Department of Electrical and Electronics Engineering

Composition of Board of Studies

SL.NO.	MEMBERS AS PER UGC NORMS	MEMBERS NOMINATED
1.	Head of the Department concerned (Chairman)	**Dr.S.Anbumalar, M.E., Ph.D.,** Professor and Head/EEE/SMVEC
2.	Entire faculty of each specialization	1. **Dr. K. Suresh , M.E., Ph.D.,** Professor/EEE/SMVEC 2. **Dr.P.Jamuna, M.Tech., Ph.D.,** Professor/EEE/SMVEC 3. **Dr.M.Susithra, M.E., Ph.D.,** Associate Professor/EEE/SMVEC 4. **Dr.S.GaneshKumaran, M.E., Ph.D.,** Associate Professor/EEE 5. **Mrs.M.Sugasini** Assistant Professor, Dept. of Mathematics, SMVEC 6. **Dr.K.Kathikeyan** Associate Professor, Dept. of Chemistry, SMVEC 7. **Mrs.G.Namita** Associate Professor, Dept. of English, SMVEC 8. **Dr.D.Mohan Radheep** Associate Professor ,Dept. of Physics, SMVEC
3.	Two experts in the subject from outside the college nominated by the Academic Council	1.**Dr. J. Kanakaraj, M.E., Ph.D.,** Professor & Head, Department of EEE , PSG College of Technology (Autonomous) Coimbatore – 641 004. 2.**Dr. P. Lakshmi,M.E., Ph.D.,** Professor, Department of EEE, College of Engineering, Guindy, Anna University, Chennai. 600 025.
4.	One Expert nominated by the Vice Chancellor from a panel of six recommended by the college Principal	**Dr.A.Kavitha,M.Tech., Ph.D** Professor, Department of EEE, College of Engineering Guindy, Anna University, Chennai-600025
5	One representative from industry / corporate sector/allied area relating to placement	**Er.S. Selva Kumar, B.Tech.** Validation Engineer Infineon Technologies India Private Limited Bengaluru, Karnataka - 560001
6	One Post Graduate meritorious alumnus nominated by the Principal	**Er.K.Ramraj,M.Tech** Technical Director, LED FORSE India, Poornankuppam,Puducherry – 605 007.

Department of Electrical and Electronics Engineering

Minutes of I[st] Board of Studies Meeting (UG)

The first Board of Studies meeting of Department of Electrical and Electronics Engineering was held on 18th July 2020 at 11:00 A.M in the Seminar Hall, Department of EEE,Sri Manakula Vinayagar Engineering College, with Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	MEMBERS AS PER UGC NORMS
1	**Dr.S.Anbumalar** Professor and Head Department of EEE SMVEC,Madagadipet-605107	Chairman
2	**Dr.A.Kavitha** Professor Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (University Nominee)
3	**Dr. P. Lakshmi** Professor Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (Academic Council Nominee)
4	**Dr. J. Kanakaraj** Professor & Head Department of EEE PSG College of Technology (Autonomous) Coimbatore – 641 004.	Subject Expert (Academic Council Nominee)
5	**Er.S. Selva Kumar, B.Tech.** Validation Engineer Infineon Technologies India Private Limited Bengaluru, Karnataka - 560001	Representative from Industry
6	**Er.K.Ramraj** Technical Director LED FORSE India Poornankuppam Puducherry – 605 007.	Postgraduate Alumnus (nominated by the Principal)
7	**Dr. K. Suresh** Professor Department of EEE,SMVEC	Internal Member
8	**Dr. P. Jamuna** Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member

9	**Dr.M.Susithra** Associate Professor Department of EEE,SMVEC , Madagadipet-605107	Internal Member
10	**Dr.S.GaneshKumaran** Associate Professor Department of EEE, SMVEC, Madagadipet-605107	Internal Member
11	**Mrs.M.Sugasini** Assistant Professor Dept of Mathematics,SMVEC, Madagadipet-605107	Internal Member
12	**Dr.K.Kathikeyan** Associate Professor Dept. of Chemistry, SMVEC, Madagadipet-605107	Internal Member
13	**Mrs.G.Namita** Associate Professor Dept. of English, SMVEC Madagadipet-605107,	Internal Member
14	**Dr.D.Mohan Radheep** Associate Professor Dept. of Physics, SMVEC, Madagadipet-605107	Internal Member
15	**Mr.D.Raja** Associate Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member
16	**Mr. A. Janagiraman** Assistant Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member

Agenda of the Meeting

1) To apprise and approve the Pondicherry University **Regulations R2013,**its curriculum for 1 to 8 semesters and syllabi for 1 to 8 semesters **for** the Present B.Tech., Electrical and Electronics Engineering, Fourth year students admitted in the academic Year 2017-18 and Third Year students admitted in the academic Year 2018-19.
   - Examination and Evaluation-SMVEC Autonomous System

2) To discuss and approve the SMVEC Autonomous Regulations R2019, its curriculum for 1 to 8 semesters and syllabi for 1 to 4 semesters from the Academic Year 2020-21 onwards, for B.Tech – Electrical and Electronics Engineering students admitted in the Academic Year 2019-20(present Second Year)
   - Credit Requirement
   - Course structures
   - Professional Core Courses
   - Professional Elective Courses
   - Open Electives offered to other departments
   - Employment Enhancement Courses
   - AICTE – Mandatory Courses

3) To discuss and approve the SMVEC Autonomous Regulations R2020, its curriculum for 1 to 8 semesters and syllabi for 1 to 4 semesters , for B.Tech – Electrical and Electronics Engineering students admitted from the Academic Year 2020-21 onwards
   - Credit Requirement
   - Course structures
   - Professional Core Courses
   - Professional Elective Courses
   - Open Electives offered to other departments
   - Employment Enhancement Courses
   - AICTE – Mandatory Courses

4) To discuss about the uniqueness of the Curriculum
   - ❖ Employability Enhancement Course introduced from I to VI semesters
   - ❖ Skill oriented Courses
   - ❖ Multidisciplinary courses
   - ❖ Human values, Ethics, NSS, Physical Education etc. are introduced as Mandatory courses
   - ❖ Optimization laboratory
   - ❖ Entrepreneurship development courses

5) To discuss and approve Evaluation Systems
   - ❖ Mark weightage for Continuous Assessment and End Semester Examination
   - ❖ Question paper pattern
   - ❖ Marks requirement to pass the course
   - ❖ Semester Grade Point Average (SGPA), Cumulative Grade Point Average (CGPA) and Percentage Conversion
   - ❖ Classification of Degree

6) To discuss and approve the Innovative Teaching Practices/Methodology, Training to be adopted to handle the emerging / Advanced Technological concept courses
7) To discuss and recommend the panel of examiners to the academic council
8) Any other item with the permission of chair
   - ❖ To suggest Exam fee and Remuneration to the examiners

Minutes of the Meeting

Dr.S.Anbumalar, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal members and thanked them for accepting to become the member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

Item:1 The Pondicherry University **Regulations R2013,**its curriculum for 1 to 8 semesters and syllabi for 1 to 8 semesters **for** the B.Tech., Electrical and Electonics Engineering were **discussed and approved** for the Fourth year students admitted in the academic Year 2017-18 and Third Year students admitted in the academic Year 2018-19. It has also been approved to conduct Examination and Evaluation by SMVEC Autonomous System.

Item:2 The SMVEC Autonomous Regulations R2019, its curriculum for 1 to 8 semesters and syllabi for 1 to 4 semesters, for B.Tech – Electrical and Electronics Engineering were **discussed.**

The following comments were given by BoS members for the Autonomous R2019 Regulations:

Sl. No	Subject / general point	Comments
Comments for curriculum of R-2019 Regulations		
1.	*NPTEL courses	NPTEL courses need not be a mandatory course. It will be difficult for the average students to complete the course.
2.	*Project work	• Give equal weightage to all 3 reviews
Comments for syllabi of R-2019 Regulations		
3.	*Electrical Machines –I	• Combine Single phase and three phase transformer. • Combine DC motor and DC generator • Testing of Transformer can be in a separate unit

		• Testing of generator can be in a separate unit • Remove the application of DC generator.
		• Three phase test can be added in the syllabus with vector diagrams.
4.	* Electrical Machines -I Lab	• Give equal weightage to transformer and dc machines experiments
5.	Electronic Devices and Circuits	• Reduce the syllabus • Change Unit title as Opto electronic devices
		Remove the semiconductor portion which the students studied already in 12th standard to reduce the bulkiness of the syllabus
		Use of Specification sheet can be mentioned explicitly. If possible advanced devices can be added in the syllabus
6.	Electronics Lab	Remove the words "verify its performance characteristics" in relaxation oscillator experiment
7.	*Electrical Machines – II	Certain changes needed in unit 5 The sequence can be Construction and Operation of special machines, and then applications
		• Unit- I – Single phase and three phase machine can be combined
8.	*Electrical Machines -II Lab	• Load test can be combined • Experiments 3 and 5 can be combined • Types of Braking can be included
9.	*Electric Circuit Analysis Lab	Remove the software name" MATLAB" in experiments so that any software can be used based on need
10.	*Linear Integrated Circuits	Use some short form in the syllabus like S&H, Vto I / I to V Syllabus is heavy, hence reduce it.
11.	*Power plant Engineering	Some topics in Unit 5 can be corrected to focus more on power plant economics
12.	*Linear Integrated Circuits Lab	Modify the experiment name as Application of IC TPS40200 Experiments 11 and 12 can be a study experiments
13.	Special Electrical Machines	This elective paper can be floated in higher semester

*The Courses are common for both R2019 and R2020 Regulations

The above corrections are incorporated and the updated version of Curriculum and Syllabi under R2019 Autonomous Regulations is approved by the BoS members for the students admitted in the Academic Year 2019-20(present Second Year) from the Academic Year 2020-21 onwards.

Item:3 The SMVEC Autonomous Regulations R2020, its curriculum for 1 to 8 semesters and syllabi for 1 to 4 semesters, for B.Tech – Electrical and Electronics Engineering, were discussed. The various points related to Credit Requirement, Course structure, Professional Core Courses, Professional Elective Courses, and Open Electives offered to other departments, Employment Enhancement Courses and AICTE – Mandatory Courses etc., were discussed.

The following comments were given by BoS members for the Autonomous R2020 regulation

SI.No	Subject / general point	Comments
Comments for syllabi of R-2020 Regulations		
1.	Electrical Engineering Lab	Winding of Transformer and Energy Audit experiments can be converted into Study experiments because it will be difficult for the students to do in first year level. In Troubleshooting experiments– two case study is enough instead of five.
2.	Measurements and instrumentation	Syllabus is Heavy, to reduce it • Remove magnetic measurements • Change the electronic measuring instruments unit title as digital instruments • Change unit IV title as Bridges • Remove storage devices and dot matrix • Remove interfacing and Level detection ;its level is high • Modify unit 5 only as Transducers ;remove data acquisition
3.	Micro controller and its applications	Remove the following topics • PF corrections ;It is heavy • BLDC should be in the drives paper • Experiments 8 and 17,it is heavy • Verify that the ICs are available in the market • Remove power electric application topics

The above corrections are incorporated in the updated version of SMVEC Autonomous Regulations R2020, its curriculum & Syllabi and approved by the BoS members for the students admitted from the Academic Year 2020-21 onwards.

Item:4	The uniqueness of the Curriculum such as Employability Enhancement Courses, Skill oriented Courses, Multidisciplinary courses, Human values, Ethics, NSS, Physical Education, Optimization laboratory and Entrepreneurship development courses etc., were discussed by the BoS members.
Item:5	The Examination and Evaluation Systems related items such as Mark weightage for Continuous Assessment & End Semester Examination, Question paper pattern, Marks requirement to pass the course, Semester Grade Point Average (SGPA), Cumulative Grade Point Average (CGPA) & Percentage Conversion and Classification of Degree etc., were discussed and approved by the BoS.
Item:6	The Innovative Teaching Practices/Methodology, Training to be adopted to handle the emerging / Advanced Technological concept courses were discussed and approved
Item:7	The panel of examiners was presented and recommended to the academic council by the BoS.
Item:8	Any other item with the permission of chair ❖ The BoS members stated that the Exam fee and Remuneration to the examiners can be fixed by the college based on its financial condition.

The meeting for U.G Regulations approval was concluded at 2:30 PM by **Dr. S.Anbumalar**, Chairman, Board of Studies, Department of Electrical and Electronics Engineering, Sri Manakula Vinayagar Engineering College.

Sl.No	Name of the Member with Designation and official Address	MEMBERS AS PER UGC NORMS	Signature
1	**Dr.S.Anbumalar** Professor and Head Department of EEE SMVEC,Madagadipet-605107	Chairman	
2	**Dr.A.Kavitha** Professor Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (University Nominee)	
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16	**Mr. A. Janagiraman** Assistant Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member	

Annexures

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

ACADEMIC REGULATIONS 2019
(R-2019)

BACHELOR OF TECHNOLOGY PROGRAMMES

(DR.S. ANBUMALAR)
Dean Academics

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

BACHELOR OF TECHNOLOGY PROGRAMMES

(Eight Semesters)

REGULATIONS 2019

CHOICE BASED CREDIT SYSTEMS (CBCS)

(Common to all B.Tech. Full Time Programmes)

1. INTRODUCTION

1.1 Sri Manakula Vinayagar Engineering College (SMVEC) envisions to foster knowledge, skills, attitude and values of the aspiring youth to enable them to become global citizens. To achieve this process, the institution has evolved a flexible integrated academic curriculum designed in accordance with the Outcome Based Education (OBE which is acquired by the learners of a programme under 'Learner Centric' Model.

1.2 All the Under Graduate Engineering programme shall be governed by the rules and regulations provided in this version of Academic Regulations (R-2019). The curriculum of each programme provides broad based knowledge, quality course content, academic flexibility, and scope for multi-disciplinary learning activities and opportunities for industry oriented projects.

1.3 The provisions made in this document shall govern the policies, procedures, curriculum, conduct of the examinations and evaluation systems.

1.4 The semester system shall be adopted for academic activities in the college. Normally, odd semester starts in second week of June and even semester starts in second week of December.

1.5 Stringent evaluation norms will be followed to maintain quality of engineering education. The examination system will be transparent and governed by the rules and regulations with time bounded activities.

Objectives of CBCS

- To shift focus from the teacher-centric to student-centric education.
- To allow students to choose inter-disciplinary, intra-disciplinary and skill oriented courses from the choices to provide more flexibility in learning system.
- To make education broad-based on par with global standards.
- To help students to earn credits by choosing unique combination of courses.
- To create an international exposure to students by providing International Certificate Courses.
- To provide necessary training to students for gaining vital life skills through skill development programmes.
- To keep abreast of industrial requirements and societal needs, students are equipped through internship and inculcate the skill of converting Project into Product.

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1.6 The rules and regulations shall be subjected to amendment made by the Academic Council (AC) from time to time based on the recommendations of the Board of Studies (BoS).

2. PRELIMINARY DEFINITIONS AND NOMENCLATURE

College	:	Sri Manakula Vinayagar Engineering College
University	:	Pondicherry University
Programme	:	B.Tech. Degree
Discipline/ Department	:	Branch or specialization of B.Tech Degree Programme like Civil Engineering, Mechanical Engineering etc.,
Course	:	Theory / Practical subject that is normally studied in a semester. Eg: Mathematics, Computer Programming, etc.,
Professional Core Course	:	Compulsory course in the curriculum
Professional Elective Course	:	A course that can be chosen from the listed courses by a student based on his/her interest which is not covered in professional core courses.
Open Elective Couse	:	A course that can be chosen by a student based on his/her interest from the list of multi-disciplinary courses offered by other departments.
Head of the Institution	:	The Director cum Principal
Controller of Examinations (CoE)	:	The authority who is responsible for all Examination related activities of the institution
Lateral Entry	:	Admission of students directly into the second year of B.Tech. Degree programme after completion of Diploma Course in Engineering
L – T – P – PW – C	:	**L** - **L**ecture, **T**- **T**utorial, **P**- **P**ractical, **PW**–**P**roject **W**ork and **C** -**C**redits respectively
Curriculum	:	The various components / courses studied in each programme that provides an appropriate outcome in the chosen branch of study.
Semester Grade Point Average (SGPA)	:	Weightage of average grade points of subjects in a semester.
Cumulative Grade Point Average (CGPA)	:	Weightage of average grade points of all subjects in all semesters completed by a student
Odd semester	:	The Semester that is typically from June to November
Even semester	:	The Semester that is typically from December to May
Period	:	50 minutes duration of a theory / practical class
Day	:	8 periods in a calendar day
Enrolment	:	Enlistment of a student on roll in an academic year
Arrear	:	A course in which a student has not fulfilled the examination passing criteria in the end semester examination.
CAT	:	Continuous Assessment Test
CAM	:	Continuous Assessment Marks
ESE	:	End Semester Examination

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ESM	:	End Semester Examination Marks
EEC	:	Employability Enhancement Course
Regular Examination	:	End semester examination conducted for the courses prescribed in the curriculum of that semester.
Arrear Examination	:	End Semester examination conducted for the students who have not fulfilled the examination passing criteria in the previous attempt(s).
Supplementary Examination	:	An additional examination exclusively conducted in the fifth and eighth semester for the students with a maximum of two arrears.
First Attempt	:	Appearing for the end semester examination of a course in a semester for which the students have registered. If a student failed to appear for the end semester examination after registration, it is also treated as first attempt.
Academic Council (AC)	:	An Apex academic body having the power to scrutinize and approve the proposals with or without modification of the Board of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto, etc.
Board of Studies (BoS)	:	An Apex academic body having the power to approve the various courses; suggest teaching methodologies, coordinate research and other academic activities keeping in view the objectives of the college.
Academic Standing Committee (ASC)	:	ASC shall perform the functions under emergent situations which are subject to ratification by the Academic Council (AC).
Academic Appeals Board (AAB)	:	If a student finds some anomaly in the award of marks in the Continuous Assessment Test / End Semester examination, he/she can make an appeal to the *Academic Appeals Board* for review of marks awarded.
Departmental Advisory Committee (DAC)	:	The Committee that formulates a process to review the post implementation effects of curriculum and suggest various measures to ensure academic standard and its excellency of the course offered by the department.
Department Consultative Committee (DCC)	:	Reviews, revises and prepares curriculum structure based on the institutional policy and suggests improvements in syllabus of a course(s) prepared by course teacher(s) and forwards the curriculum to BoS for further recommendations. It monitors the academic progress and conduct of classes throughout the semester and takes appropriate corrective measures to improve the quality of curriculum delivery.
Programme Academic Coordinator (PAC)	:	Coordinates all the academic activities of the department viz. Curriculum revision, framing of syllabus, time table, re-registration of course(s), display and submission of attendance status and BoS meeting as a member secretary.

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AICTE	:	All India Council for Technical Education
UGC	:	University Grants Commission
NBA	:	National Board of Accreditation
NAAC	:	National Assessment and Accreditation Council
CRC	:	Complaint Redressal Committee

3. BRANCHES OF STUDY

Sri Manakula Vinayagar Engineering College offers the following B.Tech. Degree Programmes:

1. B.Tech - Electrical and Electronics Engineering (EEE)
2. B.Tech - Electronics and Communication Engineering (ECE)
3. B.Tech - Computer Science and Engineering (CSE)
4. B.Tech - Information Technology (IT)
5. B.Tech - Instrumentation and Control Engineering (ICE)
6. B.Tech - Mechanical Engineering (MECH)
7. B.Tech - Civil Engineering (CIVIL)
8. B.Tech - Biomedical Engineering (BME)
9. B.Tech - Mechatronics Engineering (Mechatronics)

4. ADMISSION ELIGIBILITY

The norms for admission, eligibility criteria such as marks, age limit and mode of admission will be as prescribed by the Pondicherry University from time to time.

4.1 First Year B.Tech and Lateral Entry

4.1.1 *B.Tech -First Year*

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 Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) /Technical Vocational subject or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

4.1.2 B.Tech - Lateral Entry

For Lateral entry in to third semester of the eight semester B.Tech Degree programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in Engineering / Technology with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with Mathematics as one of the subjects of study with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects.

4.2 Age Limit

The candidate should not have completed 21 years of age as on 1st July of the Academic year under consideration. In case of SC/ST candidates, the age limit is relaxable for three years. No age limit for Lateral entry to the second year of the B.Tech degree programme.

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5 ACADEMIC STRUCTURE

5.1 Duration of the Program

A student after securing admission shall pursue B.Tech programme for a minimum period of 4 academic years (8 semesters), if not he / she has to complete the degree within the maximum period of 7 years (14 semesters) starting from the commencement of the first semester. For a student admitted in lateral-entry mode, the minimum and maximum period of study shall be 3 academic years (6 semesters) and 6 years (12 semesters) respectively starting from the commencement of the third semester.

5.2 Medium of Instruction

The medium of instruction for the entire B.Tech Degree programme shall be only in **ENGLISH**.

6 CURRICULUM STRUCTURE

According to the National Board of Accreditation (NBA), the curriculum has to be evolved after finalizing the Programme Educational Objectives (PEOs) and the corresponding Programme Outcomes (POs). The POs have been directly listed by NBA for UG programmes. Programme Specific Outcomes (PSOs) are to be evolved based on the knowledge and skills to be developed over the duration of programme. The curriculum that evolves should broadly ensure the achievement of the POs and PSOs, and thus the PEOs of the programme.

6.1 Category of Courses and its Credit Distribution

Course work is measured in units called credit hours or simply credits. The number of hours of a course per week is the number of credits for that course. One credit per lecture hour per week is assigned for each theory course. Laboratory courses and tutorial are assigned for an hour with 0.5 credits per week. The credits details of courses are shown in Table 1.

Table 1 Credits details of courses

Nature of Course	Number of hours			Credits
	L	T	P	
Theory	3	0	0	3
Theory with Tutorial	2	2	0	3
Practical	0	0	2	1
Project work	0	0	20	10
Total Number of Credits			Regular	Between 180 and 185
			Lateral entry	Between 120 and 125
Number of credits per Semester			Between 18 to 30	

EEC – Employability Enhancement Course and MC – Mandatory Course

6.2 Course Numbering Scheme

Each course is denoted by a unique code consisting of 8 alphanumeric characters. The details of the numbering scheme is shown in Fig. 1

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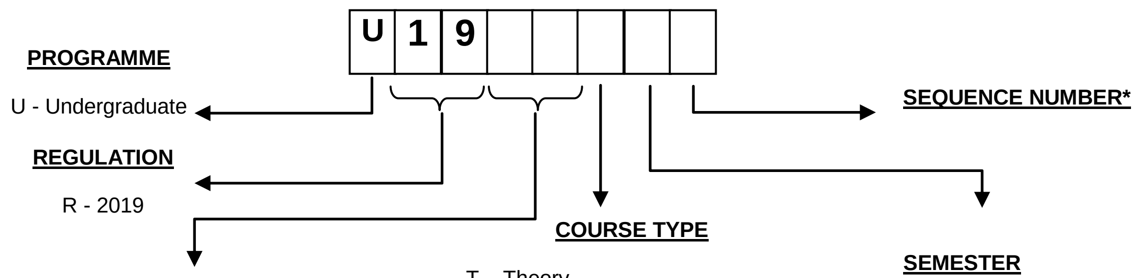

DEPARTMENT CODE

CE – Civil Engineering
CS – Computer Science and Engineering
EC – Electronics and Communication Engineering
EE – Electrical and Electronics Engineering
BM – Biomedical Engineering
IC – Instrumentation and Control Engineering
IT – Information Technology
MC – Mechatronics Engineering
ME – Mechanical Engineering

Common Code

HS – Humanities and Management
ES – Engineering Science
BS – Basic Science

COURSE TYPE

T – Theory
P – Practical
E – Professional Elective
O – Open Elective
C – Certification Course
M – Mandatory Course
S – Skill Development Course
W – Project Work

SEMESTER

1 – First Semester
2 – Second Semester
3 – Third Semester
4 – Fourth Semester
5 – Fifth Semester
6 – Sixth Semester
7 – Seventh Semester
8 – Eighth Semester

*Separate sequence of numbers for theory and practical courses

Fig. 1 Course code formation

6.3 Professional Electives

Each student shall choose a course from the professional elective list specified in the curriculum relating to his/her degree programme in consultation with the Class Advisor, Programme Academic Coordinator and the HoD.

6.4 Open Electives

Each student shall choose a course from the open elective list offered by other departments specified in the curriculum, in consultation with the Class Advisor, Programme Academics Coordinator and the HoD.

6.5 Project Work

Each student shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the guide. A student shall register for the Project Phase I and II in 7th and 8th semester respectively.

1. The process and guidelines for industry/Research organization projects

- Students opting for industry / research organization project should decide, identify and interact with relevant industry/ research organization in 7th semester itself. Training and Placement cell shall help to establish contact with industries. Students shall take necessary help from their department for exact plan of action and apply to the industry / research organization through proper channel .The departmental committee shall decide the schedule appropriately.
- Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project, progress report to the department before the end of 7th semester.

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- Director cum principal / Dean Academics shall issue permission letter to the students on the recommendation of HoD. Students shall be allowed to do the project work in the industry for a maximum period of 13 weeks in 8th semester.
- An internal guide from the department and mentor from the industry/ research organization where the project is to be undertaken shall be allocated to the students. Both guides should discuss and finalize the scope of the project work and monitor the progress together.
- Internal guide should visit the industry at least 3 times in a semester to see the progress of his/her student and a brief report should be submitted to the HoD about the project.
- Student should maintain a record on the progress and get the approval from both internal and external guides at least twice in a month either by physically or through email communication. If the progress is not found satisfactory due to any reason, the Guide should take the corrective action, after consulting with Dean Academics through HoD for further extension of the project completion.
- Progress report and certificate of completion of the project work from the industry / research organization shall be submitted by the student to the respective guide. The mode of evaluation shall be same as adopted for students carrying out in-house project.

2. The Process and guidelines for in-house project

- Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of faculty guide(s).
- Students execute their in-house project in the Department with proper approval from the HoD through the respective project guide(s).

6.6 Employability Enhancement Courses

6.6.1 ***Certification Courses*****:** Students shall choose an International certification course of 40-50 hours duration specified in the curriculum, which will be offered through Centre of Excellence. These courses carry no credit and will not be considered for CGPA calculation.

6.6.2 ***Skill Development Courses*****:** Skill development courses are non-credit courses, provided to enhance the knowledge and skill set of the students. The Skill Development Courses included in the curriculum are Foreign Language / IELTS, online certification course, Technical seminar, Presentation Skill development courses and Technical skill development courses. It is mandatory for every student to register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Expert. Students have to complete relevant online courses successfully. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the marks secured in online examinations.

6.7 Mandatory Courses

Mandatory Courses, specified by AICTE, are non-credit courses to be completed successfully by a student. The Mandatory Courses included in the curriculum are Induction Programme, Environmental Science, Physical Education, NSS, Indian Constitution, Essence of Indian Traditional Knowledge and Professional Ethics. The students are expected to undergo a mandatory three-weeks induction programme comprising of physical activity, creative arts, universal human values, proficiency modules, lectures by eminent people, visits to local areas and familiarization to department/branch & innovations immediately after admission.

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National Service Scheme (NSS) has social service activities in and around the College. Sports and Games activities include preparation for inter-collegiate sports events. Further training activities will be during weekends and the camps will be normally during vacation period. AICTE specified syllabus shall be followed for all the remaining mandatory courses.

6.8 Industrial Training / Internship

Students may undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Mentor, Class advisor and Departmental Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period.

7 COURSE ENROLMENT AND REGISTRATION

7.1 Course Registration

The registration for each semester courses shall be done in online mode which will commence preferably 10 working days prior to the last working day of the current semester.

7.1.1 After registering for all the courses, the student must attend the classes, satisfy the attendance requirements, earn Continuous Assessment Marks (CAM) and appear for the End Semester Examinations (ESE).

7.1.2 The opted Elective course will be offered only if the number of students opted for that course is not less than 30.However, if the students enrollment in a class is less than 30, the head of the department will decide the elective course.

7.2 Arrear Course Registration

In the first attempt of writing the End Semester Examination of a course if a student fails, He / She can retains the existing CAM and proceeds to write the supplementary exams / End Semester Examinations as and when they are conducted otherwise if a student wish to re-earn the Continuous Assessment Marks (CAM), He/She has to re-register by paying the prescribed fee for the course when it is offered next in the subsequent academic year. The existing CAM will get nullified. The student has to re-earn the CAM by taking-up all the internal tests, assignments and presentation as per the norms of regulations.

8 EXAMINATION

8.1 Requirements for Appearing End Semester Examination

A student is expected to maintain 100% attendance in all courses as attendance also carries internal marks (Clause 10.3). A student will be qualified to appear for End Semester Examinations in a particular course of a semester only if he/she satisfies the below mentioned requirements.

8.1.1 The student is permitted to appear for End Semester Examinations, only if he/she maintains minimum 75% of attendance. If he/she secured attendance greater than or equal to 60 % and less than 75% in any course in the current semester can be considered in case of the following reasons:

i. Medical reasons (hospitalization / accident and or illness)

ii. Due to participation in sports events or any competitions or NCC and / or NSS activities with prior written permission from the Head of the

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Institution/Dean Academics through the Head of the Department

He/she has to pay the necessary condonation prescribed by the college authority with necessary supporting documents for his/her absence.

8.1.2 The student shall be considered for exemption from the prescribed attendance requirement for the reasons stated above and if exempted, the student shall be permitted to appear for the End Semester Examination of that course. In all such cases, the students should have submitted the required documents on joining after the absence, to the Head of the Department through the Class Advisor.

8.1.3 If any student is suspended for any reason during the semester, the days of suspension of a student on disciplinary grounds will be considered as days of absence for calculating the percentage of attendance for each individual course.

8.2 Movement to Next Higher Semesters

8.2.1 A student can move to the next semester provided only if he/she fulfills the minimum attendance requirement for appearing in the end semester examination.

8.2.2 The student who has failed to fulfill the above conditions will not be permitted to move to the higher semester, and shall rejoin the programme in the next academic year in the same semester after fulfilling all the requirements as per the regulations.

8.2.3 A student who rejoins the programme after the temporary break shall be governed only by the rules, regulations, course of study and syllabi in force, at the time of rejoining the course.

8.3 Provision for Withdrawal from Examination

8.3.1 **Complete Withdrawal (applicable only for nil arrear students):** A student, who is eligible to appear for the semester examinations, will be permitted to withdraw from appearing for the entire End Semester Examinations as one unit (*Complete Withdrawal*) for valid reasons and on the recommendation of the Head of the Department and with the approval of the Dean Academics. Complete Withdrawal application shall be made before the commencement of the first examination pertaining to the semester. Such withdrawal shall be permitted ***only once*** during the entire programme.

8.3.2 A student who has completely withdrawn from appearing for End Semester Examinations in a particular semester should appear for the examinations of all the withdrawn subjects in the next semester itself.

8.3.3 If all other conditions are satisfactory, the candidate who withdraws is also eligible to be awarded DISTINCTION whereas he/she is not eligible to be awarded a rank.

8.4 Scribe for End Semester Examination

8.4.1 If any student is not in a position to write End Semester Examination on account of temporary physical disability or injury due to accident and applies for a scribe (writer) with medical certificate obtained from a medical officer not below the rank of Assistant Director level, then a scribe shall be allowed / assigned by CoE to such student. Normally, such scribe shall neither be a student nor a degree holder of any technical programme having similar competency. The student shall, however, apply in a prescribed proforma to

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CoE requesting permission for using the scribe well in advance, not on the day of examination, to make necessary arrangements (Scriber, Separate Examination Hall etc.). CoE shall take the undertaking from the scribe in a prescribed proforma. Such student shall produce the permission letter from the CoE for using scribe to the invigilator. He/She should pay the TA/DA and other charges to the scribe. Scribe shall be allowed extra time as per the norms specified by the Controller of Examinations.

8.4.2 Student admitted with differently abled category and those who can write, but at much slower speed as compared to normal student, he/she may be allowed an extra time of 30 minutes for 50 marks paper and 45 minutes for 75 marks paper to write the examination for all the courses. He/She shall seek permission from CoE for the extra time on account of his/her percentage of disability by producing necessary medical certificate from medical officer not below the rank of Assistant Director.

8.5 Supplementary Examinations

Supplementary Examination is an additional examination which will be conducted after declaration of the End Semester Examination results / revaluation results. This examination will be conducted in fifth and eighth semesters for the students who are having a maximum of two arrears only. For supplementary examination, the continuous assessment marks of the last attempt will be considered.

8.6 Malpractice in Examinations

If any student caught red-handed due to malpractices in examinations then he/she shall be punished as per the recommendations of the Complaint Redressal Committee (CRC) constituted by CoE with the approval of Head of the Institution. The CRC shall inquire and decide the punishment for the unfair means as specified in the Examination manual.

9 ASSESSMENT PROCEDURES FOR AWARDING MARKS

The total marks for each course (Theory, Practical, and Project Work) will be 100, comprising of two components namely Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM). However, there are EEC and Mandatory courses that have only continuous assessment for 100 marks without an End-Semester Examination.

The Assessment components for each course are as illustrated in Table 2. Each course shall be evaluated for a maximum of 100 marks.

Table 2 Assessment Components

Sl. No	Category of Course	Continuous Assessment Marks (CAM)	End Semester Examination Marks (ESM)
1	Theory Courses	25	75
2	Practical Courses#	50	50
3	Project phase - I	50	50
4	Project phase - II	40	60
5	Internship/In-plant training	100	-
6	Employability Enhancement Course (EEC)	100	-
7	Mandatory Courses (MC)	100	-

Business Basics for Entrepreneur and Entrepreneurship Management courses will have only continuous assessment for 100 marks.

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Students may take National/International reputed professional certification courses after due approval from Department Consultative Committee (DCC). After completion of the course, the DCC has to verify the relevant documents and certificates. The credits and grades shall be mapped by the DCC and recommended to CoE through the HoD.

10 DISTRIBUTION OF MARKS

10.1 Marks Distribution of Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM)

The scheme of assessment for Continuous Assessment Test and weightage for each assessment is shown in Table 3 and 4 respectively. Table 5 shows the scheme for End Semester Examinations.

Table 3 Scheme for Continuous Assessment Marks

S. No	Course Type	Continuous Assessment Components									Total Marks
		Test Marks	Average of Pre /post-test/viva for each experiment	Average of Marks for experiment report for each experiment	Model Exam / Report/viva-voce	Assignment**	Review-1	Review-2	Review-3	Attendance	
1	Theory	15	-	-	-	5	-	-	-	5	25
2	Practical	-	10	15	15	-	-	-	-	10	50
3	Project phase - I	-	-	-	-		15	15	20	-	50
4	Project phase - II	-	-	-	-	-	10	10	20	-	40

****** A minimum of three assignment has to be given for each course and out of them, the best two are to be considered for computation of internal assessment marks

Table 4 Weightage of Assessment for Theory Courses

S. No	Test	Portion for Test	Test Marks	Duration of Test	Weightage for Internal Marks
1	CAT – 1	1 ½ Units	50	1 ½ hours	10*
2	CAT – 2	1 ½ Units	50	1 ½ hours	
3	CAT – 3	2 units	50	1 ½ hours	
4	CAT – 4	All 5 Units	75	3 hours	5#
5	CAT – 5# (Improvement Test)	All 5 Units	75	3 hours	
Continuous Assessment for Theory courses					15

***** A minimum of three tests (CAT 1, 2 and 3) to be conducted for every theory course and, out of them, the best two are to be considered for computation of internal assessment marks.

\# CAT 5 is optional for the students those who want improvement in the internal marks based on their request to the Department consultative Committee. Either CAT 4 or CAT 5 is to be considered for the computation of internal assessment marks.

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Table 5 Scheme for End Semester Examinations

S. No	Course Type	Written Exam	Practical Exam	Practical exam viva	Report and viva -voce	Publication of papers / prototypes /patents etc	Total Marks
1	Theory	75	-	-	-	-	75
2	Practical	40		10	-	-	50
3	Project phase - I	-	-	-	50	-	50
4	Project phase - II	-	-	-	50	10	60

10.2 Question Paper Pattern– Theory

The question paper for the continuous assessment tests must follow Revised Bloom's Taxonomy and indicate expected knowledge level and Course Outcomes (COs). Question paper pattern for CAT and ESE is shown in Table 6.

Table 6 (a) Question Paper pattern for CAT 1 to 3

2 Mark Questions	5 Mark Questions	10 Mark Questions	Total Marks
5	4	2 (Out of 3 Questions)	50

Table 6 (b) Question Paper pattern for CAT 4, CAT 5 and End Semester Examination

2 Mark Questions	5 Mark Questions	10 Mark Questions	Total Marks
10	5 (one question from each unit)	3 (out of 5 Questions)	75

Table 6 (c) CAT 4, CAT 5 and End Semester Examination Question Paper pattern for 6 units courses

<table>
<tr><th>Course</th><th>2 Mark Questions</th><th>5 Mark Questions</th><th>8 /9 Mark Questions</th><th>Total Marks</th></tr>
<tr><td rowspan="2">Part A</td><td rowspan="2">5</td><td rowspan="2">2
(out of 3 questions, one from each unit)</td><td>1
8 mark question
(out of 2 questions, from unit I and Unit II)</td><td rowspan="2">37</td></tr>
<tr><td>1
9 mark question
(compulsory question from unit III)</td></tr>
<tr><td>Part B</td><td>5</td><td>2
(out of 3 questions, one from each unit)</td><td>2
9 mark questions
(out of 3 questions, one from each unit)</td><td>38</td></tr>
</table>

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10.3 Distribution of Marks for Attendance

(a). *Theory courses for which there is an internal marks of 25 that includes 5 marks for attendance* as shown in Table 3. The distribution of 5 marks for attendance is as follows:

5 marks for 95% and above
4 marks for 90% and above but below 95%
3 marks for 85% and above but below 90%
2 marks for 80% and above but below 85%
1 mark for 75% and above but below 80%

(b). Practical courses for which there is an internal marks of 50 that includes 10 marks for attendance as shown in Table 3. The distribution of 10 marks for attendance is as follows :

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%.

10.4 Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report, prepared according to the approved guidelines and duly signed by the guide and the Head of the Department shall be submitted to the department as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.
- The Continuous Assessment Marks (CAM) and End Semester Examinations marks (ESM) distribution for the Project Work is given in Table 7.

Table 7 (a) CAM & ESM break-up for Project Phase - I

<table>
<tr><th>Sl. No</th><th colspan="3">Description</th><th>Weightage</th></tr>
<tr><td>1</td><td colspan="4">Continuous Assessment Marks</td></tr>
<tr><td rowspan="2">a</td><td rowspan="2">Review 1</td><td>Review Committee#</td><td>10</td><td rowspan="2">15</td></tr>
<tr><td>Guide</td><td>5</td></tr>
<tr><td rowspan="2">b</td><td rowspan="2">Review 2</td><td>Review Committee#</td><td>10</td><td rowspan="2">15</td></tr>
<tr><td>Guide</td><td>5</td></tr>
<tr><td rowspan="2">c</td><td rowspan="2">Review 3</td><td>Review Committee#</td><td>15</td><td rowspan="2">20</td></tr>
<tr><td>Guide</td><td>5</td></tr>
<tr><td></td><td colspan="3">Total CAM</td><td>50</td></tr>
<tr><td>2</td><td colspan="4">End Semester Marks</td></tr>
<tr><td rowspan="2">d</td><td rowspan="2">Evaluation of Phase I report and Viva-voce</td><td>Internal Examiner</td><td>25</td><td rowspan="2">50</td></tr>
<tr><td>External Examiner</td><td>25</td></tr>
<tr><td></td><td colspan="3">Total ESM</td><td>50</td></tr>
<tr><td></td><td colspan="3">Total Marks</td><td>100</td></tr>
</table>

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Table 7 (b) CAM & ESM break-up for Project Phase - II

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	5	10
		Guide	5	
b	Review 2	Review Committee#	5	10
		Guide	5	
c	Review 3	Review Committee#	10	20
		Guide	10	
			Total CAM	40
2	**End Semester Marks**			
a	Evaluation of final report and Viva-voce	Internal Examiner	25	50
		External Examiner	25	
b	Outcome*	Publication of papers /prototypes /patents etc	10	10
			Total ESM	**60**
			Total Marks	**100**

* *Outcome, in terms of paper publication, patents, product development and industry projects shall be awarded by both internal and external examiners, based on the document proof submitted by the student concerned*

\# *Review committee consists of internal faculty members nominated by the Head of the Department. The guide of the student being examined shall not be part of the committee.*

10.5 Grading for Mandatory and EEC Courses

Mandatory and EEC Courses are required to be completed to fulfill the degree requirements. All Mandatory (except induction programme) and EEC Courses are assessed internally for 100 marks. The pass mark is 50%. The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations.

