation	3	0	0	3	VII
8.	PEC	EIDX 08	Power Plant Instrumentation	3	0	0	3	VII
9.	PEC	EIDX 09	Space and Navigational instrumentation	3	0	0	3	VII
10.	PEC	EIDX 10	Safety Instrumentation	3	0	0	3	VII
11.	PEC	EIDX 11	Piping and Instrumentation Diagram	3	0	0	3	VII

SPECIALIZATION II – CONTROL ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Semester offered
1.	PEC	EIDX 21	Control System Components	3	0	0	3	IV
2.	PEC	EIDX 22	Modern Control System	3	0	0	3	V
3.	PEC	EIDX 23	Industry 4.0	3	0	0	3	V
4.	PEC	EIDX 24	Robotics and Automation	3	0	0	3	V
5.	PEC	EIDX 25	Modeling and Simulation	3	0	0	3	VI
6.	PEC	EIDX 26	Digital Process Control	3	0	0	3	VI
7.	PEC	EIDX 27	Nonlinear Control System	3	0	0	3	VII
8.	PEC	EIDX 28	System Identification	3	0	0	3	VII
9.	PEC	EIDX 29	Adaptive Control	3	0	0	3	VII
10.	PEC	EIDX 30	Plant engineering	3	0	0	3	VII
11.	PEC	EIDX 31	Instrumentation and Control in Petrochemical Industries	3	0	0	3	VII
12.	PEC	EIDX 32	Instrumentation and Control in Iron and Steel Industries	3	0	0	3	VII
13.	PEC	EIDX 33	Instrumentation and control in Pharmaceutical Industries	3	0	0	3	VII
14.	PEC	EIDX 34	Instrumentation and Control in Chemical Industries	3	0	0	3	VII

SPECIALIZATION III - ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Semester offered
1.	PE	EIDX 41	MEMS and NEMS	3	0	0	3	IV
2.	PE	EIDX 42	Applied Power Electronics	3	0	0	3	IV

3.	PE	EIDX 43	Wireless Sensor Networks	3	0	0	3	V
4.	PE	EIDX 44	Industrial Drives and Control	3	0	0	3	V
5.	PE	EIDX 45	Mechatronics	3	0	0	3	V
6.	PE	EIDX 46	Design Technology and Innovation	3	0	0	3	V
7.	PE	EIDX 47	VLSI Design	3	0	0	3	VI
8.	PE	EIDX 48	Advanced Digital Signal Processing	3	0	0	3	VI
9.	PE	EIDX 49	Electronics Equipment Integration and Prototype building	3	0	0	3	VI
10	PE	EIDX 50	Digital Image Processing	3	0	0	3	VII

SPECIALIZATION IV - COMPUTER SCIENCE ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Semester offered
1.	PE	EIDX 61	Industrial Data Networks	3	0	0	3	IV
2.	PE	EIDX 62	R-Programming	3	0	0	3	IV
3.	PE	EIDX 63	3D Animation	3	0	0	3	V
4.	PE	EIDX 64	Applied Soft Computing for Instrumentation Engineers	3	0	0	3	VI
5.	PE	EIDX 65	Internet of Things for Automation	3	0	0	3	VI
6.	PE	EIDX 66	Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	VI
7.	PE	EIDX 67	Deep Learning	3	0	0	3	VII
8.	PE	EIDX 68	Big data Analytics	3	0	0	3	VII
9.	PE	EIDX 69	Data science for Engineers	3	0	0	3	VII
10.	PE	EIDX 70	Practical Machine Learning with Tensor Flow	3	0	0	3	VII

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	Probability 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

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

CHEMISTRY ELECTIVES – VI SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C
1	CHDX 01	Chemistry of Construction Materials	2	0	0	2
2	CHDX 02	Chemistry of Materials and Electrochemical Devices	2	0	0	2
3	CHDX 03	Chemistry and Instrumentation for Electrical and Electronic Applications	2	0	0	2
4	CHDX 04	Functional Materials and Applications	2	0	0	2
5	CHDX 05	Chemistry of Fuels, Combustion and Lubricants	2	0	0	2
6	CHDX 06	Instrumental Methods of Polymer Analysis	2	0	0	2
7	CHDX 07	Medicinal Chemistry	2	0	0	2

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 / GENERAL 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	3	0	0	3	CSB

		Organizational Behaviour					
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 218	Nano Materials and Technology *	2	0	2	3	Physics / Chemistry
19	GEDX 219	Numerical Computational Tools for Engineers *	2	0	2	3	EIE
20	GEDX 220	Optimization Techniques	3	0	0	3	EEE
21	GEDX 221	Polymers for Emerging Technologies	3	0	0	3	Polymer
22	GEDX 222	Programming Language Principles	3	0	0	3	CSE
23	GEDX 223	Public Speaking and Rhetoric	2	1	0	3	English
24	GEDX 224	Python Programming *	2	0	2	3	IT
25	GEDX 225	R Programming	3	0	0	3	CA
26	GEDX 226	Smart Sensors for Healthcare Applications	3	0	0	3	EIE
27	GEDX 227	Total Quality Management	3	0	0	3	Mech.
28	GEDX 228	Value Education	3	0	0	3	Commerce
29	GEDX 229	Waste Water Management	3	0	0	3	Civil
30	GEDX 230	Web Application Development	3	0	0	3	CA

OPEN / GENERAL 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 104	Behavioural Psychology	3	0	0	3	SSSH
5	GEDX 105	Building Repair Solutions	3	0	0	3	Civil
6	GEDX 106	Cloud Services and Management	3	0	0	3	CA
7	GEDX 107	Cost Management for Engineers	3	0	0	3	Commerce
8	GEDX 108	Cyber Law and Ethics	3	0	0	3	CSL
9	GEDX 109	Data Analytics and Visualization	3	0	0	3	CA
10	GEDX 110	Deep learning Essentials	3	0	0	3	CSE
11	GEDX 111	Drone Technologies	2	0	2	3	Aero
12	GEDX 112	Electric Vehicle	3	0	0	3	EEE
13	GEDX 113	Emerging Technologies in Mobile Networks	3	0	0	3	ECE
14	GEDX 114	Fundamentals of Data Science and Machine Learning	3	0	0	3	IT
15	GEDX 115	Genetic Engineering	3	0	0	3	SLS
16	GEDX 116	Green Design and Sustainability	3	0	0	3	Civil
17	GEDX 117	Image Processing and its Applications	3	0	0	3	ECE
18	GEDX 118	Industrial Automation and Control	3	0	0	3	EIE
19	GEDX 119	Industrial Safety	3	0	0	3	Mech.
20	GEDX 120	Industry 4.0	3	0	0	3	Mech.
21	GEDX 121	Introduction to Artificial Intelligence	3	0	0	3	IT
22	GEDX 122	Introduction to Artificial Intelligence and Evolutionary Computing	3	0	0	3	EEE
23	GEDX 123	Motor Vehicle Act and Loss Assessment	3	0	0	3	Automobile
24	GEDX 124	National Service Scheme	3	0	0	3	SSSH
25	GEDX 125	National Cadet Corps	3	0	0	3	SSSH
26	GEDX 126	Personal Finance and Investment	3	0	0	3	Commerce

27	GEDX 127	Soft Computing Techniques	3	0	0	3	CSE
28	GEDX 128	Value Analysis and Engineering	3	0	0	3	Mech.
29	GEDX 129	Vehicle Maintenance	3	0	0	3	Automobile

SEMESTER I

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 andapply 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, evaluateno. 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

	PO1	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	CHEMISTRY FOR ELECTRICAL AND ELECTRONIC ENGINEERING	L	T	P	C
		3	0	2	4

SDG: 9

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(phenylene vinylene), 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 Jayadev Sreedhar, 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) :
11th BoS 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.

MAD 1181	**ALGEBRA AND DIFFERENTIAL CALCULUS**	**L**	**T**	**P**	**C**
SDG: 4		**3**	**1**	**0**	**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, 5th 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) :	**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	M		-	-	-	-	-	-	-	-	-	-	-	-	-
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 Engineering problems

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 drawing 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):
18th BoS 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):
18th BoS 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 onsand mould 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):	**Academic Council:**
18thBoS of MECH held on 21.06.2021	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
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.

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

COURSE OBJECTIVES:

COB1: To explore the hardware and software components of thecomputer

COB2: To learn the structured and procedural programming concepts usingC.

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) : 18th BoS 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 1181	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, Stephen 2011. 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) :
13thBoS 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	L	T	P	C
SDG: 4	EQUATIONS AND TRANSFORMS	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) :
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	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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 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 1203	**BASIC ELECTRICAL ENGINEERING**	**L**	**T**	**P**	**C**
SDG: 3, 5, 8, 11, 12		**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 machines.

COB4: To impart knowledge on the fundamentals of transformer and AC rotating machines.

COB5: To acquaint the students with different methods of electric power generation.

MODULE I DC CIRCUITS & MEASUREMENTS 12

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 & MEASUREMENTS 18

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 MCB

MODULE III ELECTROMAGNETISM & DC MACHINES 16

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.

(Qualitativetreatment only).

MODULE IV AC MACHINES 16

Transformers: Principle of operation and construction of single-phase transformers (core and shell types) - EMF equation, efficiency and voltage regulation.

Synchronous Generators: Principle of operation; Types and constructional features - EMF equation.

Three Phase Induction Motors: Concept of rotating magnetic field - Principle of operation, types and constructional features - Slip and its significance - Applications of squirrel cage and slip ring motors - Necessity of a starter - star-delta starter.

(Qualitative treatment only)

Practical: Load Characteristics of single-phase transformer and three-phase induction motor.

MODULE V ELECTRICAL POWER SOURCES 13

Introduction to Wind, Solar, Fuel cell, Tidal, Geo-thermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation.

PRACTICALS

List of Experiments

1. Verification of KCL and KVL (ii) Measurement of voltage, current and power in DC circuits.
2. (i) Resonance of RLC series circuit
   (ii) Measurement of voltage, current, power and power factor in single phase & three phase AC circuits.
3. (i) Magnetization characteristics of DC generator
   (ii) Load Characteristics of DC shunt motor,
4. Load characteristics of single-phase transformer and three-phase induction motor.
5. Site visit to any thermal / hydro / wind / solar power generating station.

L – 45 ; P – 30 ; Total Hours – 75

REFERENCES:

1. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 12th Edition, 2016.
2. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Education, First Edition, 2017.

3. Cotton H, “Electrical Technology”, CBS Publishers, 7th Edition, 2007.
4. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2015.
5. Hayt and Kimberly, “Engineering Circuit Analysis”, Tata McGraw Hill, 2012
6. Kulshreshtha D.C., “Basic Electrical Engineering”, Tata McGraw Hill, 2009.
7. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall, India, 2009.
8. SahdevRitu, “Basic Electrical Engineering”, Khanna Book Publishing Co., 2018.

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 DC motor for specific applications based on the motor characteristics.

CO4: interpret the specifications of different AC machines used in industries.

CO5: explain the methods by which electrical energy can be generated.

Board of Studies (BoS) : 8thBoS of CSE held on 25.08.2020

Academic Council: 17th AC held on 14.07.2021

	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 electronics 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 11: Sustainable cities and communities
Statement: Understanding the renewable energy sources helps in building sustainable cities and communities.

SDG 12: Responsible consumption and production.
Statement: Use of right and energy efficient electric and electronic components and devices results is reasonable consumption and production.

EID 1201	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore various network reduction techniques and theorems.

COB2: To introduce the concept of transient analysis of first and second order linear circuits.

COB3: To explore the concept of two port networks.

COB4: To introduce the elements of network synthesis.

COB5: To introduce basic theory about the design of filters and attenuators.

MODULE I NETWORK THEOREMS FOR DC AND AC NETWORKS 9

Superposition, Thevenin's, Norton's, Maximum Power Transfer and Reciprocity theorems

MODULE II TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS 9

Transient response of RL, RC and RLC circuits using Laplace transform for DC input and A.C. sinusoidal input.

MODULE III TWO PORT NETWORKS 9

Network terminals and ports: – Z-parameters, T-equivalent of reciprocal network, Y-parameter, π-equivalent of reciprocal networks, h-parameters and g-parameters.

MODULE IV TRANSFER FUNCTION SYNTHESIS 9

Reliability of one port network – Hurwitz polynomials and properties – Positive Real functions and properties – Synthesis of RL, RC and LC one port networks using Foster and Cauer methods.

MODULE V DESIGN OF FILTER 9

Design of filters -Low pass filters, high pass filters, band pass filters, band reject filters, Butterworth filters, m-derived filters, constant k-filters

L – 45; Total Hours – 45

TEXT BOOKS:

1. Franklin F.Kuo, "Network Analysis and Synthesis" Wiley India Pvt Ltd,

New Delhi, 5th Edition, 2012.
2. Hayt.W.H.,Kemmerly.J.E., Durbin.S.M., “Engineering Circuit Analysis”, 7th Edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCES:

1. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, 5th edition, McGraw Hill Education (India) Private Limited, 2015.
2. M. E. Van Valkenburg and T.S. Rathore, “Network Analysis”, Revised Third Edition, Pearson Education India, 2019.
3. Edminister, J.A. and Nahvi, M., “Electric Circuits”, 6th Edition, Schaum’sOutline series, McGraw-Hill, New Delhi, 2013.

COURSE OUTCOMES:

CO1: Solve the electrical circuits using the network theorems.

CO2: Understand the transient analysis of first and second order linear networks.

CO3: Capable of determining Z, Y, h and ABCD parameters.

CO4: Ability to realize RL, RC and LC networks using Cauer and Foster form.

CO5: Capable of designing different types of filters and attenuators

Board of Studies (BoS) :
16th BoS meeting held on 23.6.2021

Academic Council:
17th meeting of Academic council held on 15.7.2021

	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	L	H	L	L					L	L	L	L	M	
CO2	L	L	L	L	L					L	L	L	L	H	
CO3	M	M	L	L	L					L	L	L	M		
CO4	M	M	L	L	L					L	L	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 : The understanding of solving the electrical circuits promotes lifelong learning opportunities.

EID 1202	ELECTRON DEVICES	L	T	P	C
		2	0	0	2

SDG: 4, 9, 12

COURSE OBJECTIVES:

To acquaint the students with construction, theory and characteristics of the following

COB1: P-N Junction Diode, LED, LCD and Opto-electronic devices

COB2: Bipolar Junction Transistor

COB3: Field Effect Transistor

COB4: Rectifier, Filters and Regulators

MODULE I SEMICONDUCTORDIODE AND DISPLAY DEVICES 8

Construction, working, characteristics and Applications**:** PN junction diode, Energy band diagram of PN junction diode, Biasing, Zener diode- Avalanche breakdown, Zener break down, Tunnel diode, Schottky Diode, Gunn Diode, LED, LCD, Solar cell.

MODULE II BIPOLAR JUNCTION TRANSISTORS 7

NPN -PNP -Operations-Early effect -Current equations — Input and Output characteristics of CE, CB, CC – Hybrid -π model – h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

MODULE III FIELD EFFECT TRANSISTORS 7

JFETs — Drain and Transfer characteristics, -Current equations -Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics — Comparison of MOSFET with JFET.

MODULE IV POWER SUPPLY DEVICES 8

Half Wave and Full Wave Rectifier, Inductor filter, Capacitor filter, L- section filter, p- section filter, Multiple L- section and Multiple π section filter and comparison of various filter circuits in terms of ripple factors. Zener diode characteristics-Zener Reverse characteristics – Zener as regulator.

L – 30; Total Hours – 30

TEXT BOOKS:

1. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw-Hill, 1991.
2. Millman J and Gabriel A, “Microelectronics”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2000.

REFERENCES:

1. Thomas. L. Floyd, Electronic Devices- Elctron flow Version- 9th Edition, Pearson Education- Prentice Hall of India, 2012
2. S. Salivahanan, N. Sureshkumar and A. Vallavaraj, Electronic Devices and Circuits, TMH, 2008.
3. S.M. Sze, Semiconductor Devices – Physics and Technology, 2nd Edn., John Wiley, 2002.
4. Donald A Neaman, Semiconductor Physics and Devices, Fourth Edition, Tata Mc Graw-Hill Inc. 2012.

COURSE OUTCOMES:

At the end of this course, the students will be able to

CO1: Understand the basics of semiconductor, Optoelectronic Devices and their working mechanism.

CO2: Analyze the working of BJT (Bipolar Junction Transistor) using different models.

CO3: Acquire knowledge in different types of FET (Field Effect Transistor).

CO4: Gain knowledge about the working of Rectifiers, Filters and Regulators and its applications.

Board of Studies (BoS) : 16th BoS meeting held on 23.6.2021

Academic Council: 17th AC meeting held on 15.7.2021

	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	M					L						L		
CO2	M	L										L	L		
CO3	M	L										L	L		
CO4	H	M	H								H		L	L	

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

SDG 4: To give quality education in basic electronics.

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

SDG 12: To design low power consuming basic electronic circuits.

The course gives in-depth knowledge in basic electronic components which improves the understanding of advanced electronics in future this results in improving quality of education.
This course enlightens students in promoting industrial applications of electronic components.
The holistic understanding of electronic components leads to construction of efficient DC power supply.

		L	T	P	C
EID 1203	**ELECTRON DEVICES AND NETWORK SYNTHESIS LABORATORY**	**0**	**0**	**2**	**1**
SDG: 12					

COURSE OBJECTIVES:

COB1: To provide in depth knowledge on the working of basic Semiconductor devices and DC power supply.

COB2: To get practical experience on electric circuits and verification of theorems.

COB3: To gain practical knowledge about series and parallel electric circuits.

COB4: To get exposed to Pspice/ Matlab/ Scilab to simulate various electric circuits

PRACTICALS

List of Experiments:

1. Characteristics of PN Junction Diode and Zener Diode
2. CE, CB configuration of BJT
3. JFET and MOSFET Characteristics
4. Half wave and Full wave rectifier with and without filter
5. Design of DC power supply
6. Experimental verification of network theorems (Thevenin's, Norton's, Superposition, maximum power transfer Theorem and reciprocity theorem).
7. Experimental determination of time constant of series RL, RC and RLC circuits.
8. Determination of frequency response of current in RLC circuit with sinusoidal ac input
9. Design and Simulation of series and parallel resonance circuits.
10. Determination of z and h parameters for a network and computation of Y and ABCD parameters.
11. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.

P – 30; Total Hours – 30

TEXT BOOKS:

1. Franklin F.Kuo, "Network Analysis and Synthesis" Wiley India Pvt Ltd, New Delhi, 5th Edition, 2012.
2. Geert van der Plas, Georges Gielen Willy Sansen, "A Computer-Aided

Design and Synthesis Environment for Analog Integrated Circuits", Kluwert Academic Publishers, United States, 2002. (ISBN: 978-0-7923-7697-2).

REFERENCES:

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", 5th edition, McGraw Hill Education (India) Private Limited, 2015.
2. M. E. Van Valkenburg and T.S. Rathore, "Network Analysis", Revised Third Edition, Pearson Education India, 2019.
3. Dennis Fitzpatrick, "Analog Design and Simulation using OrCAD Capture and PSpice", Newnes, 2nd edition, United Kingdom, 2017.
4. Karavokyros, L.,Katsiotis, N., Tzanis, E., Batis, G., and Beazi-Katsioti, M., "The Effect of Mix-Design and Corrosion Inhibitors on the Durability of Concrete", Journal of Materials Science and Chemical Engineering, Vol. 8, pp. 64-77, 2020. https://doi.org/10.4236/msce.2020.84005
5. http://www.leanconstruction.org/readings.html
6. Harvard University. *Soft robotic gripper for jellyfish* [Video], 2019. https://www.youtube.com/watch?v=guRoWTYfxMs

COURSE OUTCOMES:

CO1: Understand and apply circuit theorems and concepts in engineering applications.

CO2: Familiarize with electrical simulation software

Board of Studies (BoS) : 16th BoS meeting, on 23.6.2021

Academic Council: 17th AC meeting held on 15.7.2021

	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	H	H	M	M					L	H	H	H	M	
CO2	M	M	M	M	H					L	H	H	L		

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

SDG 12: Ensure sustainable consumption and production patterns

Statement: The practical knowledge on solving network theorems, developing electrical circuits will ensure sustainable consumption and production

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. Erach Bharucha, “Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education for University Grants Commission”, Orient Blackswan Pvt. 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) : 11th BoS 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

EID 2101	DIGITAL ELECTRONICS	L	T	P	C
SDG: 4, 9		3	1	0	4

COURSE OBJECTIVES:

COB 1: To study various number systems, Boolean expressions and simplifications

COB 2: To study, analyze and design of the combinational logic circuits for arithmetic operations

COB 3: To study, analyze and design of sequential circuits, registers and counters

COB 4: To study, analyze and design asynchronous sequential circuits and to know the functions of ASM charts

COB 5: To learn memory components, PLA, PAL and the basic of HDL.

MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of number systems – Arithmetic operations in binary number system – Binary codes – Boolean algebra and rules – Boolean functions: Simplifications: standard / canonical form of SOP and POS, Simplification using Karnaugh Map and Tabulation methods – Basic logic gates – Universal gates.

MODULE II COMBINATIONAL LOGIC 9

Combinational circuits – Analysis and design procedures – Circuits for arithmetic operations: Full adder, Carry look-ahead adder, binary adder, adder-subtractor, comparators – Code conversion – Decoders and Encoders – Multiplexers and De-multiplexers. Realization of combinational logic circuits using decoders and multiplexers.

MODULE III SYNCHRONOUS SEQUENTIAL LOGIC 12

Sequential circuits – Flip flops: Triggering, types, conversions, excitation tables – Analysis and design procedures – State reduction and state assignment – Shift registers – Counters: MOD counters, up-down counter, ring counters – Sequence detectors.

MODULE IV ASYNCHRONOUS SEQUENTIAL LOGIC 12

Flip flops - SR, D, JK and T. Design of synchronous sequential circuits: state diagram; state reduction; state assignment, Counters: synchronous, asynchronous, up-down and Johnson counters, Modulo counter; shift

registers.

MODULE V MEMORY AND PROGRAMMABLE LOGIC DEVICES **9**

RAM and ROM types – Memory decoding - Error detection and correction - Programmable logic devices: Programmable Array Logic – Programmable Logic Array –CPLD - FPGA – Hardware Description Language: Introduction - HDL for combinational logic circuits - HDL for Sequential logic circuits.

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Thomas L. Floyd, “Digital Fundamentals”, 11th Edition, Prentice Hall, 2015.
2. Donald P Leach, Albert Paul Malvino and GoutamSaha, “Digital Principles and Applications”, 8 th Edition, McGraw-Hill, 2014.
3. Morris Mano, M. and Michael D. Ciletti, “Digital Design with an Introduction to the Verilog HDL”, 5th Edition, Prentice Hall, 2013

REFERENCES:

1. Fundamentals of Logic Design, “Charles H Roth and Larry L KInney”, 6th Edition, Cengage Learning, 2013
2. John F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, 2008
3. NPTEL video lectures on “Digital systems Design”,Prof. D. Roychoudhury IIT Kharagpur

COURSE OUTCOMES:

At the end of the course, course the students will be able to

CO1: apply mathematical knowledge of number systems, Boolean expressions / functions to simplify and realize logical expression, understand and contrast different logic families

CO2: analyze and design combinational logic circuits.

CO3: analyze and design of sequential logic circuits.

CO4: analyze and design synchronous and asynchronous logic circuits

CO5: understand memory types and get exposed to building blocks of different Programmable Logic devices.

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022

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

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

SDG 4: Quality Education

This course ensures complete knowledge about digital electronics and promotes lifelong learning opportunities.

SDG 9: Industry, Innovation and Infrastructure

They course play a key role in providing the basic knowledge for designing logical circuits which is used to promote the new technologies that generate employment and income.

EID 2102	**LINEAR INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**
SDG: 9,12		**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

COB1: To study the characteristics and applications of Operational Amplifier

COB2: To build Filters and Waveform generator circuits

COB3: To acquaint the students with construction and theory of ADC and DAC

COB4: To design various applications of 555 timers and PLL

COB5: To study the working of AD623, LM78XX, LM317

MODULE I CHARACTERISTICS OF OPAMP 8

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters, Instrumentation amplifier and its applications for transducer Bridge.

MODULE II ACTIVE FILTERS AND WAVEFORM GENERATORS 10

First and Second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector.

MODULE III ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 10

Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2 Ladder type, Voltage Mode and Current-Mode R – 2R Ladder types – switches for D/A converters high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to-Time Conversion – Over-sampling A/D Converters, Sigma – Delta converters.

MODULE IV TIMER ICs, PHASE LOCKED LOOPS AND ANALOG MULTIPLIERS 9

Functional block, characteristics of 555 Timer and its PWM

application — IC-566 voltage-controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

MODULE V SPECIAL ICs, VOLTAGE REGULATORS AND LINEAR POWER SUPPLY SYSTEMS **8**

AD623 Instrumentation Amplifier and its application as load cell weight measurement — IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply — LM317, 723 Variability voltage regulators.

PRACTICALS **30**

1. Design of Inverting and Non-inverting Amplifiers, summer, differentiator and integrator.
2. Design of comparators and Instrumentation amplifier.
3. Design of first and second order active filters.
4. Design of Analog to Digital Converter.
5. Design of Digital to Analog Converter.
6. Any two applications of 555 timer.
7. Design of Load cell.

L - 45 ; P - 30 ; TOTAL HOURS - 75

TEXT BOOKS:

1. Ramakant A. Gayakwad, “Op-amps and Linear Integrated Circuits”, 4th edition, Pearson Education, 2019 / PHI.
2. Sergio Franco, —Design with Operational Amplifiers and Analog Integrated Circuits‖, 4th Edition, Tata Mc Graw-Hill, 2018.

REFERENCES:

1. D. Roy Choudhary, Shail B. Jain, “Linear Integrated Circuits”, Fifth edition, New Age, 2018.
2. S. Salivahanan & V.S. Kanchana Bhaskaran, —Linear Integrated Circuits‖, TMH,2nd Edition, 4th Reprint, 2018.
3. Gray and Meyer, —Analysis and Design of Analog Integrated Circuits‖, Wiley International,5th Edition, 2019.

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

CO1: Create a basic amplifier and analog arithmetic circuits using Op-amp.

CO2: Design a filter circuit to filter the specified frequency and a circuit to generate various waveforms.

CO3: Evaluate the working of different types of ADC and DAC.

CO4: Formulate Astable and Bistable multivibrator using 555.

CO5: Create an Instrumentation amplifier and Voltage regulator.

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022

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

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

SDG 9: Industry, Innovation and Infrastructure.
Statement: This course enlightens students in promoting industrial applications of electronic components.

SDG 12: Responsible, Consumption and Production.
Statement: The holistic understanding of electronic components leads to construction of efficient DC power supply.

EID 2103	TRANSDUCERS ENGINEERING	L	T	P	C
SDG: 4,8,9,12		3	0	0	3

COURSE OBJECTIVES:

COB1: To give knowledge about basic measurement Systems and Units & standards.

COB2: To provide an introductory knowledge about transducers.

COB3: To give adequate knowledge about the characteristics of transducer.

COB4: To have in depth knowledge about Resistive, capacitive and inductivetransducers.

COB5: To introduce basic knowledge about other types of transducers like Piezoelectric, magnetostrictive transducers and smart transducers.

MODULE I SCIENCE OF MEASUREMENT 7

Units and Standards - Importance of measurement – Functional blocks of a measurement system - Errors - Classification of errors – Error analysis – Statistical methods – Odds and uncertainty and its analysis- Calibration methods.

MODULE II CLASSIFICATION & CHARACTERISTICS OF TRANSDUCERS 9

Definition of transducers - classification of transducers - Static characteristics : Accuracy, precision, resolution, sensitivity, linearity, threshold, hysteresis, bias, range, span and loading effect - Dynamic characteristics: Mathematical model of transducer – Zero, I and II order transducers - Response to impulse, step, ramp , sinusoidal and nonlinear inputs.

MODULE III VARIABLE RESISTANCE TRANSDUCERS 7

Principle of operation, construction details, characteristics and applications of resistance potentiometer, strain gauge, resistance thermometer, thermistor, hotwire anemometer, piezo-resistive sensor and humidity sensor.

MODULE IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 8

Inductive Transducers: Principle of operation, Construction details,-Induction potentiometer – variable reluctance transducers – EI pick up – LVDT– synchro – MicroSyn. Capacitive transducers: Principle of operation,

Construction details three types - capacitor microphone – capacitive pressure sensor - proximity sensor.

MODULE V OTHER TRANSDUCERS 7

Piezoelectric transducer – Hall Effect Transducers- magnetostrictive transducer –Introduction to IC sensors -Thick & Thin film sensors (Bio Sensor & Chemical sensor), Introduction to MEMS – Digital transducers– Smart Transducer – Fiber optic transducer- Introduction to nano materials - Nano transducers – different types of nano position sensors - nano actuators – applications.

L – 45 ; TOTAL HOURS - 45

TEXT BOOKS:

1. Doebelin E.O, and Manik D.N., “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2011.
2. Neubert, H.K.P., “Instrument Transducers – An introduction to their Performance and Design”, Oxford University Press, Cambridge, 2003

REFERENCES:

1. A.K. Sawhney, “A course in Electrical & Electronic Measurement and Instrumentation”, Dhanpat Rai and Co (P) Ltd., 2014.
2. D. Patranabis, “Sensors and Transducers”, Prentice Hall of India, 2010.
3. John P. Bentley, “Principles of Measurement Systems”, 3rd edition, Pearson Education,2004.
4. D.V.S Murthy, “Transducers and Instrumentation”, Prentice Hall of India, 2010.
5. Renganathan S., “Transducer Engineering”, Allied Publishers, New Delhi, 2003.

COURSE OUTCOMES:

CO1: Carry out error analysis and find the probable error in a measurement system

CO2: Analyze the static and dynamic characteristics of the transducers

CO3: Compare the construction, characteristics and operation of different variable resistance transducers

CO4: Select the appropriate variable inductance and capacitive transducers for industrial applications
CO5: Evaluate the characteristics and applications of piezoelectric, magnetostrictive, digital, and smart transducers
CO6: Identify the salient features of nano transducers, nano actuators and solar cells based on nano particles

Board of Studies (BoS) :
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

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

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

SDG 4: Quality Education
The entire arrangement of the course syllabus provides quality education.

SDG 8: Decent work and economic growth
The study of this course help to identify sensors and transducers and measurement systems which provides economic growth and decent work

SDG 9: Industry, Innovation & Infrastructure
New technological application to transducer and measurement systems helps to innovate, improve the industry and infrastructure of the nation

SDG 12: Responsible consumption and production
The optimal usage of raw material and production is key factor in any process industries and this course provides the responsible consumption and production.