11 REQUIREMENTS FOR PASSING THE EXAMINATION

11.1 A student is declared to have successfully passed a theory based course if he/she has secured:

- A minimum of 40% marks out of 75 marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM).

11.2 A student is declared to have successfully passed a practical / project based course if he/she has secured:

- A minimum of 50% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM).

11.3 For mandatory courses, the student must satisfy the minimum attendance requirement and passing criteria as specified for the course in the department.

12 GRIEVANCE REDRESSAL MECHANISM IN EVALUATION

12.1 Photocopy of the Answer Script and Revaluation:

Students who are not satisfied with the grades awarded in the End Semester Examination of Theory Courses for regular and arrear examinations can seek redressal as follows:

- After declaration of results, photocopy of valued answer scripts with the marks awarded to individual answers shall be made available to the students on

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submission of an application along with the prescribed fees to Controller of Examinations.

- Students can get their answer scripts revalued by submitting an application along with the prescribed fees to the Controller of Examinations. The revaluation is extended to the students those who have maximum of two arrears in theory papers and the practical arrears are not taken into the account.
- The Controller of Examinations shall get the answer script revalued by appointing an examiner other than the one who has valued the script earlier. If the difference in marks awarded to an answer script by the examiners is less than 15 percent of the total marks earmarked for the End semester Examination, then the average of marks awarded by the two examiners is taken as the mark scored in the examination. If the difference in marks is greater than 15 percent, then the answer script will be evaluated by a third examiner and the mark awarded by the third examiner is taken as the final score.

13 LETTER GRADE AND GRADE SHEET

All assessments of a course will be evaluated exactly based on the marks. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range given in Table 8, based on the percentage of marks obtained by the candidate in each subject.

Table 8 Letter Grade and its range

S. No	Range of total marks	Letter Grade	Grade Points
1	90 to 100	S	10
2	80 to 89	A	9
3	70 to 79	B	8
4	60 to 69	C	7
5	55 to 59	D	6
6	50 to 54	E	5
7	0 to 49	F	0
8	Absent	FA	0
9	Withdrawal from examination	W	0
10	Pass in non-credit course	P	0

F – denotes Failure of the course and FA – Failure due to Absent

13.1 Grade Sheet

After declaration of results, grade sheets will be issued to each student, which will contain the following details:

- The College Name and Affiliating University.
- The list of courses registered during the semester and the grades scored.
- The Semester Grade Point Average (SGPA) for the semester.
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.
- On completion of a semester, each student is assigned a Semester Grade Point Average which is computed as below for all courses registered by the student during that semester

$$\text{Semester Grade Point Average (SGPA)} = \frac{\sum_i (C_i \times GP_i)}{\sum_i C_i} \qquad i = 1\ to\ n;$$

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Where n= Number of credit courses in that semester, C_i is the Credit of i^{th} course in that semester and GP_i is the Grade Point earned by the student for that i^{th} course. The SGPA is rounded off to two decimals.

- The overall performance of a student at any stage of the Degree programme is evaluated by the Cumulative Grade Point Average (CGPA) up to that point of time.

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum_i (C_i \times GP_i)}{\sum_i C_i} \qquad i = 1\ to\ m;$$

Where m = Number of credit courses from I^{st} semester to the completed semesters, C_i is the Credit of i^{th} course of the completed semesters at that stage and GP_i is the Grade Point earned by the student for that i^{th} course.

13.2 ***Scheme for conversion of CGPA to Percentage (%) marks***

Some employers / institutions except the students to provide the details of the percentage (%) of marks scored in the semester examination / degree programme. In this regard, a scheme to convert the Cumulative Grade Point Average (CGPA) to Percentage (%) of marks is shown below:

Percentage (%) marks = CGPA x 10

14 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of B.Tech. Degree provided for which the student has

- Successfully completed the course requirements and has passed all the prescribed End Semester Examinations in all the eight semesters (six semesters for lateral entry) within a maximum period of 7 years (6 years for lateral-entry) calculated from the commencement of the first semester to regular entry students and third semester for lateral entry students.

14.1 Classification of Degree

After successful completion of the programme, degree will be awarded as per the following classifications based on the final CGPA

1. **First class with Distinction**

   Student who satisfies the following conditions shall be declared to have passed the End Semester Examinations in *First class with Distinction:*

   (a) Students who have successfully completed the programme within eight consecutive semesters (*six consecutive semesters for lateral entry students*) and obtained a final CGPA of 8.5 or above by passing the End Semester Examinations in all the courses from first to eighth semester in the *first attempt* will be declared to have passed in ***First Class with Distinction***.

   (b) Students who have secured a final CGPA of 8.5 or above but failed to clear the courses offered from first to eighth semester in the first attempt are not eligible for ***First Class with Distinction*** classification. However, Students who have opted for authorized complete withdrawal (only one time) from examination will also be eligible for ***First Class with Distinction*** classification but it will not be considered for Ranking.

2. **First class**

   A student who satisfies all the following conditions shall be declared to have passed the End Semester Examinations in First class:

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(a) Should have passed the examination in all the courses of all eight semesters (6 semesters in the case of Lateral Entry) within Five years (Four years in the case of Lateral Entry). One-year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of five years (four years in the case of lateral entry)

(b) Should have obtained a final CGPA not less than 6.5 shall be declared to have passed in ***First Class***.

(c) Students who have lost the eligibility for ***First Class with Distinction*** classification by failing to clear the courses offered from first to eighth semesters in the first attempt but securing a final CGPA of 8.5 or above shall also be declared to have passed in ***First Class***.

3. Second class

All other students (not covered in S.No.1 and 2 under Clause14.1) who qualify for the award of the degree shall be declared to have passed the examination in Second Class.

14.2 Gold Medals and Ranks

For the Award of Gold Medal and ranks for each branch of study, the CGPA secured from 1st to 8th semester should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first five candidates in each branch of study.

15 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student shall be permitted to withdraw temporarily from the college for the reason beyond his/her control. The applicable rules are:

i. After withdrawal, the student shall rejoin next year in the same semester during which the student has withdrawn.

ii. The student shall apply to Dean Academics through HoD stating the reasons for withdrawal along with supporting documents, consent letter from his/her parent/guardian and clearance/no due from all the concerned departments.

iii. Dean Academics shall examine the case and recommend for the approval/ratification from Academic Council (AC) /Academic Standing Committee (ASC).

iv. A student availing temporary withdrawal from the college under the above provision shall be required to pay such fees and/or charges as may be fixed by the AC/ASC for his/her name to be enrolled. However, it may be noted that the fees/charges once paid shall not be refundable.

v. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed 7 years for regular entry students and 6 years for lateral entry students in any case including of the period of discontinuance.

16 TERMINATION FROM THE PROGRAM

A student shall be terminated from the program in the following cases:

i. Involved in ragging and not obeying disciplinary rules structured by college.

ii. Not completing the programme in prescribed period; Students shall have to complete B.Tech programme in the maximum period of 7 years (14 semesters) for regular entry and 6 years (12 semesters) for lateral entry from the date of

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admission. If not completed, such student will be declared as Failed to Complete Technical Education (FCTE). However, genuine cases with proper justification may be referred to AC for extending programme completion period.

17 DISCIPLINE AND CONDUCT

17.1 Any act of misconduct committed by a student inside or outside the campus shall be an act of violation of discipline of the college. Violations of the discipline shall include:

(a) Interference to teaching, examination, administrative work, curricular or extra–curricular activities and any act likely to cause disruption.

(b) Damaging or defacing the property inside or outside the college campus.

(c) Engaging in any attempt at wrongful confinement of teachers, employees and students of the college.

(d) Use of abusive and derogatory slogans or intimidators' language or incitement of hatred and violence.

(e) Ragging in any form ("Ragging means causing, inducing, compelling or forcing a student whether by way of a practical joke or otherwise to do any act that detracts human dignity or violates his person or exposes him to ridicule or to forbear from doing lawful act, by intimidating, wrongfully re-straining, wrongfully confining or injuring him or by using criminal force to him or by holding out to him any threat of such intimidation, wrongful restraint, wrongful confinement, injury or the use of criminal offense), as per the directions of Supreme Court of India, is a criminal offence.

(f) Eve teasing or disrespectful behavior to a student.

(g) An assault upon or intimidation of, or insulting behavior towards a teacher, officer, employee or student or any other person.

(h) Getting enrolled in more than one programme /course of study simultaneously.

(i) Committing forgery, tampering the documents or records, identity cards, furnishing false certificate or false information.

(j) Organizing instant agitation/meetings without prior permission in the campus.

(k) Viewing/downloading obscene information/data, images and executable files, sending obscene mails/messages via Facebook / twitter / other social sites using college servers/personal electronic gadgets in the college premises.

(l) Sharing the login and password and other details of IT facilities provided to other outside students.

(m) Refusing to provide an identity card when demanded by any teacher / college authority.

(n) Consuming or possessing alcoholic drinks, dangerous drugs or other intoxicants in the college campus.

(o) Possessing or using any weapons and fire arms in the college campus.

(p) Encroachment of hostel, accommodating guests or other persons in hostels without permission.

(q) Malpractice in examination

(r) Indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government.

(s) Any other act which may be considered by the Head of the Institution or the Discipline Committee to be an act of violation of discipline.

17.2 Any act of indiscipline of a student reported to the Head of the Institution shall be referred to Redressal and Disciplinary Committee of the college. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated. The penalties / punishment / actions may include:

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(a). Written warning and information to the parents/guardian.

(b). Imposition of fine

(c). Suspension from the College/Hostel/Mess/Library or availing of any other facility.

(d). Suspension or cancellation of scholarship/fellowship / studentship or any financial assistance from any source.

(e). Recover of loss caused to college property.

(f). Debarring from participation in sports/NSS/student club activities.

(g). Disqualifying from holding any representative position in the Class/College/Hostel Mess/Sports/Clubs and in similar other bodies.

(h). Disqualifying from appearing in placement and receiving any awards.

(i). Expulsion from the Hostel/Mess/Library/Club/College for a specified period by forfeiting fees.

(j). Debarring from appearing for an End Semester Examinations.

17.3 Student(s) involved in any act of indiscipline /malpractice in examination shall be issued notice to him/her, asked to be present before the Complaint Redressal Committee (CRC) on the day at specified time and venue with his/her parents/guardian. He/She shall give written reply /oral explanation to the charges levied against him/her for consideration. If the implicated student(s) fails to appear before the committee, then decision shall be taken as absent, on the basis of available evidence/documents which shall be binding on the concerned student.

17.4 Every admitted student shall be issued photo identification (ID) card which must be worn by the students when he /she is inside the college campus / college bus.

18 ACADEMIC CALENDAR

18.1 The academic activities of the college shall be governed by the academic calendar prepared for each academic semester and approved by the AC/ASC. It shall be notified at the beginning of each academic semester. Academic calendar shall incorporate schedule of admission, course registration, course delivery, examination/evaluation, course feedback, course/graduate exit survey, co-curricular activities, compensation of holidays in case of academic loss, meetings (AC, ASC, IQAC, BoS, and Alumni), Academic audit and vacation.

18.2 The curriculum shall be typically delivered in two semesters in an academic year. Each semester shall be of 20 weeks (approximately 100 working days) duration, including evaluation, grade moderation and result declaration. Generally, 13-14 weeks (65-70 days) for course content delivery and 4-6 weeks (20 – 30 days) for examination /evaluation shall be assigned in each semester. The academic session in each semester shall provide at least 75 teaching days with 40 hours per week. The odd and even semesters of an academic year normally begin from second week of June and second week of December respectively.

18.3 The academic calendar should be strictly adhered to all other activities including co-curricular and extra-curricular activities that should be scheduled so as not to interfere with the curricular activities as stipulated in the academic calendar.

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19 VARIOUS COMMITTEES AND ITS FUNCTIONS

19.1 Academic Council (AC)

Composition of Academic Council:

1. The Director cum Principal (Chairman)
2. All the Heads of Departments in the college
3. Four teaching staff of the college representing different designation are nominated on rotation basis according to the service of seniority.
4. Not less than four experts/academicians from outside the college representing such areas as Industry, Commerce, Law, Education, Medicine, Engineering, Sciences etc., to be nominated by the Governing Body.
5. Three nominees of the university not less than Professors.
6. A faculty member nominated by the Principal (Member Secretary).

Term: The term of the nominated members shall be three years.

Meetings: Academic Council shall meet at least twice a year.

Functions of the Academic Council:

The Academic Council shall have powers to:

(a). Scrutinize and approve the proposals with or without modification of the Board of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic Council differs on any proposal, it shall have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.

(b). Make regulations regarding the admission of students to different programmes of study in the college keeping in view the policy of the Government.

(c). Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.

(d). Recommend to introduce the new programme of study to the Governing Body proposals.

(e). Recommend to the Governing Body regarding the institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.

(f). Advise the Governing Body on suggestions(s) pertaining to academic affairs framed by it.

(g). Perform other functions as may be assigned by the Governing Body.

19.2 Board of Studies (BoS)

Composition of Board of Studies:

1. Head of the Department concerned (Chairman).
2. The entire faculty of each specialization.
3. Two subject experts from outside the Parent University to be nominated by the Academic Council.
4. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the college principal.

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5. One representative from industry/corporate sector/allied area relating to placement.
6. One postgraduate meritorious alumnus to be nominated by the principal. The Chairman, Board of Studies, may with the approval of the principal of the college, co-opt:
   (a). Experts from outside the college whenever special courses of studies are to be formulated.
   (b). Other members of staff of the same faculty.

Term: The term of the nominated members shall be three years.

Meetings: The Board of Studies shall meet at least twice a year.

Functions of BoS

The Board of Studies of a Department in the college shall:

(a). Prepare syllabi for various courses keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and approval of the Academic Council.
(b). Suggest methodologies for innovative teaching and evaluation techniques.
(c). Suggest panel of names to the Academic Council for appointment of examiners.
(d). Coordinate research, teaching, extension and other academic activities in the department/college.

19.3 Academic Standing Committee (ASC)

Composition of Academic Standing Committee is same as that of AC, except external members. ASC shall perform the functions under emergent situations subject to ratification by the AC.

19.4 Academic Appeal Board (AAB)

The entire process of Continuous Assessment shall be made transparent, in which students can get the explanation of marks being awarded from the course instructor, if and when required. However, if a student finds some anomaly in the award of marks in the continuous assessment, he/she can make an appeal to the *Academic Appeal Board* for review of marks awarded. Before appealing for such review, a student shall first approach the concerned Course Instructor and then the concerned Head of the Department, with a request to do the needful. Only after exhausting the above options and in situations where satisfactory actions / remedial measures have not been taken, the student may appeal to the Academic Appeal Board.

The Academic Appeal Board is constituted with Dean Academics as convener and two senior level professors as members, and the concerned Head of the Department and Class Advisor as co-opted members. The board will receive the grievances/complaints in writing from the aggrieved student regarding anomaly in award of marks. The board will examine the complaints and recommend appropriate measures to the Director cum Principal, for necessary action.

19.5 Departmental Advisory Committee (DAC)

DAC is another basic constituent of the academic system of an autonomous college. The composition and functions of the DAC are given below

1. Chairman : Head of the concerned Department

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2. Internal Members : Two senior faculty members of the department
3. Industry Representative : One representative from industry/corporate sector / is related to the placement
4. One academician from other Institution
5. One meritorious alumnus
6. One parent
7. One student
8. Member secretary : Programme Academic Coordinator

Term: The term of the nominated members shall be three years.

Meetings: The meeting may be scheduled as and when necessary, but at least twice a year.

Functions of DAC

The DAC of a department in the college shall

(a). Formulate a process to review post implementation effects of curriculum
(b). Suggest measures to ensure academic standard and excellence of the course offered by the department.
(c). Suggest the methodologies for innovative teaching and evaluation techniques; enhancement of industry institute interaction
(d). Identify and recommend the record of new programme
(e). Review target set for attainment of course outcomes and programme outcomes
(f). Guide and provide support to department for enhancing interaction with outside world.
(g). Plan strategically to enhance the academic quality of department.
(h). Address concerns of stakeholders expressed through feedback.
(i). Defining and redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) based on the recommendations by departmental academic committee.
(j). Study the achievement of PEOs and POs reported by department academic committee and suggest measures for improvement.

19.6 Board of Examinations (BoE)

Composition

1. Director cum Principal (Chairman)
2. Dean Academics.
3. Controller of Examination(CoE): Member Secretary
4. One expert possessing ten years of industrial/ field experience nominated by the Chairman
5. Coordinators (Examinations, Assessment, Results and Tabulation)

Functions of BoE:

(a). The BoE shall

i. Ensure proper performance of the various duties in conducting examinations viz paper setting, time table preparation, assessment and declaration of results.

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ii. Recommend examination reforms and shall implement after the approval of academic council.

iii. Prepare the detailed time table of examinations as per the schedule approved by academic council.

iv. Arrange for strict vigilance during the conduct of examination so as to avoid use of unfair means by the students, faculty and invigilators.

(b). Chairman, BoE shall constitute Complaint Redressal Committee (CRC) consisting of three members as and when required to deal with the complaints related to the conduct of examinations.

(c). The recommendations of the CRC shall be approved by Chairman for the BoE to take appropriate disciplinary actions in the concerned matter. The disciplinary actions shall be endorsed by the BoE.

(d). The BoE shall perform duties and responsibilities that are assigned by Academic Council of the institute from time to time.

19.7 Department Consultative Committee (DCC)

Composition

1. Head of Department (Chairman)
2. Five faculty members (at least one from each specialization) nominated by HOD
3. Member Secretary: Programme Academic Coordinator / Programme Evaluation Coordinator

Functions of DCC

(a). Review, revise and prepare curriculum structure based on institutional policy, suggest improvements in syllabus of a course/s prepared by course teacher/s and forward the curriculum to BoS for further recommendations.

(b). Check appropriateness of course objectives, course outcomes, and mapping of COs with POs and suggest necessary improvements/modifications.

(c). Monitor the academic progress throughout the semester, conduct of classes and take appropriate corrective measures to improve the quality of curriculum delivery.

(d). Review academic performance of students.

(e). Counsel the concerned course teachers for improvement based on student feedback, academic and question paper audit reports.

(f). Verify the attainment level of course outcomes and programme outcomes.

(g). Formulate strategy to collect feedback from stake holders, analyze the collected feedback and forward the analysis to DAC.

(h). Contribute to maintain academic standard as well as improving the quality of the courses offered by the department and enhance industry–institute interaction.

(i). Suggest open and professional electives considering societal needs.

(j). Recommend methodologies for innovative teaching and evaluation techniques to BoS.

(k). Coordinate research, teaching, extension and other academic activities in the department/college.

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(l). Carry out preparatory work for defining /redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs)periodically.

(m). Monitor evaluation of course attainments leading to achievement of programme outcomes and report the results of assessment to BoS.

19.8 Programme Academic Coordinator (PAC)

There shall be Departmental Academic Coordinator whose functions and duties are:

(a). Coordinating all academic activities of the department viz Curriculum revision, framing of syllabus, time table, member secretary for BoS meeting, re-registration of course/s, display and submission of attendance status.

(b). Conducting internal academic audit and departmental advisory committee meeting as a member secretary.

(c). Monitoring the academic activities and conduct of classes.

(d). Extending necessary help to departmental academic and evaluation committee.

(e). Recording and forwarding all academic related documents to Dean Academics.

(f). Working in association with Dean Academics.

19.9 Departmental Evaluation Coordinator (DEC)

Functions and duties of DEC are:

(a). Conduct course and graduate exit survey, make arrangements for feedback from stakeholders (industry/employer/alumni/student) and feedback analysis.

(b). Monitoring the assessment of course outcome.

(c). Computation /assessment /evaluation/achievement of PEOs and POs as per NBA/NAAC requirements.

(d). Compilation of information required for preparation of Annual Quality Assurance Report (AQAR) by the Internal Quality Assurance Cell (IQAC).

(e). Extend necessary help to departmental academic and evaluation committee.

19.10 Class Advisor

Head of the Department will allot one faculty member to be the class advisor for a particular batch of students throughout their period of study. The role of class advisors is as follows:

i. To motivate and closely monitor the performance of the students.

ii. To build a strong alumni base for the institution by maintaining a meaningful rapport with students and parents.

iii. To maintain all important documents of the students for reference/inspection by all committees.

iv. To work closely with the student counselors on matters related to students and update the details from time to time in student's profile for further reference.

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19.11 Student Counselor (Mentor)

By guiding and counseling students, faculty can create a greater sense of belongingness amongst the student community. To help the students in planning their courses and for general guidance on the academic programme, the Head of the Department will allot a certain number of students to a teacher of the department who shall function as student counselor throughout the period of study.

The student counselor will guide / monitor the courses chosen by the students, check attendance and progress of the students and counsel them periodically. The student counselors should ensure that each student is made aware of the various options for progress. Students are monitored and guided to become overall performers. Students can select and work for career choices of their interest. The student counselors shall update and maintain the student counselor record of each student under his guidance attached to them. The student counselors shall also help the class advisors to update the students details attached to them.

The student counselor may also discuss with the class advisor, HoD and parents about the progress of the students.

19.12 Class Committee

Every class will have a class committee constituted by the HoD. The members of the class committee will be as follows:

1. Chairperson (a senior faculty who is preferably not teaching any course for the class)
2. All faculty handling courses for the class
3. Students (a minimum of 6 consisting of 3 boys and 3 girls on pro-rata basis)

Functions

The functions of the class committee shall include the following: -

(a). Clarify the regulations of the programme and the details of rules therein.

(b). Inform the student representatives about the academic schedule including the dates of assessments and the syllabus coverage for each assessment.

(c). Inform the student representatives about the details of Regulations regarding marks assigned for each assessment. In the case of practical courses (laboratory/ drawing / project work / seminar etc.) the breakup marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students

(d). Analyze the performance of the students of the class, after each assessment test and initiate steps for improvement.

(e). Identify slow learners, if any, and request the faculty concerned to provide additional help / guidance / coaching to such students.

(f). Discuss and sort out problems experienced by students in the classroom and in the laboratories.

(g). The class committee shall be constituted within the first week of commencement of any semester.

(h). The chairperson of the class committee may invite the class advisor / student counselor and the Head of the Department to the meeting of the class committee.

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(i). The Director cum Principal may participate in any class committee meeting.

(j). The chairperson is required to prepare the minutes of every meeting, submit the same through the Head of the Department to the Principal within two days of the meeting and arrange to circulate the same among the students and faculty concerned. Points requiring action by the management shall be brought to the notice of the management by the Principal.

Meetings

The class committee meetings are to be conducted as scheduled below.

Meeting 1	Within one week from the date of commencement of the semester
Meeting 2	One week before the 1st assessment test
Meeting 3	One week before the 2nd assessment test

During the first meeting of the class committee, the students are to be informed about the assessment procedure as per the framework of the Regulations. During these meetings the student representatives shall meaningfully interact and express opinions and suggestions of the students of the class to improve the effectiveness of the teaching-learning process.

19.13 Course Committee for Common Courses

Each common theory / laboratory course offered to more than one class / branch shall have a Course Committee, comprising all the faculties who are teaching the common courses and one of them is nominated as a Course Coordinator.

Sl. No	Nature of common courses	Person Responsible for Forming Course Committee and Nominating Course Coordinator
1	For common course handled in a particular department	Respective HoD
2	For common courses handled in more than one department	Controller of Examinations (CoE) puts up the course committee details to the Principal to get approval for the same and intimate to the concerned faculty

The course committee will ensure that a common question paper is prepared for the tests / exams and uniform evaluation is carried out. The Course committee will meet a minimum of 3 times in each semester. The schedule for the course committee to meet is as follows.

Meeting 1	One week before the beginning of the semester
Meeting 2	One week before the 1st assessment test
Meeting 3	One week before the 2nd assessment test

20 REVISION OF REGULATIONS AND CURRICULUM

The college may revise, amend or change the regulations of curriculum and syllabi from time to time as and when found necessary.

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ANNEXURE - A

(Diploma programmes for admission to the B.Tech. Lateral Entry)

B.Tech programmes in which admission is sought	Diploma programmes eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology/Engineering Textile Engineering/Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering/Technology Electronics and Communication Engineering. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics &Communication Engineering Electronics &Instrumentation Engineering Instrumentation Engineering/Technology
Mechatronics Engineering	Mechatronics Engineering Mechanical Engineering Production Engineering Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering/Technology Electronics and Communication Engineering. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

ACADEMIC REGULATIONS 2020
(R-2020)

BACHELOR OF TECHNOLOGY PROGRAMMES

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

BACHELOR OF TECHNOLOGY PROGRAMMES
(Eight Semesters)

REGULATIONS 2020

CHOICE BASED CREDIT SYSTEMS (CBCS)

(Common to all B. Tech. Full Time Programmes)

1. INTRODUCTION

1.1 Sri Manakula Vinayagar Engineering College (SMVEC) envisions to foster knowledge, skills, attitude and values of the aspiring youth to enable them to become global citizens. To achieve this process, the institution has evolved a flexible integrated academic curriculum designed in accordance with the Outcome Based Education (OBE) which is acquired by the learners of a programme under 'Learner Centric' Model.

1.2 All the Under Graduate Engineering programme shall be governed by the rules and regulations provided in this version of Academic Regulations (R-2020). The curriculum of each programme provides broad based knowledge, quality course content, academic flexibility, and scope for multi-disciplinary learning activities and opportunities for industry oriented projects.

1.3 The provisions made in this document shall govern the policies, procedures, curriculum, conduct of the examinations and evaluation systems.

1.4 The semester system shall be adopted for academic activities in the college. Normally, odd semester starts in second week of June and even semester starts in second week of December.

1.5 Stringent evaluation norms will be followed to maintain quality of engineering education. The examination system will be transparent and governed by the rules and regulations with time bounded activities.

Objectives of CBCS

- To shift focus from the teacher-centric to student-centric education.
- To allow students to choose inter-disciplinary, intra-disciplinary and skill oriented courses from the choices to provide more flexibility in learning system.
- To make education broad-based on par with global standards.
- To help students to earn credits by choosing unique combination of courses.
- To create an international exposure to students by providing International Certificate Courses.
- To provide necessary training to students for gaining vital life skills through skill development programmes.

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- To keep abreast of industrial requirements and societal needs, students are equipped through internship and inculcate the skill of converting Project into Product.

1.6 The rules and regulations shall be subjected to amendment made by the Academic Council (AC) from time to time based on the recommendations of the Board of Studies (BoS).

2. PRELIMINARY DEFINITIONS AND NOMENCLATURE

College	:	Sri Manakula Vinayagar Engineering College
University	:	Pondicherry University
Programme	:	B.Tech. Degree
Discipline/ Department	:	Branch or specialization of B.Tech Degree Programme like Civil Engineering, Mechanical Engineering etc.,
Course	:	Theory /Practical subject that is normally studied in a semester. Eg: Mathematics, Computer Programming, etc.,
Professional Core Course	:	Compulsory course in the curriculum
Professional Elective Course	:	A course that can be chosen from the listed courses by a student based on his/her interest which is not covered in professional core courses.
Open Elective Couse	:	A course that can be chosen by a student based on his/her interest from the list of multi-disciplinary courses offered by other departments.
Head of the Institution	:	The Director cum Principal
Controller of Examinations (CoE)	:	The authority who is responsible for all Examination related activities of the institution
Lateral Entry	:	Admission of students directly into the second year of B.Tech. Degree programme after completion of Diploma Course in Engineering
L – T – P – PW – C	:	**L** - **L**ecture, **T** - **T**utorial, **P** - **P**ractical, **PW** – **P**roject **W**ork and **C** - **C**redits respectively
Curriculum	:	The various components / courses studied in each programme that provides an appropriate outcome in the chosen branch of study.
Semester Grade Point Average (SGPA)	:	Weightage of average grade points of subjects in a semester.
Cumulative Grade Point Average (CGPA)	:	Weightage of average grade points of all subjects in all semesters completed by a student
Odd semester	:	The Semester that is typically from June to November
Even semester	:	The Semester that is typically from December to May
Period	:	50 minutes duration of a theory / practical class
Day	:	8 periods in a calendar day
Enrolment	:	Enlistment of a student on roll in an academic year
Arrear	:	A course in which a student has not fulfilled the examination passing criteria in the end semester examination.
CAT	:	Continuous Assessment Test

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CAM	:	Continuous Assessment Marks
ESE	:	End Semester Examination
ESM	:	End Semester Examination Marks
EEC	:	Employability Enhancement Course
Regular Examination	:	End semester examination conducted for the courses prescribed in the curriculum of that semester.
Arrear Examination	:	End Semester examination conducted for the students who have not fulfilled the examination passing criteria in the previous attempt(s).
Supplementary Examination	:	An additional examination exclusively conducted in the fifth and eighth semester for the students with a maximum of two arrears.
First Attempt	:	Appearing for the end semester examination of a course in a semester for which the students have registered. If a student failed to appear for the end semester examination after registration, it is also treated as first attempt.
Academic Council (AC)	:	An Apex academic body having the power to scrutinize and approve the proposals with or without modification of the Board of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto, etc.,
Board of Studies (BoS)	:	An Apex academic body having the powers to approve the various courses, suggest teaching methodologies, coordinate research and other academic activities keeping in view the objectives of the college.
Academic Standing Committee (ASC)	:	ASC shall perform the functions under emergent situations which are subject to ratification by the Academic Council (AC).
Academic Appeals Board (AAB)	:	If a student finds some anomaly in the award of marks in the Continuous Assessment Test /End Semester examination, he/she can make an appeal to the *Academic Appeals Board* for review of marks awarded.
Departmental Advisory Committee (DAC)	:	The Committee that formulates a process to review the post implementation effects of curriculum and suggest various measures to ensure academic standard and its excellency of the course offered by the department.
Department Consultative Committee (DCC)	:	Reviews, revises and prepares curriculum structure based on the institutional policy and suggests improvements in syllabus of a course(s) prepared by course teacher(s) and forwards the curriculum to BoS for further recommendations. It monitors the academic progress and conduct of classes throughout the semester and takes appropriate corrective measures to improve the quality of curriculum delivery.
Programme Academic Coordinator (PAC)	:	Coordinates all the academic activities of the department viz. Curriculum revision, framing of syllabus, time table, re-registration of course(s), display and submission of attendance status and BoS meeting as a member secretary.

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AICTE	:	All India Council for Technical Education
UGC	:	University Grants Commission
NBA	:	National Board of Accreditation
NAAC	:	National Assessment and Accreditation Council
CRC	:	Complaint Redressal Committee

3. BRANCHES OF STUDY

Sri Manakula Vinayagar Engineering College offers the following B.Tech. Degree Programmes:

1. B.Tech - Electrical and Electronics Engineering (EEE)
2. B.Tech - Electronics and Communication Engineering (ECE)
3. B.Tech - Computer Science and Engineering (CSE)
4. B.Tech - Information Technology (IT)
5. B.Tech - Instrumentation and Control Engineering (ICE)
6. B.Tech - Mechanical Engineering (MECH)
7. B.Tech - Civil Engineering (CIVIL)
8. B.Tech - Biomedical Engineering (BME)
9. B.Tech - Mechatronics Engineering (Mechatronics)
10. B.Tech - Computer Science and Business Systems (CSBS)
11. B.Tech - Computer and Communication Engineering (CCE)
12. B.Tech - Artificial Intelligence and Data Science (AI&DS)
13. B.Tech - Fashion Technology (FT)

4. ADMISSION ELIGIBILITY

The norms for admission, eligibility criteria such as marks, age limit and mode of admission will be as prescribed by the Pondicherry University from time to time.

4.1 First Year B.Tech and Lateral Entry

4.1.1 *B.Tech - First Year*

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 Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology)/Technical Vocational subject or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto. amalgam

4.1.2 *B.Tech - Lateral Entry*

For Lateral entry in to third semester of the eight semester B.Tech Degree programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in Engineering / Technology with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with Mathematics as one of the subjects of study with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list

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of diploma programmes approved for admission to the various B.Tech degree programmes are given in **Annexure A.**

4.2 Age Limit

The candidate should not have completed 21 years of age as on 1st July of the Academic year under consideration. In case of SC/ST candidates, the age limit is relaxable for three years. No age limit for Lateral entry to the second year of the B.Tech degree programme.

5 ACADEMIC STRUCTURE

5.1 Duration of the Program

A student after securing admission shall pursue B.Tech programme for a minimum period of 4 academic years (8 semesters), if not he / she has to complete the degree within the maximum period of 7 years (14 semesters) starting from the commencement of the first semester. For a student admitted in lateral-entry mode, the minimum and maximum period of study shall be 3 academic years (6 semesters) and 6 years (12 semesters) respectively starting from the commencement of the third semester.

5.2 Medium of Instruction

The medium of instruction for the entire B.Tech degree programme shall be only in **ENGLISH**.

6 CURRICULUM STRUCTURE

According to the National Board of Accreditation (NBA), the curriculum has to be evolved after finalizing the Programme Educational Objectives (PEOs) and the corresponding Programme Outcomes (POs). The POs have been directly listed by NBA for UG programmes. Programme Specific Outcomes (PSOs) are to be evolved based on the knowledge and skills to be developed over the duration of programme. The curriculum that evolves should broadly ensure the achievement of the POs and PSOs, and thus the PEOs of the programme.

6.1 Category of Courses and its Credit Distribution

Course work is measured in units called credit hours or simply credits. The number of hours of a course per week is the number of credits for that course. One credit per lecture hour per week is assigned for each theory course. Laboratory courses and tutorial are assigned for an hour with 0.5 credits per week. The credits details of courses is shown in Table 1.

Table 1 Credits details of courses

Nature of Course	Number of hours			Credits
	L	T	P	
Theory	3	0	0	3
Theory with Tutorial	2	2	0	3
Practical	0	0	2	1
Project work	0	0	20	10
Total Number of Credits			Regular	Between 160 and 165
			Lateral entry	Between 121 and 126
Number of credits per Semester			Between 17 to 22	

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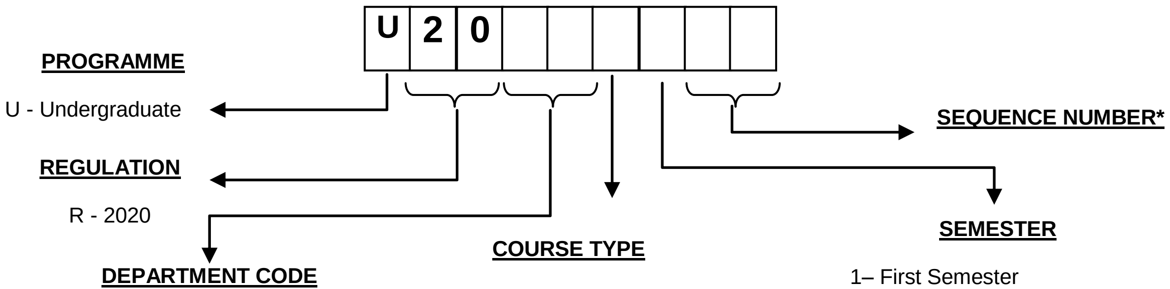
6.2 Course Numbering Scheme

Each course is denoted by a unique code consisting of 9 alphanumeric characters. The details of the numbering scheme is shown in Fig. 1



DEPARTMENT CODE

AD – Artificial Intelligence and Data Science

BM– Biomedical Engineering

CB – Computer Science and Business Systems

CC - Computer and Communication Engineering

CE – Civil Engineering

CS – Computer Science and Engineering

EC – Electronics and Communication Engineering

EE – Electrical and Electronics Engineering

FT – Fashion Technology

IC – Instrumentation and Control Engineering

IT – Information Technology

MC – Mechatronics Engineering

ME – Mechanical Engineering

COMMON CODE

HS – Humanities and Management

ES – Engineering Science

BS – Basic Science

COURSE TYPE

T –Theory

P – Practical

E – Professional Elective

O – Open Elective

C – Certification Course

M – Mandatory course

S – Skill Development Course

W – Project Work

SEMESTER

1– First Semester

2 – Second Semester

3 – Third Semester

4 – Fourth Semester

5 – Fifth Semester

6 – Sixth Semester

7 – Seventh Semester

8 – Eighth Semester

*Separate sequence of numbers for theory and practical courses

Fig. 1 Course code formation

6.3 Professional Electives

Each student shall choose a course from the professional elective list specified in the curriculum relating to his / her degree programme in consultation with the Class Advisor, Programme Academic Coordinator and the HoD.

6.4 Open Electives

Each student shall choose a course from the open elective list offered by other departments specified in the curriculum, in consultation with the Class Advisor, Programme Academic Coordinator and the HoD.

6.5 Project Work

Each student shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the guide. A student shall register for the Project Phase I and II in 7^{th} and 8^{th} semester respectively.

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1. *The process and guidelines for industry/Research organization projects*

   - Students opting for industry / research organization project should decide, identify and interact with relevant industry/ research organization in 7th semester itself. Training and Placement cell shall help to establish contact with industries. Students shall take necessary help from their department for exact plan of action and apply to the industry / research organization through proper channel .The departmental committee shall decide the schedule appropriately.
   - Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project, progress report to the department before the end of 7th semester.
   - Director cum Principal / Dean Academics shall issue permission letter to the students on the recommendation of HoD. Students shall be allowed to do the project work in the industry for a maximum period of 13 weeks in 8th semester.
   - An internal guide from the department and mentor from the industry/ research organization where the project is to be undertaken shall be allocated to the students. Both guides should discuss and finalize the scope of the project work and monitor the progress together.
   - Internal guide should visit the industry at least 3 times in a semester to see the progress of his/her student and a brief report should be submitted to the HoD about the project.
   - Student should maintain a record on the progress and get the approval from both internal and external guides at least twice in a month either by physically or through email communication. If the progress is not found satisfactory due to any reason, the Guide should take the corrective action, after consulting with Dean Academics through HoD for further extension of the project completion.
   - Progress report and certificate of completion of the project work from the industry / research organization shall be submitted by the student to the respective guide. The mode of evaluation shall be same as adopted for students carrying out in-house project.

2. *The Process and guidelines for in-house project*
   - Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project guide(s).
   - Students execute their in-house project in the Department with proper approval from the HoD through the respective supervisor.

6.6 Employability Enhancement Courses

6.6.1 Certification Courses: Students shall choose an International certification course of 40-50 hours duration specified in the curriculum, which will be offered through Centre of Excellence. These courses carry no credit and will not be considered for CGPA calculation.

6.6.2 Skill Development Courses: Skill development courses are non-credit courses, provided to enhance the knowledge and skill set of the students. The Skill Development Courses included in the curriculum are Foreign Language/IELTS, online certification course, Technical seminar, Presentation, Skill development courses and Technical skill development courses. It is mandatory for every student to register

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online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Expert. Students have to complete relevant online courses successfully. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the marks secured in online examinations.

6.7 Mandatory Courses

Mandatory Courses, specified by AICTE, are non-credit courses to be completed successfully by a student. The Mandatory Courses included in the curriculum are Induction Programme, Environmental Science, Physical Education, NSS, Indian Constitution, Essence of Indian Traditional Knowledge and Professional Ethics.

The students are expected to undergo a mandatory three-weeks induction programme comprising of physical activity, creative arts, universal human values, proficiency modules, lectures by eminent people, visits to local areas and familiarization to department/branch & innovations immediately after admission.

National Service Scheme (NSS) has social service activities in and around the College. Sports and Games activities include preparation for inter-collegiate sports events. Further training activities will be during weekends and the camps will be normally during vacation period. AICTE specified syllabus shall be followed for all the remaining mandatory courses.

6.8 Industrial Training / Internship

Students may undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Mentor, Class advisor and Departmental Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period.

7 COURSE ENROLMENT AND REGISTRATION

7.1 Course Registration

The registration for each semester courses shall be done in online mode which will commence preferably 10 working days prior to the last working day of the current semester.

7.1.1 After registering for all the courses, the student must attend the classes, satisfy the attendance requirements, earn Continuous Assessment Marks (CAM) and appear for the End Semester Examinations (ESE).

7.1.2 The opted Elective course will be offered only if the number of students opted for that course is not less than 30.However, if the students enrollment in a class is less than 30, the head of the department will decide the elective course.

7.2 Arrear Course Registration

In the first attempt of writing the End Semester Examination of a course if a student fails, He / She can retains the existing CAM and proceeds to write the supplementary exams / End Semester Examinations as and when they are conducted otherwise if a student wish to re-earn the Continuous Assessment Marks (CAM), He / She has to re-register by paying the prescribed fee for the course when it is offered next in the subsequent academic year. The existing CAM will get nullified. The student has to re-earn the CAM by taking-up all the internal tests, assignments and presentation as per the norms of regulations.

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8 EXAMINATION

8.1 Requirements for Appearing End Semester Examination

A student is expected to maintain 100% attendance in all courses as attendance also carries internal marks (Clause 10.3). A student will be qualified to appear for end semester examinations in a particular course of a semester only if he/she satisfies the below mentioned requirements.

8.1.1 The student is permitted to appear for End Semester Examinations, only if he/she maintains minimum 75% of attendance. If he/she secured attendance greater than or equal to 60 % and less than 75% in any course in the current semester can be considered in case of the following reasons:

i. Medical reasons (hospitalization / accident and or illness)

ii. Due to participation in sports events or any competitions or NCC and / or NSS activities with prior written permission from the Head of the Institution/Dean Academics through the Head of the Department

He/she has to pay the necessary condonation prescribed by the college authority with necessary supporting documents for his/her absence.

8.1.2 The student shall be considered for exemption from the prescribed attendance requirement for the reasons stated above and if exempted, the student shall be permitted to appear for the End Semester Examination of that course. In all such cases, the students should have submitted the required documents on joining after the absence, to the Head of the Department through the Class Advisor.

8.1.3 If any student is suspended for any reason during the semester, the days of suspension of a student on disciplinary grounds will be considered as days of absence for calculating the percentage of attendance for each individual course.

8.2 Movement to Next Higher Semesters

8.2.1 A student can move to the next semester provided only if he/she fulfills the minimum attendance requirement for appearing in the end semester examination.

8.2.2 The student who has failed to fulfill the above conditions will not be permitted to move to the higher semester, and shall rejoin the programme in the next academic year in the same semester after fulfilling all the requirements as per the regulations.

8.2.3 A student who rejoins the programme after the temporary break shall be governed only by the rules, regulations, course of study and syllabi in force, at the time of rejoining the course.

8.3 Provision for Withdrawal from Examination

8.3.1 **Complete Withdrawal (applicable only for nil arrear students):** A student, who is eligible to appear for the semester examinations, will be permitted to withdraw from appearing for the entire End Semester Examinations as one unit (*Complete Withdrawal*) for valid reasons and on the recommendation of the Head of the Department and with the approval of the Dean Academics. Complete Withdrawal application shall be made before the commencement of the first examination pertaining to the semester. Such withdrawal shall be permitted ***only once*** during the entire programme.

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8.3.2 A student who has completely withdrawn from appearing for End Semester Examinations in a particular semester should appear for the examinations of all the withdrawn subjects in the next semester itself.

8.3.3 If all other conditions are satisfactory, the candidate who withdraws is also eligible to be awarded DISTINCTION whereas he/she is not eligible to be awarded a rank.

8.4 Scribe for End Semester Examination

8.4.1 If any student is not in a position to write end semester examination on account of temporary physical disability or injury due to accident and applies for a scribe (writer) with medical certificate obtained from a medical officer not below the rank of Assistant Director level, then a scribe shall be allowed / assigned by CoE to such student. Normally, such scribe shall neither be a student nor a degree holder of any technical programme having similar competency. The student shall, however, apply in a prescribed proforma to CoE and requesting permission for using the scribe well in advance, not on the day of examination, to make necessary arrangements (Scriber, Separate Examination Hall etc.). CoE shall take the undertaking from the scribe in a prescribed proforma. Such student shall produce the permission letter from the CoE for using scribe to the invigilator. He / She should pay the TA/DA and other charges to the scribe. Scribe shall be allowed extra time as per the norms specified by the Controller of Examinations.

8.4.2 Student admitted with differently abled category and those who can write, but at much slower speed as compared to normal student, he/she may be allowed an extra time of 30 minutes for 50 marks paper and 45 minutes for 75 marks paper to write the examination for all the courses. He / She shall seek permission from CoE for the extra time on account of his/her percentage of disability by producing necessary medical certificate from medical officer not below the rank of Assistant Director.

8.5 Supplementary Examinations

Supplementary Examination is an additional examination which will be conducted after declaration of the End Semester Examination results/revaluation results. This examination will be conducted in fifth and eighth semesters for the students who are having a maximum of two arrears only. For supplementary examination, the continuous assessment marks of the last attempt will be considered.

8.6 Malpractice in Examinations

If any student caught red-handed due to malpractices in examinations then he/she shall be punished as per the recommendations of the Complaint Redressal Committee (CRC) constituted by CoE with the approval of Head of the Institution. The CRC shall inquire and decide the punishment for the unfair means as specified in the Examination manual.

9 ASSESSMENT PROCEDURES FOR AWARDING MARKS

The total marks for each course (Theory, Practical and Project Work) will be 100, comprising of two components namely Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM). However, there are EEC and Mandatory courses that have only continuous assessment for 100 marks without an End Semester Examination.

The Assessment components for each course are as illustrated in Table 2. Each course shall be evaluated for a maximum of 100 marks.

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Table 2 Assessment Components

Sl. No	Category of Course	Continuous Assessment Marks (CAM)	End Semester Examination Marks (ESM)
1	Theory Courses	25	75
2	Practical Courses#	50	50
3	Project phase - I	50	50
4	Project phase - II	40	60
5	Internship/In-plant training	100	-
6	Employability Enhancement Course (EEC)	100	-
7	Mandatory Courses (MC)	100	-

Business Basics for Entrepreneur and Entrepreneurship Management courses will have only continuous assessment for 100 marks.

Students may take National/International reputed professional certification courses after due approval from Department Consultative Committee (DCC). After completion of the course, the DCC has to verify the relevant documents and certificates. The credits and grades shall be mapped by the DCC and recommended to CoE through the HoD.

10 DISTRIBUTION OF MARKS

10.1 Marks Distribution of Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM)

The scheme of assessment for Continuous Assessment Test and weightage for each assessment is shown in Table 3 and 4 respectively. Table 5 shows the scheme for End Semester Examinations.

Table 3 Scheme for Continuous Assessment Marks

S. No	Course Type	Continuous Assessment Components									Total Marks
		Test Marks	Average of Pre /post-test/viva for each experiment	Average of Marks for experiment report for each experiment	Model Exam / Report/viva-voce	Assignment**	Review-1	Review-2	Review-3	Attendance	
1	Theory	15	-	-	-	5	-	-	-	5	25
2	Practical	-	10	15	15	-	-	-	-	10	50
3	Project phase - I	-	-	-	-	-	15	15	20	-	50
4	Project phase - II	-	-	-	-	-	10	10	20	-	40

** A minimum of three assignment has to be given for each course and out of them, the best two are to be considered for computation of internal assessment marks

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Table 4 Weightage of Assessment for Theory Courses

S. No	Test	Portion for Test	Test Marks	Duration of Test	Weightage for Internal Marks
1	CAT – 1	1 ½ Units	50	1 ½ hours	10*
2	CAT – 2	1 ½ Units	50	1 ½ hours	
3	CAT – 3	2 units	50	1 ½ hours	
4	CAT – 4	All 5 Units	75	3 hours	5#
5	CAT – 5# (Improvement Test)	All 5 Units	75	3 hours	
Continuous Assessment for Theory courses					15

***** A minimum of three tests (CAT 1, 2 and 3) to be conducted for every theory course and, out of them, the best two are to be considered for computation of internal assessment marks.

CAT 5 is optional for the students those who want improvement in the internal marks based on their request to the Department consultative Committee. Either CAT 4 or CAT 5 is to be considered for the computation of internal assessment marks.

Table 5 Scheme for End Semester Examinations

S. No	Course Type	Written Exam	Practical Exam	Practical exam viva	Report and viva - voce	Publication of papers / prototypes /patents etc	Total Marks
1	Theory	75	-	-	-	-	75
2	Practical	40		10	-	-	50
3	Project phase - I	-		-	50	-	50
4	Project phase - II	-	-	-	50	10	60

10.2 Question Paper Pattern – Theory

The question paper for the continuous assessment tests must follow Revised Bloom's Taxonomy and indicate expected knowledge level and Course Outcomes (COs). Question paper pattern for CAT and ESE is shown in Table 6.

Table 6 (a) Question Paper pattern for CAT 1 to 3

2 Mark Questions	5 Mark Questions	10 Mark Questions	Total Marks
5	4	2 (Out of 3 Questions)	50

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Table 6 (b) Question Paper pattern for CAT 4, CAT 5 and End Semester Examination

2 Mark Questions	5 Mark Questions	10 Mark Questions	Total Marks
10	5 (one question from each unit)	3 (out of 5 Questions)	75

Table 6 (c) CAT 4, CAT 5 and End Semester Examination Question Paper pattern for 6 units courses

<table>
<tr><th>Course</th><th>2 Mark Questions</th><th>5 Mark Questions</th><th>8 /9 Mark Questions</th><th>Total Marks</th></tr>
<tr><td rowspan="2">Part A</td><td rowspan="2">5</td><td rowspan="2">2
(out of 3 questions, one from each unit)</td><td>1
8 mark question
(out of 2 questions, from unit I and Unit II)</td><td rowspan="2">37</td></tr>
<tr><td>1
9 mark question
(compulsory question from unit III)</td></tr>
<tr><td>Part B</td><td>5</td><td>2
(out of 3 questions, one from each unit)</td><td>2
9 mark questions
(out of 3 questions, one from each unit)</td><td>38</td></tr>
</table>

10.3 Distribution of Marks for Attendance

(a). *Theory courses for which there is an internal marks of 25 that includes 5 marks for attendance* as shown in Table 3.

The distribution of 5 marks for attendance is as follows:

5 marks for 95% and above
4 marks for 90% and above but below 95%
3 marks for 85% and above but below 90%
2 marks for 80% and above but below 85%
1 mark for 75% and above but below 80%

(b). Practical courses for which there is an internal marks of 50 that includes 10 marks for attendance as shown in Table 3.

The distribution of 10 marks for attendance is as follows :

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%.

10.4 Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report prepared according to the approved guidelines and duly signed by the guide and the Head of the Department shall be submitted to the department as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation

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of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

- The Continuous Assessment Marks (CAM) and End Semester Examinations marks (ESM) distribution for the Project Work is given in Table 7.

Table 7 (a) CAM & ESM break-up for Project Phase - I

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	10	15
		Guide	5	
b	Review 2	Review Committee#	10	15
		Guide	5	
c	Review 3	Review Committee#	15	20
		Guide	5	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of Phase I report and Viva-voce	Internal Examiner	25	50
		External Examiner	25	
			Total ESM	50
			Total Marks	100

Table 7 (b) CAM & ESM break-up for Project Phase - II

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	5	10
		Guide	5	
b	Review 2	Review Committee#	5	10
		Guide	5	
c	Review 3	Review Committee#	10	20
		Guide	10	
			Total CAM	40
2	**End Semester Marks**			
a	Evaluation of final report and Viva-voce	Internal Examiner	25	50
		External Examiner	25	
b	Outcome*	Publication of papers /prototypes /patents etc	10	10
			Total ESM	**60**
			Total Marks	**100**

\# *Review committee consists of internal faculty members nominated by the Head of the Department. The guide of the student being examined shall not be part of the committee.*

* *Outcome, in terms of paper publication, patents, product development and industry projects shall be awarded by both internal and external examiners, based on the document proof submitted by the student concerned*

10.5 Grading for Mandatory and EEC Courses

Mandatory and EEC Courses are required to be completed to fulfill the degree requirements. All Mandatory (except induction programme) and EEC Courses are assessed internally for 100 marks. The pass mark is 50%. The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations.

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11 REQUIREMENTS FOR PASSING THE EXAMINATION

11.1 A student is declared to have successfully passed a theory based course if he/she has secured:

- A minimum of 40% marks out of 75 marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM).

11.2 A student is declared to have successfully passed a practical / project based course if he/she has secured:

- A minimum of 50% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM).

11.3 For mandatory courses, the student must satisfy the minimum attendance requirement and passing criteria as specified for the course in the department.

12 GRIEVANCE REDRESSAL MECHANISM IN EVALUATION

12.1 Photocopy of the Answer Script and Revaluation:

Students who are not satisfied with the grades awarded in the End Semester Examination of Theory Courses for regular and arrear examinations can seek redressal as follows:

- After declaration of results, photocopy of valued answer scripts with the marks awarded to individual answers shall be made available to the students on submission of an application along with the prescribed fees to Controller of Examinations.
- Students can get their answer scripts revalued by submitting an application along with the prescribed fees to the Controller of Examinations. The revaluation is extended to the students those who have maximum of two arrears in theory papers and the practical arrears are not taken into the account.
- The Controller of Examinations shall get the answer script revalued by appointing an examiner other than the one who has valued the script earlier. If the difference in marks awarded to an answer script by the examiners is less than 15 percent of the total marks earmarked for the End Semester Examination, then the average of marks awarded by the two examiners is taken as the mark scored in the examination. If the difference in marks is greater than 15 percent, then the answer script will be evaluated by a third examiner and the mark awarded by the third examiner is taken as the final score.

13 LETTER GRADE AND GRADE SHEET

All assessments of a course will be evaluated exactly based on the marks. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range given in Table 8, based on the percentage of marks obtained by the candidate in each subject.

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Table 8 Letter Grade and its range

S. No	Range of total marks	Letter Grade	Grade Points
1	90 to 100	S	10
2	80 to 89	A	9
3	70 to 79	B	8
4	60 to 69	C	7
5	55 to 59	D	6
6	50 to 54	E	5
7	0 to 49	F	0
8	Absent	FA	0
9	Withdrawal from examination	W	0
10	Pass in non-credit course	P	0

F – denotes Failure of the course and FA – Failure due to Absent

13.1 Grade Sheet

After declaration of results, grade sheets will be issued to each student, which will contain the following details:

- The College Name and Affiliating University.
- The list of courses registered during the semester and the grades scored.
- The Semester Grade Point Average (SGPA) for the semester.
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.
- On completion of a semester, each student is assigned a Semester Grade Point Average which is computed as below for all courses registered by the student during that semester

$$\text{Semester Grade Point Average (SGPA)} = \frac{\sum_i (C_i \times GP_i)}{\sum_i C_i} \qquad i = 1\ to\ n;$$

Where n= Number of credit courses in that semester. C_i is the Credit of i^{th} course in that semester and GP_i is the Grade Point earned by the student for that i^{th} course. The SGPA is rounded off to two decimals.

- The overall performance of a student at any stage of the Degree programme is evaluated by the Cumulative Grade Point Average (CGPA) up to that point of time.

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum_i (C_i \times GP_i)}{\sum_i C_i} \qquad i = 1\ to\ m;$$

Where m = Number of credit courses from I^{st} semester till the completed semesters, C_i is the Credit of i^{th} course of the completed semesters at that stage and GP_i is the Grade Point earned by the student for that i^{th} course.

13.2 *Scheme for conversion of CGPA to Percentage (%) marks*:

Some employers / institutions except the students to provide the details of the percentage (%) of marks scored in the semester examination / degree programme. In this regard, a scheme to convert the Cumulative Grade Point Average (CGPA) to Percentage (%) of marks is shown below:

Percentage (%) marks = CGPA x 10

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14 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of B.Tech. Degree provided for which the student has

- Successfully completed the course requirements and has passed all the prescribed End Semester Examinations in all the eight semesters (six semesters for lateral entry) within a maximum period of 7 years (6 years for lateral-entry) calculated from the commencement of the first semester to regular entry students and third semester for lateral entry students.

14.1 Classification of Degree

After successful completion of the programme, degree will be awarded as per the following classifications based on the final CGPA

1. **First class with Distinction**

   Student who satisfies the following conditions shall be declared to have passed the End Semester Examinations in *First class with Distinction:*

   (a) Students who have successfully completed the programme within eight consecutive semesters (*six consecutive semesters for lateral entry students*) and obtained a final CGPA of 8.5 or above by passing the End Semester Examination in all the courses from first to eighth semester in the *first attempt* will be declared to have passed in ***First Class with Distinction***.

   (b) Students who have secured a final CGPA of 8.5 or above but failed to clear the courses offered from first to eighth semester in the first attempt are not eligible for ***First Class with Distinction*** classification. However, Students who have opted for authorized complete withdrawal (only one time) from examination will also be eligible for ***First Class with Distinction*** classification but it will not be considered for Ranking.

2. **First class**

   A student who satisfies all the following conditions shall be declared to have passed the End Semester Examinations in First class:

   (a) Should have passed the examination in all the courses of all eight semesters (6 semesters in the case of Lateral Entry) within Five years (Four years in the case of Lateral Entry). One-year authorized break of study (if availed of) or prevention from writing the End Semester Examination due to lack of attendance (if applicable) is included in the duration of five years (four years in the case of lateral entry)

   (b) Should have obtained a final CGPA not less than 6.5 shall be declared to have passed in ***First Class***.

   (c) Students who have lost the eligibility for ***First Class with Distinction*** classification by failing to clear the courses offered from first to eighth semesters in the first attempt but securing a final CGPA of 8.5 or above shall also be declared to have passed in ***First Class***.

3. **Second class**

   All other students (not covered in S.No.1 and 2 under Clause14.1) who qualify for the award of the degree shall be declared to have passed the examination in Second Class.

14.2 Gold Medals and Ranks

For the Award of Gold Medal and ranks for each branch of study, the CGPA secured

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from 1^{st} to 8^{th} semester should be considered and it is mandatory that the candidate should have passed all the subjects from 1^{st} to 8^{th} semester in the first attempt. Rank certificates would be issued to the first five candidates in each branch of study.

15 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student shall be permitted to withdraw temporarily from the college for the reason beyond his/her control. The applicable rules are:

i. After withdrawal, the student shall rejoin next year in the same semester during which the student has withdrawn.

ii. The student shall apply to Dean Academics through HoD stating the reasons for withdrawal along with supporting documents, consent letter from his/her parent/guardian and clearance/no due from all the concerned departments.

iii. Dean Academics shall examine the case and recommend for the approval/ratification from Academic Council (AC) /Academic Standing Committee (ASC).

iv. A student availing temporary withdrawal from the college under the above provision shall be required to pay such fees and/or charges as may be fixed by the AC/ASC for his/her name to be enrolled. However, it may be noted that the fees/charges once paid shall not be refundable.

v. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed 7 years for regular entry students and 6 years for lateral entry students in any case including of the period of discontinuance.

16 TERMINATION FROM THE PROGRAM

A student shall be terminated from the program in the following cases:

i. Involved in ragging and not obeying disciplinary rules structured by college.

ii. Not completing the programme in prescribed period; Students shall have to complete B.Tech programme in the maximum period of 7 years (14 semesters) for regular entry and 6 years (12 semesters) for lateral entry from the date of admission. If not completed, Such student will be declared as Failed to Complete Technical Education (FCTE). However, genuine cases with proper justification may be referred to AC for extending programme completion period.

17 DISCIPLINE AND CONDUCT

17.1 Any act of misconduct committed by a student inside or outside the campus shall be an act of violation of discipline of the college. Violations of the discipline shall include:

(a). Interference to teaching, examination, administrative work, curricular or extra–curricular activities and any act likely to cause disruption.

(b). Damaging or defacing the property inside or outside the college campus.

(c). Engaging in any attempt at wrongful confinement of teachers, employees and students of the college.

(d). Use of abusive and derogatory slogans or intimidators' language or incitement of hatred and violence.

(e). Ragging in any form ("Ragging means causing, inducing, compelling or forcing a student whether by way of a practical joke or otherwise to do any act that detracts human dignity or violates person or exposes him to ridicule or to forbear from doing lawful act, by intimidating, wrongfully re-straining, wrongfully confining or injuring him or by using criminal force to him or by holding out to him any threat of such

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intimidation, wrongful restraint, wrongful confinement, injury or the use of criminal offense), as per the directions of Supreme Court of India, is a criminal offence.

(f). Eve teasing or disrespectful behavior to a student.

(g). An assault upon or intimidation of, or insulting behavior towards a teacher, officer, employee or student or any other person.

(h). Getting enrolled in more than one programme /course of study simultaneously.

(i). Committing forgery, tampering the documents or records, identity cards, furnishing false certificate or false information.

(j). Organizing instant agitation/meetings without prior permission in the campus.

(k). Viewing/downloading obscene information/data, images and executable files, sending obscene mails/messages via Facebook / twitter / other social sites using college servers/personal electronic gadgets in the college premises.

(l). Sharing the login and password and other details of IT facilities provided to other outside students.

(m). Refusing to provide an identity card when demanded by any teacher / college authority.

(n). Consuming or possessing alcoholic drinks, dangerous drugs or other intoxicants in the college campus.

(o). Possessing or using any weapons and fire arms in the college campus.

(p). Encroachment of hostel, accommodating guests or other persons in hostels without permission.

(q). Malpractice in examination

(r). Indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government.

(s). Any other act which may be considered by the Head of the Institution or the Discipline Committee to be an act of violation of discipline.

17.2 Any act of indiscipline of a student reported to the Head of the Institution shall be referred to Redressal and Disciplinary Committee of the college. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated. The penalties / punishment / actions may include:

(a). Written warning and information to the parents / guardian.

(b). Imposition of fine

(c). Suspension from the College / Hostel / Mess / Library or availing of any other facility.

(d). Suspension or cancellation of scholarship/fellowship / studentship or any financial assistance from any source.

(e). Recover of loss caused to college property.

(f). Debarring from participation in sports / NSS / student club activities.

(g). Disqualifying from holding any representative position in the Class / College / Hostel Mess / Sports / Clubs and in similar other bodies.

(h). Disqualifying from appearing in placement and receiving any awards.

(i). Expulsion from the Hostel / Mess / Library / Club / College for a specified period by forfeiting fees.

(j). Debarring from appearing for an end semester examination.

17.3 Student(s) involved in any act of indiscipline / malpractice in examination shall be issued notice to him/her, asked to be present before the Complaint Redressal Committee (CRC) on the day at specified time and venue with his/her parents /

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guardian. He / She shall give written reply / oral explanation to the charges levied against him/her for consideration. If the implicated student(s) fails to appear before the committee, then decision shall be taken as absent, on the basis of available evidence / documents which shall be binding on the concerned student.

17.4 Every admitted student shall be issued photo identification (ID) card which must be worn by the students when he/she is inside in the college campus / college bus.

18 ACADEMIC CALENDAR

18.1 The academic activities of the college shall be governed by the academic calendar prepared for each academic semester and approved by the AC/ASC. It shall be notified at the beginning of each academic semester. Academic calendar shall incorporate schedule of admission, course registration, course delivery, examination/evaluation, course feedback, course/graduate exit survey, co-curricular activities, compensation of holidays in case of academic loss, meetings (AC, ASC, IQAC, BoS, and Alumni), Academic audit and vacation.

18.2 The curriculum shall be typically delivered in two semesters in an academic year. Each semester shall be of 20 weeks (approximately 100 working days) duration, including evaluation, grade moderation and result declaration. Generally, 13-14 weeks (65-70 days) for course content delivery and 4-6 weeks (20 – 30 days) for examination /evaluation shall be assigned in each semester. The academic session in each semester shall provide at least 75 teaching days with 40 hours per week. The odd and even semesters of an academic year normally begin from second week of June and second week of December respectively.

18.3 The academic calendar should be strictly adhered to all other activities including co-curricular and extra-curricular activities that should be scheduled so as not to interfere with the curricular activities as stipulated in the academic calendar.

19 VARIOUS COMMITTEES AND ITS FUNCTIONS

19.1 Academic Council (AC)

Composition of Academic Council:

1. The Director cum Principal (Chairman)
2. All the Heads of Departments in the college
3. Four teaching staff of the college representing different designation are nominated on rotation basis according to the service of seniority.
4. Not less than four experts/academicians from outside the college representing such areas as Industry, Commerce, Law, Education, Medicine, Engineering, Sciences etc., to be nominated by the Governing Body.
5. Three nominees of the university not less than Professors.
6. A faculty member nominated by the Principal (Member Secretary).

Term: The term of the nominated members shall be three years.

Meetings: Academic Council shall meet at least twice a year.

Functions of the Academic Council:

The Academic Council shall have powers to:

(a). Scrutinize and approve the proposals with or without modification of the Board of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic

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Council differs on any proposal, it shall have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.

(b). Make regulations regarding the admission of students to different programmes of study in the college keeping in view the policy of the Government.

(c). Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.

(d). Recommend to introduce the new programme of study to the Governing Body proposals.

(e). Recommend to the Governing Body regarding the institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.

(f). Advise the Governing Body on suggestions(s) pertaining to academic affairs framed by it.

(g). Perform other functions as may be assigned by the Governing Body.

19.2 Board of Studies (BoS)

Composition of Board of Studies:

1. Head of the Department concerned (Chairman).
2. The entire faculty of each specialization.
3. Two subject experts from outside the Parent University to be nominated by the Academic Council.
4. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the college principal.
5. One representative from industry/corporate sector/allied area relating to placement.
6. One postgraduate meritorious alumnus to be nominated by the principal. The Chairman, Board of Studies, may with the approval of the principal of the college, co-opt:

   (a). Experts from outside the college whenever special courses of studies are to be formulated.

   (b). Other members of staff of the same faculty.

Term: The term of the nominated members shall be three years.

Meetings: The Board of Studies shall meet at least twice a year.

Functions of BoS

The Board of Studies of a Department in the college shall:

(a). Prepare syllabi for various courses keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and approval of the Academic Council.

(b). Suggest methodologies for innovative teaching and evaluation techniques.

(c). Suggest panel of names to the Academic Council for appointment of examiners.

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(d). Coordinate research, teaching, extension and other academic activities in the department/college.

19.3 Academic Standing Committee (ASC)

Composition of Academic Standing Committee is same as that of AC, except external members. ASC shall perform the functions under emergent situations subject to ratification by the AC.

19.4 Academic Appeal Board (AAB)

The entire process of Continuous Assessment shall be made transparent, in which students can get the explanation of marks being awarded from the course instructor, if and when required. However, if a student finds some anomaly in the award of marks in the continuous assessment, he/she can make an appeal to the *Academic Appeal Board* for review of marks awarded. Before appealing for such review, a student shall first approach the concerned Course Instructor and then the concerned Head of the Department, with a request to do the needful. Only after exhausting the above options and in situations where satisfactory actions / remedial measures have not been taken, the student may appeal to the Academic Appeal Board.

The Academic Appeal Board is constituted with Dean Academics as convener and two senior level professors as members, and the concerned Head of the Department and Class Advisor as co-opted members. The board will receive the grievances/complaints in writing from the aggrieved student regarding anomaly in award of marks. The board will examine the complaints and recommend appropriate measures to the Director cum Principal, for necessary action.

19.5 Departmental Advisory Committee (DAC)

DAC is another basic constituent of the academic system of an autonomous college. The composition and functions of the DAC are given below:

1. Chairman : Head of the concerned Department
2. Internal Members : Two senior faculty members of the department
3. Industry Representative : One representative from industry/corporate sector / is related to the placement
4. One academician from other Institution
5. One meritorious alumnus
6. One parent
7. One student
8. Member secretary : Programme Academic Coordinator

Term: The term of the nominated members shall be three years.

Meetings: The meeting may be scheduled as and when necessary, but at least twice a year.

Functions of DAC

The DAC of a department in the college shall

(a). Formulate a process to review post implementation effects of curriculum.

(b). Suggest measures to ensure academic standard and excellence of the course offered by the department.

(c). Suggest the methodologies for innovative teaching and evaluation techniques;

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enhancement of industry institute interaction.

(d). Identify and recommend the record of new programme.

(e). Review target set for attainment of course outcomes and programme outcomes.

(f). Guide and provide support to department for enhancing interaction with outside world.

(g). Plan strategically to enhance the academic quality of department.

(h). Resolve the address issues express by the stakeholders through feedback.

(i). Defining and redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) based on the recommendations by departmental academic committee.

(j). Study the achievement of PEOs and POs reported by department academic committee and suggest measures for improvement.

19.6 Board of Examinations (BoE)

Composition

1. Director cum Principal (Chairman)
2. Dean Academics
3. Controller of Examination(CoE): Member Secretary
4. One expert possessing ten years of industrial/ field experience nominated by the Chairman
5. Coordinators (Examinations, Assessment, Results and Tabulation)

Functions of BoE:

(a). The BoE shall

i. Ensure proper performance of the various duties in conducting examinations viz. paper setting, time table preparation, assessment and declaration of results.

ii. Recommend examination reforms and shall implement after the approval of academic council.

iii. Prepare the detailed time table of examinations as per the schedule approved by academic council.

iv. Arrange for strict vigilance during the conduct of examination so as to avoid use of unfair means by the students, faculty and invigilators.

(b). Chairman, BoE shall constitute Complaint Redressal Committee (CRC) consisting of three members as and when required to deal with the complaints related to the conduct of examinations.

(c). The recommendations of the CRC shall be approved by Chairman for the BoE to take appropriate disciplinary actions in the concerned matter. The disciplinary actions shall be endorsed by the BoE.

(d). The BoE shall perform duties and responsibilities that are assigned by Academic Council of the institute from time to time.

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19.7 Department Consultative Committee (DCC)

Composition

1. Head of Department (Chairman)
2. Five faculty members (at least one from each specialization) nominated by HOD
3. Member Secretary: Programme Academic Coordinator / Programme Evaluation Coordinator

Functions of DCC

(a). Review, revise and prepare curriculum structure based on institutional policy, suggest improvements in syllabus of a course/s prepared by course teacher/s and forward the curriculum to BoS for further recommendations.

(b). Check appropriateness of course objectives, course outcomes, and mapping of COs with POs and suggest necessary improvements/modifications.

(c). Monitor the academic progress throughout the semester, conduct of classes and take appropriate corrective measures to improve the quality of curriculum delivery.

(d). Review academic performance of students.

(e). Counsel the concerned course teachers for improvement based on student feedback, academic and question paper audit reports.

(f). Verify the attainment level of course outcomes and programme outcomes.

(g). Formulate strategy to collect feedback from stake holders, analyze the collected feedback and forward the analysis to DAC.

(h). Contribute to maintain academic standard as well as improving the quality of the courses offered by the department and enhance industry–institute interaction.

(i). Suggest open and professional electives considering societal needs.

(j). Recommend methodologies for innovative teaching and evaluation techniques to BoS.

(k). Coordinate research, teaching, extension and other academic activities in the department/college.

(l). Carry out preparatory work for defining /redefining the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) periodically.

(m). Monitor evaluation of course attainments leading to achievement of programme outcomes and report the results of assessment to BoS.

19.8 Programme Academic Coordinator (PAC)

The functions and duties of DAC are:

(a). Coordinating all academic activities of the department viz Curriculum revision, framing of syllabus, time table, member secretary for BoS meeting, re-registration of course/s, display and submission of attendance status.

(b). Conducting internal academic audit and departmental advisory committee meeting as a member secretary.

(c). Monitoring the academic activities and conduct of classes.

(d). Extending necessary help to departmental academic and evaluation committee.

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(e). Recording and forwarding all academic related documents to Dean Academics.

(f). Working in association with Dean Academics.

19.9 Departmental Evaluation Coordinator (DEC)

The functions and duties of DEC are:

(a). Conduct course and graduate exit survey, make arrangements for feedback from stakeholders (industry/employer/alumni/student) and feedback analysis.

(b). Monitor the assessment of course outcome.

(c). Compute / assess / evaluate the achievement of PEOs and POs as per NBA/NAAC requirements.

(d). Compile the information required for the preparation of Annual Quality Assurance Report (AQAR) by the Internal Quality Assurance Cell (IQAC).

(e). Extend necessary help to departmental academic and evaluation committee.

19.10 Class Advisor

Head of the Department will allot one faculty member to be the class advisor for a particular batch of students throughout their period of study. The role of class advisors is as follows:

i. To motivate and closely monitor the performance of the students.

ii. To build a strong alumni base for the institution by maintaining a possible rapport with students and parents.

iii. To maintain all important documents of the students for reference/inspection by all committees.

iv. To work closely with the student counselors on matters related to students and update the details from time to time in student's profile for further reference.

19.11 Student Counselor (Mentor)

By guiding and counseling students, faculty can create a greater sense of belongingness amongst the student community. To help the students in planning their courses and for general guidance on the academic programme, the Head of the Department will allot a certain number of students to a teacher of the department who shall function as student counselor throughout the period of study.

The student counselor will guide / monitor the courses chosen by the students, check attendance and progress of the students and counsel them periodically. The student counselors should ensure that each student is made aware of the various options for progress. Students are monitored and guided to become overall performers. Students can select and work for career choices of their interest. The student counselors shall update and maintain the student counselor record of each student under his guidance attached to them. The student counselors shall also help the class advisors to update the students details attached to them.

The student counselor may also discuss with the class advisor, HoD and parents about the progress of the students.

19.12 Class Committee

Every class will have a class committee constituted by the HoD. The members of the class committee will be as follows:

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1. Chairperson (a senior faculty who is preferably not teaching any course for the class)
2. All the course handling staff of the class
3. Students (a minimum of 6 consisting of 3 boys and 3 girls on pro-rata basis)

Functions

The functions of the class committee shall include the following: -

(a). Clarify the regulations of the programme and the details of rules therein.

(b). Inform the student representatives about the academic schedule including the dates of assessments and the syllabus coverage for each assessment.

(c). Inform the student representatives about the details of Regulations regarding marks assigned for each assessment. In the case of practical courses (laboratory/ drawing / project work / seminar etc.) the breakup marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students

(d). Analyze the performance of the students of the class after each assessment test and initiate steps for improvement.

(e). Identify slow learners, if any, and request the faculty concerned to provide additional help / guidance / coaching to such students.

(f). Discuss and sort out problems experienced by students in the classroom and in the laboratories.

(g). The class committee shall be constituted within the first week of the commencement of any semester.

(h). The chairperson of the class committee may invite the class advisor / student counselor and the Head of the Department to the meeting of the class committee.

(i). The Director cum Principal may participate in any class committee meeting.

(j). The chairperson is required to prepare the minutes of every meeting, submit the same through the Head of the Department to the Principal within two days of the meeting and arrange to circulate the same among the students and faculty concerned. Points requiring action by the management shall be brought to the notice of the management by the Principal.

Meetings

The class committee meetings are to be conducted as scheduled below.

Meeting 1	Within one week from the date of commencement of the semester
Meeting 2	One week before the 1st assessment test
Meeting 3	One week before the 2nd assessment test

During the first meeting of the class committee, the students are to be informed about the assessment procedure as per the framework of the Regulations. During these meetings the student representatives shall meaningfully interact and express opinions and suggestions of the students of the class to improve the effectiveness of the teaching-learning process.

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19.13 Course Committee for Common Courses

Each common theory / laboratory course offered to more than one class / branch shall have a Course Committee, comprising all the faculties who are teaching the common courses and one of them is nominated as a Course Coordinator.

Sl. No	Nature of common courses	Person Responsible for Forming Course Committee and Nominating Course Coordinator
1	For common courses handled in a particular department	Respective HoD
2	For common courses handled in more than one department	Controller of Examinations (CoE) inform the course committee details to the Principal to get approval for the same and intimate to the concerned faculty

The course committee will ensure that a common question paper is prepared for the tests / exams and uniform evaluation is carried out. The Course committee will meet a minimum of 3 times in each semester. The schedule for the course committee to meet is as follows.

Meeting 1	One week before the beginning of the semester
Meeting 2	One week before the 1^{st} assessment test
Meeting 3	One week before the 2^{nd} assessment test

20 REVISION OF REGULATIONS AND CURRICULUM

The college may revise, amend or change the regulations of curriculum and syllabi from time to time as and when found necessary.

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ANNEXURE - A

(Diploma programmes for admission to the B.Tech. Lateral Entry)

B.Tech programmes in which admission is sought	Diploma programmes eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology/Engineering Textile Engineering/Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Instrumentation and Control Engineering Bio Medical Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering/Technology Electronics and Communication Engineering. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering/Technology
Mechatronics Engineering	Mechatronics Engineering Mechanical Engineering Production Engineering Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering/Technology Electronics and Communication Engineering. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Computer Science and Business Systems	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology Electronics Engineering (Instrumentation) Computer Technology Instrumentation Technology Instrumentation and Control Engineering Electrical Engineering (Instruments and Control)

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	Electrical Engineering (Sandwich) Information Technology Electronics(WSI) Electrical Engineering Computer Engineering Computer Networks Electrical and Electronics Engineering (Sandwich) Electronics(Robotics) Electronics(Robotics) (Sandwich) Mechatronics Engineering Electronics and Communication Engineering (Sandwich)
Computer and Communication Engineering	Computer Science and Engineering Computer Technology Electronics and Communication Engineering Information Technology Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Instrumentation and Control Engineering Bio Medical Engineering Electrical Engineering Electrical and Electronics Engineering Mechatronics Engineering
Artificial Intelligence and Data Science	Computer Science and Engineering Computer Technology
Fashion Technology	Textile Technology Textile Processing Textile Engineering Textile marketing and Management Textile Design and Weaving Man Made Fibre Technology Knitting Technology Garment Technology Textile Design Fashion Design and Clothing Technology Handloom Technology Khadi and Handloom Technology Textile Processing (Sandwich) Textile Technology (Sandwich) Costume Design and Dressing Textile Manufacturing Fashion Technology Apparel Technology Applied Arts & Crafts (Fashion & Apparel Design) Shuttleless Weaving Home Textile Textronics Textile Technology (Knitting and garment Technology)

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SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS 2019
(R-2019)

CURRICULUM AND SYLLABI

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1:Quality Education:

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation:

To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society

DEPARTMENT VISION AND MISSION

Vision

To promote proficiency in the field of Electrical and Electronics Engineering by creating a stimulating environment for research, innovation and entrepreneurship.

Mission

M1: Quality Education:

To impart high quality technical education with problem solving capabilities by innovative pedagogy in emerging technologies

M2: Industrial and Societal Needs:

To cater the dynamic needs of the industry and society by strengthening industry-institute interaction.

M3: Research and Innovation:

To nurture the spirit of research attitude by carrying out innovative technologies pragmatically

M4: Placement and Entrepreneurship:

To inculcate the professionalism in career by advancing synergetic skills to compete in the corporate world

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

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

PO2: Problem analysis:

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

PO3: Design/development of solutions:

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

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

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

PO7: Environment and sustainability:

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

PO8: Ethics:

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

PO9: Individual and team work:

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

PO10: Communication:

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

PO11: Project management and finance:

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

PO12: Life-long learning:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Professional Knowledge:

To possess strong educational foundation in Electrical and Electronics Engineering to attain successful career with professional responsibility

PEO2: Innovative Skills:

To exploit the skills to design and develop innovative solutions for engineering problems in a multidisciplinary environment

PEO3: Ethics:

To actively embrace leadership qualities for achieving professional goals with ethical values

PEO4: Adaptability:

To enhance intellectual competency along with technical skills by adapting to the current trends through eternal learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Core Proficiency:

Utilize the engineering core knowledge to identify, formulate, design, and investigate the complex engineering problems of Power Electronics, Electrical Machines and Power Systems.