EID 2104	ELECTRICAL, ELECTRONIC AND	L	T	P	C
SDG: 4,8,9	PHYSICAL MEASUREMENTS	3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the student to the various measurement of electrical parameters

COB2: To provide the analog and digital meters used for measurements

COB3: To bring out the importance of bridges for measurement of electrical parameters

COB4: To introduce knowledge of signal generators and analyzers

COB5: To provide awareness of measurement using Oscilloscopes.

MODULE I MEASUREMENT OF ELECTRICAL PARAMETERS 9

Galvanometers – Ballistic, D' Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type, Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading.

MODULE II ANALOG AND DIGITAL METERS 12

D.C, A.C voltmeters, ammeters - multimeter, Energy meter, power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument, Electronic ohm meter, Differential Voltmeter - Instrument Transformers, Digital Voltmeters, Digital Multimeter, Digital Frequency meter, Electronic counter, Digital Tachometer.

MODULE III BRIDGES 9

DC Bridges-Wheatstone bridge – Kelvin double bridge - A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hay's bridge – Schering bridge—High voltage Schering bridge – Anderson bridge – Universal Impedance bridge– Bridge sensitivity - Errors, Wagner Earthing Device.

MODULE IV SIGNAL GENERATORS & ANALYZERS 8

Sine wave generator – Frequency synthesized sine wave generator – Sweep frequency generator, pulse and square wave generator—Triangular wave generator Wave analyzer – Applications – Harmonic distortion analyzer –Total harmonic distortion analyzer- spectrum analyzer.

MODULE V OSCILLOSCOPE 7

General purpose oscilloscope - Specification of Oscilloscope - Special oscilloscopes: Digital Storage oscilloscopes – Sampling oscilloscope – Comparison between Analog and Digital oscilloscopes.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Golding E.W., and Widdis F. C., “Electrical Measurements and Measuring Instruments”, 5th Edition, Reem Publications,2011.
2. Sawhney A.K., “Electrical & Electronic Measurements and Instrumentation”, Dhanpath Rai & Co (P) Ltd, 2014.

REFERENCES:

1. Gupta J.B., “A Course in Electronic and Electrical Measurements and Instrumentation”, S.K. Kataria & Sons, Delhi, 2008.
2. Kalsi H.S., Electronic Instrumentation, McGraw-Hill Education, New Delhi, 2010.
3. Martia Reissland U., “Electrical Measurement”, New Age International (P) Ltd., 2001.
4. Oliver B.M., and Cage J.M., “Electronic Measurements & Instrumentation”, McGraw Hill International Edition, 2009.
5. Bell D. A., “Electronic Instrumentation and Measurements”, Prentice Hall of India, 2010.

COURSE OUTCOMES:

On completion of this course the student will be able to

CO1: choose proper meters for measurement of electrical parameters

CO2: suggest / Identify typical analog and digital meters for specific applications

CO3: measure electrical parameters using bridges

CO4: generate and analyze different test signals using analyzers

CO5: choose proper Oscilloscopes during measurements for different applications

Board of Studies (BoS) :
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	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	L	-	L	L	L	L	L	L	H	L	-
CO2	M	M	L	L	L	-	L	L	L	L	L	L	M	L	-
CO3	M	M	L	L	L	-	L	L	L	L	L	L	H	L	-
CO4	M	M	L	L	M	-	L	L	L	L	L	L	H	L	-
CO5	H	M	M	L	M	-	L	L	L	L	L	L	H	L	-

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

SDG 4: Quality Education

The entire arrangement of the course syllabus provides quality education

SDG 8: Decent work and economic growth

The study of this course help to identify measurement system and monitoring devices which provides economic growth and decent work

SDG 9: Industry, Innovation & Infrastructure

New technological application to measurement systems helps to innovate, improve the industry and infrastructure of the nation

EID 2105	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
SDG: 4, 9,12		0	0	2	1

COURSE OBJECTIVES:

COB1: To study Boolean function and implementation using basic gates.

COB2: To design and implement combinational and sequential circuits using basic gates and specialized ICs

List of Experiments:

1. Realization of basic gates using universal logic gates
2. Design and implementation of Adders and Subtractors using logic gates.
3. Design and verification of code converters using logic gates
4. To exhibit the use of IC 7483 as 4–bit binary Adder/ Subtractor and BCD Adder
5. To design and implement a 2 Bit Magnitude Comparator using logic gates and
   8 Bit Magnitude Comparator using IC 7485
6. Design and implementation of encoder and decoder using logic gates and study of IC 7445 and IC 74154
7. Design and implementation of Multiplexer and De-multiplexer using logic gates
   and study of IC 74150 and IC 74154
8. Implementation and study of SR , JK, D, T Flip Flops.
9. Design and implementation of 3-Bit synchronous counter
10. Construction and verification of Asynchronous counters
11. Implementation of universal shift registers / Modulo counters using ICs.
12. Design of combinational / sequential logic circuit for instrumentation application such as Alarm / Interlock.

P – 30; TOTAL HOURS – 30

COURSE OUTCOMES:

On Completion of this course the student will be able to

CO1: design, implementation and operation of combinational circuits like adders, subtractors, code converters, multiplexer – demultiplexer, encoder – decoder and magnitude comparator.

CO2: design, implementation and operation of sequential circuits like flip flops, counters and shift registers.

CO3: solve engineering problems in the area of digital logic circuit.

Board of Studies (BoS) :
17th BoS held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

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

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

SDG 4: Quality Education

This course is used to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

Goal 9: Industry, Innovation and Infrastructure

It is used to promote inclusive and sustainable industrialization by significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

GOAL 12: Responsible Consumption and Production

It is used to strengthen the scientific and technological capacity to move towards more sustainable patterns of consumption and production.

		L	T	P	C
EID 2106	**TRANSDUCERS AND**				
SDG: 4,8,9	**MEASUREMENTS LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To provide practical knowledge in sensors and transducers.

COB2: Emphasis on static, dynamic characteristics and response of various transducers like resistive, inductive and capacitive type.

COB3: To measure resistance, inductance and capacitance using bridge circuits

COB4: To calibrate the electrical instruments like Wattmeter, Energy meter, Ammeter and Voltmeter.

COB5: To provide practical knowledge in sensors and transducers.

PRACTICALS

List of Experiments:

1. Characteristics of LDR and phototransistor
2. Characteristics of Temperature Transducer (RTD, thermocouple and thermistor)
3. Characteristics and signal conditioning of Strain Gauge and Load cell
4. Characteristics of Capacitive Transducer
5. Characteristics of Position transducer (Potentiometer- Loading Effect of potentiometer, LVDT)
6. Characteristics of Hall Effect Voltage Sensor
7. Characteristics of Piezoelectric Transducer
8. Step response of RTD and thermocouple
9. Response of Digital transducer
10. Measurement of resistance using Kelvin Double Bridge and Wheatstone Bridge
11. Measurement of Capacitance using Schering Bridge and Anderson Bridge for inductance measurement
12. Calibration of Voltmeter and Ammeter using potentiometer
13. Calibration of single phase Energymeter and Wattmeter

P – 30 ; TOTAL HOURS – 30

REFERENCES:

1. Sawhney A.K., “Electrical & Electronic Measurements and Instrumentation”, Dhanpath Rai & Co (P) Ltd, 2014.
2. Gupta J.B., “A Course in Electronic and Electrical Measurements and Instrumentation”, S.K. Kataria & Sons, Delhi, 2008

COURSE OUTCOMES:

After completion of this course the students will able to

CO1: understand the concept of measurement and about error

CO2: analyze the static and dynamic characteristics of a transducer

CO3: get the knowledge in characteristics of various transducers like resistive, inductive and capacitive type.

CO4: use transducer for Instrument and control systems applications.

CO5: know to work as a team to execute any task

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

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

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

SDG 4: Quality Education

The entire arrangement of the course syllabus provides quality education

SDG 8: Decent work and economic growth

The study of this course help to identify sensors and transducers and measurement systems which provides economic growth and decent work

SDG 9: Industry, Innovation & Infrastructure

New technological application to transducer and measurement systems helps to innovate, improve the industry and infrastructure of the nation

GED 2101	**ESSENTIAL SKILLS AND APTITUDE**	**L**	**T**	**P**	**C**
SDG: 17	**FOR ENGINEERS**	**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) :
13thBoS 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

EID 2201	INDUSTRIAL INSTRUMENTATION – I	L	T	P	C
SDG: 4, 9,12		3	0	0	3

COURSE OBJECTIVES:

COB1: To make the students understand the various measuring techniques for force, torque, speed, acceleration, vibration, density, level, temperature and pressure

COB2: To make the students understand the construction, working principle, application and selection of various transducers used for the measurement of force, torque and speed.

COB3: To give the students knowledge about various methods of acceleration, vibration and density measurement practiced in industries.

COB4: To provide knowledge on different pressure and temperature measurement techniques and its selection.

COB5: To learn about measuring high temperatures with pyrometers.

MODULE I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 8

Different types of load cells: Magneto-elastic load cells, Strain gauge load cell, piezoelectric load cell– Different methods of torque measurement: Strain gauge, relative regular twist. Speed measurement: Revolution counter, Capacitive tacho, drag cup type tacho, D.C. and A.C. tacho generators – Stroboscope.

MODULE II MEASUREMENT OF ACCELERATION AND VIBRATION 8

Accelerometers: LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometers – Calibration of vibration pickups.

MODULE III PRESSURE MEASUREMENT 10

Modules of pressure – Manometers – Different types – Elastic type pressure gauges: Bourdon tube, bellows, Diaphragms – Electrical methods: Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor - Measurement of Vacuum: McLeod gauge– Thermal conductivity gauges - Ionization gauge – Testing, calibration and selection of pressure gauges – Dead weight tester. Differential Pressure Transmitter

MODULE IV TEMPERATURE MEASUREMENT 9

Definitions and standards - Different types of filled in system thermometer - Bimetallic thermometer – Electrical methods of temperature measurement, signal conditioning of

industrial RTD and their characteristics - three lead and four lead RTD. Types of thermocouples - Response of thermocouple -Fabrication of industrial thermocouples – signal containing of thermocouples - commercial circuits for cold junction compensation -Thermograph, Temperature switches and thermostats smart temperature transmitter and its advantages.

MODULE V HIGH TEMPERATURE MEASUREMENTS 8

Radiation method of Temperature measurements - Radiation fundamentals, Total Radiation and selective Radiation, Optical Pyrometer - Two colour radiation pyrometers. Fibre optic temperature measurements systems – thermopile - Temperature sensor selection, Installation and Calibration

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Doebellin, E.O. and Manik D.N., “Measurement systems Application and Design”, 5th Edition, Tata McGraw Hill Education Pvt. Ltd, 2008.
2. Jones. B.E., “Jones”s Instrument Technology”, Vol.2, Butterworth-Heinemann, 4thEdition, Elsevier, 2016.