PSO2: Cutting Edge Technologies:

Explore the new cutting edge technologies in the field of Electric Vehicle, Automation, Artificial Intelligence, Robotics and Renewable Energy to compete in global market

PSO3: Design and Evolution:

Capability to comprehend the technological advancements with the usage of modern design tools for analysing and designing systems to confront the rapid pace of industrial innovations.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Science (HS)	09
2	Basic Sciences(BS)	35
3	Engineering Sciences (ES)	32
4	Professional Core (PC)	68
5	Professional Electives (PE)	18
6	Open Electives (OE)	09
7	Project Work and Internship (PW)	12
8	Employability Enhancement Courses (EEC*)	-
9	Mandatory courses (MC*)	-
Total		**183**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	4	-	-	-	3	-	1	1	09
2	Basic Sciences(BS)	16	12	3	3	1	-	-	-	35
3	Engineering Sciences (ES)	10	18	-	4	-	-	-	-	32
4	Professional Core (PC)	-	-	18	8	15	15	8	4	68
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	3	-	3	3	-	09
7	Project Work (PW)	-	-	-	-	-	-	2	8	10
8	Internship (PW)	-	-	-	-	-	-	2	-	02
9	Employability Enhancement Courses (EEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**30**	**30**	**21**	**21**	**22**	**21**	**19**	**19**	**183**

** EEC and MC are not included for CGPA calculation*

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	T101	Mathematics – I	BS	3	1	0	4	25	75	100
2	T102	Physics	BS	4	0	0	4	25	75	100
3	T103	Chemistry	BS	4	0	0	4	25	75	100
4	T110	Basic Civil and Mechanical Engineering	ES	4	0	0	4	25	75	100
5	T111	Engineering Mechanics	ES	3	1	0	4	25	75	100
6	T112	Communicative English	HS	4	0	0	4	25	75	100
Practical										
7	P104	Physics Lab	BS	0	0	3	2	50	50	100
8	P105	Chemistry Lab	BS	0	0	3	2	50	50	100
9	P106	Workshop Practice	ES	0	0	3	2	50	50	100
							30	300	600	900

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	T107	Mathematics –II	BS	3	1	0	4	25	75	100
2	T108	Material Science	BS	4	0	0	4	25	75	100
3	T109	Environmental Science	BS	4	0	0	4	25	75	100
4	T104	Basic Electrical and Electronics Engineering	ES	3	1	0	4	25	75	100
5	T105	Engineering Thermodynamics	ES	3	1	0	4	25	75	100
6	T106	Computer Programming	ES	3	1	0	4	25	75	100
Practical										
7	P101	Computer Programming Laboratory	ES	0	0	3	2	50	50	100
8	P102	Engineering Graphics	ES	0	0	3	2	50	50	100
9	P103	Basic Electrical and Electronics Laboratory	ES	0	0	3	2	50	50	100
Mandatory Course										
10	P107	NSS / NCC *	MC	0	0	0	-	-	-	-
							30	300	600	900

To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET31	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U19EET32	Electric Circuit Analysis	PC	2	2	0	3	25	75	100
3	U19EET33	Electromagnetic Theory	PC	3	0	0	3	25	75	100
4	U19EET34	Electrical Machines – I	PC	3	0	0	3	25	75	100
5	U19EET35	Electronic Devices and Circuits	PC	3	0	0	3	25	75	100
6	U19EET36	Digital Electronics	PC	3	0	0	3	25	75	100
Practical										
7	U19EEP31	Electric Circuit Analysis Lab	PC	0	0	2	1	50	50	100
8	U19EEP32	Electrical Machines Lab- I	PC	0	0	2	1	50	50	100
9	U19EEP33	Electronics Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19EEC3X	Certification Course – I **	EEC	0	0	4	-	100	-	100
11	U19EES31	Skill Development Course 1: General Proficiency - I	EEC	0	0	2	-	100	-	100
12	U19EES32	Skill Development Course 2 *	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U19EEM31	Physical Education	MC	0	0	2	-	100	-	100
							21	700	600	1300

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET41	Probability and Statistics	BS	2	2	0	3	25	75	100
2	U19EET42	Data Structure and Object Oriented Programming	ES	3	0	0	3	25	75	100
3	U19EET43	Electrical Machines – II	PC	3	0	0	3	25	75	100
4	U19EET44	Linear Integrated Circuits	PC	3	0	0	3	25	75	100
5	U19EEE4X	Professional Elective - I #	PE	3	0	0	3	25	75	100
6	U19XXO4X	Open Elective-I $	OE	3	0	0	3	25	75	100
Practical										
7	U19EEP41	Data Structure and Object Oriented Programming Lab	ES	0	0	2	1	50	50	100
8	U19EEP42	Electrical Machines Lab- II	PC	0	0	2	1	50	50	100
9	U19EEP43	Linear Integrated Circuits Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19EEC4X	Certification Course – II **	EEC	0	0	4	-	100	-	100
11	U19EES41	Skill Development Course 3: General Proficiency - II	EEC	0	0	2	-	100	-	100
12	U19EES42	Skill Development Course 4 *	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U19EEM41	Indian Constitution	MC	2	0	0	-	100	-	100
							21	700	600	1300

#Professional Electives are to be selected from the list given in annexure I

$Open electives are to be selected from the list given in Annexure II

*** Certification courses are to be selected from the list given in Annexure III*

** Skill Development Courses (2 and 4) are to be selected from the list given in Annexure IV*

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET51	Measurements and Instrumentation for Electrical Engineering	PC	3	0	0	3	25	75	100
2	U19EET52	Control Systems	PC	2	2	0	3	25	75	100
3	U19EET53	Transmission and Distribution	PC	3	0	0	3	25	75	100
4	U19EET54	Microprocessor and Microcontroller	PC	3	0	0	3	25	75	100
5	U19EEE5X	Professional Elective - II #	PE	3	0	0	3	25	75	100
6	U19XXO5X	Open Elective – II $	HS	3	0	0	3	25	75	100
Practical										
7	U19EEP51	Numerical Methods and Optimization Lab	BS	0	0	2	1	50	50	100
8	U19EEP52	Measurements and Instrumentation Lab	PC	0	0	2	1	50	50	100
9	U19EEP53	Control Systems Lab	PC	0	0	2	1	50	50	100
10	U19EEP54	Microcontroller and its applications Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U19EEC5X	Certification Course – III **	EEC	0	0	4	-	100	-	100
12	U19EES51	Skill Development Course 5: Foreign Language / IELTS - I	EEC	0	0	2	-	100	-	100
13	U19EES52	Skill Development Course 6: Presentation Skills using ICT	EEC	0	0	2	-	100	-	100
Mandatory Course										
14	U19EEM51	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							22	750	650	1400

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET61	Embedded System	PC	3	0	0	3	25	75	100
2	U19EET62	Power Electronics and Drives	PC	3	0	0	3	25	75	100
3	U19EET63	Power System Analysis	PC	3	0	0	3	25	75	100
4	U19EET64	Electrical Machine Design	PC	3	0	0	3	25	75	100
5	U19EEE6X	Professional Elective - III #	PE	3	0	0	3	25	75	100
6	U19XXO6X	Open Elective – III $	OE	3	0	0	3	25	75	100
Practical										
7	U19EEP61	Embedded System Lab	PC	0	0	2	1	50	50	100
8	U19EEP62	Power Electronics and Drives Lab	PC	0	0	2	1	50	50	100
9	U19EEP63	Power System Analysis Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U19EEC6X	Certification Course – IV **	EEC	0	0	4	-	100	-	100
11	U19EES61	Skill Development Course 7: Foreign Language / IELTS - II	EEC	0	0	2	-	100	-	100
12	U19EES62	Skill Development Course 8: Technical Seminar	EEC	2	0	0	-	100	-	100
13	U19EES63	Skill Development Course 9: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U19EEM61	Professional Ethics	MC	2	0	0	-	100	-	100
							21	800	600	1400

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET71	Industrial Automation and Control	PC	3	0	0	3	25	75	100
2	U19EET72	Electrical and Hybrid Vehicle	PC	3	0	0	3	25	75	100
3	U19EEE7X	Professional Elective – IV #	PE	3	0	0	3	25	75	100
4	U19XXO7X	Open Elective – IV $	OE	3	0	0	3	25	75	100
Practical										
5	U19EEP71	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U19EEP72	Industrial Automation and Control Lab	PC	0	0	2	1	50	50	100
7	U19EEP73	Electrical and Hybrid Vehicle Lab	PC	0	0	2	1	50	50	100
Project Work										
8	U19EEW71	Project Phase – I	PW	0	0	4	2	50	50	100
9	U19EEW72	Internship / Inplant Training	PW	0	0	0	2	100	-	100
							19	450	450	900

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19EET81	Protection and Switchgear	PC	3	0	0	3	25	75	100
2	U19EEE8X	Professional Elective – V #	PE	3	0	0	3	25	75	100
3	U19EEE8X	Professional Elective – VI #	PE	3	0	0	3	25	75	100
Practical										
4	U19EEP81	Entrepreneurship Management	HS	0	0	2	1	100	-	100
5	U19EEP82	Comprehensive Viva	PC	0	0	2	1	50	50	100
Project Work										
6	U19EEW81	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
7	U19EES81	Skill Development Course 10: NPTEL / MOOC -II	EEC	0	0	0	-	100	-	100
							19	365	335	700

Annexure - I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE41	Electrical Safety Engineering
2	U19EEE42	Computer Aided Design for Electrical Apparatus
3	U19EEE43	Sensors and Transducers for Electrical Engineering
4	U19EEE44	Finite Element Analysis
5	U19EEE45	Energy Storage Technology
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE51	Utilization of Electrical Energy
2	U19EEE52	Renewable Energy Sources
3	U19EEE53	Electrical Energy Audit and Conservation
4	U19EEE54	Automotive Electronics for Electrical Engineering
5	U19EEE55	Industrial Electrical System
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE61	Smart Grid
2	U19EEE62	High Voltage Engineering
3	U19EEE63	Special Electrical Machines
4	U19EEE64	Digital Signal Processing
5	U19EEE65	Advanced Control Systems
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE71	Communication Engineering
2	U19EEE72	Distributed Generation and Microgrids
3	U19EEE73	Power Electronics for Renewable Energy Systems
4	U19EEE74	Power System Operation and Control
5	U19EEE75	SMPS and UPS

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE80	Power System Economics
2	U19EEE81	Modern Power Electronic Converters
3	U19EEE82	Electric Traction
4	U19EEE83	Soft Computing Techniques
5	U19EEE84	Fundamentals of Solar photovoltaic system and applications
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE85	Power Electronics Applications in Power Systems
2	U19EEE86	EHV AC and DC transmission
3	U19EEE87	Restructured Power System
4	U19EEE88	Power System Stability
5	U19EEE89	Robotics and Control

Annexure – II

OPEN ELECTIVE COURSES

Sl. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U19EEO41	Solar Photovoltaic Fundamentals and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics
2	U19EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, BME, IT, CSE
3	U19ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, BME, Mechatronics
4	U19ECO42	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U19CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19CSO43	Programming in JAVA	CSE	ECE, MECH, Mechatronics
8	U19ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, BME
9	U19ITO42	R programming	IT	EEE, ECE, ICE, BME, MECH, Mechatronics

10	U19ICO41	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL
11	U19ICO42	Control System Engineering	ICE	CSE, IT, MECH
12	U19MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME
13	U19MEO42	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
14	U19MEO43	Power Plants for Electrical Engineering	MECH	EEE
15	U19CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics
16	U19CEO42	Building Science and Engineering	CIVIL	EEE, MECH, BME
17	U19BMO41	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
18	U19BMO42	Telemedicine	BME	EEE, ECE, CSE, IT, ICE
19	U19CCO41	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19CCO42	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics
Open Elective – II / Open Elective – III				
1	U19HSO51 / U19HSO61	Product Development and Design	MBA	**Common to B. Tech** (Offered in Semester V for **EEE, ECE, ICE, CIVIL, BME**) (Offered in Semester VI for **CSE, IT, MECH, Mechatronics**)
2	U19HSO52 / U19HSO62	Intellectual Property and Rights	MBA	
3	U19HSO53 / U19HSO63	Marketing Management and Research	MBA	
4	U19HSO54 / U19HSO64	Project Management for Engineers	MBA	
5	U19HSO55 / U19HSO65	Finance for Engineers	MBA	
Open Elective – II / Open Elective – III (Offered in Semester V for **CSE, IT, MECH, Mechatronics**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME**)				
1	U19EEO53 / U19EEO63	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
2	U19EEO54 / U19EEO64	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics
3	U19ECO53 / U19ECO63	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE MECH, BME, Mechatronics
4	U19ECO54 / U19ECO64	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U19CSO54 / U19CSO64	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
6	U19CSO55 / U19CSO65	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
7	U19ITO53 / U19ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME

8	U19ITO54 / U19ITO64	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
9	U19ITO55 / U19ITO65	Data Structures	IT	MECH
10	U19ICO53 / U19ICO63	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME
11	U19ICO54 / U19ICO64	Measurement and Instrumentation	ICE	ECE, Mechatronics
12	U19MEO54 / U19MEO64	Heating, ventilation and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
13	U19MEO55 / U19MEO65	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
14	U19CEO53 / U19CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19CEO54 / U19CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
16	U19BMO53 / U19BMO63	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, MECH, Mechatronics
17	U19BMO54 / U19BMO64	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, MECH, CIVIL , Mechatronics
18	U19CCO53 / U19CCO63	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME
19	U19CCO54 / U19CCO64	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U19ADO51 / U19ADO61	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL
21	U19ADO52 / U19ADO62	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
Open Elective – IV (Offered in Semester VII)				
1	U19EEO75	Hybrid and Electrical Vehicle	EEE	ECE, Mechatronics , MECH
2	U19EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics
3	U19ECO75	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL
4	U19ECO76	Cellular and Mobile Communications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics
5	U19CSO76	Artificial Intelligence	CSE	EEE, ICE, CIVIL, MECH
6	U19CSO77	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, BME, Mechatronics
7	U19ITO76	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, BME, Mechatronics
8	U19ITO77	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, BME
9	U19ICO75	Process Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, BME, Mechatronics.
10	U19ICO76	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics

11	U19MEO76	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U19MEO77	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U19CEO75	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH
14	U19CEO76	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME
15	U19MCO71	Building Automation	Mechatronics	MECH, CIVIL
16	U19MCO72	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
17	U19BMO75	Internet of Things for Healthcare	BME	EEE, ECE, ICE
18	U19BMO76	Telehealth Technology	BME	EEE, ECE, ICE
19	U19CCO75	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
20	U19CCO76	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME,
21	U19ADO73	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, Mechatronics
22	U19ADO74	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME

Annexure – III

EMPLOYABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

Sl. No	Course Code	Course Title
1	U19EECX1	AutoCAD for Electrical
2	U19EECX2	Solar and Smart Energy System with IOT
3	U19EECX3	ANSYS- Multi-Physics
4	U19EECX4	Design and documentation using Eplan Electric P8
5	U19EECX5	Python Programming
6	U19EECX6	Artificial intelligence and Edge computing
7	U19EECX7	JAVA Programming
8	U19EECX8	Machine Learning and Deep Learning
9	U19EECX9	Revit MEP

Annexure – IV

EMPLOYABILITY ENHANCEMENT COURSES – (B) SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U19EES31	Skill Development Course 1 : General Proficiency - I
2	U19EES32	Skill Development Course 2 *
		1) Testing of Electronics Devices and PCB Board Designing
		2) Design of Solar power plant and Installation
		3) Demonstration / Troubleshooting of Electrical and Electronics Equipments
3	U19EES41	Skill Development Course 3 : General Proficiency - II
4	U19EES42	Skill Development Course 4 *
		1) Mobile Phone Servicing
		2) Autonomous Robotics
		3) Repair and Maintenance of Power Supply, Inverter and UPS
5	U19EES51	Skill Development Course 5 : Foreign Language/ IELTS -I
6	U19EES52	Skill Development Course 6 : Presentation Skills using ICT
7	U19EES61	Skill Development Course 7 : Foreign Language/ IELTS - II
8	U19EES62	Skill Development Course 8 : Technical Seminar
9	U19EES63	Skill Development Course 9 : NPTEL/MOOC - I
10	U19EES81	Skill Development Course 10 : NPTEL/MOOC-II

Any one course to be selected from the list

T101

MATHEMATICS – I

(Common to all Branches)

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To introduce the idea of applying calculus concepts to problems in Engineering.
- To understand the concept of partial differentiation
- To develop logical thinking and analytic skills in evaluating multiple integrals.
- To introduce mathematical tools to solve first order differential equations.
- To learn linear differential equations of higher order with constant coefficients.

Course Outcomes

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

CO1 – Understand the concept of curvature. **(K2)**
CO2 – Solve different types of partial differential equation. **(K3)**
CO3 – Understand the concept of double and triple integrals. **(K2)**
CO4 – Solve differential equations. **(K3)**
CO5 – Solve higher order differential equations. **(K3)**

UNIT I CALCULUS (12 Hrs)

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II FUNCTIONS OF SEVERAL VARIABLES (12 Hrs)

Partial derivatives, Total derivatives, Differentiation of implicit functions, Change of Variables, Jacobians and their properties, Taylor's series for functions of two variables, Maxima and minima, Lagrange's method of undetermined multipliers.

UNIT III MULTIPLE INTEGRALS AND APPLICATIONS (12 Hrs)

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT IV DIFFERENTIAL EQUATIONS (12 Hrs)

Exact equations, First order linear equations, Bernoulli's equation, orthogonal Trajectories, growth, decay and geometrical applications. Equations not of first degree: Equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT V DIFFERENTIAL EQUATIONS (Higher order) (12 Hrs)

Linear differential equations of higher order - with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, simultaneous linear Differential equations, solution by Variation of parameters method simple application to Electric circuits.

Text Books

1. Venkataraman M.K, Engineering Mathematics-First year, National Publishing Company, Chennai, 2010
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011.

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8th Edition.
5. Bali N.P and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

Web References

1. https://www.youtube.com/watch?v=rAof9Ld5sOg
2. https://nptel.ac.in/courses/111/104/111104092/
3. https://nptel.ac.in/courses/111/107/111107108/
4. https://www.youtube.com/watch?v=BJ_0FURo9RE
5. https://www.youtube.com/watch?v=p_di4Zn4wz4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	2	1	1
2	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1
3	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1
5	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1

Correlation Level: 1-Low, 2-Medium, 3- High

T102

PHYSICS

(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	60

Course Objectives

- To understand the concepts of physics and its significant contributions in the advancement of technology and invention of new products that dramatically transformed modern-day society.
- To expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines
- To understand the concepts and applications of Ultrasonics, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics

Course Outcomes

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

CO1 - Understand the basic concepts of sound Engineering and ideas to get good audibility inside a hall. Also gain knowledge about the production, propagation, properties and application of ultrasonic waves. **(K2)**

CO2 - Interpret the different characteristic behavior of light waves with air, glass, lens, grating, prism etc., Gain adequate knowledge about the interference, diffraction and polarization phenomenon of light waves and their applications. **(K2)**

CO3 - Understand the principle mechanism of laser light; distinguish between ordinary light and laser light. Basic idea about the various laser sources. Also gain knowledge about the optical fibers and their importance in communication. **(K3)**

CO4 - Understand the basic concept of quantum mechanics, dual nature of matter, and importance of energy of electrons associated with the properties of the materials. Also able to calculate energy of electron in an energy level by solving Schrodinger's equation. **(K1)**

CO5 - Gain knowledge about the structure of nucleus its constituents, nature. Understanding the nuclear energy fission and fusion concepts. Basic ideas of nuclear reactors to produce energy. **(K3)**

UNIT I ACOUSTICS & NDT (12 Hrs)

ultrasonics - Ultrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating) NDT applications – Ultrasonic Pulse Echo Method - Liquid Penetrant Method

Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time – Doppler effect and its application to Radars. (elementary ideas)

UNIT II OPTICS (12 Hrs)

Interference - Air Wedge – Michelson's Interferometer - Wavelength Determination – Interference Filter – Antireflection Coatings

Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism

Polarisation - Basic concepts of Double Refraction - Huygens Theory of Double Refraction- Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

UNIT III LASERS & FIBER OPTICS (12 Hrs)

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – types of Optical resonators (qualitative ideas) – Types of Lasers - NdYAG, CO_2 laser, GaAs Laser - applications of lasers

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode) - applications to sensors and Fibre Optic Communication

UNIT IV WAVE MECHANICS (12 Hrs)

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V NUCLEAR ENERGY SOURCE **(12 Hrs)**

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission – Nuclear Reactor: Materials Used in Nuclear Reactors. – PWR – BWR – FBTR. Nuclear fusion reactions for fusion reactors - D-D and D-T reactions, Basic principles of Nuclear Fusion reactors.

Text Books

1. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi, 2011. (For units I to IV only)
2. Arthur Beiser, Concepts of Modern Physics, 6th Edition, TMH, New Delhi 2008. (For unit V only)

Reference Books

1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
4. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
5. Science of Engineering Materials, 2nd Edition, C.M. Srivastava and C. Srinivasan, New Age Int. (P) Ltd, New Delhi, 1997.
6. Avadhanulu M N, Engineering Physics, S. Chand & Co, 2009.

Web References

1. https://swayam.gov.in/nd1_noc20_ph15/preview
2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	1	3	1
2	3	3	2	2	3	-	-	-	-	-	-	-	1	2	3
3	3	3	2	3	3	-	-	-	-	-	-	-	2	2	3
4	3	3	3	3	2	-	-	-	-	-	-	-	2	-	-
5	3	3	3	1	3	-	-	-	-	-	-	-	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T103

CHEMISTRY
(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	60

Course Objectives
- Know the fundamental principles of Engineering Chemistry required solving engineering problems.
- Practical implementation of fundamental theory concepts.
- Introducing new techniques and latest information that motivates the students to bring out his or her views and work effectively.
- To enable the students understand the role of engineering materials such as polymers, energy production, electrical field basic concepts of material behaviour and study the environmental applications in the field of engineering and technology
- To acquire knowledge of engineering materials and about fuels and batteries

Course Outcomes
After completion of the course, the students will be able to

CO1 - Understand the basic concept of hardness of water, the chemicals responsible for it, measurement of hardness, its disadvantages and its removal. **(K2)**

CO2 - Understand the synthesis of various organic and inorganic polymer **(K3)**

CO3 - Understand the application of the concept of oxidation and reduction reaction to various cells **(K2)**

CO4 - Understand the application of electrochemistry in corrosion of metals and also about different types of corrosion control methods **(K3)**

CO5 - Understand the concept of phase equilibrium and its application to different types of heterogeneous equilibrium system like eutectic alloys. **(K3)**

UNIT I WATER (12 Hrs)
Hardness of water - units and calcium carbonate equivalent. Determination of hardness of water – EDTA method. Disadvantages of hardwater – boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods – internal & external conditioning – Lime-Soda process, Zeolite process and Ion-exchange process. Desalination – reverse osmosis & electrodialysis.

UNIT II POLYMER (12 Hrs)
Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties –chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers– vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers–classification and applications. Polymer composites – FRP – laminar composites. Moulding constituents of plastic, moulding techniques – compression, injection, transfer and extrusion moulding.

UNIT III ELECTROCHEMICAL CELLS (12 Hrs)
Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes–hydrogen, calomel, Ag/AgCl & glass electrodes. Batteries – primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells – H_2-O_2 fuel cell

UNIT IV CORROSION AND ITS CONTROL (12 Hrs)
Chemical & electrochemical corrosion – Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion – corrosion control methods – cathodic protection and corrosion inhibitors. Protective coating – types of protective coatings – metallic coating–tinning and galvanizing, cladding, electroplating and anodizing

UNIT V PHASE RULE (12 Hrs)
Definition and derivation of phase rule. Application to one component system – water and sulfur systems. Thermal analysis, condensed phase rule. Two component systems– Pb-Ag, Cu-Ni, and Mg-Zn systems.

Text Books
1. P.C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai and Sons, New Delhi 15th Ed,2010.
2. B.Sivasankar (2008) , "Engineering Chemistry ", Tata McGraw Hill , India
3. Shaley Oberoi & Monica Malik (2009), "Engineering Chemistry made easy", Cengage Learning, Delhi.

4. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016)
5. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)

Reference Books

1. S. S. Dara, A Textbook of Engineering Chemistry, 11th Ed, S.Chand& Co., Ltd. New Delhi, 2008.
2. B. K. Sharma, Engineering Chemistry, 3rdedition Krishna Prakashan Media (P) Ltd., Meerut, 2001.
3. P. Kannan and A. Ravi Krishnan "Engineering Chemistry" Hi-Tech Sri Krishna Publications, Chennai, 9th Ed, 2009
4. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2ndEd. PHI Learning PVT., LTD, New Delhi, 2008
5. C.V.Agarwal, C.P.Naidu, "A text book of Engineering Chemistry", BS Publication, Hyderabad.

Web References

1. https://water.usgs.gov/edu/hardness.html
2. https://www.polymer-project.org/
3. www.materials.unsw.edu.au/tutorials/online-tutorials/corrosion
4. www.electrochem.org/redcat-blog/4-useful-electrochemistry-websites-2/
5. https://serc.carleton.edu/research_education/equilibria/phaserule.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	-	1	-
2	2	1	-	-	-	1	1	-	-	-	-	1	3	1	-
3	2	1	-	-	-	1	1	-	-	-	-	1	3	1	-
4	2	1	-	-	-	1	1	-	-	-	-	1	1	1	-
5	2	1	-	-	-	1	1	-	-	-	-	1	2	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T110 **BASIC CIVIL AND MECHANICAL ENGINEERING**
(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	45

Course Objectives

- To be able to differentiate the type of buildings according to national building code.
- To understand building components and their functions.
- Discuss the different types of roads, bridges and dams.
- To describe different types of combustion systems such as Internal and External Combustion systems
- To discuss various Energy Resources available for power generation.
- To explain the working of various different manufacturing process.

Course Outcomes

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

CO1 - Understand the basic concepts of different types of buildings and building materials. **(K3)**
CO2 - Learn various types of building components and their functions. **(K3)**
CO3 - Describe the importance of the basic infrastructure. **(K3)**
CO4 - Understand the classification of engines, low pressure Steam generators, its mounting and accessories. **(K2)**
CO5 - Apply the knowledge of thermal systems and equipment's in power plants and analyze the way of harnessing the renewable energies and its utilization. **(K3)**
CO6 - Understand the basic principles of machining, manufacturing and metal joining processes such as Lathe machine, Drilling, Grinding, Welding, green sand moulding foundry process. **(K2)**

PART – A CIVIL ENGINEERING

UNIT I BUILDINGS, BUILDING MATERIALS **(10 Hrs)**
Buildings – Definition - Classification according to NBC - plinth area, Floor area, carpet area, floor space index - construction materials - stone, brick , cement, cement-mortar, concrete, steel-their properties and uses.

UNIT II BUILDINGS AND THEIR COMPONENTS **(10 Hrs)**
Buildings: Various Components and their functions. Soils and their classification. Foundation: function and types. Masonry - function and types. Floors: definition and types of floors. Roofs: definition and types.

UNIT III BASIC INFRASTRUCTURE **(10 Hrs)**
Surveying: classification, general principles, types, Uses, instruments used. Roads- types: components, types and their advantage and disadvantages. Bridges: components and types of bridges. Dams: purpose, types of dams. Water supply- sources and quality requirements, need and principles of rainwater harvesting

PART – B MECHANICAL ENGINEERING

UNIT IV INTERNAL AND EXTERNAL COMBUSTION SYSTEMS **(10 Hrs)**
IC engines – Classification – Working principles – Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits. Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits – Applications.

UNIT V POWER GENERATION SYSTEMS **(10 Hrs)**
Conventional and Non-Conventional: Hydraulic – Thermal – Nuclear Power plants – Schemes and layouts (Description only) Solar – Wind – Geothermal – Wave – Tidal and Ocean Thermal Energy Conversion systems – Basic power plant schemes and layouts (Description only).

UNIT VI MANUFACTURING PROCESS **(10 Hrs)**
Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only) Machine Process – Turning – Planning – Facing – Blanking – Drilling – Punching – Shearing – Bending – Drawing – Filling – Sawing – Grinding. Moulding and Metal Joining – Pattern making – Green and dry sand moulding – Arc and Gas welding – Brazing – Soldering (process description only).

Text Books

1. Natarajan, K V, Basic Civil Engineering, 11th edition, Dhanalakshmi publications Chennai, 2011.
2. Venugopal, K and Prabhu Raja, Basic Mechanical Engineering, Anuradha Publisher, 2012.

3. K.Pravin Kumar, Basic Mechanical Engineering, Pearson Publications, 2009.
4. Shanmugam G, Palanichamy MS, Basic Civil and Mechanical Engineering, 1st Edition, McGraw Hill Education, 2018.
5. R.Vaishnavi, M.Prabhakaran, V.Vijayan, Basic Civil and Mechanical Engineering, S. Chand Publisher, 2013.

Reference Books

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai, 2001
2. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New delhi, 2012.
3. Punmia, B.C., et. al., surveying, Vol-1, Laxmi publishers, New Delhi, 2012.
4. Punmia, B.C., et. al., Building Construction, Laxmi publishers, New Delhi, 2012
5. El. Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co., 1985.
6. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media promoters publishers Pvt. Ltd., Bombay, 2004.
7. Lindberg, R.A. Process and Materials of Manufacture, PHI, 1999.
8. H.N.Gupta, R.C. Gupta and Arun Mittal, Manufacturing Process, New Age Publications, 2001.
9. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/ lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
2	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
3	3	1	3	1	1	2	1	-	1	2	1	3	-	-	-
4	3	2	1	-	-	1	2	-	-	-	-	3	1	1	1
5	3	2	2	2	2	2	2	-	-	-	-	3	3	3	1
6	3	2	2	2	2	2	2	-	-	-	-	3	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T111

ENGINEERING MECHANICS

(Common to all Branches)

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To understand the vector and scalar representation of forces and moments, static equilibrium of particles and rigid bodies in two dimensions.
- To comprehend the effect of friction on equilibrium
- To analysis of trusses and friction
- To understand the laws of motion, the kinematics of motion and the interrelationship and to learn to write the dynamic equilibrium equation
- To emphasis the concepts through solved examples

Course Outcomes

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

CO1 - Understand the concepts of Equilibrium of a body, Moment of a force and to convert multiple forces into a single resultant force **(K2)**

CO2 - Apply the principles of internal forces, support reactions on Trusses/beams and friction between two surfaces. **(K3)**

CO3 - Interpret the knowledge of Centroid and center of gravity for different sections to calculate the moment of inertia for sections. **(K3)**

CO4 - Analyze and compare the principle of conservative forces, conservation of energy and D'Alembert's principle **(K4)**

CO5 - Analyze and compare the kinematics and kinetics of rigid bodies. **(K4)**

UNIT I FUNDAMENTAL OF MECHANICS (12 Hrs)

Basic Concepts Force System and Equilibrium, Definition of force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non-concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, applications in solving the problems on static equilibrium of bodies.

UNIT II PRACTICAL APPLICATION OF FORCE SYSTEM (12 Hrs)

Structural member: Definition, degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of trusses-method of joints, method of sections. Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges.

UNIT III PROPERTIES OF SURFACES (12 Hrs)

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product of moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV KINEMATICS AND KINETICS OF PARTICLES (12 Hrs)

Equations of motion – Rectilinear motion, curve linear motion, relative motion, D'Alembert's principle, work-Energy equation – conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact

UNIT V KINEMATICS AND KINETICS OF RIGID BODIES (12 Hrs)

Plane motion, absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2002.
2. Dr.I.S.Gujral, "Engineering Mechanicas" second edition, Lakshmi Publication (P), Ltd., 2011.
3. Dr. Sadhu Singh, A Textbook of Engineering Mechanics, S Chand & company Pvt Ltd., 2013.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill, 2011.

2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw - Hill International Edition, 1997.
3. Bhavikatti,S.S and K.G. Rajashekarappa, Engineering Mechanics, New Age International (p) Ltd, New Delhi, 2010.
4. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Thomson Asia Private Limited, Singapore, 2010.
5. D.P.Sharma "Engineering Mechanics", Dorling Kindersley India Pvt. Ltd, New Delhi, 2010.

Web References

1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR / Engineering mechanics / Table of Contents.html
3. https://nptel.ac.in/courses/112/106/112106286/
4. https://www.coursera.org/learn/engineering-mechanics-statics
5. https://nptel.ac.in/courses/122/104/122104014/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
2	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
3	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
4	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
5	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T112

COMMUNICATIVE ENGLISH

(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	60

Course Objectives

- To improve the LSRW skills of I B.Tech students
- To instil confidence and enable the students to communicate with ease
- To equip the students with the necessary skills and develop their language prowess
- To sequence the thought of writing with cohesion and coherence
- To extend knowledge on varied aspects of business correspondence

Course Outcomes

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

CO1 - Procure holistic development of LSRW skills **(K2)**
CO2 - Gain efficacies to compete confidently in the interviews **(K3)**
CO3 - Effectively enhances the oral communication skills **(K3)**
CO4 - Select compile and synthesize information for written mode of communication **(K2)**
CO5 - Familiarize and Excels in different business correspondence in work place **(K3)**

UNIT I BASIC COMMUNICATION THEORY **(12 Hrs)**

Importance of Communication – stages of Communication - modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective - listening skills.

UNIT II COMPREHENSION AND ANALYSIS **(12 Hrs)**

Comprehension of technical and non-technical material – Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context- Intensive Reading and Reviewing

UNIT III WRITING **(12 Hrs)**

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary - Writing – Four modes of writing – Use of dictionaries, indices, library references – making - bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV BUSINESS WRITING / CORRESPONDENCE **(12 Hrs)**

Report writing – Memoranda – Notice – Instruction– Letters – Resumes – Job applications

UNIT V ORAL COMMUNICATION **(12 Hrs)**

Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing –Short Extempore – Debates-Role Plays-Conversation Practice

Text Books

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.

Reference Books

1. Robert J. Dixson., Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi, 2006.
2. Boove, Courtland R et al., Business Communication Today, Pearson Education, New Delhi, 2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles and Practice, OUP, 2007.
4. Robert J. Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
5. Sethi, J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice- Hall of India Pvt. Ltd, New Delhi, 2007

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1. https://books.google.co.in/books/about/Effective_Tech_Communication.html
2. http://www.prenhall.com/bov
3. https://global.oup.com/academic/product/technical-communication
4. https://www.amazon.in/Everyday-Dialogues-English-Dixson-R-J/dp
5. https://www.sapnaonline.com/books/practical-course-english-pronunciation-w-sethi-j-812032594x-9788120325944

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

P104

PHYSICS LAB
(Common to all Branches)

L	T	P	C	Hrs
0	0	3	2	30

Course Objectives
- To provide a practical understanding of some of the concepts learnt in the theory course on Physics.

Course Outcomes
After completion of the course, the students will be able to

CO1 - Operate optical equipments like Spectrometer, Polarimeter to find the optical properties like dispersive power, Resolving power and specific rotatory power. **(K2)**

CO2 - Capable of handling screw gauge, venire caliper and travelling microscope to calculate the required parameters. **(K4)**

CO3 - Acquired basic knowledge about Thermal conduction and magnetic field due to a current carrying coil. **(K3)**

CO4 - Prepare formal laboratory reports describing the results of experiments and to interpret the data from the experiments. **(K5)**

List of Experiments (Any 10 Experiments)

1. Thermal conductivity – Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton's rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly's experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber
16. Electrical conductivity of semiconductor – two probe / four probe method
17. Hall effect in semiconductor

Reference Books
1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
4. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
5. Avadhanulu M N, Engineering Physics, S. Chand & Co, 2009.
6. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi, 2011.
7. Arthur Beiser, Concepts of Modern Physics, 6th Edition, TMH, New Delhi 2008.

Web References
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2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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1	3	3	1	1	3	3	2	2	3	3	2	3	**2**	**2**	**1**
2	3	3	1	1	3	3	1	2	3	3	2	3	**1**	**1**	-
3	3	3	2	1	3	3	2	2	3	3	2	3	**2**	**1**	**1**
4	3	3	2	1	-	3	2	3	3	3	2	3	**1**	-	**1**

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P105

CHEMISTRY LAB

(Common to all Branches)

L	T	P	C	Hrs
0	0	3	2	30

Course Objectives

- To gain a practical knowledge of Engineering Chemistry in relevance to Industrial applications
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.
- To understand and explain scientifically the various chemistry related problems in the industry
- To develop experimental skills for building technical competence.
- To learn the laboratory skills needed to design, safely conduct and interpret chemical research

Course Outcomes

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

CO1 - To understand about titrimetric analysis which can be used to estimate the amount of metal in a mineral. **(K2)**

CO2 - To understand about titrimetric analysis which can be used to estimate the amount of chemical present in a sample **(K3)**

CO3 - To understand about titrimetric analysis which can be used to estimate the quality of any sample. **(K2)**

CO4 - To perform conductometric titration and its uses to analyze any sample. **(K3)**

CO5 - To perform experiments by using colorimeter From which concentration of a sample can be determined from absorbance value.**(K3)**

List of Experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of acetic acid in vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permagnanometry
12. Estimation of iron by colorimetry

Demonstration Experiments (Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry
3. Percentage composition of sugar solution by viscometry

Reference Books

1. Vogel's Text book of Macro and Semimicro Qualitative Analysis G. Svehla, Longman Inc., Newyork. 1997
2. Basic Principles of Practical Chemistry, Venkateswaran. V, Veeraswmay. R, Kulandaivelu. A.R., Pearson Education. 1989.
3. Vogel's Text book of Quantitative Analysis, Mendham. J, Denney. R.C, Bames. J.D, and Thomas, M. Pearson Education. 1989.
4. Practical Chemistry, D. N Bajpai, S. Giri and O P Pandey, Chand Publishing 2013
5. Allied Practical Chemsitry, A R Kulandaivelu , V Venkateswaran & R Veeraswamy, Chand Publications, 2001

Web References

1. https://edu.rsc.org/resources/titration-screen-experiment/2077.article
2. https://edu.rsc.org/resources/aspirin-screen-experiment/1644.article

3. https://www.stem.org.uk/resources/collection/3959/practical-chemistry
4. https://www.scienceinschool.org/2010/issue14/practical
5. http://www.chemlabs.bris.ac.uk/outreach/resources/Teachers_Websites.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	2	2	-	-	1	3	1	-	-	-	-	-
2	-	-	-	2	2	-	-	1	3	1	-	-	-	-	-
3	-	-	-	2	2	-	-	1	3	1	-	-	1	2	-
4	-	-	-	2	2	-	-	1	3	1	-	-	-	1	-
5	-	-	-	2	2	-	-	1	3	1	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P106

WORKSHOP PRACTICE

(Common to all Branches)

L	T	P	C	Hrs
0	0	3	2	30

Course Objectives

- To convey the basics of mechanical tools used in engineering
- To establish hands on experience on the working tools
- To develop basic joints and fittings using the hand tools
- To establish the importance of joints and fitting in engineering applications
- To explain the role of basic workshop in engineering and underlying physical mechanism used in mechanical machines.

Course Outcomes

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

CO1 - Understand the functioning and usage of basic hand tools of fitting, welding and carpentry. **(K2)**

CO2 - Apply the knowledge of fitting tools and machineries to perform the exercise on fitting joints like symmetric asymmetric and angular fitting. **(K3)**

CO3 - Apply the knowledge of gas and Arc welding principles to perform to join the metal with joints like Lap and V- Butt joints. **(K3)**

CO4 - Apply the knowledge of metal joining process using sheet metals and to perform to make tray and frustum. **(K3)**

CO5 - Apply the knowledge of carpentry tools and equipment's to perform the joints like mortise and half lap joint. **(K3)**

Sl. No.	Trade	List of Exercises
1	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercise on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – Exercise on simple products like Office tray and waste collection tray.
4	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

LIST OF EXERCISES

I - FITTING

1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

II - WELDING

1. Study of arc and gas welding equipment and tools
2. Simple lap welding (Arc)
3. M Single V butt welding (Arc)

III - SHEET METAL WORK

1. Study of tools and machineries
2. Frustum
3. Waste collection tray

IV - CARPENTRY

1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.

Reference Books

1. HS Bawa, Workshop Practices, Tata Mc Graw Hill Publishing Co Ltd, 2015
2. S.K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology", Vol I:Manufacturing Processes, 15th Edition Reprinted, Media Promoters & Publishers Pvt Ltd.,2013
3. D.Sathish, Engineering Workshop Practices Laboratory Manual, Notion press publisher, 2019
4. R.K. Rajput, Workshop Practice, Published by Laxmi Publications Pvt. Ltd. 2011
5. RS Khurmi and JK Gupta, Basics of Workshop Practice, S Chand Publisher, 2011

Web References

1. http://www.nptelvideos.in/2012/12/manufacturing-processes-ii.html
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=3804
3. https://www.tpctraining.com/collections/machine-shop-practices-training
4. https://www.vlab.co.in/broad-area-mechanical-engineering
5. https://nptel.ac.in/courses/112/107/112107219/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	1	1	-	-	-	-	-	-	-	1	-	-
2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
3	2	1	-	1	-	-	-	-	-	-	-	-	1	-	1
4	2	1	-	-	1	-	-	-	-	-	-	-	1	-	-
5	2	1	1	1	-	-	-	-	-	-	-	-	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

T107

MATHEMATICS – II
(Common to all Branches)

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives
- To familiarize the concept of matrices.
- To introduce the concepts of curl, divergence and integration of vectors in vector calculus
- To equip themselves familiar with Laplace transform
- To solve the differential equations using Inverse Laplace transform techniques.
- To gain good knowledge in application of Fourier transform.