REFERENCES:

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 4th Edition, 2012.
2. Patranabis, D., “Principles of Industrial Instrumentation”, 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
3. Eckman D.P., “Industrial Instrumentation”, Wiley Eastern Limited, 2016.
4. Singh,S.K., “Industrial Instrumentation and Control”, Tata Mc-Graw-Hill Education Pvt. Ltd., 3 rd Edition, New Delhi, 2010.
5. AlokBarua, “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Kharagpur.
6. Jayashankar, V., “Lecture Notes on Industrial Instrumentation”, NPTEL, E-Learning Course, IIT Madras.

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: compare instruments used for measurement of force, torque, speed, acceleration, vibration, density, level, pressure and temperature.

CO2: select instruments according to the application.

CO3: calibrate measuring instruments.

CO4: design compensation techniques for measuring instruments

CO5: design signal conditioning circuits for various transducers.

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	H	H	M	H	M	L	L	-	M	M	H	H	-
CO2	H	M	H	H	M	H	M	L	L	-	M	M	H	H	-
CO3	H	M	H	M	M	H	M	L	L	-	M	M	H	H	-
CO4	H	M	H	M	M	H	M	L	L	-	M	M	H	H	-
CO5	H	M	H	M	M	H	M	L	L	-	M	M	H	H	-

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

SDG 4: Quality Education

This course is used to substantially increase the number of youth and adults who have technical knowledge about sensors and transducers for employment, decent jobs and entrepreneurship

SDG 9: Industry, Innovation and Infrastructure

The knowledge about various sensors is used to promote inclusive and sustainable industrialization by significantly raise industry's share of employment and gross domestic product, in line with national circumstances.

SDG 12: Responsible Consumption and Production

It is used to strengthen the scientific and technological capacity to move towards more sustainable patterns of consumption and production of various sensors

EID 2202	CONTROL SYSTEMS	L	T	P	C
SDG: 4,8,9,12		3	1	0	4

COURSE OBJECTIVES:

COB1: To prepare the student to understand the open loop and closed loop systems.

COB2: To provide knowledge about mathematical modeling, transfer function model and state variable model.

COB3: To acquaint the student to understand time domain and frequency domain analysis of control systems required for stability analysis.

COB4: To provide the student to learn the compensation technique that can be used to stabilize the control systems.

MODULE I INTRODUCTION TO CONTROL SYSTEM 6

Concept of automatic controls, Open loop and closed loop systems, Feedback control system concepts, Control system components, Introduction to controllers.

MODULE II MODELING OF PHYSICAL SYSTEMS 10

Mathematical model of physical systems - Transfer function models - Mechanical systems and Electrical systems, Block diagram reduction technique, Signal flow graph- Mason's gain formula.

MODULE III TIME DOMAIN ANALYSIS 10

Standard input signals, type & order of the system, first order and second order system response to step, ramp and impulse inputs, time domain specifications, generalized error series, steady state error, System stability: Routh's-Hurwitz Criterion, Root Locus method.

MODULE IV FREQUENCY DOMAIN ANALYSIS 10

Frequency domain specification, Frequency plots - Polar plots, Bode plot, Nichol's Chart, M & N circles, Nyquist stability criterion.

MODULE V DESIGN OF COMPENSATORS 9

Compensators – Introduction - Design Specification – Lag-Lead, Lag & Lead Compensator design using Bode plot technique.

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2. Gopal, M., "Control Systems, Principles and Design", Tata McGraw-Hill Pub. Co., 2nd Edition, New Delhi, 2012.
3. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5th Edition, 2010.

REFERENCES:

1. Benjamin C. Ku and Farid Golnaraghi, "Automatic Control Systems",10th edition McGraw-Hill Education, 2017
2. Richard C.Dorf., Robert H.Bishop., "Modern Control Systems", Education Pearson, Third Impression 2009.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: derive the transfer function for the given electrical & mechanical systems.

CO2: obtain the transfer function using block diagram reduction technique and Mason's gain formula.

CO3: perform time domain analysis for a first and second order systems.

CO4: perform frequency domain analysis using Polar, Bode and Nyquist plots.

CO5: design suitable compensators for the given specifications.

CO6: determine the stability of the system using Root Hurwitz, root locus & Nyquist stability criterion.

CO7: work in teams to complete the given task pertaining to the course.

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	L	L	-	M	L	L	-	-	-	L	L	-	-	M
CO2	H	L	L	-	M	L	L	-	-	-	L	L	-	-	M
CO3	L	L	M	L	M	L	M	-	-	L	M	L	-	L	H
CO4	L	L	M	L	M	L	M	-	-	L	M	L	-	L	H
CO5	H	L	M	L	H	L	M	-	-	L	M	L	-	-	H

CO6	M	L	L	L	M	L	M	-	-	L	M	L	-	L	M
CO7	-	-	-	L	-	-	-	M	H	H	M	-	-	-	L

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

SDG 4: Quality Education

The entire arrangement of the course syllabus provides quality education

SDG 8: Decent work and economic growth

The study of this course improves automation and provides economic growth in industries

SDG 9: Industry, Innovation & Infrastructure

This course will help to in cultivate new technology thereby improving the infrastructure of the nation

SDG 12: Responsible consumption and production

The optimal usage of raw material and production is key factor in any process industries and this course provides the responsible consumption and production

EID 2203	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
SDG: 8, 9		3	0	0	3

COURSE OBJECTIVES:

During the course the student will be able

COB1: to understand the concepts of 8086 microprocessors.

COB2: to acquire knowledge on interfacing devices.

COB3: to know the concept of 8051 microcontrollers.

COB4: to design simple applications of microcontroller.

COB5: understand the concepts of advanced microcontrollers.

MODULE I INTRODUCTION TO 8086 PROCESSOR 9

8086 architecture- functional diagram, Register organization, memory segmentation, programming model, Memory addresses, physical memory organization, Signal descriptions of 8086–Interrupts, Addressing modes, instruction set, assembler directives. Simple programs involving logical, branch and call instructions.

MODULE II PERIPHERAL INTERFACING 9

Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8237, 8251, 8279, - A/D and D/A converters & Interfacing with 8086,

MODULE III INTRODUCTION TO MICROCONTROLLERS 9

Overview of 8051 microcontroller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple programs using Assembly and Embedded C.

MODULE IV APPLICATIONS OF 8051 9

Application – Stepper motor control, speed and position control of dc motors, closed loop control of servo motor, control of physical parameters like temp, pressure, flow and level, case study - home protection system, Traffic light control, Smart card application- simple project using 8051.

MODULE V ADVANCED MICROCONTROLLERS 9

Architecture, Memory Organization, I/O Ports, Timers/ Counters of:
LPC 2148 Microcontroller, Aurdino Uno - ATmega328.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

3. Douglas V. Hall, "Microprocessors and Interfacing", Tata McGraw Hill, Revised Third Edition 2017.
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "THE 8051 MICROCONTROLLER AND EMBEDDED SYSTEMS: USING ASSEMBLY AND C", 2nd Edition, Pearson Education. 12th impression 2018.

REFERENCES:

5. Krishna Kant, “Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096’’, PHI, 2007, 7th Reprint, 2017.
6. Kenneth J. Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning’’, 2018.
7. A.K. Ray, K.M. Bhurchandi, “Advanced Microprocessor and Peripherals’’, 3rd Edition, Tata McGraw-Hill, 2nd Edition, 2017.
8. ARM System-on-Chip Architecture, Second Edition, by Steve Furber, PEARSON, 2018.
9. Mark Torvalds, “Arduino Programming: Step-by-Step Guide to Master Arduino Hardware and Software” Createspace Independent Pub, 2017.

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

CO1: Program 8086 processors for simple applications.

CO2: Interface external I/O devices with 8086 microprocessors.

CO3: utilize the instructions effectively and develop an assembly language program using 8051.

CO4: Design and develop applications using 8051 Microcontroller.

CO5: Gain knowledge on advanced Microcontrollers.

Board of Studies (BoS):	**Academic Council:**
17th BoS of EIE held on 16.12.21	18th AC held on 24.02.2022

	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	L	L	L	L	L	L	L
CO2	M	L	M	L	L	M	L	L	L	L	L	L	L	L	M
CO3	M	L	L	L	L	L	M	L	L	L	L	M	L	L	L
CO4	M	L	L	L	L	L	L	L	M	L	M	L	M	L	L
CO5	M	L	H	L	L	L	L	L	L	L	M	M	L	L	L

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

SDG 8: Decent work and economic growth.
Statement: This course motivates to design projects addressing the issues faced by industries in their economic growth.

SDG 9: Industry, Innovation and Infrastructure.
Statement: This course enlightens students in promoting industrial applications of programable devices.

EID 2204	PYTHON FOR INSTRUMENTATION ENGINEERS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basics of simple data types, expressions with pertinence to python programming

COB2: To learn the control structures of Python programming

COB3: To learn indexing methods, scope of variables used in function

COB4: To acquire programming skills with inheritance concepts

COB5: To describe the various application programming with Python

MODULE I INTRODUCTION TO PYTHON 8

Basic Elements of Python - object, expression and numeric type -variables and assignment types - data types - Input statements - Branching program s- Looping programs -strings - IDE basic syntax – While loop

MODULE II FUNCTIONS AND STRUCTURES 9

Functions and scoping - function definitions - keyword arguments - default values - scoping - specifications - recursion – global variables – modules – tuples – lists – Dictionaries.

MODULE III CLASSES AND OBJECTES 9

Static and Dynamic classes – classes – inheritance – multiple level of inheritance – substitution principles – Encapsulation –Information hiding.

MODULE IV FILES AND EXCEPTION 10

Reading the text files – using parameter and Return value – keyword arguments – Default parameter – accessing dictionary values – handling Expections – Network programming.

MODULE V PYTHON AND MCU APPLICATION 9

Introduction to Raspberry Pi – GPIOs – serial port – SPI interface – I/O modules with Raspberry Pin – WIFI controlled led – Working with ThingSpeak to display sensor's output - Home automation – camera interface.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Zelle, John M.Python Programming: An Introduction to Computer Science.1st ed.Frankin Beedle & Associates ,2003

REFERENCES:

1. Mark Lutz," Learning Python, Powerful OOPs,O'reilly,2011
2. Robert Sedgewick, Kevin Wayne ,Robert Dondero,Intro Programming in Python, Pearson, 2016.
3. Mark J.Guzdial, Barbara Ericson, "Introduction to Computing & Programming in Python,4th Edition Pearson,2015.
4. Budd, Timothy. Exploring Python. McGraw-Hill science, 2009. Science. 1st ed. Franklin Beedle& Associates, 2003.

COURSE OUTCOMES:

CO1: Apply the concepts and techniques of Python in various related fields.

CO2: Form the ontology for different domains and generate the equivalent representations.

CO3: Use various inheritance techniques in various application areas

CO4: Implementing programs in Raspberry pi

CO5: Apply Sensor interfacing techniques and analysis

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	H	M	H	M	H	L	H	L	M	L	M	M	-	-	-
CO2	H	M	M	M	H	L	H	L	M	L	M	M	-	-	-
CO3	H	M	M	M	H	L	H	L	M	L	M	M	-	-	-
CO4	H	M	H	M	H	L	H	L	M	L	M	M	-	-	-
CO5	H	M	H	M	H	L	H	L	M	L	M	M	-	-	-

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

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

Statement: Information retrieval can provide organizations with immediate value-while it's important to try to figure out ways to capture tacit knowledge, information retrieval provides a means to get at information that already exists in electronic formats. Thus, learning the various information retrieval techniques helps in promoting inclusive and sustainable industrialization and foster innovation.

MED 2281	THERMODYNAMICS AND FLUID MECHANICS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To study the fundamentals and laws of thermodynamics

COB2: To gain knowledge on power generating machines

COB3: To familiarize about various types of compressors, refrigeration and air conditioning systems

COB4: To learn the fundamental concepts of fluid mechanics

COB5: To acquire knowledge on hydraulic turbines and pumps

MODULE I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 9

Basic concepts - Types of thermodynamic systems - Property, state, path and process -Quasi-static process - Work, modes of work -Zeroth law of thermodynamics – Concept of temperature and heat -Concept of ideal and real gases - First law of thermodynamics : Application to closed and open systems -Internal energy - Specific heat capacities – Enthalpy - Steady flow process - Second law of thermodynamics :Kelvin's and Clausius' statements.

MODULE II POWER GENERATING MACHINES 9

Layout of thermal and gas turbine power plants - Combined cycle power plants–Otto cycle, Diesel cycle, Rankine cycle and Brayton cycle: P-V, T-S planes and thermal efficiency - Working of SI and CI engines – Recent trends in IC engines.

MODULE III COMPRESSORS, REFRIGERATION AND AIR CONDITIONING SYSTEM 8

Air compressor: Classifications and working principle - Vapour compression refrigeration system: Working principle and performance calculations, Air conditioning systems : Classifications, working principle- Heat transfer - Modes of heat transfer :Conduction, convection and radiation - Simple problems.

MODULE IV FUNDAMENTALS OF FLUID MECHANICS 9

Introduction - Properties of fluids - Density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and Capillarity -Concept of fluid static pressure, absolute and gauge pressures – Pressure measurements by manometers and pressure gauges.
Types of fluids - Classification of fluid flows -Concepts of streamline and stream tube -Principles of continuity, energy, momentum and Bernoulli's equation – Flow measurement: Orifice meter, venturi meter and pitot tube.

MODULE V HYDRAULIC TURBINES AND PUMPS 10

Turbines**:** Definition and classifications – Impulse and Reaction turbines: Working principles, velocity triangle, work done, specific speed, efficiencies and performance curves
Pumps: Definition and classifications – Centrifugal pump: working principle, velocity triangle, specific speed, efficiency and performance curves – Reciprocating pump: Classifications, working principle

L – 45; TOTAL HOURS – 45

TEXT BOOK:

3. Nag. P.K., Engineering Thermodynamics, 5th Edition, TataMcGraw-Hill, 2013
4. Bansal. R.K Fluid Mechanics and hydraulics Machines, Revised 9th edition, Laxmi Publications (P) Ltd, New Delhi, 2015.

REFERENCES:

1. YunusCengel and Michael Boles, Thermodynamics: An Engineering Approach, NinthEdition –Tata McGraw Hill, 2019
2. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2017
3. Kumar.K.L., "Engineering Fluid Mechanics ", Eurasia Publishing House(P) Ltd, New Delhi, Eightedition, 2014.
4. White, F.M., Fluid Mechanics", Tata McGraw Hill, 8th Edition, NewDelhi-2016

COURSE OUTCOMES:

After completion of the course, students should be able to
CO1: apply the fundamentals of thermodynamics to quantify energy transfer.
CO2: describe and evaluate the performance of power generating machines
CO3: demonstrate the various types of compressors, refrigeration and air conditioning systems
CO4: explain the fundamental concepts of fluid mechanics
CO5: analyze the performance of hydraulic turbines and pumps

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	H	M	L		M		M					L			
CO2	H	M	L		M		M					L			
CO3	H	M	L		M		M					L			
CO4	H	M	L		M		M					L			
CO5	H	M	L		M		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 understanding of thermodynamic and fluid mechanics principles enables to design and develop sustainable thermal and fluid power systems.

EID 2205	INDUSTRIAL INSTRUMENTATION	L	T	P	C
SDG: 4, 9,12	LABORATORY- I	0	0	2	1

COURSE OBJECTIVES:

COB1: To provide good hands-on experience on industrial instruments.

COB2: To familiarize with pressure Instruments, vacuum Instruments, pyrometers.

COB3: They may able to tackle any problem when working in core industry.

COB4: To expose the students pertaining to various lab instruments which they will come across in the industry.

LIST OF EXPERIMENTS

1. Measurement of Pressure using Bourdon tube.
2. Measurement of acceleration, velocity displacement using Accelerometer.
3. Torque measurement.
4. Vacuum pressure measurement
5. Measurement of temperature using IR thermometer and IC sensor
6. Measurement of Absorbance and Transmittance of Test solutions using UV- Spectrometer
7. Speed control of stroboscope
8. Signal conditioning of RTD
9. Cold junction compensation of thermocouple.
10. Radiation pyrometer.
11. Blood pressure measurement, ECG and Oximetry
12. Study on industry standards
13. Study on Three way and Five-way manifold

P – 30; TOTAL HOURS – 30

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: test the characteristics of various pressure and speed measuring instruments

CO2: estimate the concentration of unknown substance using analytical instruments

CO3: design, implementation and testing of temperature measuring instruments

CO4: test the characteristics of health care instruments

CO5: Interpret the results of analysis and draw meaningful conclusions

Board of Studies (BoS):
17th BoS of EIE held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

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

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

SDG 4: Quality Education
This course is used to substantially increase the number of youth and adults who have technical knowledge about sensors and transducers for employment, decent jobs and entrepreneurship.

SDG 9: Industry, Innovation and Infrastructure
The knowledge about various sensors is used to promote inclusive and sustainable industrialization by significantly raise industry's share of employment and gross domestic product, in line with national circumstances.

SDG 12: Responsible Consumption and Production
It is used to strengthen the scientific and technological capacity to move towards more sustainable patterns of consumption and production of various sensors

EID 2206	MICROPROCESSOR AND	L	T	P	C
SDG: 4, 8, 9	MICROCONTROLLER LABORATORY	0	0	2	1

COURSE OBJECTIVES:

COB1: To know the concept of 8085 microprocessors.

COB2: To know the concept of 8051 microcontrollers.

COB3: To acquire knowledge on interfacing devices.

COB4: To learn about simple applications of microcontroller.

COB5: To familiarize with advanced microcontrollers.

LIST OF EXPERIMENTS:

1. Arithmetic operations using 8086
    a. Addition and subtraction of 8-bit numbers
    b. Addition and subtraction of 16-bit numbers
    c. Multiplication and division of 8-bit numbers
    d. To find largest and smallest number in a number series
    e. To arrange the number series in ascending and descending order.
2. Arithmetic operations using 8051
    a. Addition and subtraction of 8-bit numbers
    b. Addition and subtraction of 16-bit numbers
    c. Multiplication and division of 8-bit numbers
    d. To find largest and smallest number in a number series
    e. To arrange the number series in ascending and descending order.
2. Logical operations using 8051.
3. To transfer a block of data from one memory zone to the others.
4. Stepper motor interfacing with 8051
    a. for full and half step rotation
    b. for rotating motor in clockwise and anticlockwise direction
5. Interfacing of D/A converter MODULEs with 8051 to generate the following waveform and to measure the time period and frequency of each waveform.
    a. Saw tooth waveform
    b. Triangular waveform
    c. Square waveform
6. Interfacing traffic light control system
7. Interface 8279 with 8051 to perform the following functions

a. To display different alphabets and numbers in the 7-segment display

b. to read various keys form the keyboard

8. Study of Arduino UNO board, Arduino IDE and ‘C’ Programming

9. Interfacing LED and LCD with Arduino UNO
10. Design of Load cell using Arduino UNO

P – 30; TOTAL HOURS – 30

COURSE OUTCOMES: At the end of this course,

CO1: The students will effectively carryout programming of microprocessor and microcontroller interfacing for industrial applications.

CO2: The students will be able to design mini projects using sensors and microcontrollers for industrial applications.

Board of Studies (BoS) :
17th BoS held on 16.12.21

Academic Council:
18th AC held on 24.02.2022

	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	M	L	L	L	L	L	L	L	L	L	L	M	L	L
CO 2	H	H	M	H	L	L	L	L	L	L	L	L	L	L	H

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

SDG 8 : To design projects involving economic growth.

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

The course gives in-depth knowledge in basic microprocessor and microcontrollers which improves the understanding of advanced electronics in future this results in improving quality of education.

This course motivates to design projects addressing the issues faced by industries in their economic growth.

This course enlightens students in promoting industrial applications of programable devices.

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) :
13thBoS 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	INDIAN CONSTITUTION AND HUMAN RIGHTS	L	T	P	C
SDG: 16		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) :
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			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.

PROGRAM ELECTIVE I - IV SEMESTER

		L	T	P	C
EIDX 01	**FIBRE OPTIC AND LASER INSTRUMENTATION**				
SDG: 4,9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide knowledge on the basic concepts of optical fibres and their properties.

COB2: To impart exposure to the industrial applications of optical fibres

COB3: To provide adequate knowledge on the fundamentals of Laser and their industrial applications

COB4: To provide exposure to holography and medical applications of Laser

MODULE I OPTICAL FIBRES AND THEIR FUNDAMENTALS 8

Principles of light propagation through a fibre – Fibre optic materials and their Characteristics-Different types of fibres and their properties - Transmission characteristics of optical fibre- Absorption losses -Scattering losses – Dispersion losses.