Course Outcomes
After completion of the course, the students will be able to

CO 1 - Understand the concept of Eigen values and Eigen vectors, Diagonalization of a matrix. **(K2)**
CO 2 - Understand the use of vector calculus. **(K2)**
CO 3 - Apply Laplace transform of simple function. **(K3)**
CO 4 - Apply inverse Laplace transform of simple functions. **(K3)**
CO 5 - Compute Fourier transforms of various functions. **(K3)**

UNIT I MATRICES (12 Hrs)
Eigen values and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors. Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation. Nature of quadratic forms.

UNIT II VECTOR CALCULUS (12 Hrs)
Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke's theorem (without proof). Simple application problems

UNIT III LAPLACE TRANSFORMS (12 Hrs)
Definition, Transforms of elementary functions, properties. Transform of derivatives and Integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and Final value theorems

UNIT IV APPLICATIONS OF LAPLACE TRANSFORM (12 Hrs)
Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT V FOURIER TRANSFORMS (12 Hrs)
Fourier Integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms their properties, convolution and Parseval's identity.

Text Books
1. Venkataraman M.K., Engineering Mathematics, National Publishing Company, Chennai, 2012
2. Kandasamy P. et al, Engineering Mathematics, Vol.2 & 3, S. Chand & Co., New Delhi.

Reference Books
1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 1st Edition, 2011.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

Web References
1. https://www.youtube.com/watch?v=1wjXVdwzgX8
2. http://www.snggdcg.ac.in/pdf/study-material/mathematics/SMch18.pdf
3. https://www.youtube.com/watch?v=MLSfh33ZCwE
4. https://www.khanacademy.org/math/differential-equations/laplace-transform/convolution-integral/v/the-convolution-and-the-laplace-transform
5. http://www-users.math.umn.edu/~mille003/fouriertransform.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	3	2	2
2	2	1	-	-	-	1	1	-	-	-	-	1	3	2	2
3	3	2	1	1	-	1	-	-	-	-	-	1	3	2	2
4	3	2	1	1	-	1	-	-	-	-	-	1	3	2	2
5	3	2	1	1	-	1	-	-	-	-	-	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

T108

MATERIAL SCIENCE

(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	60

Course Objectives

- To understand the importance of Material Science as a subject that revolutionized modern day technologies
- To understand the significance of material science in the development of new materials and devices for all branches of Engineering
- To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology

Course Outcomes

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

CO1 - Identify crystal lattices and their structures, crystalline planes and directions in a crystal lattice in terms of Miller Indices. To interpret X-ray diffraction studies and different types of lattice defects and their impact. **(K2)**

CO2 - Identify the nature of polarization in a dielectric material and to explain the various dielectric material and their characterization. **(K2)**

CO3 - Understand the source of a materials magnetic behaviour and be able to distinguish types of magnetism. Having Basic idea about the read/ write mechanism of various magnetic storage devices. **(K3)**

CO4 - Differentiate semiconductors; calculate the intrinsic carrier concentration in semiconductors.Understand the phenomenon of superconductivity: Student is able to define basic properties of superconducting materials and identify potential areas of their applications. **(K1)**

CO5 - Differentiate between nanomaterials and conventional materials. Have a broad understanding of the techniques used to synthesize nanomaterials, evaluate the properties of nanomaterials, identify the role of nanomaterials in current nanotechnology revolution and be prepared for more advanced courses in Materials Science and Engineering. **(K3)**

UNIT I CRYSTAL STRUCTURE AND LATTICE DEFECTS **(12 Hrs)**

Crystal structure - Bravais Lattices, Crystal Systems — Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices- Powder X Ray Diffraction Method

Lattice defects – Qualitative ideas of point, line, surface and volume defects

UNIT II DIELECTRIC PROPERTIES **(12 Hrs)**

Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field-Clausius-Mossotti relation. Basic ideas of Dielectric loss - frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and Applications

UNIT III MAGNETIC PROPERTIES **(12 Hrs)**

Origin of atomic magnetic moment – Bohr magneton - Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri). – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic data storage – Magnetic tapes, Hard disks, Magneto optical recording

UNIT IV SEMICONDUCTORS AND SUPERCONDUCTORS **(12 Hrs)**

Semiconductors -Derivation of Carrier concentration in intrinsic Semiconductors – Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors (without derivations) - temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect, Basic Ideas of Compound Semiconductors (II - VI & III - V)

Superconductivity - Basic concepts – transition temperature – Meissener effect – Type I and II superconductors – high temperature superconductors – 123 superconductor – Applications of superconductors.

UNIT V ADVANCED MATERIALS (12 Hrs)

Liquid Crystals – Types – Application as Display Devices
Metallic Glasses – preparation by melt spinning. Twin roller system, properties and applications
Shape Memory alloys (SMA), Shape memory effect, Properties and applications of SMA
Nanomaterials- Nano materials (one, Two & three Dimensional) –Methods of synthesis (PVD, CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nanomaterials. carbon nanotubes–Properties and applications.

Text Books

1. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi 2011.

Reference Books

1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
4. V Raghavan, Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
5. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
6. M.N. Avadhanulu, Enginerring Physics- Volume-II, S.Chand & Co, New Delhi, 2009
7. Pillai S.O, Solid State Physics, 6th Edition – New Age International, 2005.

Web References

1. https://swayam.gov.in/nd1_noc20_ph15/preview
2. https://swayam.gov.in/nd1_noc20_ph22/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	1	2	3	1	1	1	2	3	3	1	2	-
2	3	3	3	1	2	3	1	1	1	2	1	3	3	1	1
3	3	3	3	1	3	3	2	1	1	2	1	3	3	2	2
4	3	3	3	1	3	3	2	1	1	2	2	3	2	1	-
5	3	1	3	1	3	3	2	1	1	2	3	3	2	2	.2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T109

ENVIRONMENTAL SCIENCE
(Common to all Branches)

L	T	P	C	Hrs
4	0	0	4	60

Course Objectives
- To know about the environment
- To understand about environmental pollution
- To apply the knowledge in understanding various environmental issues and problems
- Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms
- Evaluate and interpret various forms of evidence, including text, data, and other media about the environment

Course Outcomes
After completion of the course, the students will be able to

CO1 - Understand the various environmental segments, its significance to life, also about various natural resources, effects of over utilization and its protection which can lead to sustainable development. **(K2)**
CO2 - Understand the study of ecology of various systems of nature and also about the diverse species present and its protection. **(K3)**
CO3 - Understand various sources of air pollution, the scientific basis behind it and its effect on nature. **(K2)**
CO4 - Understand the various ways of water pollution, its sources and effects, different water pollution monitoring technique, treatment of waste water and also the effects of solid waste and its management. **(K3)**
CO5 - Understand the concept of spectroscopy and its application to monitor pollution. **(K3)**

UNIT I ENVIRONMENT AND ENERGY RESOURCES
(12 Hrs)

Environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Atmospheric layers. Pollution definition and classification. Pollutants classification. Forest resources – use and over exploitation, deforestation, forest management. Water resources – use and conflicts over water, dams – benefits and problems. Mineral resources – mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources – world food problems, environmental impact of modern Agriculture – fertilizer and pesticides. Energy resources – growing needs, renewable and non-renewable energy resources and use of alternate energy sources. From unsustainable to sustainable development.

UNIT II ECOSYSTEM AND BIODIVERSITY
(12 Hrs)

Concept of an ecosystem - structure and function of an ecosystem. Producers, consumers, and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grassland, desert and aquatic (fresh water, esturine and marine) ecosystems. Biodiversity – definition, genetic species and ecosystem diversity. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wildlife, human wildlife conflicts. Endangered and endemic species. Conservation of biodiversity – in-situ and ex-situ conservation of biodiversity.

UNIT III AIR POLLUTION
(12 Hrs)

Definition and classification. Chemical and photochemical reaction in different layers of atmosphere .Causes, sources, effects and control measures of air pollutants - oxides of Nitrogen, oxides of Carbon, oxides of Sulfur, hydrocarbons, chloro-fluoro carbons and particulates. Mechanism and effects of air pollution phenomenon – Global Warming, Ozone Depletion, Acid Rain, Sulfurous Smog and Photochemical Smog

UNIT IV WATER AND LAND POLLUTION
(12 Hrs)

Water pollution – causes and effects of organic water pollutants – pesticides, insecticides, detergents and surfactants. Causes and effects of inorganic water pollutants – heavy metal pollution due to Hg, Pb, Cr & Cu. Water pollution control and monitoring – DO, COD, BOD & TOC. Land Pollution – Solid waste management – causes, effect and control measures of urban and industrial wastes. Thermal and radioactive pollution.

UNIT V POLLUTION CONTROL AND MONITORING **(12 Hrs)**

Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NO_x, CO_x, SO_x, H_2S, Hydrocarbons and particulates.

Text Books

1. PK. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010.
2. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2nd Ed, Scitech Publications (India) Pvt Ltd, India, 2010.
3. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India, 2000.
4. Essentials of Ecology and Environmental Science, S. V. S. Rana , PHI learning, 2009
5. Basics of Environmental Science and Engineering, Sivashanmugam, P., new publishing book house, 2007
6. V Rajendran, Engineering Physics, 2nd Edition, TMH, New Delhi 2011.

Reference Books

1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut, 2007.
2. S.S.Dara, and D.D. Mishra "A text book of environmental chemistry and pollution control, 5th Ed, S.Chandand Company Ltd, New Delhi, 2012.
3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10th edition, Prentice Hall, 2008
4. Environmental Science, P N Palanisamy , Pearson publications,2012
5. Fundamentals of Environmental Studies, Mahua Basu, Xavier Savarimuthu, SJ, Cambridge University Press· 2017

Web References

1. www.ifpri.org/topic/environment-and-natural-resources
2. https://www.iucn.org/content/biodiversity
3. http://www.world.org/weo/pollution
4. www.water-pollution.org.uk/
5. https://www.tceq.texas.gov/airquality/monops/sites
6. https://guides.library.illinois.edu/c.php?g=347044&p=2349046

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	3	-	-	-	-	2	2	3	1
2	2	1	1	1	-	1	3	-	-	-	-	2	2	3	1
3	3	1	1	1	-	1	3	-	-	-	-	2	2	3	1
4	3	1	1	1	-	1	3	-	-	-	-	2	2	3	1
5	3	1	1	1	-	1	3	-	-	-	-	2	2	3	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T104	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to all Branches)	L	T	P	C	Hrs
		3	1	0	4	60

Course Objectives

- To understand and gain basic knowledge about magnetic and electrical circuits
- To gain basic knowledge about single phase and three phase power measurement
- To understand the operating principles of stationary and rotating machines
- To understand the characteristics and applications of semiconductor devices
- To provide the basic knowledge in Digital electronics
- To understand the purpose of communication and acquire knowledge on different communication systems

Course Outcomes

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

CO1 - Analyze the basic concepts, various laws and theorems used in DC circuits. **(K3)**
CO2 - Analyze and solve the AC circuits and develop resonance circuits for transmitter and receiver. **(K4)**
CO3 - Gain the knowledge of power production in power system and application of transformers and motors in real time. **(K2)**
CO4 - Understand the operations of semiconductor diode, BJT, FET and its applications. **(K2)**
CO5 - Summarize the digital electronics concepts for sequential and combinational circuits. **(K2)**
CO6 - Explain and Relate different Communication Systems. **(K2)**

PART A – ELECTRICAL

UNIT I DC CIRCUITS **(10 Hrs)**

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchoff's law & its applications – Simple Problems - Division of current in Series & parallel circuits - star/delta conversion - Node and mesh methods of analysis of DC circuits

UNIT II AC CIRCUITS **(10 Hrs)**

Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system - Power measurement by two wattmeter method.

UNIT III ELECTRICAL MACHINES AND POWER PLANTS **(10 Hrs)**

Law of Electromagnetic induction, Fleming's Right & Left hand rule - Principle of DC rotating machine, Single phase transformer and single phase induction motor (Qualitative approach only) - Simple layout of thermal and hydro generation (block diagram approach only).Fundamentals of fuses and circuit breakers.

PART B – ELECTRONICS

UNIT IV ELECTRONIC CIRCUITS **(10 Hrs)**

V-I Characteristics of diode - Half-wave rectifier and Full-wave rectifier – with and without capacitor filter - Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier - Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT V DIGITAL ELECTRONICS **(10 Hrs)**

Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem - Logic gates -Implementation of Boolean expressions - Flip flops - RS, JK, T and D. Combinational logic - Half adder, Full adder and Subtractors. Sequential logic - Ripple counters and shift registers.

UNIT VI COMMUNICATION AND COMPUTER SYSTEMS **(10 Hrs)**

Model of communication system - Analog and digital - Wired and wireless channel. Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system. Network model - PAN, LAN, MAN and WAN - Circuit and packet switching - Overview of ISDN.

Text Books

1. Kothari D P and Nagrath I J , Basic Electrical Engineering, Tata McGraw Hill,2009.(For Units I to III)
2. Rajendra Prasad, "Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011. (For Unit IV)
3. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008. (For Unit V)
4. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Sixth Edition, Pearson Education, 2004. (For Unit VI)

Reference Books

1. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004.
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi, 1993.
3. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, Fourth Edition, 2008
4. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition,Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008.
5. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013.
6. Jacob Millman and Christos C. Halkias, "Electronic Devices and Circuits" Tata McGraw Hill
7. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI Learning Private Limited, Ninth Edition, 2008
8. M.S.Sukija and T.K.Nagasarkar, "Basic electrical and Electronics Engineering", Oxford University Press, 2012.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
4. http://electrical-engineering-portal.com/
5. http://www.electronics-tutorials.ws
6. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
7. https://nptel.ac.in/courses/117/102/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
2	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
3	3	3	2	2	3	-	-	-	-	-	-	-	3	3	3
4	3	1	2	2	-	-	-	-	-	-	-	-	3	3	3
5	3	2	2	2	-	-	-	-	-	-	-	-	2	3	2
6	3	-	2	-	-	-	-	-	-	-	-	-	1	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

T105

ENGINEERING THERMODYNAMICS

(Common to all Branches)

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To understand the basics of the thermodynamic principles
- To establish the relationship of these principles to thermal system behaviors
- To develop methodologies for predicting the system behavior
- To establish the importance of laws of thermodynamics applied to energy systems
- To explain the role of refrigeration and heat pump as energy systems and develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world

Course Outcomes

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

CO1 - Understand the fundamental thermodynamic concepts and its basic laws. **(K2)**

CO2 - Apply first law of thermodynamics concepts to calculate the system work for closed and open systems. **(K3)**

CO3 - Apply Second Law of Thermodynamics and entropy concepts to evaluate the performance of heat engine, heat pump and refrigerator.**(K3)**

CO4 - Apply the principles of gas power cycles to calculate its thermal performance. **(K3)**

CO5 - Understand the basic working principle of refrigeration systems. **(K2)**

UNIT I BASIC CONCEPTS AND DEFINITIONS (12 Hrs)

Energy conversion and efficiencies - system, property and state – Thermal equilibrium – Temperature – Zeroth law of Thermodynamics – Pure substance – P, V and T diagrams – Thermodynamic diagrams.

UNIT II FIRST LAW OF THERMODYNAMICS (12 Hrs)

The concept of work and adiabatic process – First law of thermodynamics – conservation of Energy Principle for closed and open systems – Calculation of work for different processes of expansion of gases

UNIT III SECOND LAW OF THERMODYNAMICS (12 Hrs)

Equilibrium and the second law – Heat engines – Kelvin-Plank statement of second law of thermodynamics – Reversible and irreversible processes – Carnot principle – Clausius inequality – Entropy

UNIT IV GAS POWER CYCLES (12 Hrs)

Air standard cycles: The air standard carnot cycle – Air standard Otto cycle, Diesel cycle, Dual cycle and Brayton cycles and their efficiencies

UNIT V REFRIGERATION CYCLES AND SYSTEMS (12 Hrs)

Reverse Carnot cycle – COP – Vapor compression refrigeration cycle and systems (only theory) – Gas refrigeration cycle – Absorption refrigeration system – Liquefaction – Solidification (only theory).

Text Books

1. P.K.Nag, "Engineering Thermodynamics", 4th edition, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2008.
2. R. K. Singal, Mridul Singal "A text book of Engineering Thermodynamics", I.K. International Publishing House Pvt. Limited, 2010.
3. Er.S.K.Gupta, "Engineering Thermodynamics", S. Chand publishers, 2013.

Reference Books

1. Arora, C.P., "Thermodynamics", Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2010.
2. Burghardt, M.D., "Engineering Thermodynamics with Applications", 4th edition, Harper & Row, N.Y., 2009.
3. Huang, F.F., "Engineering Thermodynamics" 2nd edition, Macmillan Publishing Co. Ltd., N.Y., 2011.
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics – An Engineering approach", 5th edition, Mc Graw Hill, 2008.
5. Wark, K., "Thermodynamics", 4th edition Mc-Graw Hill, N.Y., 2009.

Web References

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2. https://nptel.ac.in/courses/112108148/
3. https://nptel.ac.in/courses/112/103/112103275/
4. https://www.linkedin.com/company/heat-transfer-and-process-design-htpd
5. https://www.udemy.com/course/an-introduction-to-heat-transfer/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	-	-	-	1	-	2	-
2	3	2	2	2	2	-	-	-	-	-	-	1	-	1	-
3	3	2	3	3	2	-	-	-	-	-	-	1	-	1	-
4	3	2	3	3	-	-	-	-	-	-	-	1	-	2	-
5	3	2	3	3	-	-	-	-	-	-	-	1	-	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

T106

COMPUTER PROGRAMMING

(Common to all Branches)

L	T	P	C	Hrs
3	1	0	4	60

Course Objectives

- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.
- To study the basic concepts of File operations.

Course Outcomes

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

CO1 - Identify and understand the working components of a computer system. **(K1)**

CO2 - Understand, analyze and implement like algorithm, pseudo codes and programming structures. **(K2)**

CO3 - Analyze and make use of logical structure of a C program. **(K3)**

CO4 - Make use of pointers, memory allocation and data handling to implement C programs. **(K3)**

CO5 - Understand the working of files and directives. **(K3)**

UNIT I INTRODUCTION TO COMPUTERS (12 Hrs)

History of Computers – Block diagram of a Computer – Components of a Computer system –Classification of computers - Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.

UNIT II INTRODUCTION TO C (12 Hrs)

Problem solving techniques – Program – Program development cycle – Algorithm design– Flowchart - Pseudo code.

Introduction to C – History of C – Importance of C - C tokens – data types – Operators and expressions – I/O functions.

UNIT III DECISION MAKING AND ARRAYS (12 Hrs)

Decision making statements – branching and looping – arrays – multidimensional arrays– Functions – Recursion – Passing array to functions. Storage classes – Strings – String library functions.

UNIT IV STRUCTURES AND POINTERS (12 Hrs)

Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types – Union. Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and Structures.

UNIT V FILE MANAGEMENT AND PREPROCESSORS (12 Hrs)

Files – operations on a file – Random access to files – command line arguments. Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Sixth edition, 2012.
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Kenneth A. Reek, "Pointers on C", Pearson Education, 2007.

Reference Books

1. Vikas Verma, "A Workbook on C ", Cengage Learning, Second Edition,2012.
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
4. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
5. Stephen G. Kochan, "Programming in C", Third Edition, Pearson Education, 2007

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1. https://www.geeksforgeeks.org/classification-of-computers/
2. http://www.btechsmartclass.com/c_programming/C-Program-Development-Life-Cycle.html
3. https://www.learn-c.org/en/Multidimensional_Arrays
4. https://www.tutorialspoint.com/cprogramming/c_structures.htm
5. https://www.w3schools.in/c-tutorial/command-line-arguments/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
2	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P101	COMPUTER PROGRAMMING LABORATORY (Common to all Branches)	L	T	P	C	Hrs
		0	0	3	2	45

Course Objectives

- To study and understand the use of OS commands
- To gain a hands on experience of compilation and execution of 'C' programs
- To understand the working of control statements
- To design functional methods.
- To make use pointers in various programs

Course Outcomes

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

CO1 - Apply and practice logical ability to solve the problems. Understand C programming development. environment, compiling, debugging, linking and executing a program using the development environment.**(K2)**

CO2 - Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.**(K2)**

CO3 - Understand and apply the in-built functions and customized functions for solving the problems. **(K3)**

CO4 - Understand and apply the pointers, memory allocation techniques and use of files for dealing with variety of problems. **(K3)**

CO5 - Document and present the algorithm's, flowcharts and programs in form of user-manuals. **(K3)**

List of Exercises

1. Study of OS Commands
2. Write a simple C program to find the Area of the triangle.
3. Write a simple C program to find the total and average percentage obtained by a student for 6 subjects.
4. Write a simple C program to read a three digit number and produce output like
   1 hundreds
   7 tens
   2 units
   for an input of 172.
5. Write a simple C program to check whether a given character is vowel or not using Switch – Case statement.
6. Write a simple C program to print the numbers from 1 to 10 along with their squares.
7. Write a simple C program to find the sum of 'n' numbers using for, do – while statements.
8. Write a simple C program to find the factorial of a given number using Functions.
9. Write a simple C program to swap two numbers using call by value and call by reference.
10. Write a simple C program to find the smallest and largest element in an array.
11. Write a simple C program to perform matrix multiplication.
12. Write a simple C program to demonstrate the usage of Local and Global variables.
13. Write a simple C program to perform various string handling functions: strlen, strcpy, strcat, strcmp.
14. Write a simple C program to remove all characters in a string except alphabets.
15. Write a simple C program to find the sum of an integer array using pointers.
16. Write a simple C program to find the Maximum element in an integer array using pointers.

17. Write a simple C program to create student details using Structures.
18. Write a simple C program to display the contents of the file on the monitor screen.
19. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
20. Write a simple C program to pass the parameter using command line arguments.

Reference Books

1. VikasVerma, "A Workbook on C ", Cengage Learning, Second Edition, 2012
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
4. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007
5. Stephen G. Kochan, "Programming in C", Third Edition, Pearson Education, 2007

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1. https://www.javatpoint.com/factorial-program-in-c
2. https://www.studytonight.com/c/programs/array/largest-and-smallest-element-in-array
3. https://www.programiz.com/c-programming/examples/information-structure-array
4. https://www.geeksforgeeks.org/c-program-print-contents-file/
5. https://www.studytonight.com/c/command-line-argument.php

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
2	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P102

ENGINEERING GRAPHICS

(Common to all Branches)

L	T	P	C	Hrs
0	0	3	2	45

Course Objectives

- To convey the basics of engineering drawing
- To explain the importance of an engineering drawing
- To teach different methods of making the drawing
- To establish the importance of projects and developments mode in drawing that are used in real systems·
- To develop the role of computer aided design Auto Cad and significance of using these drawings

Course Outcomes

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

CO1 - Understand the basic concepts of engineering drawings. **(K2)**

CO2 - Apply various concepts like dimensioning, conventions and BIS codes, the theory and methods of projection. **(K3)**

CO3 - Improve their imagination and visualization skills to design new products. **(K4)**

CO4 - Create engineering drawing of physical object representing engineering systems. **(K4)**

CO5 - Analysis the different views and computer aided drafting tools. **(K3)**

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

UNIT I (9 Hrs)

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and planes

UNIT II (9 Hrs)

Projection of Solids and Sections of solids.

UNIT III (9 Hrs)

Development of surfaces – Intersection of surfaces (Cylinder-Cylinder, cylinder-cone)

UNIT IV (9 Hrs)

Isometric projections and Orthographic projections

UNIT V (9 Hrs)

Computer Aided Drafting: Introduction to computer Aided Drafting hardware- overview of application software – 2D drafting commands (Auto CAD) for simple shapes – Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.
2. Dhananjayan A. Jolhe, Engineering Drawing with introduction to Autocad, Tata McGrawHill Publishing company Limited, 2008.
3. Basant Agrwal and Agarwal C W., Engineering Drawing, Tata Tata McGrawHill Publishing company limited, 2008.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
2. K. Venugopal, Engineering Drawing and Graphics + Auto CAD, 4th edition, New Age International Publication Ltd., 2004.
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design with computer applications, Holt – Sounders Int. Edn. 1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.
5. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
6. BIS, Engineering Drawing practice for Schools & Colleges, 1992.

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2. https://en.wikipedia.org/wiki/Engineering drawing
3. https://nptel.ac.in/courses/105/104/105104148/
4. https://onlinecourses.nptel.ac.in/noc20_me79/preview
5. https://www.btechguru.com/courses--nptel--engineering-drawing----video-lecture.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-
2	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-
3	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-
4	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-
5	3	1	-	-	3	-	-	-	-	-	-	3	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P103

BASIC ELECTRICAL AND ELECTRONICS LABORATORY

(Common to all Branches)

L	T	P	C	Hrs
0	0	3	2	45

Course Objectives

- To get an exposure on the basic electrical tools, applications and precautions
- To gain training on different types of wiring used in domestic and industrial applications.
- To detect and find faults in electrical lamp and ceiling fan
- To get an exposure on the measurements of voltage and phase using CRO, basic operation and applications devices such as PN junction diode and transistor
- To gain a practical knowledge on the functions and application of basic logic gates and flip flops

Course Outcomes

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

CO1 - Follow the safety procedures when working with electricity and various tools. **(K4)**

CO2 - Do line diagram and wiring practices for domestic application. **(K5)**

CO3 - Use the protection circuits for electrical networks**. (K3)**

CO4 - Design and verify the kirchoff's law. **(K4)**

CO5 - Analyze the characteristics of PN diode and use it for rectifier applications. **(K4)**

CO6 - Gain knowledge on digital electronics to solve problems related to boolean algebra. **(K4)**

ELECTRICAL LAB

List of Experiments

1. Electrical Safety, Precautions, study of tools and accessories.
2. Practices of different joints.
3. Wiring and testing of series and parallel lamp circuits.
4. Staircase wiring.
5. Doctor's room wiring.
6. Bed room wiring.
7. Go down wiring.
8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
9. Study of different types of fuses, circuits breakers and A.C and D.C meters.

ELECTRONICS LAB

List of Experiments

1. Study of CRO
   (a) Measurement of AC and DC voltages
   (b) Frequency and phase measurements (using Lissajou's figures)
2. Verification of Kirchoff's Voltage and Current Laws
   Determine the voltage and current in given circuits using Kirchoff's laws theoretically and verify the laws experimentally.
3. Characteristics and applications of PN junction diode.
   Forward and Reverse characteristics of PN junction diode.
   Application of Diode as Half wave Rectifier – Measurement of ripple factor with and without capacitor filter
4. Frequency Response of RC Coupled Amplifiers
   Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.
5. Study of Logic Gates
   (a) Verification of Demorgan's theorems
   (b) Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
   (c) Implementation of digital functions using logic gates and Universal gates.

Reference Books

1. Kothari D P and Nagrath I J, Basic Electrical Engineering, Tata McGraw Hill, 2009.
2. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004
3. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2010.
4. Rajendra Prasad, "Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011.
5. Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 6th edition, Tata McGraw Hill Publishing Company Ltd.,New Delhi,2008
6. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008
7. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 10th Edition, 2010.

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1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://www.circuitlab.com/
4. http://www.electronics-tutorials.ws
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
6. https://nptel.ac.in/courses/117/102/117102059/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	3	-	-	-	3	3	3
2	3	3	3	3	3	-	-	-	3	-	-	-	3	3	3
3	3	3	2	3	3	-	-	-	3	-	-	-	3	3	3
4	3	3	2	3	2	-	-	-	3	-	-	-	3	3	3
5	3	3	2	3	2	-	-	-	3	-	-	-	3	3	3
6	3	3	2	3	2	-	-	-	3	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

P107

NSS / NCC

(Common to all Branches)

L	T	P	C	Hrs
0	0	0	-	-

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 30 hours.
4. The above activities will be monitored by the respective faculty in-charge.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate Fails, he/she has to repeat the course in the subsequent years.

Pass in this course is mandatory for the award of degree

U19EET31

COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

(Common to EEE, ICE, MECH, Mechatronics)

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose to the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two-dimensional heat flow equations.

Course Outcomes

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

CO1 - Understand the concepts of function of a complex variable. **(K2)**
CO2 - Transform complex functions from one plane to another plane. **(K3)**
CO3 - Apply the concepts of complex integration over contour. **(K3)**
CO4 - Understand the concept of initial and boundary value problems **(K2)**
CO5 - Solve the one and two-dimensional heat equation using Fourier series. **(K3)**

UNIT I FUNCTION OF A COMPLEX VARIABLE (12 Hrs)

Continuity, derivative and analytic functions – Necessary conditions – Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function

UNIT II CONFORMAL MAPPINGS (12 Hrs)

Conformal mapping – Simple and standard transformations like $w = z+c$, cz, z^2, e^z, $\sin z$, $\cosh z$ and $z+1/z$ – Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem – Series expansion of complex valued functions – classification of singularities.

UNIT III COMPLEX INTEGRATION (12 Hrs)

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma – Application of residue theorem to evaluate real integrals – unit circle and semicircular contour

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one dimensional wave equation – Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS (12 Hrs)

Fourier series solutions of one dimensional heat flow equation – Fourier series solutions of two dimensional heat flow equation under steady state conditions.

Text Books

1. B.S Grewal., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2020.
2. N.P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearsons Publications, New Delhi, 4th Edition, 2017.

Reference Books

1. C. B. Gupta, Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 1st Edition, 2015.
2. H. K. Dass and Dr. Rama Verma, "Introduction to Engineering Mathematics-volume II", S. Chand and Co., New Delhi, 9th Edition, 2019.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, New Delhi, 10th Edition,2019.
4. Ravish R. Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 1st Edition, 2016.
5. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2018.

Web References

1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111107119/
3. https://youtu.be/W3HXK1Xe4nc
4. https://youtu.be/Mwpz1zjPlzl
5. https://youtu.be/CnrAivf9I6o

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	2	2	2
2	3	2	1	1	-	-	-	-	-	-	-	1	2	2	2
3	3	2	1	1	-	-	-	-	-	-	-	1	2	2	2
4	2	1	-	-	-	1	-	-	-	-	-	1	2	2	2
5	3	2	1	1	-	1	-	-	-	-	-	1	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET32	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To gain knowledge on computing electrical parameters like current, voltage and power using various network theorems for AC and DC circuits
- To gain knowledge on three phase circuits using phasor diagram and to apply for different load conditions
- To gain knowledge on analyze electric circuit using Graph theory.
- To gain knowledge on transient response of RL, RC and RLC circuits for DC and AC excitation
- To gain knowledge of R, L, C components for resonance and coupled circuits

Course Outcomes

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

CO1 - Analyze and solve DC network using various network theorems. **(K4)**
CO2 - Analyze and solve AC network using various network theorems. **(K4)**
CO3 - Analyze the behavior of three phase circuits using network topology for different type of loads under balanced and unbalanced conditions. **(K4)**
CO4 - Analyze the steady state and transient behavior of RL, RC and RLC circuit using Laplace transformations for DC and AC excitations. **(K4)**
CO5 - Analyze the resonance and tuned circuits for series and parallel connections. **(K4)**

UNIT I CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR DC CIRCUITS (12 Hrs)

Review - Mesh and Nodal methods for DC circuits. Theorems – Thevenin's, Norton's, Superposition, Compensation, Tellegan's, Reciprocity, Maximum power transfer theorem, Millman's theorem – Application :DC circuit network theorems are used to compute various electrical parameters like current, voltage and power of transmission line in electrical network.

UNIT II CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR AC CIRCUITS (12 Hrs)

Mesh and Nodal methods for AC circuits. Theorems -Thevenin, Norton's, Superposition, Compensation, Tellegan's, Reciprocity, Maximum power transfer theorems, Millman's theorem – Application :AC circuit network theorems are used to compute various electrical parameters like current, voltage and power of transmission line in electrical network.

UNIT III THREE PHASE CIRCUITS AND NETWORK TOPOLOGY (12 Hrs)

Three phase circuits: Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected balanced and unbalanced loads.

Basic concepts of graph theory: Graph, directed graph, branch, chord, Tree, incidence and reduced incidence matrices - application to network solutions - tie set, cut set, duality and dual networks- Introduction to two port networks - Case study of three phase circuit with different types of loads under balanced and unbalanced conditions for the Power generation, Transmission and Distribution.

UNIT IV TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER CIRCUITS (12 Hrs)

Transient response of RL, RC and RLC circuits to DC and AC excitation - Natural and forced oscillations - Laplace transform application to transient solution – Application: design of filter circuit used in power converters and choppers.

UNIT V RESONANCE AND COUPLED CIRCUITS (12 Hrs)

Resonant circuits: series, parallel and series – parallel circuits – effect of variation of Q on resonance. Relations between circuit parameters - Q, resonant frequency and bandwidth.

Coupled circuits: Self-inductance, mutual inductance – coefficient of coupling – dot convention – analysis of simple coupled circuits - Inductively coupled circuits - single tuned and double tuned circuits - Application:. design of tuned circuit for Radio Frequency receiver and transmitter section for frequency tuning.

Text Books

1. William H Hayt, J. E. Kemmerly and Steven M Durbin, “Engineering Circuit Analysis”, McGraw Hill, 8th Edition, 2013.
2. Charles K. Alexander and Matthew N. O. Sadiku, “Fundamentals of Electric Circuits”, McGraw-Hill International Edition, 3rd Edition, 2013.
3. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, John Wiley & Sons, Inc. 7th Edition, 2015.
4. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 5th Edition, 2013.

Reference Books

1. A. Sudhakar, Shyammohan S. Palli , “Circuits and Networks: Analysis and Synthesis”, McGraw Hill Publications, 5th Edition, 2015.
2. MahmoodNahvi, Joseph Edminister, “Electric Circuits (Schaum's Outline series)”, McGraw-Hill Publications, 5th Edition, 2017.
3. Sukhija and Nagsarkar, “Circuits and Networks”, Oxford University Press, 2nd Edition, 2016.

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2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.youtube.com/watch?v=83IVK6i8EB0&list=PLX2gX-ftPVXUkVZ2eafafDwcs5nDldeBD
4. https://www.youtube.com/watch?v=zDcXt9Vx34o
5. https://www.youtube.com/watch?v=YLGrugmDvc0
6. https://www.academia.edu/35158206/EE8251_CIRCUIT_THEORY_OBJECTIVES

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3
4	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3
5	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET33	ELECTROMAGNETIC THEORY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the basic mathematical concepts related to electrostatic vector fields.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To familiarize the students with the different concepts of magneto-statics, magnetic flux density, scalar and vector potential and their applications.
- To impart knowledge on the application of magnetic field.
- To expose the concepts of electromagnetic waves and wave propagation

Course Outcomes

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

CO1 - Apply the mathematical concepts to electrostatic vector fields. **(K3)**

CO2 - Analyze the distribution of the charges in electric field applications. **(K4)**

CO3 - Calculate the magnetic field for the analysis of all electrical machines.**(K4)**

CO4 - Design an inductor that is often used to produce magnetic field and used as filter element. **(K4)**

CO5 - Compute the concept of Maxwell equation for electromagnetic field applications. **(K3)**

UNIT I ELECTROSTATIC FIELD (9 Hrs)

Co-ordinate Systems: Cartesian, Cylindrical and Spherical – Scalar and vector product- Coulomb's law - Electric field – Electric field intensity(E) due to point, line, surface and volume charge distribution - Electric flux density (D) - gradient and Curl of a field, Gauss Law and its applications, Divergence of a vector field. Application - Testing equipment to electrostatic discharge. Case study: communication cables.

UNIT II ELECTRIC FIELDS IN MATERIAL SPACE (9 Hrs)

Electric potential and potential gradient-Electric dipole and dipole moment - Nature of Dielectrics and Conductors - Polarization in dielectrics - Electric field in multiple dielectrics - Boundary conditions for electrostatic field- Poisson's and Laplace's Equations - Capacitance-Energy density - Applications - method of images, Electrostatic Precipitators, Xerography.

UNIT III MAGNETOSTATIC FIELDS (9 Hrs)

Biot-Savart law - Magnetic field intensity (H) and magnetic flux density (B) - Ampere's Circuital Law, magnetic flux density in a finite and infinite conductor, solenoid and toroid-Magnetic field in multiple media-Magnetic dipole-Scalar and vector magnetic potential I– Stoke's theorem-Micro magnetic, Application-LF Magnetic shielding.

UNIT IV APPLICATION OF MAGNETIC FIELD (9 Hrs)

Boundary condition for magneto static fields - Magnetic field in matter and magnetic circuits. Magnetic Forces and torque on current carrying conductors – potential energy and force on magnetic energy - Inductance and mutual inductance-Inductance of solenoids, toroid's and transmission lines –Faraday's Law, Time varying magnetic field – Application of magnetic field in induction heating, Helmholtz coil.

UNIT V ELECTROMAGNETIC AND WAVE PROPAGATIONS (9 Hrs)

Maxwell's equation: displacement current - continuity equation, Differential and integral forms - Wave equation - Wave propagation in lossless media, good conductor and dielectrics - Flow of electromagnetic Power and Poynting vector: instantaneous and average power densities. Applications of electromagnetic waves – Antennas and radiation of electromagnetic energy, Case study: Effects of Electromagnetic fields (EMF) near high voltage transmission line

Text Books

1. Mathew N. O. Sadiku, "Principles of Electromagnetics", Oxford University Press Inc., 6th Edition, 2015.
2. AshutoshPramanik, "Electromagnetism Applications - Vol. 2: Magnetic Diffusion and Electromagnetic Waves", PHI Learning Private Limited, New Delhi, 2014.
3. K. A. Gangadhar, P. M. Ramanthan, "Electromagnetic Field Theory (including Antennas and wave propagation", Khanna Publications, 16th Edition, 1997.

Reference Books

1. Joseph. A. Edminister, Schaum's, "Outline of Electromagnetics", (Schaum's Outline Series), Tata McGraw Hill, 4th Edition, 2014
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 9th Edition, 2018.
3. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International, 5th Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu, "Electromagnetic field theory Fundamentals", Cambridge University Press; 2nd Revised Edition, 2009.

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3. https://www.youtube.com/watch?v=HcPDc23ZLEs
4. http://scienceworld.wolfram.com/physics/ElectromagneticForce.html
5. http://www.unitconversion.org/unit_converter/magnetic-field-strength.html
6. http://www.wolfsonelectrostatics.com/04_news/index.html#can-shocks-from-static-electricity-damage-your-health

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
2	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET34	ELECTRICAL MACHINES – I	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the performance characteristics of DC machines.
- To equip the students to test and analyze the characteristics of DC machines.
- To get familiar with performance characteristics of single phase transformers and special transformers.
- To learn different types of three phase transformer connections and savings of copper in autotransformer.
- To equip the students to test and analyze the characteristics of Transformers.

Course Outcomes

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

CO1 - Analyze the performance of DC machines under various operating conditions using their characteristics **(K4)**

CO2 - Interpret the efficiency of DC machines by conducting Suitable tests. **(K4)**

CO3 - Inspect the performance of single phase transformers using phasor diagrams and equivalent circuits and understand the characteristics of special transformers. **(K4)**

CO4 - Outline the different types of connections in three phase transformers and savings of copper in autotransformers. **(K2)**

CO5 - Interpret the efficiency of Transformers by conducting Suitable tests. **(K4)**

UNIT I DC MACHINES (9 Hrs)

Electromechanical energy conversion concept–Single and multiple excited systems.

DC Generators: Construction of DC Machine – Principle of operation - Types of Windings – EMF equation - Armature Reaction – Commutation - methods of improving commutation – DC Generators types - Performance characteristics– Applications.

DC Motors: Principle of operation - Back emf - Torque equation – types - Performance characteristics. Starters: Need for starter – types – 2, 3, 4 point starters – electronic soft starters. Speed control: Armature and field Speed control - Solid state speed control. Electric braking – Applications

UNIT II TESTING OF DC MACHINES (9 Hrs)

Testing of DC Machines: Losses – efficiency – Condition for maximum efficiency - Power flow diagram – Testing: Load test – Swinburne's test - Hopkinson's test - Retardation test - Field's test – Separation of losses.

UNIT III SINGLE PHASE TRANSFORMERS AND SPECIAL TRANSFORMERS (9 Hrs)

Single Phase Transformers: Construction - Types – Principle of operation - emf equation - Equivalent circuit - phasor diagram - Parallel operation. Auto transformer: copper savings – Applications.

Special Transformer: Variable frequency transformer– audio frequency Transformer– Instrument transformers– Pulse transformer– Welding transformer – Traction transformer– Isolation transformer – Applications.

UNIT IV POLYPHASE TRANSFORMERS (9 Hrs)

Three Phase Transformers: Construction – Principle of operation – Types of connections – Open delta – Scott connection – three-phase to single phase conversion – three phase to two phase conversion – three phase to six phase conversion – Tap changing transformers – Three winding transformer– Transformers for HVDC applications.

UNIT V TESTING OF TRANSFORMERS (9 Hrs)

Testing of Transformers: Losses - Efficiency - Condition for maximum efficiency - all day efficiency – voltage regulation - Power flow diagram – Testing: Load test – OC and SC test – Polarity test - Sumpner's test – Separation of no load losses.

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
2. J. B. Gupta, "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, New Delhi, 14th Edition, 2010.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology-Vol. II", S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2009.

Reference Books

1. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw Hill Education Pvt. Ltd, 5th Edition, 2012.
2. D. P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. Vincent Del Toro, "Basic Electric Machines", Pearson India Education, 1st Edition, 2016.
4. Irving. L. Kosow, "Electrical Machines and Transformers", PHI, 2nd Edition, 2007.
5. Albert E. Clayton, "The performance and design of direct current machines", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

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2. https://nptel.ac.in/courses/108/105/108105017/
3. https://www.studocu.com/
4. http://electrical-engineering-portal.com/
5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	-	1	-	-	-	-	-	-	1	3	3	2
2	3	2	2	-	1	-	-	-	-	-	-	1	3	3	2
3	3	3	2	-	1	-	-	-	-	-	-	1	3	3	2
4	3	3	3	-	1	-	-	-	-	-	-	1	3	3	2
5	3	3	3	-	1	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EET35 **ELECTRONIC DEVICES AND CIRCUITS**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To provide a platform for students to understand the characteristics of devices such as Diode, BJT, FET, MOSFET and special devices.
- To introduce biasing techniques for stable operating point in BJT and FET.
- To explain the operation and applications of special diodes and opto electronic devices.
- To explore the application of diode as rectifiers, clipper and clamper circuits.
- To impart knowledge on frequency response of small signal and large signal amplifiers.
- To explore the working of amplifiers with positive and negative feedback systems.

Course Outcomes

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

CO1 - Use the PN junction diode for applications like rectifiers, clippers, clampers and Zener as regulator circuits.**(K2)**

CO2 - Apply CB, CE and CC Configurations of BJT in applications like isolator, amplifier and voltage follower circuit respectively. **(K3)**

CO3 - Use FET as a buffer , voltage variable resistor etc., **(K3)**

CO4 - Use special and optoelectronics devices for various applications as variable capacitance, oscillator, isolator, light intensity measurement and display devices. **(K3)**

CO5 - Design the transistor amplifiers using its small signal model and evaluate the performance analysis of large signal amplifier. **(K4)**

CO6 - Design oscillators for different types of signal generation and analyse the frequency response of negative feedback amplifiers. **(K4)**

UNIT I PN JUNCTION DEVICES **(9 Hrs)**

Introduction –Semiconductor–PN junction diode – Mathematical model of PN diode – Effect of temperature on diode operation – Static and Dynamic resistance – Diode equivalent models – Transition and diffusion capacitances – Diode switching Characteristics – Reverse Recovery time – Diode applications: Rectifiers, Clippers and Clampers – Zener diode – VI Characteristics – Zener as regulator – Special devices: Varactor diode – PIN diode – Gunn Diode–Tunnel diode – Schottky diode – SCR – SCS – DIAC and UJT – Selection of devices using specification sheets– Introduction to SiC diodes

UNIT II BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS **(9 Hrs)**

BJT: NPN and PNP transistors – Ebers - Moll model - CB, CE and CC configurations – Transistor characteristic – Biasing– DC and AC load line – Operating point – Stabilization– Bias compensation techniques – Thermal stability and runaway – Amplification –BJT as a switch – FET: JFET – Drain and transfer characteristics – Shockley's equation – Comparison between JFET and BJT – Biasing of FETs. – MOSFET: Types and characteristics –MOSFET as a switch – Selection of devices using specification sheets – Introduction to SJT and SiC MOSFET

UNIT III OPTO ELECTRONIC DEVICES **(9 Hrs)**

Opto electronic devices: Optical absorption in a semiconductor, photon absorption coefficient – Electron hole pair generation– Homo junction and hetero junction– Optical absorption, loss and gain – Threshold current –LEDs and LCDs – Photo diodes – Photo transistors – Photoconductive cells – PV cells – Applications of photodiode as optocoupler -Opto isolator.

UNIT IV SMALL AND LARGE SIGNAL AMPLIFIERS **(9 Hrs)**

Transistor hybrid model and H-parameters – Determination of H-parameters from transistor characteristics – Analysis of CB, CE and CC circuits using H-parameter model–Comparison– Transistor R_e model - Cascading amplifier – Direct and RC coupled two stage CE amplifiers – Darlington pair –Cascode amplifier – Tuned amplifier–Classification of Power amplifiers – Class A , Class B , Class AB , Class C , Class D and Class E amplifier– Conversion efficiency calculations– Power transistor heat–Low frequency FET model – Source follower – Analysis of CS and CD circuits.

UNIT V POSTIVE AND NEGATIVE FEEDBACK AMPLIFIERS (9 Hrs)

Feedback concept – Gain with feedback – General characteristics of negative feedback amplifiers – Four basic types of feedback – Multistage feedback amplifiers –Two stage CE amplifier with series voltage negative feedback –Schmitt trigger- Frequency response and stability –Conditions for sustained oscillations – Barkhausen criterion – LC oscillators – Analysis of Hartley, Colpitt, Tuned oscillators , RC Phase shift, Wein-bridge oscillators, Franklin – Armstrong and Twin T oscillators – Analysis– Crystal oscillators and frequency stability – UJT relaxation oscillators.

Text Books

1. David A. Bell, “Electronic devices and circuits”, Oxford University higher education, 5th Edition, 2008.
2. Muhammad H. Rashid, “Microelectronic Circuits: Analysis and Design”, Cengage learning Inc, 2nd Edition 2011.
3. G.S. Tomar, Ashish Bagwari, “Fundamentals of Electronic Devices and Circuits”, Springer Nature, 1st Edition, 2019.
4. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit theory”, Pearson Education, 9th Edition, 2007.
5. Battula Tirumala Krishna and Dharma raj cheruku, “Electronic Devices and circuits”, Pearson Education India, 2nd Edition, 2008.

Reference Books

1. Thomas L.Floyd, “Electronic devices”, Pearson prentice hall, 10thEdition, 2017.
2. Donald A Neamen, “Electronic Circuit Analysis and Design” Tata McGraw Hill, 3rdEdition, 2003.
3. Robert L.Boylestad, “Electronic devices and circuit theory”, Pearson Prentice Hall, 10thEdition, 2009.
4. Mahesh B. Patil, “Basic electronic devices and circuits”, PHI Learning Pvt. Ltd., 1st Edition, 2013.
5. Andrei Grebennikov, “RF and Microwave Transistor Oscillator Design”, John Wiley & Sons, 2007

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3. https://nptel.ac.in/courses/117106086/
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5. http://www.iitg.ac.in/apvajpeyi/ph218/Lec-5.pdf
6. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_jfet_1.pdf
7. http://www.ece.ubc.ca/~pulfrey/paper_encyclo.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	1	-	-	-	-	-	-	1	2	3	3
2	2	3	3	3	2	-	-	-	-	-	-	1	2	3	3
3	1	1	3	2	1	-	-	-	-	-	-	1	2	3	3
4	3	3	2	3	2	-	-	-	-	-	-	1	2	3	3
5	3	3	2	3	3	-	-	-	-	-	-	1	2	3	3
6	3	3	2	3	3	-	-	-	-	-	-	1	2	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET36

DIGITAL ELECTRONICS

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To study various number systems and to simplify the logical expressions using Boolean functions.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the design procedures for synchronous and asynchronous sequential circuits.
- To study the various semiconductor memories and its related technology.
- To introduce digital simulation for development of application oriented logic circuits.

Course Outcomes

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

CO1 - Use the Boolean laws to simplify the logical functions. **(K3)**
CO2 - Design 'n' bit counters and shift registers. **(K4)**
CO3 - Design and analyze the synchronous and asynchronous sequential circuits. **(K4)**
CO4 - Gain knowledge on the design and fabrications of semiconductor memories.**(K2)**
CO5 - Design, debug and test digital logic circuits using VHDL. **(K4)**

UNIT I COMBINATIONAL CIRCUITS (9 Hrs)

Number systems: Binary, Decimal, Octal and Hexa decimal – 1s and 2s complement – Binary Arithmetic – BCD addition and subtraction – Boolean theorems – Digital Logic gates – Universal Gates –Design of combination circuits using NAND and NOR gates – POS, SOP simplification – Minterms and Maxterms – Karnaugh map – Don't Care conditions – Design of adders, subtractor – half, full – Multiplexers – Demultiplexers – Application of Multiplexer as Logic function generator – Magnitude comparators – Encoder and Decoders – Priority Encoders – Parity Generator – Code Converters and BCD to Seven Segment Display driver.

UNIT II COUNTERS AND SHIFT REGISTERS (9 Hrs)

Flip flops: SR, D, JK, T and Master Slave – Edge and level triggered– Design of Synchronous counters – Asynchronous counter: UP/Down counter – decade counter – Modulo – n counter – Ring counter – Johnson counter – BCD Counters – Application of counters as frequency divider – Registers – Shift Registers – Application of shift register as Delay line – Bi directional shift registers – Parallel/serial converter.

UNIT III DESIGN OF SEQUENTIAL CIRCUITS (9 Hrs)

Design of Synchronous sequential circuits: Model Selection – State transition diagram – state synthesis table – Design equations and circuit diagram – State reduction technique – Asynchronous sequential circuits – Analysis – Problems with asynchronous sequential circuits – Design of asynchronous sequential circuits State transition diagram, Primitive table, State reduction, state assignment and design equations –Transition stability –flow stability-race conditions, hazards and errors in digital circuits.

UNIT IV MEMORIES AND LOGIC FAMILIES (9 Hrs)

Memory structure: RAM - ROM – PROM – EPROM – EEPROM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – CPLD – FPGA.
Logic families: RTL, DTL, TTL, I^2L and ECL Circuits – Metal Oxide Semiconductor (MOS) – Complementary MOS (CMOS).

UNIT V VHDL (9 Hrs)

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers and De multiplexers).

Text Books

1. Morris. M. Mano and Michael. D. Ciletti, "Digital Design", Pearson Education, 5th Edition, 2013.
2. Floyd and Jain, "Digital Fundamentals", Pearson Education, 11th Edition, 2015.
3. Comer "Digital Logic & State Machine Design", Oxford, 3rd Edition, 2012.
4. John F.Wakerly, "Digital Design Principles & Practices", Prentice Hall, 4th Edition, 2008.
5. M. Morris Mano, "Digital Design with an introduction to the VHDL", Pearson Education, 5th Edition, 2013.

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1. D. P. Kothari, J. S. Dhillon, "Digital circuits and Design", Pearson Education, 1st Edition, 2016.
2. Raj Kamal, "Digital systems-Principles and Design", Pearson Education, 2nd Edition, 2007.
3. Roger L.Tokheim, "Digital Electronics: Principles and Applications", McGraw Hill Education, 8th Edition, 2014.
4. William Keitz, "Digital Electronics-A Practical Approach with VHDL", Pearson, 9th Edition, 2013.
5. Charles H. Roth, Jr. LizyLizyKurian John, "Digital System Design using VHDL", Cengage, 3rd Edition, 2018.

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5. http://nptel.unipune.ac.in/LocalG/listLectures.php?cid=70cfb15a91cff73d&bid=927d7542627865a3
6. https://www.elprocus.com/what-is-a-shift-register-different-types-counters-and-applications/
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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	2	-	-	-	-	-	-	-	2	2	2
2	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
3	2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
4	1	1	1	2	2	-	-	-	-	-	-	-	2	2	2
5	1	1	1	3	3	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19EEP31	ELECTRIC CIRCUIT ANALYSIS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course objectives

- To gain practical experience on electric circuits to measure various electrical parameters like current, voltage and power using various network theorems for DC and AC circuits
- To gain practical experience to evaluate the solution of three phase AC balanced and unbalanced circuits for star and delta connection
- To gain practical experience to evaluate steady state and transient behavior of networks with RL, RC and RLC circuit for DC and AC excitations.
- To gain practical experience to analyze series and parallel resonance circuits
- To simulate various electric circuit using simulation software.

Course Outcomes

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

CO1 - Verify the basic laws and simplify more complicated circuits into simple equivalent circuits using network theorems to compute various parameters of typical DC and AC electrical circuits. **(K4)**

CO2 - Evaluate the solution of three phase AC balanced and unbalanced circuits with different types of loads. **(K4)**

CO3 - Analyze the transient response of RL, RC and RLC circuits with DC and AC input used in power converters, choppers and sweep circuits. **(K4)**

CO4 - Design tuned circuit for given frequency used in radio amplifiers for frequency tuning. **(K5)**

CO5 - Make use of Electrical software for simulating various electrical circuits. **(K5)**

List of Experiments

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws
2. Simulation and experimental verification of electrical circuit problems using Superposition theorem
3. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem and Norton's theorem
4. Simulation and experimental verification of electrical circuit problems using Maximum Power Transfer theorem
5. Simulation and experimental verification of electrical circuit problems using Reciprocity theorem
6. Simulation and experimental verification of electrical circuit problems using Compensation and Millman's theorem
7. Simulation and verification in between voltage and current in three phase balanced star and delta connected loads
8. Simulation and experimental validation of time response of R-L circuit
9. Simulation and experimental validation of time response of R-C circuit
10. Simulation and experimental validation of time response of RLC circuit
11. Design and simulation of R-L-C series resonance circuit for $X_L > X_C$ and $X_L < X_C$
12. Design and simulation of R-L-C parallel resonance circuit for $X_L > X_C$ and $X_L < X_C$

Reference Books

1. William H Hayt, J E Kemmerly and Steven M Durbin, "Engineering Circuit Analysis", McGraw Hill, 8th Edition, 2013.
2. Charles K. Alexander and Matthew N. Q. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill International Edition, 3rd Edition, 2013.
3. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", John Wiley & Sons, Inc., 7th Edition, 2015.
4. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 5th Edition, 2013.
5. J. Nagrath and Kothari, "Theory and Problems of Basic Electrical Engineering", PHI Learning Private Limited, Delhi, 2nd Edition, 2016.

6. A. Sudhakar, Shyammohan S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill Publications, 5th Edition, 2015.
7. MahmoodNahvi, Joseph Edminister, “Electric Circuits (Schaum's Outline Series)”, McGraw-Hill Publications, 5th Edition, 2017.
8. Sukhija and Nagsarkar, “Circuits and Networks”, Oxford University Press, 2nd Edition, 2016.

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3. https://www.circuitlab.com/
4. https://www.youtube.com/watch?v=VjWliIjcDQg
5. http://www.circuit-magic.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	2	3	2	3	3	-	-	-	2	-	-	-	3	3	2
3	3	3	2	3	3	-	-	-	2	-	-	-	3	2	2
4	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19EEP32	ELECTRICAL MACHINES LAB - I	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To equip the students to test and evaluate the performance of various DC machines and transformers by conducting appropriate experiments.
- To learn different methods to predetermine the characteristics of DC machines and transformers.
- To get familiar with different types of speed control of DC motors.
- To understand the parallel operation and load sharing of single phase transformers.
- To learn the assembling of different types of DC machines.

Course Outcomes

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

CO1 - Test the performance of any DC machine (shunt, series or compound) and transformer by conducting suitable experiments and report the results. **(K5)**

CO2 - Predetermine the different performance characteristics of DC machines and transformers. **(K5)**

CO3 - Experiment and analyze the various speed control techniques for DC motors. **(K5)**

CO4 - Experiment the parallel operation and analyze the load sharing of single phase transformers. **(K4)**

CO5 - Develop any prototype modules implementing different control techniques in DC machine and transformers for various applications. **(K5)**

List of Experiments

DC MACHINES

1) (a). Load test on DC shunt Motor
   (b). Load test on DC series Motor
   (c). Load test on DC Compound Motor
2) Speed control of DC Motors: Field control, Armature control
3) Electrical braking in DC shunt motor
4) (a). Open Circuit Characteristics and Load test on separately excited DC Generator
   (b). Open Circuit Characteristics and Load test on DC shunt Generator
   (c). Load test on DC series Generator
5) Swinburne's Test
6) Separation of losses in a DC shunt machine
7) Hopkinson's test on DC Machines
8) Study on Retardation test on DC shunt motor
9) Assembling and Testing of DC machines

TRANSFORMERS

10) Load test on single phase transformer
11) O.C and S.C test on single phase transformer and separate its losses.
12) Parallel operation of single phase transformers
13) Study of Sumpner's test on single phase transformers
14) Study of three phase transformer connections
15) Load test on three phase transformer
16) O.C and S.C test on three phase transformer

Reference Books

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D. R Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand and Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, "Electrical Machines Lab Manual with MATLAB Programs", Laxmi Publications Pvt Limited, 1st Edition, 2015.

4. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw Hill Education Pvt. Ltd, 5th Edition, 2012.
6. Vincent Del Toro, "Basic Electric Machines", Pearson India Education, 1st Edition, 2016.Irving. L. Kosow, "Electrical Machines and Transformers", PHI, 2nd Edition, 2007.
7. Albert E. Clayton, "The performance and design of direct current machines", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

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3. http://em-iitr.vlabs.ac.in/
4. https://ndl.iitkgp.ac.in
5. https://nptel.ac.in/courses/108/105/108105017/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
2	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
3	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
4	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
5	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19EEP33 **ELECTRONICS LAB**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To understand the characteristics of various electronic devices.
- To study and implement diode applications for rectifiers, clippers and clampers.
- To develop the biasing circuits for BJT and FET for proper amplification.
- To impart knowledge on design trade-offs in regulator circuits.
- To understand the effects of negative feedback on amplifier circuits

Course Outcomes

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

CO1 - Analyze the characteristics of different electronic devices such as diode, BJT, FET etc. **(K4)**
CO2 - Design clipper, clamper, and rectifier using PN and regulator circuits using zener diodes. **(K5)**
CO3 - Demonstrate the characteristics of opto electronic devices. **(K3)**
CO4 - Experiment the characteristics of various special devices. **(K4)**
CO5 - Design oscillator circuits for signal generation and evaluate the frequency response of amplifier circuits. **(K5)**

List of Experiments

1. Determination of dynamic resistance of PN Junction diode and construct the half wave and full wave rectifiers.
2. Design and implementation of clipping and clamping circuits.
3. Design a voltage regulator using zener diode and verify its characteristics.
4. Determination of characteristic parameters of BJT for Common Emitter configuration.
5. Design the Biasing Circuits for BJT (Fixed bias, collector to base bias, potential divider).
6. Design the Biasing Circuits for FET (Self bias, potential divider)
7. Determination of characteristic parameters of FET/MOSFET and application of MOSFET as a switch.
8. Verify the characteristics of photo diode and photo transistor.
9. Verify the characteristics of LED/LCD/LDR.
10. Verify the Characteristics of UJT.
11. Design the common emitter BJT amplifier and analyze the frequency response characteristics.
12. Design the common source FET amplifier and analyze the frequency response characteristics.
13. Design a UJT relaxation oscillator.
14. Design a wein bridge and Phase shift oscillators using BJT.
15. Design and verify the Schmitt trigger using BJT.

Reference Books

1. Louis E. Frenzel, "Practical Electronic Design for Experimenters", McGraw Hill Professional, 1st Edition, 2020.
2. A. P. Malvino and D. Bates, "Electronic Principles", Tata McGraw-Hill, 8th Edition, 2016.
3. David A. Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual", Oxford University higher education, 5th Edition, 2009.
4. David A. Bell, "Laboratory Manual for Electronic Devices and Circuits", Oxford University higher education, 4th Edition, 2001.
5. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit theory", Pearson Prentice Hall, 9th Edition, 2007.
6. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge Univ. Press, 3rd Edition, 2015.
7. Thomas L. Floyd, "Electronic devices", Pearson prentice hall, 10th Edition, 2017.
8. Robert L. Boylestad, "Electronic devices and circuit theory", Pearson Prentice Hall, 10th Edition, 2009

Web References

1. https://nptel.ac.in/courses/108/106/108106084/
2. https://learnabout-electronics.org/Oscillators/osc21.php
3. https://swayam.gov.in/nd1_noc19_ee54/preview
4. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_jfet_1.pdf
5. https://nptel.ac.in/courses/117103064/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	2	-	-	-	3	2	2
2	3	3	2	3	2	-	-	-	2	-	-	-	3	3	2
3	3	2	3	2	2	-	-	-	2	-	-	-	3	3	2
4	3	3	2	3	2	-	-	-	2	-	-	-	3	2	2
5	3	3	3	3	2	-	-	-	2	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19EEC3X	CERTIFICATION COURSE - I	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U19EES31	SKILL DEVELOPMENT COURSE 1 **GENERAL PROFICIENCY – I** (Common to all Branches)	L	T	P	C	Hrs
		0	0	2	-	30

Course Objectives

- To enrich strong vocabulary and decoding skills through comprehension analysis
- To advance communication and leadership skills pragmatically
- To pronounce English sounds in isolation and in connected speech
- To expand effective written communication skills to meet organizational goals
- To extend knowledge on verbal aptitude and prepare for interviews

Course Outcomes

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

CO1 – Interpret meaning and apply reading strategies in technical and non-technical context. ***(K2)***
CO2 – Develop interpersonal communication skills professionally.**(K3)**
CO3 – Infer the distinct speech sounds and overcome native language influence. **(K2)**
CO4 – Demonstrate various forms of formal writing. **(K2)**
CO5 – Apply the techniques of verbal aptitude in competitive exams. **(K3)**

UNIT I COMPREHENSION ANALYSIS (6 Hrs)

Listening: Listening Comprehension (IELTS based) – **Speaking**: Break the iceberg - **Reading:** Reading technical passage (IELTS based) - **Writing:** Writing Task: 1 (IELTS: Graph/ Process /Chart Description) **Vocabulary:** Synonyms (IELTS)

UNIT II PERSONALITY DEVELOPMENT (6 Hrs)

Listening: Interview Videos- **Speaking:** Extempore and Presentation (Soft Skills) - **Reading:** British and American Vocabulary, Read and review (Books, Magazines) - **Writing**: SWOT Analysis - **Vocabulary:** Idioms (IELTS)

UNIT III INFERENTIAL LEARNING (6 Hrs)

Listening: Listening Speech sounds to overcome Mother Tongue Influence, Anecdotes – **Speaking**: Interpersonal Interaction and Situational attribution – **Reading**: Distinguish between facts and opinions - **Writing:** Writing Conversation to different context - **Vocabulary:** Phrasal Verbs (IELTS).

UNIT IV INTERPRETATION AND FUNCTIONAL WRITING (6 Hrs)

Listening: Group Discussion videos - **Speaking:** Group Discussion Practice - **Reading:** Interpretation of data - Graph, table, chart, diagram (IELTS based) - **Writing**: Writing Task: 2 (IELTS) **Vocabulary:** Collocations (IELTS).

UNIT V APTITUDE (6 Hrs)

Language Enhancement: Articles, Preposition, Tenses - **Verbal Ability Enhancement:** Blood Relation, Completing Statements- Cloze test, Spotting Errors – Sentence Improvement, One Word Substitution, Word Analogy, Word Groups(**GATE**).

Reference Books

1. Jeff Butterfield, "Soft Skills for Everyone", Cengage Learning, New Delhi, 2012.
2. Mn.Taylor and Grant Taylor. "English Conversation Practice". Tata McGraw-Hill Education, 2004.
3. Bailey, Stephen. "Academic writing: A practical guide for students". Psychology Press, 2003.
4. R. S. Aggarwal, "A Modern Approach to Verbal & Non Verbal Reasoning", S. Chand, 2010.
5. Wren, Percival Christopher and Wren Martin. "High School English Grammar and Composition". S Chand, 2005.

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1. https://www.ielts-exam.net/grammar/
2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
2	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19EES32

SKILL DEVELOPMENT COURSE 2

(Choose anyone of the below three courses)

L	T	P	C	Hrs
0	0	2	-	30

1. TESTING OF ELECTRONICS DEVICES AND PCB BOARD DESIGNING

Course Content:

1. Identification of different component and its symbols.
2. To study and operation of multimeter, function generator and regulated power supply.
3. Testing of electronic component by CRO and their measurement by LCR bridges.
4. Identify the value and test different types of resistors, capacitors and inductors.
5. Make use of resister, capacitor, inductor in series and parallel connection
6. Identify different types of cables, connectors, fuse, switches, relays and discover their application
7. Read and interpret data sheet of various junction diodes and Transistors.
8. Measure amplitude and frequencies of different sine waveform using CRO and Function Generator.
9. Develop fabrication and mount components on PCB for Doorbell/cordless bell
10. Develop fabrication and mount components on PCB for Clapping switch and IR switch
11. Develop fabrication and mount components on PCB for Cell charger, battery charger, mobile charger
12. Develop fabrication and mount components on PCB for Fire/smoke/intruder alarm

2. DESIGN OF SOLAR POWER PLANT AND INSTALLATION

Course Content:

1. Selection of site/location and shadow analysis
2. Selection of PV module technology
3. Connection of PV Module (Series and Parallel Circuit)
4. Design and sizing of panel capacity for suitable loads
5. Preparation of single line diagram and plant array layout.
6. Design of Power converters (for ON/Off Grid)
7. Solar power plant string combiner box/ ACDB/ MDB/Metering cubical
8. Selection and sizing of AC and DC Cables
9. Selection and sizing of AC/DC side earthing along with lightning protection
10. Plant Installation and Commissioning
11. Maintenance and Troubleshooting of the solar power plant
12. Costing and Tendering of solar power plant
13. Net Metering and Introduction to Smart grid
14. Plant visit and Report Preparation

3. DEMONSTRATION / TROUBLESHOOTING OF ELECTRICAL AND ELECTRONICS EQUIPMENTS

Course Content:

1. Demonstration of electrical safety and electricity tariff calculation for household appliances.
2. Single phase house wiring, Fuse calculation and Extension box installation
3. Demonstration of electrical measuring instruments (Ammeter, Voltmeter, CRO, DSO and Multimeter)
4. a) Electrical wiring for fan and tube light.

   b) Demonstration of coil rewinding of ceiling fan
5. Practical approach towards testing of semiconductor devices using multimeter.
6. Troubleshooting of electrical and electronic home appliances (Electric water heater, Induction stove, Iron box, Mixer, Hair dryer, Mosquito bat and Aquarium water pump)
7. Study of practical approach on audrino board.
8. Demonstration of water level indicator for domestic purpose.
9. Construction of series and parallel connection of LED for decoration purpose.
10. Design of Regulated Power Supply circuit.
11. Demonstration of coil design for specific inductance.

U19EEM31	PHYSICAL EDUCATION	L	T	P	C	Hrs
		0	0	2	-	30

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 30 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

U19EET41

PROBABILITY AND STATISTICS

(Common to EEE, ICE)

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- To acquire skills in handling situation including more than one random variable.
- To familiarize the student about the continuous random variables and their applications.
- To study the basic concepts of Statistics.
- To learn the concept of testing of hypothesis using statistical analysis.
- To learn the concept of Small sampling

Course Outcomes

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

CO1 - Apply the concept of probability in random variables. **(K3)**
CO2 - Apply the basic rules of continuous random variables. **(K3)**
CO3 - Understand the basic concepts of Statistics. **(K2)**
CO4 - Derive the inference for various problems using testing of hypothesis in large samples. **(K3)**
CO5 - Solve the problems related to testing of hypothesis in small samples. **(K3)**

UNIT I DISCRETE RANDOM VARIABLES (12 Hrs)

Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial – Geometric – Negative Binomial and Poisson.

UNIT II CONTINUOUS RANDOM VARIABLES (12 Hrs)

Some important distributions – Exponential distribution –Gamma –Weibull– Gaussian distributions. Application of distribution – Reliability – Failure density and Hazard function.

UNIT III STATISTICS (12 Hrs)

Measures of central tendency– Arithmetic Mean, Median and Mode – Measures of dispersion and Standard deviation –Skewness and Measures of Skewness– Pearson's coefficient of skewness– Moments – Correlation – Rank correlation and regression

UNIT IV LARGE SAMPLES (12 Hrs)

Curve fitting by the method of least squares – fitting of straight lines – second degree parabolas and more general curves – Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V SMALL SAMPLES (12 Hrs)

Test for single mean – Difference of means and correlations of coefficients – Test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers- Paperback, 3rd Edition, 2017.
2. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 2008.
3. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback – 1, 2019.

Reference Books

1. Ravish R. Singh, Mukul Bhatt, "Engineering Mathematics", McGraw-Hill, 1st Edition, 2017.
2. William Mendenhall, Robert J. Beaver, Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning, 15th Edition, 2019.
3. Richard. A. Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. EhsanesSaleh, "An Introduction to Probability and Statistics", Wiley, 2008.
5. E. Rukmangadachari, "Probability and Statistics", Pearson Education India , 2012.

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1. http://www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	3	1	2
2	3	2	1	1	-	-	-	-	-	-	-	1	3	1	2
3	2	1	-	-	-	1	-	-	-	-	-	1	3	1	2
4	3	2	1	1	-	1	-	-	-	-	-	1	3	1	2
5	3	2	1	1	-	1	-	-	-	-	-	1	3	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET42	DATA STRUCTURE AND OBJECT ORIENTED PROGRAMMING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamentals of algorithm, various searching and sorting techniques.
- To study the basic concept about stack, queue and linked list
- To understand the implementation and various operation on trees and graphs.
- To understand the programming principles using C++.
- To study about File Management Operations, inheritance, templates and exception handling in C++.

Course Outcomes

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

CO1 - Summarize searching and sorting techniques.**(K2)**
CO2 -Demonstrate, apply and Analyze stack, queue, linked list and its operation. **(K3)**
CO3 - Construct the tree, graph and its various applications.**(K3)**
CO4 - Write a maintainable C++ Program for a given algorithm and implement the same. **(K3)**
CO5 - Demonstrate the use of inheritance, templates, files, templates and its relevant applications. **(K3)**

UNIT I INTRODUCTION TO ALGORITHM, SEARCHING AND SORTING TECHNIQUES (9 Hrs)

Introduction to Algorithm – Programming principles – Creating programs– Analyzing programs. Arrays: One dimensional array, multidimensional array. Pointers – Searching: Linear search, Binary Search. Sorting techniques: Internal sorting –Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Merge Sort and Radix Sort.

UNIT II STACK, QUEUE AND LINKED LIST (9 Hrs)

Stacks: Definition – Operations – Applications of stack. Queues: Definition–Operations – Priority queues – De queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List

UNIT III TREES AND GRAPHS (9 Hrs)

Trees: Binary tree, Terminology, Representation, Traversals, Applications Graph: Terminology, Representation, Traversals – Applications – spanning trees, shortest path and Transitive closure, Hash tables.

UNIT IV INTRODUCTION TO OBJECT ORIENTED PROGRAMMING, CONSTRUCTOR, DESTRUCTOR AND OPERATOR OVER LOADING (9 Hrs)

Principles of Object Oriented Programming – Beginning With C++ – Tokens - Expressions-control Structures – Functions in C++, classes and objects, constructors and destructors, operators overloading and type conversions.

UNIT V INHERITANCE, FILES, TEMPLATES AND EXCEPTION HANDLING (9 Hrs)

Inheritance: Extending classes, Pointers, Virtual functions and polymorphism, File Handling Templates, Templates – Exception Handling.

Text Books

1. Ellis Horowitz and SartajSahni, "Fundamentals of Data Structures", Universities Press, 2nd Edition, 2004.
2. D. Samanta, "Classic Data Structures, Prentice-Hall of India Pvt. Ltd., India, 2nd Edition, 2012.
3. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Education, 6th Edition, 2013.

Reference Books

1. Robert Kruse, C. L. Tondo and Bruce Leung, "Data Structures and Program Design in C", Prentice-Hall of India, 2nd Edition, 2007.
2. Seymour Lipschutz, "Data Structures", McGraw Hill Education, Revised 1st Edition, 2014.
3. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to data structures with applications", McGraw Hill, 2nd Edition, 2017.
4. Bjarne Stroustrup, "The C++ Programming Language", Pearson Addison-Wesley, 4th Edition, 2013.

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2. http://nptel.iitm.ac.in
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
4. https://www.tutorialspoint.com/cplusplus/index.htm
5. https://www.javatpoint.com/data-structure-tutorial

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	2	2	-	-	-	-	-	-	-	2	3
2	3	3	3	3	2	1	-	-	-	-	-	-	-	2	3
3	3	3	3	3	2	1	-	-	-	-	-	-	-	2	3
4	3	3	3	3	2	1	-	-	-	-	-	-	-	2	3
5	3	3	3	3	2	1	-	-	-	-	-	-	-	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19EET43	ELECTRICAL MACHINES – II	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To equip the students to understand and analyze the characteristics of Induction motor.
- To learn different types of starters and speed control of three phase induction motor.
- To equip the students to understand and analyze the characteristics of alternator.
- To learn characteristics of synchronous motor and effect of varying load and excitation.
- To get familiar with performance characteristics of special machines.

Course Outcomes

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

CO1 - Evaluate and analyze the performance of Induction motor using equivalent circuits and circle diagram.**(K3)**

CO2 - Apply suitable starting and speed control methods to enhance the performance of three phase induction motors. **(K3)**

CO3- Analyze the performance characteristics of alternator and compute voltage regulation with different methods. **(K4)**

CO4 - Analyze the characteristics of synchronous motor and its performance with effect of varying load and excitation. **(K4)**

CO5 - Recognize the characteristics of special machines as well as choose an appropriate motor for any industrial application. **(K3)**

UNIT I INDUCTION MOTOR (9 Hrs)

Single phase Induction Motors: Construction – Principle of operation - Double revolving field theory - Torque-speed characteristics – starting methods – Applications.
Three phase Induction Motors: Construction – principle of operation – Types - Effect of slip on rotor parameters – Torque equation - phasor diagram - effect of voltage variation and rotor resistance on torque slip characteristics - Power Stages - equivalent circuit – no load and blocked rotor test - circle diagram – Separation of no load losses - Losses and efficiency – Applications.

UNIT II STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR (9 Hrs)

Starters: Need for starters – Starting methods. Speed control: Stator side – Rotor side – Solid state control. Cogging and Crawling - Electric Braking - deep bar and double cage rotor – Synchronous induction motor – Induction generator – Applications.

UNIT III ALTERNATOR (9 Hrs)

Alternator: Construction – operation – Types of rotors – EMF equation – Synchronous reactance – Armature reaction - Alternator on load – phasor diagram. Voltage regulation: EMF, MMF, ZPF. Synchronizing and parallel operation – effect of change of excitation and prime mover inputs – automatic voltage regulators – Two reaction theory of Salient pole machines – slip test - power angle diagram – Applications.

UNIT IV SYNCHRONOUS MOTOR (9 Hrs)

Construction - principle of operation - starting methods - Torque and power equations - speed control– phasor diagram – effect of varying load and excitation - 'V' and inverted 'V' curves - hunting – synchronous condenser – Applications.

UNIT V SPECIAL MACHINES (9 Hrs)

Stepper motors - Reluctance motor - Hysteresis motor– Servo motor– Linear induction motor– AC series motor - switched reluctance motor - Brushless DC motors– PMSM – Applications.

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
2. R. K. Rajput, "Electrical Machines", Laxmi publications Pvt. Ltd, New Delhi, 6th Edition, 2008.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology", Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Edition, 2009.

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1. M. G. Say, "Alternating Current Machines", Pitman Publishing, 5th Edition, 2002.
2. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3rd Edition, 2013.
3. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2nd Edition, 2001.
4. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
5. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6th Edition, 2006.

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3. http://electrical-engineering-portal.com/
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5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EET44	**LINEAR INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**	**Hrs**
		3	**0**	**0**	**3**	**45**

Course Objectives

- To introduce IC fabrication process and basic building blocks of linear integrated circuits.
- To familiarize the AC and DC characteristics of OP AMP 741 and its basic application circuits.
- To outline the design procedure of active filters and waveform generation using operational amplifiers.
- To illustrate the design procedure of various Regulator ICs for power supply circuits.
- To impart knowledge on the fundamental blocks and applications of special ICs like 555 and 565 ICs.

Course Outcomes

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

CO1 - Describe the IC fabrication process for any circuits. **(K2)**
CO2 - Design and analyze OP AMP based circuits for different applications like A/D and D/A conversion. **(K3)**
CO3 - Design filters and waveform generators using OP AMP. **(K3)**
CO4 - Design regulators for power supply circuits. **(K3)**
CO5 - Design multi-vibrators using 555 timer and demodulators using 565 PLL. **(K3)**

UNIT I IC FABRICATION **(9 Hrs)**

IC classification – Fundamental of monolithic IC technology – Epitaxial growth, masking and etching, diffusion of impurities – Realization of monolithic ICs and packaging: Fabrication of resistance, diode, capacitance and PV cells –BJT – FET – HFET – CMOS technology.

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS **(9 Hrs)**

OP-AMP equivalent circuit – CMRR – AC and DC characteristics – Open and closed loop configuration – Properties of practical op-amps (LM741, LM124, OP07, TL082) – Interpretation of OP-AMP data sheet – Applications – Instrumentation amplifier – Clipper and Clamper – D/A converters– A/D converter – TLC0820 and TLC7524 ICs–S/H circuit.

UNIT III ACTIVE FILTERS AND WAVEFORM GENERATOR USING OP AMP **(9 Hrs)**

Ist and IInd order Active filter – Low pass, high pass, wide band pass and band stop Butterworth filters –Narrow band pass and notch filters – State variable filter – Switched capacitor filter – Waveform generator: RC Phase shift and Wien bridge oscillators – Triangular and saw tooth wave generator – Effect of Slew Rate on waveform generation – Schmitt trigger and Multivibrators – Applications

UNIT IV ANALOG IC APPLICATIONS **(9 Hrs)**

Series op-amp regulator – IC voltage regulators: LM78XX, LM79XX Dual tracking regulators – Positive and Negative voltage regulators IC 723 – Adjustable voltage regulators: LM117, LM317 – Switching regulator – SMPS – LM2524 – V/F converter – F/V converter – Analog Multiplier MPY634– AGC and AVC– INA121 Instrumentation Amplifier – LM 380 Power amplifier – Comparator IC LM311

UNIT V PHASE LOCKED LOOP AND TIMER **(9 Hrs)**

PLL: 74HCT7046 – phase comparator – PLL Applications: Frequency synthesis, AM and FM detection, FSK demodulator and Motor speed control – IC555 timer – Functional diagram –Multivibrators – Schmitt trigger – Application as Missing pulse detector, Frequency counter – Dual timer SN74AH – CD4093 ICs.

Text Books

1. Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, 5th Edition, 2015.
2. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", Prentice Hall of India, New Delhi, 2nd Edition, 2010.
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill, 1st Edition, 2018.
4. Muhammad H. Rashid, "Microelectronic Circuits: Analysis and Design", Cengage learning Inc, 2nd Edition, 2011.
5. D. Roy Choudhary, Sheil. B. Jani, "Linear Integrated Circuits", New Age Publication, 5th Edition, 2018.
6. David A. Bell, "Op-amp and Linear ICs", Oxford Higher Education, 3rd Edition, 2013.