MODULE II OPTICAL SOURCES AND DETECTORS 8

Introduction to Optical sources LED-structures, Types, characteristics, Applications, LD. Optical detectors: PIN structures, Types, characteristics, Applications, APD - Wavelength Division Multiplexing.

MODULE III INDUSTRIAL APPLICATIONS OF OPTICAL FIBRES 8

Fibre optic sensors- Fibre optic instrumentation System-Different types of modulators –Detectors-Application in instrumentation- Interferometric method of Length measurement-Moire fringes-Measurement of pressure, Temperature, current, Voltage, liquid level and strain.

MODULE IV LASER FUNDAMENTALS 9

Fundamental characteristics of laser-Three level and four level lasers-Properties of lasers-Laser modes-Resonator configuration-Q-switching and mode locking-Cavity dumping-Types of laser-Gas laser, solid laser, liquid laser, semiconductor laser.

MODULE V HOLOGRAPHY , MEDICAL AND INDUSTRIAL APPLICATION OF LASER 12

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect-Material processing-Laser heating, welding, melting and trimming materials, removal and vaporization Holography- Basic principle, methods-Holographic interferometer and applications –Holography for nondestructive testing-Holographic components-Medical application of lasers-laser and tissue interaction-Removal of tumors of vocal cards-Plastic surgery-Endoscopy.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Gerd Keiser, “Optical Fibre Communications”, McGraw-Hill, International Edition, 2010

REFERENCES:

1. D.C.O’shea, Russel Callen, “Introduction to lasers and their applications”, Mc Millan, 1977.
2. John and Harry, “Industrial lasers and their applications”, McGraw Hill, 1974.
3. John senior, “Optical communications”, PHI
4. John F Ready, “Industrial applications of lasers”, Academic press, 1978.
5. Monte Ross, “Laser applications”, McGraw Hill, 1968.

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: Classify the optical fibers based on their properties and characteristics and to analyze various losses.
CO2: Identify the optical sources and detectors used in fiber communication
CO3: Design fibre optic systems and apply in various fields
CO4: Understand the Laser fundamentals and their types
CO5: Apply the concept of laser in various Industries
CO6: Apply the knowledge about lasers in Medical field and holography.

Board of Studies (BoS) :
17th BoS of EIE held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022

	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	M	L	L	L					L	L	L	H		
CO2	H	M	M	L	L					L	L	L	H		
CO3	H	H	M	L	L					L	L	L	H	L	L
CO4	H	M	L	L	L					L	L	L	H		
CO5	H	H	M	L	L					L	L	L	H	L	L
CO6	H	M	H	L	L					L	L	L	H	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.

SDG 9: To promote Innovations and Infrastructure developments in Communication Technology.

The understanding and identification of proper optical and laser instruments for use in communication industries promotes innovations and lifelong learning opportunities.

EIDX 21	CONTROL SYSTEM COMPONENTS	L	T	P	C
SDG: 4,8,9		3	0	0	3

COURSE OBJECTIVES:

COB1: To provide knowledge on Control System Parameters.

COB2: To provide knowledge on Gears & Gyroscope.

COB3: To give acquaintance on Potentiometer &Synchros.

COB4: To make the students to understand Servomotors & Stepper Motors

COB5: To make the students to understand Tachometers.

MODULE I INTRODUCTION 6

Introduction - Accuracy and Mode of Control - Closed Loop Control System - Components of Control System.

MODULE II GEARS AND GYROSCOPES 10

Introduction - Types of Gears : Spur Gear and Pinion, Rack and pinion, Helical Gear, Herringbone Gear, Bevel Gear, Worm Gear - Gear for Load Matching, Design of Gear Trains - Backlash in Gears Introduction - Gyroscopic effect - Positional References - Construction of the Gyroscope - Working and application of Horizontal Gyroscope - Construction and use of vertical gyroscope - Equations of Gyroscope - Application of Gyroscope.

MODULE III POTENTIOMETERS AND SYNCHROS 10

Introduction - Types of potentiometers - Applications of Potentiometers - selection of Potentiometers - Synchro Construction and Operation - Charactersitics - Application - Synchro pair as error detector.

MODULE IV SERVO AND STEPPER MOTOR 10

Introduction - DC Servo motors : Transfer function of DC Servomotor, Transfer function of field controlled DC Servomotor, Armature controller DC Servomotor, AC Servo motor : Construction, Theory of operation of Induction Motor, Ac Servomotor Introduction - Permanent Magnet stepper motor - Variable Reluctance motor - Hybrid Stepper Motor – Applications.

MODULE V TACHOMETERS 9

Introduction - Characteristic requirements of tachogenerator - DC Tachogenerator : Construction, working, Advantages & Disadvantages, EMF

equation - AC Tachogenerators : AC Induction Tachogenerator, working, sources of error - Tachometer applications : Position control, Tachometer as an integrator

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. M.D. Desai, 'Control System Components' PHI Learning, New Delhi - 110 001, 2008, ISBN 9788120336056.

REFERENCES:

1. Benjamin C. Ku and Farid Golnaraghi, "Automatic Control Systems",10th edition McGraw-Hill Education, 2017
2. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: Identify the components suitable for closed loop control of a process

CO2: Apply the components for automation solutions

CO3: Understand the construction of the different control system components

CO4: Integrate the required components to build a control loop

CO5: Design the components to assess the performance for a particular application

Board of Studies (BoS) :

17th BoS held on 16.12.21

Academic Council:

18th Academic Council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	H	L	L	-	M	L	L	-	-	-	L	L	L	-	M
CO2	H	L	L	-	M	L	L	-	-	-	L	L	L	-	H
CO3	L	L	M	L	M	L	M	-	-	-	M	L	L	L	H
CO4	L	L	M	L	M	L	M	-	-	-	M	L	-	L	H
CO5	H	L	M	L	H	L	M	-	-	L	M	L	-	L	H

SDG 4: Quality Education

The entire arrangement of the course syllabus provides quality education

SDG 8: Decent work and economic growth

The study of this course improves automation and provides economic growth in industries

SDG 9: Industry, Innovation & Infrastructure

This course will help to in cultivate new technology thereby improving the infrastructure of the nation

EIDX 41	MEMS AND NANO SCIENCE	L	T	P	C
SDG: 4,9,12		3	0	0	3

COURSE OBJECTIVES:

COB1: To provide wide knowledge of semiconductors and solid mechanics to fabricate MEMS devices

COB2: To educate on the rudiments of Micro fabrication techniques

COB3: To educate on applications of MEMS

COB4: To analyze methods involving preparation of nano scale devices

MODULE I OVERVIEW OF MEMS AND MICROSYSTEMS 7

Introduction to MEMS and Microsystems, Need for Miniaturization, MEMS and Microsystem products: Micro gears - Micro turbines – Micromotors - Micro optical devices. Microsystems and Microelectronics, Application of Microsystems in Automotive Industries: Safety - Engine and power trains - Comfort and convenience, Micro actuation: Actuation using thermal forces - actuation using shape memory alloys - Actuation using piezoelectric effect - Actuation using Electrostatic forces.

MODULE II MICROSYSTEM FABRICATION PROCESS 6

Photolithography, Ion Implantation, Diffusion, Oxidation: Thermal Oxidation-Oxidation by colour, Chemical Vapour Deposition, Physical Vapour Deposition: Sputtering, Etching: Chemical Plasma, Micromaching: Bulk Micromachining - Surface Micromachining.

MODULE III POLYMERS AND OPTICAL MEMS 7

Polymers in MEMS: Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – 90 Perylene – Fluorocarbon, Optical MEMS: Lenses and Mirrors – Actuators for Active Optical MEMS, Assembly of 3D MEMS – Foundry process.

MODULE IV MEMS 8

General Principle of Nano Fabrication, Nano products, Applications of Nano products, Quantum physics, Fluid flow in submicrometers and nanoscales: Rarefied Gas – Knudsen and match numbers – Modelling of micro and nanoscale gas flow, Heat Conduction at Nanoscale, Challenges in Nanoscale Engineering, New materials for NEMS.

MODULE V PATTERNING AND PREPARATION METHODS 7

Bottom-up Synthesis – Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE, Patterning: Introduction to optical/UV electron beam and X-ray Lithography systems and processes. Clean rooms: specifications and design, air and water purity, requirements for particular processes.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Tai Ran Hsu “MEMS and Microsystems Design: Manufacture and Nano Scale Engineering”, John Wiely& Sons, INC., 2nd Edition, 2008.

2. A.S. Edelstein and R.C. Cammearata, eds., Nanomaterials: Synthesis, Properties and Applications, (Institute of Physics Publishing, Bristol and Philadelphia, 1996).

REFERENCES:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001.
3. Nadim Maluf, “An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
4. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999.
5. N John Dinardo, Nanoscale characterisation of surfaces & Interfaces, Second edition, Weinheim Cambridge, Wiley-VCH, 2000.

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: understand the operation of micro devices, micro systems and their applications.

CO2: design the micro devices, micro systems using the MEMS fabrication process.

CO3: understand the use of polymers for MEMS applications

CO4: understand the operation of nano devices, nano systems and their applications.

CO5: design nano devices, nano systems using the preparation methods

Board of Studies (BoS) :
17th BoS held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022

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

SDG 4 : Quality Education

This course is used to substantially increase the number of youth and adults who have the skills in MEMS technology , for employment, decent jobs and entrepreneurship.

SDG 9: Industry, Innovation and Infrastructure

The study of nanotechnology is used to promote inclusive and sustainable industrialization by significantly raise domestic product, in line with national circumstances.

SDG 12: Responsible Consumption and Production

It is used to strengthen the scientific and technological capacity to move towards more sustainable patterns of consumption and production of micro/nano materials and nano sensors.

EIDX 42	APPLIED POWER ELECTRONICS	L	T	P	C
SDG: 7, 8,9		3	0	0	3

COURSE OBJECTIVES:

COB1: To apply mathematics in analyzing switching converter circuit performance.

COB2: To understand the operation of DC to DC converter and apply it for electric drive system

COB3: To know the significance of multilevel converter and its real time applications

COB4: To apply power electronic converters for the control of HVDC system

COB5: To perform reactive power compensation in the power system network using power electronic devices.