Reference Books

1. James M. Fiore, “Opamps and Linear Integrated Circuits Concepts and Applications”, Cengage learning, 1st Edition, 2010.
2. Bruce Carter, Ron Mancini, “Op Amps for Everyone”, Newnes Publication, 5th Edition, 2017.
3. Floyd, Buchla, “Fundamentals of Analog Circuits”, Pearson Education, 2nd Edition, 2013.
4. Jacob Millman, Christos C. Halkias, “Integrated Electronics - Analog and Digital circuits system”, Tata McGraw Hill, 2nd Edition, 2009.
5. Robert F. Coughlin, Fredrick F. Driscoll, “Op-amp and Linear ICs”, PHI Learning, 6th Edition, 2012.

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1. https://nptel.ac.in/courses/108/108/108108111/
2. https://nptel.ac.in/courses/117/107/117107094/
3. https://nptel.ac.in/courses/108/108/108108114/
4. https://www.electronics-tutorials.ws/opamp/opamp_1.html
5. https://www.tutorialspoint.com/semiconductor_devices/semiconductor_devices_operational_amplifiers.htm
6. https://www.allaboutcircuits.com/video-lectures/op-amp-applications/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	-	-	-	-	-	1	1	3
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEP41	DATA STRUCTURE AND OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To understand the fundamentals of algorithm, various searching and sorting techniques.
- To study the basic concept about stack, queue and linked list
- To understand the implementation and various operation on trees and graphs.
- To understand the programming principles using C++.
- To study about File Management Operations, inheritance, templates and exception handling in C++.

Course Outcomes

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

CO1 - Compare different type of searching and sorting techniques. **(K2)**
CO2 - Design the different type of stack, queue and linked list. **(K4)**
CO3 - Construct the tree, graph and its various applications. **(K4)**
CO4 - Formulate a maintainable C++ Program for a given algorithm and implement the same. **(K4)**
CO5 - Describe the use of inheritance, templates, files, templates and its relevant applications. **(K2)**

List of Experiments

C language

1. Searching Techniques
2. Sorting Techniques
3. Single Linked List and Doubly Linked list and its applications
4. Stack and its applications
5. Binary tree traversal
6. Graph Traversal
7. Minimum Spanning Tree
8. Shortest path algorithms

C++ language

9. Programs to implement classes and objects with constructor and destructors
10. Programs to implement different types of inheritance like multiple, multilevel and hybrid inheritance
11. Programs to implement virtual function to demonstrate the use of run time polymorphism
12. Program to implement template
13. Programs to implement Exception handling
14. Programs to implement queue and its applications

Reference Books

1. Ellis Horowitz and SartajSahni, “Fundamentals of Data Structures”, Universities Press, 2nd Edition, 2004.
2. D. Samanta, “Classic Data Structures, Prentice-Hall of India Pvt. Ltd., India, 2nd Edition, 2012.
3. E. Balagurusamy, “Object Oriented Programming with C++”, McGraw Hill Education, 6th Edition, 2013.
4. Robert Kruse, C. L. Tondo and Bruce Leung, “Data Structures and Program Design in C”, Prentice-Hall of India, 2nd Edition, 2007.
5. Seymour Lipschutz, “Data Structures”, McGraw Hill Education, Revised 1st Edition, 2014.
6. Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to data structures with applications”, McGraw Hill, 2nd Edition, 2017.
7. Bjarne Stroustrup, “The C++ Programming Language”, Pearson Addison-Wesley, 4th Edition, 2013.

Web References

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2. http://nptel.iitm.ac.in
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
4. https://www.tutorialspoint.com/cplusplus/index.htm
5. https://www.javatpoint.com/data-structure-tutorial

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	2	2	-	-	1	-	-	-	-	2	3
2	3	3	3	3	2	1	-	-	3	-	-	-	-	2	3
3	3	3	3	3	2	1	-	-	3	-	-	-	-	2	3
4	3	3	3	3	2	1	-	-	3	-	-	-	-	2	3
5	3	3	3	3	2	1	-	-	3	-	-	-	-	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEP42 ELECTRICAL MACHINES LAB - II

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To equip the students to test and evaluate the performance of induction and synchronous machines by conducting appropriate experiments.
- To learn different methods to predetermine the characteristics of single phase and three phase induction motors
- To get familiar with different types of speed control and electrical braking of induction motor.
- To understand the synchronization of three phase alternator with infinite bus bar.
- To learn the assembling of different types of AC machines.

Course Outcomes

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

CO1 - Test the performance of induction and synchronous machines by conducting suitable experiments and report the results.**(K4)**

CO2 - Predetermine the different performance characteristics of single phase and three phase induction motors.**(K4)**

CO3 - Analyze the speed control techniques and electrical braking of induction motor. **(K4)**

CO4 - Experiment the synchronization of alternators and analyze the power exchange with the grid. **(K3)**

CO5 - Develop any prototype modules implementing different control techniques in Induction and Synchronous machines for various applications. **(K5)**

List of Experiments

1. Load test on single phase induction motor
2. No load and blocked rotor tests on single phase induction motor
3. Load test on three phase squirrel cage and slip ring induction motors
4. No load and blocked rotor tests on three phase induction motor and Separate its no load losses
5. Speed control of induction motor
   (i). Stator voltage control
   (ii). Rotor resistance control
6. Electrical Braking of Induction motor
   (i). Dynamic Braking
   (ii). Plugging
   (iii). Regenerative Braking
7. Load test on induction generator
8. Load test on Single phase alternator
9. Load test on three-phase alternator
10. Voltage regulation of alternator (emf, mmf, zpf)
11. Slip test on three phase salient pole alternator
12. Synchronization of three phase alternator with infinite bus bar
13. V and inverted V curves of synchronous motor
14. Performance Characteristics of Universal Motor
15. Assembling and Testing of AC machines

Reference Books

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D.R. Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand & Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, "Electrical Machines Lab Manual with MATLAB Programs", Laxmi Publications Pvt Limited, 1st Edition, 2015.
4. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. M. G. Say, "Alternating Current Machines", Pitman Publishing, 5th Edition, 2002.

6. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3rd Edition, 2013.
7. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2nd Edition, 2001.
8. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6th Edition, 2006.

Web References

1. http://em-coep.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php
3. http://em-iitr.vlabs.ac.in/
4. http://vem-iitg.vlabs.ac.in/
5. https://nptel.ac.in/courses/108/105/108105131/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
2	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
3	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
4	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
5	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEP43 LINEAR INTEGRATED CIRCUITS LAB

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To learn design, testing and characterizing of circuit behavior with analog ICs.
- To familiarize the AC and DC characteristics of OPAMP 741.
- To outline the design procedure of the different applications of OPAMP 741.
- To introduce the design of filters and waveform generators using OPAMP 741.
- To impart knowledge on the design and realization of multivibrator circuits using 555 Timer.

Course Outcomes

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

CO1 - Design and use the OPAMP for various applications. **(K4)**

CO2 - Design the application circuits like A/D, D/A filters using OPAMP and special ICs. **(K4)**

CO3 - Design and test various waveform generation circuits using OPAMPS and special ICs. **(K4)**

CO4 - Design and test regulator circuits for power supplies using voltage regulator ICs. **(K4)**

CO5 - Verify and demonstrate V/F, frequency multiplier and SMPS. **(K4)**

List of Experiments

1. Obtain various characteristic parameters of IC 741
2. Design and analysis of Inverting, non-inverting amplifiers, Voltage follower, Adder and subtractor using OPAMP 741
3. Design and analysis of Integrator, Differentiator, Log and Antilog amplifier using OPAMP 741.
4. Design and analysis of comparator circuits (PWM and SPWM) and instrumentation amplifier using OPAMP 741.
5. a. Design and analysis of D/A and A/D converters using opamp 741.
   b. Verification of A/D conversion and D/A conversion using TLC0820 and TLC7524
6. Design and analysis of schmitt trigger and filter circuit (Ist order and IInd order) using OPAMP 741.
7. Design and analysis of wein-bridge and RC phase shift oscillator.
8. Design and verification of waveform generator using opamp 741
9. a. Design and analysis of low and high voltage regulators using IC 723 and variable voltage regulator using IC LM317.
   b. Design and verification of power source using LM2524 IC.
10. a. Design and analysis of Monostable and Astable multivibrator using IC555.
    b. Design and verification of Monostable and Astable multivibrator using SN74AH.
11. Implementation of Frequency multiplication using 74HCT7046
12. Design and analysis of FSK MOD/DEMOD using 74HCT7046

Reference Books

1. R. M. Marston, "Op-Amp Circuits Manual", Elsevier, 2016.
2. Ron Mancini, "Op Amps for Everyone: Design Reference", Newnes, 2nd Edition, 2003.
3. Walt Jung, "Op Amp Applications Handbook", Newnes, 1st Edition, 2005.
4. Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, 5th Edition, 2015.
5. James M. Fiore, "Opamps and Linear Integrated Circuits Concepts and Applications", Cengage learning, 1st Edition, 2010.
6. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson Education, 2nd Edition, 2013.
7. Jacob Millman, Christos C. Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2nd Edition, 2009.
8. Robert F. Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2012.

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3. https://www.circuitlab.com/circuit/bkg2qg/op-amp-inverting-amplifier/
4. https://electrosome.com/723-voltage-regulator/
5. https://www.electronicshub.org/how-555-timer-ic-testing-circuit-works/
6. http://www.infocobuild.com/education/audio-video-courses/electronics/op-amp-practical-applications-iisc-bangalore.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
2	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEC4X **CERTIFICATION COURSE - II**

L	T	P	C	Hrs
0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U19EES41	SKILL DEVELOPMENT COURSE 3: GENERAL PROFICIENCY– II (Common to all Branches)	L	T	P	C	Hrs
		0	0	2	-	30

Course Objectives

- To examine various standardized test in English language.
- To recognize the key features of various technical writing.
- To integrate LSRW skills to endorse multifarious skill set in practical situation.
- To understand the factors that influences the usage of grammar.
- To understand the basic concepts of logical reasoning skills.

Course Outcomes

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

CO1 - Infer ideas to attend international standardized test by broadening receptive and productive skills. **(K2)**
CO2 - Interpret the types of writing in different state of affairs. **(K2)**
CO3 - Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation. **(K3)**
CO4 - Identify the rules of grammar in academic discourse settings. **(K3)**
CO5 - Extend the skills to compete in various competitive exams like GATE, GRE, CAT, UPSC, etc. **(K2)**

UNIT I CAREER SKILLS (6 Hrs)

Listening: Listening at specific contexts - **Speaking:** Mock interview (Personal and Telephonic) - **Reading:** Read and Review -Newspaper, Advertisement, Company Handbooks and Guidelines (IELTS based) - **Writing:** Essay Writing (TOEFL) - **Vocabulary:** Words at specified context (IELTS).

UNIT II CORPORATE SKILLS (6 Hrs)

Listening: Listening and replicating - **Speaking**: Team Presentation (Work Place Etiquettes) - **Reading:** Short texts (signs, emoticons, messages) - **Writing:** E-mail writing - Hard skills – Resume Writing, Job Application Letter, Formal Letter - **Vocabulary:** Glossary (IELTS).

UNIT III FUNCTIONAL SKILLS (6 Hrs)

Listening: Listening TED Talks – **Speaking:** Brainstorming and Individual Presentation, Persuasive Communication – **Reading:** Text Completion (GRE Based). **Writing:** Expansion of Compound Words - **Vocabulary:** Expansion of vocabulary (IELTS).

UNIT IV TRANSFERABLE SKILLS (6 Hrs)

Listening: Listening Documentaries and making notes – **Speaking:** Conversation practice at formal and informal context - **Reading:** Read and transform - report, memo, notice and advertisement -**Writing:** Euphemism, Redundancy and Intensifiers- **Vocabulary:** Refinement of vocabulary (IELTS).

UNIT V APTITUDE (6 Hrs)

Transformational Grammar: Phrases and Clauses, Concord, Conditional Clauses, Voice, Modals.
Verbal Ability Enhancement: Letter Series, Coding and Decoding, Sentence Completion (GATE), Critical Reasoning and Verbal Deduction (GATE), Syllogism.

Reference Books

1. Lougheed, Lin. "Barron's Writing for the TOEFL IBT: With Audio CD". Barron's Educational series, 2008.
2. Tulgan, Bruce. "Bridging the soft skills gap: How to teach the missing basics to today's young talent". John Wiley & Sons, 2015.
3. Sherfield, Robert M. "Cornerstone: Developing Soft Skills". Pearson Education India, 2009.
4. Cullen, Pauline, Amanda French and Vanessa Jakeman, "The official Cambridge guide to IELTS for academic & general training", Cambridge, 2014.
5. Ramesh, Gopalaswamy. "The ace of soft skills: attitude, communication and etiquette for success". Pearson Education India, 2010.

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2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	1	-	-	1
2	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
4	1	-	-	-	-	-	-	1	-	3	-	1	-	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EES42	**SKILL DEVELOPMENT COURSE 4** (Choose anyone of the below three courses)	L	T	P	C
		0	0	2	-

Hrs: 30

1. MOBILE PHONE SERVICING

Course Content:

1. Fundamentals of Mobile Phone Technology
2. Assembling and disassembling of various models of mobile phones.
3. Study of various tools and equipment used in mobile phone repairs.
4. Study of Printed Circuit Board (Motherboard) and various components on PCB
5. Study and testing of various parts, components and different ICs (chips) used on the motherboard.
6. Reheating and mounting of various BGA and SMD chips.
7. Detailed study of various faults arising due to corrupt software.
8. Introduction of various flasher boxes and software.
9. Flashing of various brands of handsets.
10. Procedure to remove virus from infected phones.
11. Unlocking of handsets through codes and/or software.
12. Use of various secret codes
13. Water damaged repair techniques.
14. Circuit tracing, jumper techniques and solutions.
15. Use of internet for troubleshooting faults.
16. Advanced troubleshooting techniques.

2. AUTONOMOUS ROBOTICS

Course Content:

1. Introduction, features and applications to Robotics
2. Building the PC Controlled Robot
3. Programming the PC Controlled Robot and testing it
4. Building the Line Follower Robot
5. Programming the Line Follower Robot and testing it
6. Building the Obstacle Avoiding Robot
7. Programming the Obstacle Avoiding Robot and testing it
8. Building the Pit Avoiding Robot
9. Programming the Pit Avoiding Robot and testing it
10. Building the Light Following Robot
11. Programming the Light Following Robot and testing it
12. Troubleshooting of Robotics.

3. REPAIR AND MAINTENANCE OF POWER SUPPLY, INVERTER AND UPS

Course Content:

1. Study on use of appropriate repair tools and Equipments
2. Identify, place, solder, de-solder and test different SMD discrete components
3. Rework on PCB after identifying defects from SMD soldering and de-soldering
4. Identify different front panel controls and connectors of the given power supply.
5. Open the power supply and identify major sections and power components with heat sinks.
6. Identify various input and output sockets/ connectors of the given SMPS and measure its outputs using a multimeter
7. Identify and replace the faulty components in SMPS used in TVs and PCs
8. Identify front panel control and indicators of Inverter and also understand the use of back panel sockets and connections.
9. Testing of battery mode (Battery – Inverter – Load) in interconnected system
10. Open Top cover and identify various circuit boards in Inverter and also monitor voltages at various test points.
11. Troubleshooting of inverter
12. Identify front and back panel control, indicators, sockets and connections of UPS
13. Identify various circuit boards in UPS and monitor voltages at various test points
14. Troubleshooting of UPS

U19EEM41

INDIAN CONSTITUTION

L	T	P	C	Hrs
2	0	0	-	30

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21.

PROFESSIONAL ELECTIVE PAPERS

U19EEE41	ELECTRICAL SAFETY ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To familiarize the Indian Electricity Rules and Act related with electrical safety.
- To provide a knowledge about electrical shocks and safety precautions.
- To create awareness of the electrical safety associated with installation of electrical equipment.
- To analyze different Hazardous areas for electrical safety.
- To expose knowledge about necessity of safety policy and safety management.

Course Outcomes

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

CO1 - Describe the Indian Electricity (IE) acts and various rules for electrical safety.**(K1)**
CO2 - Expose safety measures to prevent electrical shock in handling of domestic electrical appliances. **(K2)**
CO3 - Evaluate the safety aspects during installation of plant and equipment. **(K3)**
CO4 - Describe the various hazardous area and application of electrical safety in various places. **(K1)**
CO5 - Acquire knowledge about importance of electrical safety training to improve quality management in electrical systems. **(K2)**

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS (9 Hrs)

Objective and scope of electrical safety - National electrical Safety code - Statutory requirements – Indian Electricity acts related to electrical Safety - Safety electrical one line diagram - International standards on electrical safety safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement

UNITII ELECTRICAL SHOCKS AND THEIR PREVENTION (9 Hrs)

Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Shocks due to flash/ Spark over's - Firing shock - Multi storied building - Prevention of shocks - Safety precautions - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Case studies on electrical causes of fire and explosion

UNIT III SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE (9 Hrs)

Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Safe guards for operators - Safety equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation– Agricultural pump installation

UNIT IV HAZARDOUS ZONES (9 Hrs)

Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I(Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations-Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- calculating the required level of arc protection

UNIT V SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS (9 Hrs)

Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical workplace safety practices.

Text books

1. John Cadick, Mary CapelliSchellpfeffer, Dennis Neitzel, Al Winfield, "Electrical Safety Handbook", McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, "Electrical Safety and the Law: A Guide to Compliance", Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, "Electric Safety: Practice and Standards", CRC Press; 1st Edition, 2013.

Reference books

1. Rob Zachariason, "Electrical Safety", Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, "Principles of Electrical Safety", Wiley-IEEE Press; 1st Edition, 2014.

Web References

1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/
6. https://www.constellation.com/energy-101/electrical-safety-tips.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
2	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
3	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	3
5	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE42	COMPUTER AIDED DESIGN FOR ELECTRICAL APPARATUS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the basic concepts of MagNet software for the design of Electrical Machine.
- To get familiar with various design procedure and type of solver used in MagNet software.
- To acquire the knowledge about design procedure of core type and shell type transformer using MagNet software.
- To equip the students with design procedure and analysis of DC Machines using MagNet software.
- To educate the design procedure and analysis of induction machine using MagNet software.

Course Outcomes

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

CO1 - Illustrate the purpose and various components of MagNet software in the design of electrical machines. **(K3)**
CO2 - Develop a basic FEM model, 1D, 2D, 3D using MagNet software. **(K4)**
CO3 - Analyze the various characteristic of DC Machines in magnet software under different loading condition. **(K4)**
CO4 - Evaluate the performance of the core type and shell type transformer design using MagNet software. **(K4)**
CO5 - Interpret and validate the performance characteristic of induction machine using MagNet software. **(K4)**

UNIT I INTRODUCTION TO FINITE ELEMENT ANALYSIS (FEA) (9 Hrs)
History – Purpose of FEA – Discretization model – Mesh refinement – Types of Finite elements Boundary condition – General procedure for FEA (Preprocessing, solution, post processing) – Application of FEA

UNIT II BASICS OF MAGNET SOFTWARE (9 Hrs)
Introduction – Design of Object – Elements – Nodes – Make component in a line – One dimension design of line – Two dimension design of Cylinder, rectangular, cube – three dimension design of fan, wheel, spanner – Initial 2D mesh – Types of solvers.

UNIT III DC MACHINE (9 Hrs)
Principle – EMF equation – speed torque equation – Electrical/Mechanical characteristics starters – Applications – Design of series DC motor: Wireframe model – Solid model – Transient 2D with motion analysis.

UNIT IV TRANSFORMER (9 Hrs)
Principle and operation – EMF equation – Phasor diagram, equivalent circuit – Application – Design of core and shell type transformer: Wireframe model – Solid model – Static analysis.

UNIT V THREE PHASE INDUCTION MOTOR (9 Hrs)
Three phase Induction Motor types and constructional features – Torque equation – Star delta and DOL starter – Applications, design of Squirrel cage Motor: Wireframe model – Solid model Transient 2D with motion analysis.

Text Books

1. J. N. Reddy, "An introduction to the Finite Element Method", Tata McGraw Hill, 3rd Edition, 2005.
2. P. Seshu, "Test book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 10th Edition, 2012.
3. Dr. P. S. Bhimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2007.
4. I. J. Nagrath and D. P. Kothari, "Electrical Machines", Tata McGraw Hill Education, 4th Edition, 2010.
5. M. G. Say, "Performance and design of Alternating Current Machines", John Wiley and Sons Publications, 3rd Edition, 1983.

Reference Books

1. S. S. Rao, "The Finite Element Method in Engineering", Butterworth Heinemann, 3rd Edition, 2004.
2. D. L. Logan, "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002.
3. Arthur Eugene Fitzgerald and Charles Kingsley, "Electric Machinery", Tata McGraw Hill Education Publications, 6th Edition, 2002.

4. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice hall Publications, 2nd Edition, 2003.
5. N. N. Parkar Smith, "Problems in Electrical Engineering", CBS Publishers and Distributers, 9th Edition 1984.

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3. https://nptel.ac.in/courses/108/101/108101090/
4. http://www.nptelvideos.in/2012/12/finite-element-method.html
5. http://www.motor-engineer.net/engineering-center/learn/tutorial-electric-machine-design-hendershot/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
2	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE43	SENSORS AND TRANSDUCERS FOR ELECTRICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course objectives

- To expose the students to various sensors and transducers for measuring physical quantities
- To identify the various resistance based transducers for the measurement of pressure, force, vibration etc.,
- To study about various types of inductive and capacitive transducer for the measurement of strain, motion, position and light
- To study about Sensors used to measure viscosity, humidity , moisture and temperature in industrial applications

Course outcomes

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

CO1 - Familiarize with the fundamentals of Sensors and transducers.**(K2)**
CO2 - Design the signal conditioning circuits using resistive transducers. **(K4)**
CO3 - Identify a specific measurement application for measurement of strain, motion, position and light. **(K3)**
CO4 - Study the electro-chemical sensors and transducers used for density and viscosity measurement. **(K2)**
CO5 - Classify and describe the resistive, inductive and capacitive transducers which are used for measuring various parameters like displacement, temperature, humidity etc., **(K3)**

UNIT I INTRODUCTION **(9 Hrs)**

General concepts and terminology of measurement systems, general input – output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data – Definition – principle of sensing – classification Mechanical and Electromechanical sensors – Transducers and sensors, classification, emerging fields of sensor technologies.

UNIT II RESISTIVE TRANSDUCERS **(9 Hrs)**

Resistive transducers: Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge and its signal conditioning circuits, strain gauge applications: Load and torque measurement, Resistance temperature detector (RTD), design of LDR, Thermistor, hot-wire anemometer and humidity sensor.

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCERS **(9 Hrs)**

Induction potentiometer – Variable reluctance transducers – LVDT –Tacho generators and stroboscope, Proximity transducers – Capacitive transducer and types – Capacitor 14 microphone – capacitive thickness Transducers, capacitive strain transducers. Piezoelectric transducer, magnetostrictive transducer – Digital transducers – Fiber optic transducer – Hall Effect transducer – Photo electric transducer – I/P and P/I transducer- Points to be considered for selecting a transducer

UNIT IV DIGITAL AND SEMICONDUCTOR SENSORS **(9 Hrs)**

Sensors Based On Semiconductor Junctions: Sensors Based On MOSFET Transistors – Charge – Coupled And CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic Based Sensors, Biosensors – Proximity Sensors: Typical Sensor Characteristics, Technologies For Proximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors – real time capacitive senor for automatically measuring liquid level-Current sensor Heading Sensors- MEMS and Nano Sensors, LASER sensors-Tactile sensors- Smart sensors

UNIT V SPECIAL TRANSDUCER **(9 Hrs)**

Viscosity: Saybolt viscometer – Rotameter type and Torque type viscometers - Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers - Moisture: Different methods of moisture measurements – Microwave, IR and NMR sensors, Application of moisture measurement – Moisture measurement in solids - Temperature sensor selection, Installation and Calibration - humidity measurement using capacitive sensor

Text Books

1. D.Patranabis, "Sensors and Transducers", Prentice Hall of India, 2nd Edition, 2004.
2. S. Ranganathan, "Transducer Engineering", Allied Publishers Pvt. Ltd., 1st Edition, 2003.
3. D.V.S. Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2nd Edition, 2011.

Reference Books

1. Ramon Pallas & John G. Webster, "Sensors and Signal Conditioning", John Wiley & Sons, 2nd Edition, 2001.
2. S.M. Sze, "Semiconductor sensors", John Wiley & Sons Inc., 3rd Edition, 2006.
3. John P. Bentley, "Principles of Measurement Systems", Pearson Education, 4th Edition, 2005.

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2. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
3. https://nptel.ac.in/courses/108/108/108108147/
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.1721&rep=rep1&type=pdf
5. https://www.researchgate.net/journal/1726-5479_Sensors_and_Transducers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
2	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
3	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
4	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
5	3	3	3	2	2	2	2	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE44	FINITE ELEMENT ANALYSIS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the basic principles of finite element analysis.
- To gain knowledge on the methods for solving field equations.
- To derive the system equations in one and two dimensions using finite element methods.
- To compute the basic electrical quantities using FEM analysis.
- To provide the basic skills to design and analyze the electrical apparatus using FEM software.

Course Outcomes

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

CO1 - Formulate and compute Electromagnetic Fields from Maxwell's equations. **(K3)**
CO2 - Apply the various solution methods to solve field equations. **(K3)**
CO3 - Apply finite element formulations to solve one and two dimensional problems. **(K3)**
CO4 - Compute the basic quantities like flux and torque using FEM packages. **(K4)**
CO5 - Design and analyze the performance of electrical apparatus by Finite Element Method. **(K4)**

UNIT I INTRODUCTION (9 Hrs)

Review of basic field theory – Maxwell's equations – Constitutive relationships and Continuity equations – Laplace – Poisson and Helmholtz equation – principle of energy conversion –force/torque calculation.

UNIT II BASIC SOLUTION METHODS FOR FIELD EQUATIONS (9 Hrs)

Limitations of the conventional design procedure – need for the field analysis based design problem definition – boundary conditions – Solution by analytical methods: direct integration method –variable separable method – method of images – solution by numerical methods – solution for matrix equations – finite difference method.

UNIT III FORMULATION OF FINITE ELEMENT METHOD (9 Hrs)

Variational formulation – energy minimization – discretisation – shape functions – stiffness matrix –1D and 2D planar and axial symmetry problems – mesh generation in 2D – axi-symmetric applications.

UNIT IV COMPUTATION OF BASIC QUANTITIES USING FEM PACKAGES (9 Hrs)

Basic quantities – energy stored in electric field – capacitance – magnetic field – linked flux – inductance – force – torque – skin effect – resistance – computation of electric field, magnetic field intensity.

UNIT V DESIGN APPLICATIONS (9 Hrs)

Introduction to software packages of finite element analysis – applications to magnetic circuit design – modeling and design of insulators – magnetic actuators – transformers – rotating machines.

Text Books

1. J. N. Reddy, "An Introduction to the Finite Element Method", Tata McGraw-Hill, 3rd Edition, 2005.
2. P. Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., 10th Edition, 2012.

Reference Books

1. Matthew. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 4th Edition 2007.
2. Charles W. Steels, "Numerical Computation of Electric and Magnetic fields", Van Nostrand Reinhold Company, 2nd Edition, 2012.
3. Silvester and Ferrari, "Finite Elements for Electrical Engineers", Cambridge University press, 3rd Edition, 1996.
4. S. J. Salon, "Finite Element Analysis of Electrical Machines", Kluwer Academic Publishers, 1st Edition, 1995.
5. Nicola Biyanchi, "Electrical Machine analysis using Finite Elements", Taylor and Francis Group, CRC Publishers, 1st Edition, 2005.

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2. https://nptel.ac.in/courses/108/106/108106152
3. https://nptel.ac.in/courses/108/101/108101090
4. https://www.youtube.com/watch?v=4c-sPXolD0w
5. https://nptel.ac.in/courses/112/104/112104116/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE45	ENERGY STORAGE TECHNOLOGY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the purpose of energy storage systems.
- To learn the different energy storage techniques.
- To learn about the different types of batteries available for energy storage.
- To impart knowledge regarding on the advanced energy storage systems.
- To learn about the different vehicular energy storage schemes.

Course Outcomes

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

CO1 - Familiarize the need for energy storing.**(K2)**

CO2 - Analyze the various energy storage techniques in the form of electrical, magnetic and chemical systems. **(K3)**

CO3 - Analyze the different batteries and its characteristics used for storing the energy in electric vehicles, nano-tubes etc. **(K4)**

CO4 - Impart the concepts of Superconducting Magnet Energy Storage Systems and super-capacitors in digital cameras, PC cards, electric vehicles, medical applications etc. **(K3)**

CO5 - Analyze the various energy storage techniques used in Electric vehicles and its hybridization concepts, power grid stabilization, rail-system power models etc. **(K4)**

UNIT I ENERGY STORAGE NEEDS (9 Hrs)

Energy Storage Need of energy storage - Different modes of Energy Storage - Potential energy - Pumped hydro storage - Kinetic Energy and Compressed gas system - Flywheel storage, compressed air energy storage - Demand for Portable Energy - Demand and scale requirements - Environmental and sustainability issues.

UNIT II ENERGY STORAGE TYPES (9 Hrs)

Electrical and Magnetic energy storage, Capacitors, electromagnets - Chemical Energy storage - Thermo-chemical, photo-chemical, bio-chemical, electro-chemical, fossil fuels and synthetic fuels - Hydrogen for energy storage, Solar Ponds for energy storage. Electrochemical Energy Storage Systems, Case study on perovskite solar cell.

UNIT III BATTERIES (9 Hrs)

Batteries - Primary, Secondary, Lithium, Solid-state and molten solvent batteries - Lead acid batteries - Nickel Cadmium Batteries - Advanced Batteries - Role of carbon nano-tubes in electrodes - Flow battery operation - Case study on Flexible fiber - shaped metal - air batteries

UNIT IV SUPERCONDUCTING MAGNET ENERGY STORAGE SYSTEMS (9 Hrs)

Superconducting Magnet Energy Storage(SMES) systems - Capacitor and Batteries: Comparison and application - Super capacitor - Electrochemical Double Layer Capacitor (EDLC), principle of working, structure, performance and application, role of activated carbon and carbon nano-tube - Super Capacitors - power calculation – operation and design.

UNIT V VEHICULAR ENERGY STORAGE SYSTEMS (9 Hrs)

Energy storage technologies in hybrid vehicles – flywheel, hydraulic, fuel cell and hybrid fuel cell energy storage system – ultra capacitors – comparison – battery charging control – Case study on Hybridization of different energy storage devices.

Text Books

1. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, "Electrochemical Technologies for Energy Storage and Conversion-2 Volume set", John Wiley and Sons, 1st Edition, 2011.
2. DetlefStolten, "Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications", Wiley, 1st Edition, 2010.
3. Robert Huggins, "Energy Storage: Fundamentals, Materials and Applications", Springer, 2nd Edition, 2016.
4. Andrei G. Ter-Gazarian, "Energy Storage for Power Systems", Institution of Engineering and Technology, 3rd Edition, 2020.

Reference Books

1. Francois Beguin and Elzbieta Frackowiak, "Super capacitors: Materials, Systems and Applications", Wiley-VCH, 1st Edition, 2013.
2. Doughty Liaw, Narayan and Srinivasan, "Batteries for Renewable Energy Storage", The Electrochemical Society, New Jersy, 2010.
3. Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles", CRC Press, 1st Edition, 2003.
4. Chris Mi, M. AbulMasrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", Wiley, 1st Edition, 2011.

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5. https://en.wikipedia.org/wiki/Energy_storage
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COs/POs/PSOs Mapping

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1	3	3	-	2	1	-	-	-	-	-	-	-	3	3	3
2	3	3	-	2	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE

U19ECO41

ENGINEERING COMPUTATION WITH MATLAB

(Common to ICE, EEE, MECH, CIVIL, BME, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand basic representation of Matrices and vectors in MATLAB.
- To learn various programming structures in MATLAB.
- To study built in and user defined functions in MATLAB.
- To become conversant with 2D as well as 3D graphics in MATLAB.
- To make a Graphical User Interface (GUI) in MATLAB in order to achieve interactivity.

Course Outcomes

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

CO1 - State the basics of MATLAB. **(K1)**
CO2 - Explain how to work with matrices, and their operations. **(K2)**
CO3 - Use the MATLAB functions relevant to communication engineering. **(K3)**
CO4 - Demonstrates various file operations in MATLAB. **(K3)**
CO5 - Applying the plotting capabilities of MATLAB effectively to various systems. **(K3)**

UNIT I INTRODUCTION TO MATLAB (9 Hrs)

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions – User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files.

UNIT II LOOPS & CONTROL STATEMENTS (9 Hrs)

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval & lastern commands.

UNIT III PLOTS IN MATLAB & GUI (9 Hrs)

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLARCOMET, Grid axis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions.

UNIT IV MISCELLANEOUS TOPICS (9 Hrs)

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time – Format Conversions - Date & Time, Functions - Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation

UNIT V SIMULINK & APPLICATIONS (9 Hrs)

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2nd order systems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs - Frequency response of filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration.

Text Books

1. RudraPratap, "Getting Started with MATLAB 6.0",1st Edition, Oxford University Press, 2004.
2. Duane Hanselman ,Bruce Little Field, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J.Palm, "Introduction to MATLAB 6.0 for Engineers", McGraw Hill & Co, 2001.

Reference Books

1. M.Herniter, "Programming in MATLAB", Thomson Learning, 2001
2. John OkyereAltla, "Electronics and circuit analysis using MATLAB", CRC press, 1999
3. K.K.Sharma, "MATLAB Demustifyied", Vikas Publishing House Pvt Ltd. 2004

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2. https://www.tutorialspoint.com/matlab/index.htm
3. https://www.cmu.edu/computing/software/all/matlab/
4. https://ctms.engin.umich.edu/CTMS/index.php?aux=Home

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2	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2
3	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2
4	2	2	-	2	3	-	-	-	-	-	-	-	-	1	1
5	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

CONSUMER ELECTRONICS

U19ECO42	(Common to EEE, ICE, CSE, MECH, IT, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To enable the troubleshoot of different types of microphones and loudspeakers.
- To make the students to analyze the working of digital console, digital FM tuner and troubleshoot audio systems.
- To train and test the working of various colour TV.
- To empower them to troubleshoot colour TV receivers.
- To equip them to maintain various electronic home and office appliances.

Course Outcomes

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

CO1 - Describe the fundamental audio characteristics and measurements, operating principles of microphone and loudspeaker. **(K1)**

CO2 - Explain the working of digital console, digital FM tuner and troubleshoot the audio systems. **(K2)**

CO3 - Distinguish the salient features of colour TV and Monochrome and troubleshoot TV camera. **(K2)**

CO4 - Demonstrate various interfaces in digital TV, the working of DTH receiver, CD/DVD players. **(K3)**

CO5 - Explain the working of FAX, Microwave oven, Washing machine, Air conditioner, Refrigerators and camera. **(K2)**

UNIT I AUDIO FUNDAMENTALS AND DEVICES (9 Hrs)

Basic characteristics of sound signal, Microphone - working principle, sensitivity, nature of response. Types of Microphone, Loud speaker - working principle, Woofers and Tweeters, characteristics. Types of Loudspeaker. Sound recording.

UNIT II AUDIO SYSTEMS (9 Hrs)

Introduction to audio system, Digital Console- Block diagram, working principle, applications, FM tuner- concepts of digital tuning, ICs used in FM tuner TD702IT, PA address system- Planning, speaker impedance matching, characteristics, Power amplifier specification.

UNIT III TELEVISION SYSTEMS (9 Hrs)

Monochrome TV standards, Components of TV system, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal, Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera.

UNIT IV TELEVISION RECEIVERS AND VIDEO STANDARDS (9 Hrs)

Colour TV receiver- block diagram, Digital TVs- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI, Digital Video Interface, CD and DVD player: working principles, interfaces

UNIT V HOME AND OFFICE APPLIANCES (9 Hrs)

Microwave Oven: Types, technical specifications. Washing Machine: hardware and software. Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices, picture processing, picture storage

Text Books

1. Bali S.P., "Consumer Electronics", copyright 2008,Pearson Education India
2. Bali R and Bali S.P. "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd.
3. Gulati R.R., "Modern Television practices", 5th Edition, 2015, New Age International Publication (P) Ltd

Reference Books

1. Gupta R.G., 'Audio video systems', 2nd edition,2017, Tata Mcgraw Hill, New Delhi, India
2. Whitaker Jerry & Benson Blair, 'Mastering Digital Television', McGraw-Hill Professional, 2006
3. Whitaker Jerry & Benson Blair, 'Standard handbook of Audio engineering', 2nd edition,2002, McGraw-Hill Professional

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2. http://www.cosc.brocku.ca/Offerings/3P92/seminars/HDTV.ppt
3. http://www.circuitstoday.com/blu-ray-technology-working
4. http://www.freevideolectures.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
2	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
3	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
4	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
5	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CSO41	WEB DEVELOPMENT (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the fundamentals of web application development.
- To understand the design components and tools using CSS.
- To learn the concepts Java Script and programming fundamentals.
- To study about advance scripting and Ajax applications.
- To understand the working procedure of XML.

Course Outcomes

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

CO1 - Develop basic web applications. **(K5)**
CO2 - Design the web applications using CSS. **(K5)**
CO3 - Validate the web pages using java scripts functions. **(K5)**
CO4 - Demonstrate the web 2.0 application to advance scripts. **(K3)**
CO5 - Update the knowledge of XML Data. **(K4)**

UNIT I INTRODUCTION TO WWW & HTML (9 Hrs)

Protocols – Secure Connections – Application and development tools – Web browser – Server definition – Dynamic IP. Web Design: Web site design principles – Planning the site and navigation. HTML: Development process – Html tags and simple HTML forms – Web site structure.

UNIT II STYLE SHEETS (9 Hrs)

Introduction to CSS: Need for CSS – Basic syntax and structure using CSS – Background images – Colors and properties – Manipulating texts using fonts, borders and boxes – Margins, padding lists, positioning using CSS – CSS2

UNIT III JAVA SCRIPTS (9 Hrs)

Client side scripting: Basic JavaScript – Variables – Functions – Conditions – Loops. Applications: Page Validation – Reporting.

UNIT IV ADVANCE SCRIPT (9 Hrs)

JavaScript and objects – DOM and Web browser environments – Forms and Validations – DHTML. AJAX: Introduction – Web applications – Alternatives of AJAX.

UNIT V XML (9 Hrs)

Introduction to XML – Uses of XML – Simple XML – XML key components – DTD and Schemas – Well-formed XML document – Applications of XML – XSL and XSLT.

Text Books

1. Keith Wald, Jason Lengstorf," Pro PHP and jQuery", Paperback, 2016.
2. Semmy Purewal, "Learning Web App Development", O'Reilly Media, 2014.
3. P.J. Deitel and H.M. Deitel," Internet and World Wide Web - How to Program", Pearson Education, 2009.

Reference Books

1. Yakov Fain, Victor Rasputnis, Anatole Tartakovsky and Viktor Gamov, "Enterprise Web Development ", O'Reilly Media, 2014.
2. Steven Suehring, Janet Valade, "PHP, MySQL, JavaScript & HTML5 All-in-One", John Wiley & Sons, Inc, 2013.
3. Uttam K. Roy, "Web Technologies", Oxford University Press, 2010.
4. Rajkamal, "Web Technology", Tata McGraw-Hill, 2009.
5. Shklar, Leon, Rosen, Rich, "Web Application Architecture: Principles, Protocols and Practices", Wiley Publication, 2009.

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2. https://www.geeksforgeeks.org/web-technology/
3. https://www.guru99.com/cakephp-tutorial.html
4. https://www.ithands.com/blog/cms-or-php-framework-which-technology-is-better-for-my-business
5. http://Oriel.ly/learning-web-app

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	-	-	3	-	-	-	2
2	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2
3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	2
4	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2
5	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CSO42	ANALYSIS OF ALGORITHMS (Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To analyze the performance of algorithms in terms of time and space complexity.
- To understand the performance of the algorithms such as divide and conquer, greedy method
- To solve problems using Dynamic Programming and derive the time complexity.
- To solve problems using Backtracking technique and derive the time complexity.
- To solve problems using Branch and Bound technique and derive the time complexity.