MODULE I SWITCHING VOLTAGE REGULATORS 7

Switching Voltage Regulators: Introduction - Linear power supply (voltage regulators). Non-isolated dc-dc converters: Buck, boost, buck-boost, Cuk converter - Isolated dc-dc converters: Flyback, forward, half bridge, full bridge and push-pull. power factor correction at AC mains in these converters.

MODULE II DC DRIVES WITH DC-DC CONVERTERS 10

Principle of power control (motoring control) of separately excited and series motor with DC-DC Converter - Steady- state analysis - Principle of Regenerative Braking- Chopper configuration for Regenerative braking - Analysis for minimum and maximum speed for Regenerative Braking - Combined regenerative and rheostatic brake control - Two Quadrant operation - Four quadrant of DC-DC converter drive.

MODULE III MULTI LEVEL CONVERTERS 9

Need for multi-level inverters, PWM technique for multi-level converters - Multi-level inverter topologies - Diode Clamped - Flying capacitor and Cascaded H-bridge multilevel Converters configurations – multilevel inverters for electric vehicle.

MODULE IV HVDC TRANSMISSION 10

Introduction - Comparison of AC and DC transmission- HVDC system – control modes, control schemes- Multi-terminal HVDC system- Operation of 12-pulse converter as receiving and sending terminals of HVDC system -

Equipment required for HVDC System its control and significance.

MODULE V FACTS DEVICES 9

Importance of reactive power compensation - Thyristor Controlled Reactor (TCR) - Fixed Capacitor Thyristor Controlled Reactor (FC-TCR) – Thyristor Switched Capacitor - STATCOM - SVC - Static Synchronous Series Compensator – UPFC.

L – 45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Ned Mohan, Undeland and Robbin, "Power Electronics - converters, Application and design", John Wiley and sons.Inc, New York, Third Edition 2009.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hall India, New Delhi, Third Edition 2011
3. P.S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Vedam Subramanyam, "Thyristor control of Electrical Drives", Mc Graw Hill Education (India) Pvt. Ltd., 3rd Edition, 2015
2. Pillai.S.K., "A First Course on Electrical Drives", New Age International (P) Ltd., 2nd Edition, 2015
3. Gopal K.Dubey, "Power semiconductor controlled drives", Prentice Hall international, 2013
4. KR Padiyar, "HVDC Power Transmission Systems", Willey Eastern Limited, Second edition,2013.
5. Vijay K. Sood, "HVDC and FACTS Controllers Applications of Static Converters in Power Systems", Kluwer Academic Publishers, Boston, 2004.
6. Narain G. Hingorani, Laszlo Gyugyi, " Understanding facts: Concepts and Technology of Flexible AC Transmission Systems" 2000.

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: analyze the operation of isolated and non isolated DC-DC converter and its applications.

CO2: design, analyze and apply chopper fed drive system for real time applications

CO3: design, analyze and apply multilevel inverters for societal applications.

CO4: design, model and modify power electronic controllers for HVDC transmission system.

CO5: apply power electronic control for reactive power compensation in power system network.

Board of Studies (BoS) :
17th BoS held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022.

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

SDG 7 : Affordable & Clean Energy

Understanding the fundamentals of power electronics helps to interface quality power from clean energy sources to the utility grid.

SDG 8 :Decent Work and Economic Growth

The complete understanding of power converters leads to have sustainable industrialization and promote economic development.

SDG 9 :Industry, Innovation & Infrastructure

Understanding the fundamentals of FACTS device and HVDC transmission leads to innovative design which further enhances the industry and infrastructure

EIDX 61	INDUSTRIAL DATA NETWORKS	L	T	P	C
SDG: 4,8,9		2	0	0	3

COURSE OBJECTIVES:

COB1: To educate on the basic concepts of data networks

COB2: To introduce the basics of inter networking and serial communications

COB3: To provide details on HART and Field buses

COB4: To educate on MODBUS, PROFIBUS and other communication protocol

COB5: To introduce industrial Ethernet and wireless communication

MODULE I DATA NETWORK FUNDAMENTALS

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing -CSMA/CD, TCP/IP.

MODULE II INTERNET WORKING and RS 232, RS485

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Devicenet.

MODULE III HART AND FIELD BUS

Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications - Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).

MODULE IV MODBUS AND PROFIBUS PA/DP/FMS AND FF

MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway.

MODULE V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum.

L – 45 ; TOTAL HOURS - 45

TEXT BOOKS:

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004.
2. A.Behrouz Forouzan ,Data Communications & Networking ,3RD edition, Tata Mc Graw hill,2006.
3. William Buchanan, Computer Buses, CRC Press, 2000.

REFERENCES:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
2. Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2ndEdition, 2001.
3. William Stallings, Wireless Communication and Networks, Prentice Hall of India, 2nd Edition, 2005.

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: define basic concepts of data communication and its importance.

CO2: explain the various internetworking devices involved in industrial networks

CO3: explain the various serial communication used in process industries.

CO4: illustrate, compare and explain the working of HART and Field bus used in process digital communication.

CO5: summarize the operation of MODBUS, PROFIBUS protocol and its applications.

CO6: explain and adopt the different Industrial Ethernet protocol and usage of wireless communication in process applications.

Board of Studies (BoS):
17th BoS held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022.

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

SDG 4: Quality Education

The entire arrangement of the course syllabus provides quality education

SDG 8: Decent work and economic growth

The study of this course help to identify sensors and transducers and measurement systems which provides economic growth and decent work

SDG 9: Industry, Innovation & Infrastructure

New technological application to transducer and measurement systems helps to innovate, improve the industry and infrastructure of the nation

EIDX 62	R PROGRAMMING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To familiarize the students with R programming Environment

COB2: ToKnow the functions in R and important points in Comments and commands.

COB3: To understand the programming concept of R, class and objects.

COB4: To Work with basic R commands, packages and accessing R packages.

COB5: To provide practical knowledge for handling and analyzing data sets covering a variety of real-world applications.

MODULE I INTRODUCTION TO R PROGRAMMING 9

Introduction to scientific programming, R basics, code editors for R, finding help, control structures, conditional execution, loops.

MODULE II FUNCTIONS AND COMMANDS 9

Functions in R, useful utilities, debugging utility, regular expressions, interpreting character string as expression, time-date-sleep, calling external software with system commands, running R commands.

MODULE III OBJECT ORIENTED PROGRAMMING IN R 9

Object oriented programming in R, define class and objects in R, assign generics and methods.

MODULE IV PACKAGES IN R 9

Packages in R, installation process of various packages in R, data science packages in R, Building R packages.

MODULE V USE CASES OF SCIENTIFIC PROGRAMMING 9

Comparison of R with other scientific programming software, implementation of various industry use cases of scientific programming using R .

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1.Mark Gardener,“Beginning R: The Statistical Programming language ”,Wiley Publishers, 1rd edition, New Jersy 2013.ISBN: 9788126541201

REFERENCES:

1. Roger Peng , “R Programming for Data “, Lulu Publisher, 2016. (ISBN 1365056821)
2. Grolemund, Garrett, “Hands-On programming with R” O Reilly Publications,2017.(ISBN1449359019)

COURSE OUTCOMES:

After completion of this course the students will be able to

CO1: Develop R program how to use R for effective data analysis.

CO2: Apply different searching, planning algorithms to reach the goal in state-space problems.

CO3: Understand complexity of R programming algorithms and their limitations**.**

CO4: Implement common R programming algorithms and interpret the results.

CO5: Design R packages using real-world data to address social and business problems.

Board of Studies (BoS) :
17th BoS held on 16.12.21

Academic Council:
18th Academic Council held on 24.02.2022.

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

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

SDG 9 : Industry, innovation and infrastructure

Statement: To enable computers to perform such intellectual tasks as decision making, problem solving, perception, and statistical analyzing.

MATHEMATICS ELECTIVE
(SEMESTER III)

		L	T	P	C
MADX 01	**TRANSFORMS AND PARTIAL**				
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) :	**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														
CO4	M														
CO5	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
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 will lead to knowledge of applications in Engineering problems

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
CO1	M														
CO2	M														
CO3	M														
CO4	M														
CO5	H														

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 Engineering problems

MADX 04	RANDOM PROCESSES	L	T	P	C
SDG: 4		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, 2000

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
CO1	M														
CO2	M														
CO3	M														
CO4	L														
CO5	L														

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														
CO2	M														
CO3	M														
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 methods in numerical analysis will lead to use of applications in many projects in Engineering.

HUMANITIES ELECTIVES – III SEMESTER

SSDX 01	**ENGINEERING ECONOMICS AND MANAGEMENT**	**L**	**T**	**P**	**C**
SDG: 4, 8, 9,12		**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:

1. Andrew Gillespie, “Foundations of Economics”, OUP Oxford, England, 2007.
2. Acemoglu, D., Laibson, D., & List, J., “Microeconomics”, Pearson Education, 2nd Edition, Boston, 2017.
3. Brinkman John , “Unlocking the Business Environment”, Routledge, 1st Edition, London, United Kingdom, 2010.(ISBN 9780340942079)
4. Cleaver Tony, “Economics: The Basics”, Routledge, 3rd Edition, London, United Kingdom, 2014.
5. H. L. Ahuja, “Macroeconomics”, S Chand Publishing; Twenty Edition, New Delhi, India, 2019.
6. Koutsoyiannis A, “Modern Microeconomics”, Palgrave Macmillan, 2nd Edition, U.K, 2003.

7. R.A. Musgrave and P.B. Musgrave, “Public Finance in Theory and Practice” , McGraw Hill Education India, Fifth Edition, India, 2017.
8. Mell Andrew and Walker Oliver, “The Rough Guide to Economics”, Rough Guide Ltd, 1st Edition, London, 2014.
9. R. Paneerselvam, “Engineering Economics”, PHI Publication, 2nd Edition, New Delhi, India, 2014.
10. 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
CO2		H	M			M					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. Ltd2017
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) :
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	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.

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.

MODULE IV INDUSTRIAL POLICY 9

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:

7. Barthwal R R "Industrial Economics: An Introductory Textbook", New Age International Pvt. Ltd Publishers, 2017
8. 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) :	**Academic Council:**
Mention details of BoS	18th Academic council held on
5thBoS of SSSH held on 29.12.2021	24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
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.

		L	T	P	C
SSDX 04	**DYNAMICS OF INDIAN SOCIAL STRUCTURE**				
SDG: 10, 16		**3**	**0**	**0**	**3**

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) :
5thBoS of SSSH held on 29.12.2021

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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
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.