Course Outcomes

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

CO1 - Choose the appropriate data structure and algorithm design method for a specified application. **(K2)**
CO2 - Understand the design technique such as divide and conquer, greedy method applied to realistic problems and analyse them. **(K3)**
CO3 - Understand the dynamic programming design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO4 - Understand the backtracking design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO5 - Understand Branch and Bound design technique and how it is applied to realistic problems and analyze them. **(K2)**

UNIT I INTRODUCTION (9 Hrs)

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis – Time complexity, Space complexity, Asymptotic Notation – Big oh notation, Omega notation, Theta notation and Little oh notation.

UNIT II DIVIDE AND CONQUER METHOD AND GREEDY METHOD (9 Hrs)

Divide and Conquer method: Applications – Binary search, Merge sort, Quick sort. Greedy method: General method, applications – Knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III DYNAMIC PROGRAMMING (9 Hrs)

Dynamic Programming: Applications - Multistage graphs, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT IV BACKTRACKING (9 Hrs)

Backtracking: General method, Applications – N-queen problem, Sum of subsets problem, Graph Coloring – Hamiltonian Cycles.

UNIT V BRANCH AND BOUND (9 Hrs)

Branch and Bound: General method, Applications – Traveling sales person problem, 0/1 Knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution.

Text Books

1. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", Galgotia Publications, 2nd Edition, 2010.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms", PHI/Pearson Education, 3rd Edition, 2009.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.

Reference Books

1. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley India, 2006.
2. Sara Baase and Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", Pearson Education Asia, 3rd Edition, 2010.
3. Donald E Knuth, "The Art of Computer Programming, Volume I & II", Addison Wessely, Third Edition, 2011.

4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2006.
5. Harsh Bhasin, “Algorithms Design and Analysis”, Oxford university press, 2016.

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1. https://swayam.gov.in/nd1_noc20_cs71/preview
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
3. https://www.javatpoint.com/daa-tutorial
4. https://www.guru99.com/design-analysis-algorithms-tutorial.html
5. https://www.geeksforgeeks.org/fundamentals-of-algorithms/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	2	1	-	-	-	-	-	2	1	2
2	3	2	3	3	2	2	1	-	-	-	-	-	2	1	2
3	3	3	3	3	2	2	2	-	2	-	-	-	2	1	2
4	3	2	3	3	3	2	2	-	-	-	3	-	2	1	2
5	3	3	3	3	2	2	2	-	-	-	3	2	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CSO43

PROGRAMMING IN JAVA
(Common to ECE, MECH, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To gain and explore the knowledge of Java programming.
- To know the principles of inheritances and packages.
- To learn about the usage of interfaces in Java.
- To gain and explore the event handling in Java.
- To get familiarized to the interfaces generic programming, multithreading concepts.

Course Outcomes

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

CO1 – Write a maintainable java Program for a given algorithm and implement the same. **(K2)**
CO2 – Demonstrate the use of inheritance and package in relevant applications. **(K3)**
CO3 – Construct Java programs using interfaces. **(K3)**
CO4 – Build Java applications using Event Handling. **(K3)**
CO5 – Create Java applications using multithreading and generic programming. **(K3)**

UNIT I INTRODUCTION TO JAVA PROGRAMMING (9 Hrs)

The History and Evolution of Java - Byte code - Java buzzwords - Data types – Variables – Arrays – Operators - Control statements - Type conversion and casting – Objects and classes in Java – Defining classes – Methods - Access specifiers – Static members – Constructors – Finalize method.

UNIT II INHERITANCE AND PACKAGES (9 Hrs)

Arrays – Strings - Packages – Java-Doc comments — Inheritance – Class hierarchy – Polymorphism – Dynamic binding – Final keyword – Abstract classes

UNIT III INTERFACES (9 Hrs)

The Object class – Reflection – Interfaces – Object cloning – Inner classes – Proxies - I/O Streams - Graphics programming – Frame – Components – Working with 2D shapes.

UNIT IV EVENT HANDLING (9 Hrs)

Basics of event handling – Event handlers – Adapter classes – Actions – Mouse events – AWT event hierarchy – Introduction to Swing – Model-View-Controller design pattern – Buttons – Layout Management – Swing Components – Exception handling – Exception hierarchy – Throwing And catching exceptions.

UNIT V GENERIC PROGRAMMING AND MULTITHEARDING (9 Hrs)

Motivation for generic programming – Generic classes – Generic methods – Generic code and virtual machine – Inheritance and generics – Reflection and generics - Multi-threaded programming – Interrupting threads – Thread States – Thread properties – Thread synchronization – Executors – Synchronizers. Enumeration – Autoboxing – Generics.

Text Books

1. Herbert Schildt, "Java: The Complete Reference", TMH Publishing Company Ltd, 11th Edition, 2018.
2. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018.
3. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Sun Microsystems Press, Eighth Edition, 2008.
4. Herbert Schildt, "The Complete Reference JAVA 2", TMH, Seventh Edition, 2006.

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1. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.
2. H.M.Dietel and P.J.Dietel, "Java How to Program", Pearson Education/PHI, 11th Edition, 2017.
3. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Vol 2, Advanced Features, Pearson Education, 8th Edition, 2008.
4. Java for Programmers, P.J. Dietel and H.M Dietel, Pearson Education (OR) JAVA:
5. Programming in Java, S.Malhotra and S.Choudary, Oxford Univ. Press.

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1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM's tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	-	2
2	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19ITO41

DATABASE SYSTEM: DESIGN & DEVELOPMENT

(Common to EEE, ECE, ICE, BME)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

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

CO1 - Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application. **(K2)**
CO2 - Manipulate and build database queries using Structured Query Language and relational algebra. **(K2)**
CO3 - Apply data normalization principles to develop a normalized database for a given application. **(K3)**
CO4 - Explain various storage & indexing techniques, transactions and recovery techniques. **(K2)**
CO5 - Apply tools like NoSQL, MongoDB, Cassandra on real time applications. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Database Systems– Data Models – Database System Architecture - Entity-Relationship Model - ER Diagram-Extended ER Model –ER into Relational Model - **Relational Model**: Structure of Relational Databases, Database Schema, Keys, Tables

UNIT II DATABASE LANGUAGES (9 Hrs)

Relational Algebra – Extended-Relational Algebra Operations – **SQL**: Introduction – DDL – DML –Integrity Constraints-Set Operations-Joins – Nested Queries -View- Trigger - Stored Procedures

UNIT III RELATIONAL - DATA BASE DESIGN (9 Hrs)

Introduction to Schema Refinement – Decomposition – Lossless Decomposition – Functional Dependencies – Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form.

UNIT IV DATA STORAGE (9 Hrs)

RAID - File Organization - Indexing, Ordered Index, Index files, Hashing - Static and dynamic hashing.
Transactions: Transaction concepts and states– Concurrent Execution-Serializability-Concurrency Control: Lock based Protocol - Timestamp based Protocol - **Recovery System**: – Log-Based Recovery – Shadow Paging

UNIT V CASE STUDY (9 Hrs)

NoSQL – Document Database : MongoDB - Multi-dimensional: Cassandra

Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition – McGraw-Hill Higher Education, International Edition, 2019.
2. RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson, 2016

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1. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, —An Introduction to Database Systems‖, 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1st Edition, Kindle Edition

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	1
4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19IT042	R PROGRAMMING (Common to EEE, ECE, ICE, BME, MECH, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of data frames and tables
- To able to appreciate and apply the R programming from a statistical perspective
- To understand the interface model

Course Outcomes

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

CO1 - Create artful graphs to visualize complex data sets and functions. **(K3)**
CO2 - Write more efficient code using parallel R and vectorization. **(K3)**
CO3 - Create data frames and working with tables. **(K3)**
CO4 - Interface R with C/C++ and Python for increased speed or functionality. **(K2)**
CO5 - Find new packages for text analysis, image manipulation &perform statistical analysis. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT II MATRICES AND ARRAYS (9 Hrs)

Matrices, Arrays And Lists Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III DATA FRAMES (9 Hrs)

Data Frames Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions

UNIT IV FUNCTIONS AND ARGUMENTS (9 Hrs)

Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

UNIT V INTERFACING (9 Hrs)

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

Text Books

1. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Books

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

Web References

1. https://www.coursera.org/learn/r-programming
2. https://www.r-project.org/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
2	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
3	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
5	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19MEO41

RAPID PROTOTYPING

(Common to EEE, ECE, ICE, CIVIL, BME)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the development of RP systems.
- To learn the classification of liquid based and solid based rapid prototyping systems.
- To understand the powder based rapid prototyping systems.
- To learn about the materials for rapid prototyping systems.
- To discuss about the reverse engineering and new technologies.

Course Outcomes

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

CO1 - Acquire knowledge about the product development. **(K1)**
CO2 - Analyse the classification of liquid based and solid based rapid prototyping systems. **(K4)**
CO3 - Analyse the powder based rapid prototyping systems. **(K4)**
CO4 - Acquire knowledge about the materials for rapid prototyping systems. **(K1)**
CO5 - Acquire knowledge about reverse engineering and new technologies. **(K1)**

UNIT I INTRODUCTION (9 Hrs)

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format– Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Classification – Liquid based system – Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing.

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS (9 Hrs)

Nature of material – type of material – polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES (9 Hrs)

Introduction, measuring device - contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Text Books

1. Rafiq I. Noorani, Rapid Prototyping, "Principles and Applications", Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", World Scientific, 2nd Edition, 2003.
3. Amitav Ghosh, "Introduction to Rapid Prototyping", North West Publication, New Delhi, 2008.

Reference Books

1. Hopkinson N, R.J.M, Hauge, P M, Dickens, “Rapid Manufacturing – An Industrial revolution for the digital age”, Wiley, 2006
2. Ian gibson, “Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying”, Wiley, 2006
3. Paul F. Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereo lithography”, McGraw Hill 1993.
4. Pham D.T and Dimov, “Rapid Manufacturing”, Springer Verlog 2001.
5. Liou W. Liou, Frank W. Liou ,”Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2007.

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1. https://nptel.ac.in/courses/112/104/112104265/
2. https://www.digimat.in/nptel/courses/video/112104265/L01.html
3. https://nptel.ac.in/courses/112/107/112107078/
4. https://www.youtube.com/watch?v=oDdOqLblmVQ
5. https://www.youtube.com/watch?v=OhNnKTaciVI

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
2	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
3	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
4	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
5	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

MATERIAL HANDLING SYSTEM

U19MEO42

(Common to EEE, ICE, CIVIL, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

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

CO1 - Describe the principal groups of material handling equipments. **(K2)**
CO2 - Describe about the flexible hosting appliances. **(K2)**
CO3 - Explains about the material handling attachments, hook bearings, crane attachment. **(K1)**
CO4 - Illustrate the basic material handling system, selection. **(K1)**
CO5 - Define theergonomics related to material handling equipment. **(K1)**

UNIT I MATERIAL HANDLING EQUIPMENTS (9 Hrs)

Types of intraplant transporting facility - principal groups of material handling equipments - choice of material handling equipment - hoisting equipment, screw type, hydraulic and pneumatic conveyors - general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications - Introduction to control of hoisting equipments.

UNIT II FLEXIBLE HOSTING APPLIANCES (9 Hrs)

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains - selection of hemp rope chains and steel wire rope - selection of ropes - fastening of chain sand ropes - different types of load suspension appliances - fixed and movable pulleys, different types of pulley systems, multiple pulley systems - Chain and rope sheaves and sprockets.

UNIT III MATERIAL HANDLING ATTACHMENTS (9 Hrs)

Load handling attachments - standard forged hook, hook weights, hook bearings, cross piece and casing of hook - crane grab for unit and piece loads - carrier beams and clamps - load platforms and side dump buckets- electric lifting magnets - grabbing attachments for loose materials - crane attachments for handling liquid materials.

UNIT IV MATERIAL HANDLING SYSTEMS (9 Hrs)

Basic Material Handling systems - Selection, Material Handling method - path, Equipment - function oriented systems.

UNIT V METHODS TO MINIMIZE COST OF MATERIAL HANDLING (9 Hrs)

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments - Safety in handling - Ergonomics of Material Handling equipment - Design, Miscellaneous equipment

Text Books

1. Rudenko N, "Materials Handling Equipment", Envee Publishers, New Delhi, 2017.
2. Alexandrov M. P, "Materials Handling Equipment", Mie publications, Moscow, 2013.
3. **White**, John A., **Pence**, Ira W, "Materials handling and logistics", Envee Publishers, New Delhi, 2016.

Reference Books

1. Arora K.C, Vikas V. Shinde, "Aspects of Material handling", Laxmi Publications; First edition, 2015.
2. Siddhartha Ray, "Introduction to Material Handling", New Age International, 2nd Edition, 2017.
3. Chowdary RB, G. R. N. Tagore, "Plant Layout and Material Handling", Khanna publishers; 2nd Edition, 2016.
4. James A Apple, "Plant layout and Material Handling", Krieger Pub Co, 2016.
5. Mahapatra P.B, "Operations Management", PHI, 2016

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1. https://nptel.ac.in/courses/112/102/112102011/
2. https://nptel.ac.in/courses/112/107/112107142/
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://www.youtube.com/watch?v=WXmIdbVDJqE
5. https://www.youtube.com/watch?v=BBWPIByOEfI

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
4	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
5	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19MEO43	POWER PLANTS FOR ELECTRICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basic knowledge of various types of power plants and the factors considered for site selection
- To have a clear idea about the operation of Steam Power Plants with detailed study of the associated equipments and machineries
- To know the working principle, basic components and various modern reactors of the nuclear power plants
- To get a clear knowledge about how power is generated using diesel, gas and combined cycle power plants
- To know the importance in selection of equipments and various tariff structures involved with power plants.

Course Outcomes

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

CO1 - Relate the various conventional energy systems and factors affecting their site selection. **(K2)**
CO2 - Illustrate power generation using steam power plants along with the detailed review on its equipments used. **(K3)**
CO3 - Explain about the nuclear energy production, its equipments and reactors model inside the plant. **(K2)**
CO4 - Express and compare the construction, working principle of various equipments used with diesel, gas turbine and combined cycle power plants. **(K2)**
CO5 - Evaluate economic feasibility and importance of equipment selection to formulate tariff structure for power generating units. **(K4)**

UNIT I INTRODUCTION TO POWER PLANTS (9 Hrs)

Conventional and Non-Conventional Sources of Energy and their availability in India - Different Types of Power Plants - Choice of Power Generation - Basic schemes and constituents of Steam, Nuclear, Diesel and Gas Turbine power stations - Factors to be considered for selection of site - Power Plants in India.

UNIT II STEAM POWER PLANT (9 Hrs)

Layout and types of Steam Power Plants - Fuel and Ash handling systems - Dust collectors – combustion equipment for steam boilers – Economizer and Air pre heater - Mechanical stokers – Pulverizes – Electrostatic precipitator – Draughts – Steam condensers - Cooling Ponds and Cooling Towers - Pollution Controls - Methods of Feed water treatment – Generating efficiency - Power generation capacities of various plants in India.

UNIT III NUCLEAR POWER PLANTS (9 Hrs)

Nuclear energy - Fission and Fusion reaction - Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors - Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium - Uranium reactor (CANDU), Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors - Safety measures for Nuclear Power plants - Case study: Comparison of various nuclear power plants in India.

UNIT IV DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS (9 Hrs)

Layout of Diesel power plants and components - Selection of engine – types and applications - Gas Turbine power plant – Classifications - Layout – Merits – fuels – Combined Cycle Power Plants -Integrated Gasified based Combined Cycle systems - Introduction to Energy storage – Case study: Decentralized Power technologies.

UNIT V POWER PLANT ECONOMICS (9 Hrs)

Economics of Power generation - Cost of Electrical Energy, Expression for cost of electrical energy, interest, depreciation - Power tariff - types - Load distribution parameters - Load curve - load duration Curve – Effect of load on power plant design – Load forecasting – Peak load pricing - Comparison of site selection criteria - Relative merits and demerits - Capital and Operating Cost of different power plants.

Text Books

1. El-Wakil, “Power Plant Technology”, McGraw-Hill, 1st Edition, 2010.
2. Frederick T. Morse, “Power Plant Engineering”, Affiliated East-West Press Pvt Ltd, 7th Edition, 2008.
3. R. K. Rajput, “Power Plant Engineering”, Laxmi Publications, 4th Edition, 2016.

Reference Books

1. Leonjard L. Grigsby, "Electric Power Generation, Transmission and Distribution", CRC Press, 3rd Edition, 2012.
2. Bernhardt G.A. Skrotzki, "Power Station Engineering and Economy", Tata McGraw Hill, Indian Edition, 2001.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Standard Handbook of Power Plant Engineering", McGraw Hill, 2nd Edition, 2012.
4. P.K. Nag, "Power plant Engineering", Tata McGraw-Hill, 4th Edition, 2017.

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3. https://swayam.gov.in/nd1_noc20_me40/preview
4. https://swayam.gov.in/nd1_noc20_me33/preview
5. https://swayam.gov.in/nd1_noc20_ee86/preview
6. https://sga-site.yolasite.com/resources/books/MET401-Power%20Plant%20Engineering.pdf
7. https://www.gpstrategies.com/solution/plant-training-documentation-workforce-development/
8. https://powertechreview.com/industry-4-0-for-power-industry-digitization-tool-for-engineering-for-power-epc-and-power-plants/
9. https://www.tepco.co.jp/en/challenge/energy/thermal/power-g-e.html
10. https://www.e-education.psu.edu/eme801/node/530

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
2	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
3	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
4	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
5	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CEO41

ENERGY AND ENVIRONMENT

(Common to EEE, ECE, MECH, BME, IT, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Explain the importance of energy, classifications of energy sources and energy demand scenario
- Analyze the impacts of energy on environment & sustainability energy options
- Outline the harness of various renewable energy sources
- Discuss the positive and negative aspects of renewable energy along with hybrid technologies
- Explain the importance of biomass energy and its applications

Course Outcomes

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

CO1 - Apply the knowledge of science & engineering to the contemporary issues of Energy for better humankind & environment. **(K3)**

CO2 - Identify, review & analyze the complex problems of Energy crises. **(K4)**

CO3 - Designing solutions for the energy crises in the form of renewable energy systems to meet the needs by understanding the limitations. **(K4)**

CO4 - Understanding the complex problems of impact of energy on environment providing Solutions for sustainable development. **(K5)**

CO5 - Apply biomass energy under relevant technologies. **(K3)**

UNIT I ENERGY (9 Hrs)

Introduction, Importance of energy, role of energy consumption in economic and social transformation, Energy needs and crisis. Energy production, utilization. Global energy scenario, Indian energy scenario, Codes, standards and legislation, Types and classification of energy sources, Conventional & unconventional energy, Renewable sources & Nonrenewable sources of energy advantages, limitations, comparisons

UNIT II ENVIRONMENT (9 Hrs)

Impact of energy on economy & environment, Concerns about change in global temperature, Regional impacts of temperature change, Global warming, Greenhouse effect, Acid rain, Ozone layer depletion, International agreements on environment, Indian environment degradation, Environmental laws , Water Act 1974 (Prevention & control of pollution), The environment protection act 1986 , Air act ,Energy for sustainable development.

UNIT III HYDROPOWER ENERGY (9 Hrs)

Introduction, Advantages of hydropower generation, Site selection, layout of hydro power plant, components & working, classifications, power station, structure and control, case study, Numerical Nuclear Energy - Introduction, Site selection, layout of power plant, components & working, reactors, adverse effects, safety measures, disposal of nuclear waste, case study, Numerical.

UNIT IV SOLAR ENERGY (9 Hrs)

Introduction, Advantages, Sun as source of energy, Site selection, layout of power plant components & working, classifications, Types of collectors, collection systems efficiency, Solar cells, cell technology, PV technology characteristics of PV, case study, Numerical Wind Energy - Introduction, advantages/limitations, history of wind energy, global & Indian wind energy scenario Site selection, layout of power plant, components &working, classifications, case study.

UNIT V BIOMASS ENERGY (9 Hrs)

Introduction, advantages/limitations, Photosynthesis, biomass fuel, biomass conversion technologies, biomass gasification, biogas from waste biomass, factors affecting biogas generation, types of biogas plant – KVIC & janata model , Biomass programme in India, case study, Numerical Hybrid / Unconventional Energy Technologies: Introduction, need, advantages, Technologies.

Text Books

1. Trivedi R.R. and Jalka K.R, "Energy Management", Commonwealth Publication, 2017.
2. Diamant R.M.E., "Total Energy", Pergamon, Oxford Publishers, 2017.
3. N.G. Ajjanna " Energy auditing & demand side management" first edition, Gouthami Publications, Shimoga
4. Chakrabarti, M.L.Soni, P.V. Gupta,U.S. Bhatnagar " Power system Engineering" 2001, Dhanpat Rai & Co, New Delhi.
5. D. P. Kothari, K.C Singal, Rajesh Ranjan, "Renewable Energy sources and Emerging Technologies", second edition , PHI , India

Reference Books

1. Boyle G, Everett B and Ramett J, "Energy systems and sustainability", Oxford University Press, 2018
2. "Pollution Control Acts, Rules and Notifications", CPCB, Pollution Control series, PC/2/2014, Vol.I,2014
3. Peavy.H, Rowe.D and Tchobanoglous, G., Environmental Engineering, Tata McGraw-Hill, 2013
4. S.Rao, Dr. BB Parulekar "Energy Technologies" Khanna Publications , New Delhi
5. David M Buchla, Thomas E Kissel, Thomas L Floyd "Renewable Energy systems" Pearson, India
6. Godfrey Boyle, "Renewable Energy power for sustainable future" oxford Publications , New Delhi

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2. https://swayam.gov.in/nd1_noc20_ce23/preview
3. www.iucn.org
4. www.cites.org
5. www.thesummitbali.com/
6. http://engineering geology.gov.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
2	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
3	3	3	3	3	2	3	3	3	2	3	2	3	3	3	3
4	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
5	3	3	2	3	2	3	2	3	2	3	2	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CEO42	BUILDING SCIENCE AND ENGINEERING (Common to EEE, MECH, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the basic materials in civil engineering and Have an insight to different types of doors, windows.
- Analyze the types of foundation.
- Gain the knowledge of bylaws for the planning of a public/private building.
- Understand the different methods and materials of interiors for building.
- Understand the concept of landscaping.

Course Outcomes

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

CO1 - Apply the knowledge of engineering fundamentals to understand, the characteristics of basic civil engineering materials. **(K2)**

CO2 - Apply the knowledge of engineering fundamentals and analyze the types of foundation **(K2)**

CO3 -Develop plan, section and apply bylaws and investigate causes and remedies for cracks, have an insight to cost effective construction. **(K3)**

CO4 - Understand, design and work in a team and develop the interiors. **(K5)**

CO5 - Understand, design and work in a team and develop landscaping for buildings as per design guidelines. **(K5)**

UNIT I MATERIALS FOR CONSTRUCTION (9 Hrs)

Cement concrete: introduction, ingredients of cement, grade of concrete, properties..Steel :definition , types of steel, uses of steel, market forms of steel used in construction Doors and windows : location of doors and windows, types of doors, types of windows, Stairs : requirements of good stairs, types , stairs of different materials

UNIT II FOUNDATION AND STRUCTURAL MEMBERS (9 Hrs)

Selection of site, substructure, objectives of foundation, site inspection, soils, loads on foundations, essential requirements of good foundation, types of foundation, failure of foundation and remedial measures. Structural members: columns, lintels, roofing (flat roof and sloped roof), flooring (types of floors and floor covering), damp proofing, plastering.

UNIT III BUILDING PLANNING AND MAINTAINENCE (9 Hrs)

Plan, section and elevation .Introduction, classification of buildings, components of buildings, building bylaws, orientation of buildings, ventilation, acoustic requirements, Superstructure: introduction, brick masonry, stone masonry and RCC. Building maintenance Deterioration of concrete, deterioration of masonry works, prevention of cracks and leaks, cost effective construction, anti-termite treatment in building.

UNIT IV INTERIOR DESIGN (9 Hrs)

Functional requirement of interior designer, basic elements of interior design, design problems :Interior design for spacious rooms, comfortable rooms, theme rooms, living area, cooking area, drinking area dining area, home offices, sleeping area, bathrooms, public/private buildings

UNIT V LANDSCAPING (9 Hrs)

Elements of Landscape architecture, specialization in landscape, landscape products, landscape materials, and water efficient landscaping, design guidelines for interior landscape

Text Books

1. Basic civil engineering : M.S.palanichamy, fourth edition Tata mcgraw hill limited ,2005
2. Basic civil engineering : sateeshgopi ,pearson, 2010
3. Building Science: Concepts and Applications: Jens Pohl, Wiley-Blackwell, 2011

Reference Books

1. Basic civil engineering : Dr.B.C.Punmia, Ashok kumarjain, ArunkumarjainLaxmi publications year of publication ,2004

2. Basic civil engineering : S.S.Bhavikatti New Age International Limited, 2010
3. Interior Design and Decoration: Seetharaman P.2019

Web References

1. https://www.youtube.com/watch?v=XsFeVuVQE-E
2. https://www.youtube.com/watch?v=LYvDoy7MtkE
3. https://www.youtube.com/watch?v=zjZVlFt3WQY
4. https://www.youtube.com/watch?v=pYAXsbsFBC8
5. https://www.youtube.com/watch?v=PIY63QacRTc

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	3	3	3	2	3	3	3	3	3	3
2	3	3	2	3	1	3	3	3	2	3	3	3	3	3	3
3	3	3	2	3	1	3	3	3	2	3	3	3	3	3	3
4	3	3	2	3	2	3	3	3	2	3	3	3	3	3	3
5	3	3	2	3	2	3	2	3	2	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19BMO41

MEDICAL ELECTRONICS

(Common to EEE, ECE, CSE, IT, ICE, MECH, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To gain knowledge about the various physiological parameters measurements.
- To understand the various biochemical and nonelectrical sensors.
- To study about the assist devices.
- To gain knowledge on surgical equipments and telemetry in healthcare.
- To understand the concepts of recent advancements in healthcare.

Course Outcomes

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

CO1 - Explain the electro- physiological parameters and bio-potentials recording. **(K2)**
CO2 - Measure the biochemical and non-electrical physiological parameters. **(K2)**
CO3 - Interpret the various assist devices used in the hospitals. **(K3)**
CO4 - Identify physical medicine methods and biotelemetry. **(K3)**
CO5 - Analyse recent trends in medical instrumentation. **(K3)**

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9 Hrs)

Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT (9 Hrs)

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES (9 Hrs)

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY (9 Hrs)

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION (9 Hrs)

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip, Cryogenic Technique.

Text Books

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2011.
2. R. S. Khandpur, “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2017.
3. John G. Webster, “Medical Instrumentation Application and Design”, Third Edition, Wiley India, 2012

Reference Books

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2011.
2. R. Anandanatarajan, “Biomedical Instrumentation and Measurements”, Second Edition, PHI Learning, 2016.
3. Mandeepsingh, “Introduction to Biomedical Instrumentation”, Second Edition, Prentice Hall of India, New Delhi, 2014.
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Cengage Learning, 2012
5. C.RajaRao, SujoyK.Guha, “Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2010.

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2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapetic systems
3. https://nptel.ac.in/courses/127/106/127106136/
4. medicinenet.com/script/main/art.asp?articlekey=6414
5. https://www.verywellhealth.com/cardiopulmonary-bypass-machine-used-for-surgery-3157220

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	1	-	-	-	-	1	-	1
2	3	2	-	2	2	2	-	1	-	-	-	-	1	-	1
3	3	-	-	2	3	3	-	1	-	-	-	-	1	-	1
4	3	-	2	2	3	2	-	1	-	-	-	-	1	-	1
5	3	2	2	3	3	2	-	1	-	-	-	-	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19BMO42	TELEMEDICINE (Common to EEE, ECE, CSE, IT, ICE)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the classification of telemetry.
- To gain knowledge about biotelemetry principles.
- To know about the applications of telemetry in various fields.
- To provide the idea about the value of telemedicine.
- To know the various applications in telemedicine.

Course Outcomes

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

CO1- Categorize the telemetry systems. **(K2)**
CO2- Understand the principles of biotelemetry in transmission of biological signals. **(K3)**
CO3 - Apply the various Biotelemetry applications for diagnostics. **(K3)**
CO4- Acquire clear idea about the fundamentals of telemedicine. **(K2)**
CO5 - Know about various applications of telemedicine. **(K3)**

UNIT I INTRODUCTION TO TELEMETRY (9 Hrs)

Basic system, Classification, Non electrical telemetry systems, Mechanical and Pneumatic type, Voltage and Current telemetry systems, Local transmitters and Converters, Frequency telemetry system, Power Line carrier communication (PLCC).

UNIT II BIOTELEMETRY (9 Hrs)

Radio Telemetry principles, FM, AM, PCM, Transmission of biological data through radio telemetry.

UNIT III APPLICATION OF BIOTELEMETRY (9 Hrs)

Wireless Telemetry - Single Channel and Multi-channel Telemetry systems, Multi Patient Telemetry, Implantable Telemetry Systems, Ambulatory patient monitoring.

UNIT IV FUNDAMENTALS OF TELEMEDICINE (9 Hrs)

History and advancements in telemedicine, Benefits of telemedicine, Functional Block of a telemedicine system, Use of computers in distance mode of healthcare delivery, Familiarizing with technology of telemedicine, scanner, electro stethoscope, data reception equipment, Scope for telemedicine, Limitations of telemedicine.

UNIT V APPLICATIONS OF TELEMEDICINE (9 Hrs)

Telemedicine in Neuroscience, Telecardiology, Telepathology, Telepediatrics, Telepharmacy, Telepsychiatry and mental health, Veterinary.

Text Books

1. Marilyn J. Field, "A Guide to Assessing Telecommunications in Health Care", Academy Press, 4th Edition, 2011.
2. R. L. Bashshur, J. H. Sanders and G. Shannon, "Telemedicine: Theory and Practice", Springer, 8th Edition, 2014.
3. Olga (EDT), Ferre Roca, M. Sosa, "Handbook of Telemedicine", IOS press, 3rd Edition, 2009.

Reference Books

1. Bemmel, J.H. van, Musen, M.A. (Eds.), "Handbook of Medical Informatics", Springer, 2nd Edition, 2010.
2. W. Simpson, "Video over IP. A practical guide to technology and applications", Focal Press, Elsevier, 9th Edition, 2009.
3. Ferrer-Roca, O., Sosa-Iudicissa, "Handbook of Telemedicine", IOS Press, 2012
4. A. C. Norris, "Essentials of Telemedicine and Telecare", Wiley, 8th Edition, 2017.
5. R. Wotton, J. Craig, V. Patterson (Eds.), "Introduction to Telemedicine", Royal Society of Medicine Press Ltd., 5th Edition, 2014.

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2. https://www.who.int/goe/publications/goe_telemedicine_2010.pdf
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5927731/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	2	1	-	1	-	2	-	-	-	-	-
2	3	2	-	-	2	1	-	1	-	2	-	-	-	-	-
3	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-
4	3	2	-	2	2	1	-	1	-	2	-	-	-	-	1
5	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CCO41	BASIC DBMS (Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand about basics of Database Management System.
- To provide a general introduction to relational model and relational algebra.
- To study about normalization and SQL.
- To acquire knowledge about storage indexing and transaction management.
- To gain knowledge about the backup and recovery in database.

Course Outcomes

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

CO1 – Explain the concept of database management system. (**K2**)
CO2 – Create conceptual data model using entity relationship diagram. (**K2**)
CO3 – Analyze the various normalization. (**K4**)
CO4 – Describe the concept of storage indexing and transactions. (**K2**)
CO5 – Explain the database recovery and security. (**K2**)

UNIT I INTRODUCTION TO DATABASE MANAGEMENT (9 Hrs)

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture-Entity - relationship data model

UNIT II THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA (9 Hrs)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT III STRUCTURED QUERY LANGUAGE AND NORMALIZATION (9 Hrs)

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security. Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT IV STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 Hrs)

Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree. Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT V DATABASE BACKUP, RECOVERY AND SECURITY (9 Hrs)

Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

Text Books

1. Gupta.G.K, "Database Management Systems", Tata McGraw Hill, 2011
2. Abraham Silberschatz, Henry F Korth, S Sudharshan, Database System Concepts 7th Edition, McGraw-Hill International Edition, 2019.
3. RamezElmasri and ShamkantNavathe, Durvasula V L N Somayajulu, Shyam K Gupta, "Fundamentals of Database Systems", Pearson Education, USA, 2018.

Reference Books

1. Silberschatz, Korth.H and Sudarshan.S, "Database System Concepts", 6th Edition, McGraw-Hill International, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, "Database System The Complete Book, 1st Edition, Pearson 2002.
3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System, 8th Edition, Pearson Education-2006.

4. Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2014.
5. RamezElmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.

Web References

1. https://docs.oracle.com/cd/E11882_01/server.112/e41084/toc.htm MySQL Online Documentation
2. http://dev.mysql.com/doc/
3. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
4. http://www.w3schools.com/
5. https://www.codecademy.com/learn/learn-

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1
2	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1
3	3	3	1	-	1	-	-	-	-	-	1	1	-	-	1
4	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1
5	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19CCO42	INTRODUCTION TO COMMUNICATION SYSTEMS (Common to EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide basic knowledge of signals
- To study the various analog and digital modulation techniques
- To study the pulse modulation and multiplexing
- To infer Digital transmission techniques
- To provide knowledge about various multiple access technology and advanced communication techniques

Course Outcomes

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

CO1 - Comprehend the basic Characteristics of the signals. (**K2**)
CO2 - Comprehend needs of modulation and various analog modulation techniques. (**K2**)
CO3 - Illustrate pulse modulation and multiplexing. (**K3**)
CO4 - Explain Digital transmission techniques. (**K2**)
CO5 - Describe multiple access techniques and advanced communication systems. (**K2**)

UNIT I SIGNAL ANALYSIS (9 Hrs)

Introduction to Signals- Representation and classification of Signals, Representation of signal in frequency domain, introduction to Spectrum of signal- Introduction to Fourier series and Fourier Transform

UNIT II ANALOG COMMUNICATION (9 Hrs)

Need for Modulation-– Block diagram of analog communication System- Amplitude Modulation – AM, DSBSC, SSBSC, modulators and demodulators – Angle modulation – PM and FM – modulators and demodulators – Superheterodyne receivers

UNIT III PULSE COMMUNICATION (9 Hrs)

Low pass sampling theorem – Quantization – PAM – PCM, DPCM, DM, and ADPCM And ADM - Time Division Multiplexing, Frequency Division Multiplexing

UNIT IV DIGITAL COMMUNICATION (9 Hrs)

Comparison of digital and analog communication system- Block diagram of digital communication system Phase shift keying – BPSK, DPSK, QPSK

UNIT V MULTIPLE ACCESS TECHNIQUES AND ADVANCED COMMUNICATION (9 Hrs)

Multiple Access techniques- FDMA, TDMA, CDMA- Frequency reuse, Handoff- Block diagram of advanced communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.

Text Books

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", 3rd edition, TMH 2007
2. S. Haykin, "Digital Communications", John Wiley, 2005
3. B.P.Lathi," Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2007

Reference Books

1. H P Hsu, Schaum Outline Series, "Analog and Digital Communications", TMH 2006
2. B.Sklar," Digital Communications Fundamentals and Applications", 2nd edition Pearson Education 2007.
3. A.Bource Carson and Paul B.Crilly, "Communication Systems", 5th Edition, McGraw Hill, 2010
4. Torrieri, Don, "Principles of Spread Spectrum Communication Systems", Springer, 2015
5. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001.

Web References

1. www.allaboutcircuits.com
2. https://nptel.ac.in/courses/108/102/108102096/
3. http://www.electronics-tutorials.ws
4. www.tutorialspoint.com
5. https://nptel.ac.in/courses/108/104/108104091/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	1
4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

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ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS 2020
(R-2020)

CURRICULUM AND SYLLABI

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

Mission

M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation:

To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To promote proficiency in the field of Electrical and Electronics Engineering by creating a stimulating environment for research, innovation and entrepreneurship

Mission

M1: Quality Education:

To impart high quality technical education with problem solving capabilities by innovative pedagogy in emerging technologies.

M2: Industrial and Societal Needs:

To cater the dynamic needs of the industry and society by strengthening industry-institute interaction.

M3: Research and Innovation:

To nurture the spirit of research attitude by carrying out innovative technologies pragmatically.

M4: Placement and Entrepreneurship:

To inculcate the professionalism in career by advancing synergetic skills to compete in the corporate world.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

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

PO2: Problem analysis:

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

PO3: Design/development of solutions:

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

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

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

PO7: Environment and sustainability:

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

PO8: Ethics:

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

PO9: Individual and team work:

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

PO10: Communication:

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

PO11: Project management and finance:

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

PO12: Life-long learning:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Professional Knowledge:

To possess strong educational foundation in Electrical and Electronics Engineering to attain successful career with professional responsibility

PEO2: Innovative Skills:

To enrich the skills to design and develop innovative solutions for engineering problems in a multidisciplinary environment

PEO3: Ethics:

To actively embrace leadership qualities for achieving professional goals with ethical values

PEO4: Adaptability:

To enhance intellectual competency along with technical skills by adapting to the current trends through eternal learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Core Proficiency:

Utilize the engineering core knowledge to identify, formulate, design, and investigate the complex engineering problems of Power Electronics, Electrical Machines and Power Systems.

PSO2: Cutting Edge Technologies:

Explore the new cutting edge technologies in the field of Electric Vehicle, Automation, Artificial Intelligence, Robotics and Renewable Energy to compete in global market

PSO3: Design and Evolution:

Capability to comprehend the technological advancements with the usage of modern design tools for analysing and designing systems to confront the rapid pace of industrial innovations.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Science (HS)	7
2	Basic Sciences(BS)	16
3	Engineering Sciences (ES)	18
4	Professional Core (PC)	84
5	Professional Electives (PE)	18
6	Open Electives (OE)	9
7	Project Work and Internship (PW)	12
8	Employability Enhancement Courses (EEC*)	-
9	Mandatory courses (MC*)	-
	Total	**164**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	-	-	1	1	3	-	1	1	07
2	Basic Sciences(BS)	3	3	3	3	4	-	-	-	16
3	Engineering Sciences (ES)	7	3	4	4	-	-	-	-	18
4	Professional Core (PC)	8	15	14	8	11	15	9	4	84
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	3	-	3	3	-	09
7	Project Work (PW)	-	-	-	-	-	-	2	8	10
8	Internship (PW)	-	-	-	-	-	-	2	-	02
9	Employability Enhancement Courses (EEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
	Total	**18**	**21**	**22**	**22**	**21**	**21**	**20**	**19**	**164**

**** EEC and MC are not included for CGPA calculation***

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST101	Engineering Mathematics – I Calculus and Linear Algebra	BS	2	2	0	3	25	75	100
2	U20EST101	Programming in C	ES	3	0	0	3	25	75	100
3	U20EST119	Engineering Mechanics	ES	2	2	0	3	25	75	100
4	U20EET101	Electrical Engineering	PC	3	0	0	3	25	75	100
5	U20EET102	Electronic Devices	PC	3	0	0	3	25	75	100
Practical										
6	U20ESP102	Programming in C Lab	ES	0	0	2	1	50	50	100
7	U20EEP101	Electrical Engineering Lab	PC	0	0	2	1	50	50	100
8	U20EEP102	Electronics Lab - I	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
9	U20EEC1XX	Certification Course – I**	EEC	0	0	4	-	100	-	100
Mandatory Course										
10	U20EEM101	Induction Program	MC	3 Weeks			-	-	-	-
							18	375	525	900

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST215	Engineering Mathematics –II Multiple Integrals and Transforms	BS	2	2	0	3	25	75	100
2	U20EST238	Basic Engineering Science for Electrical Engineering	ES	3	0	0	3	25	75	100
3	U20EET203	Electric Circuit Analysis	PC	2	2	0	3	25	75	100
4	U20EET204	Electrical Machines – I	PC	3	0	0	3	25	75	100
5	U20EET205	Electronic Circuits	PC	3	0	0	3	25	75	100
6	U20EET206	Digital Electronics	PC	3	0	0	3	25	75	100
Practical										
7	U20EEP203	Electric Circuit Analysis Lab	PC	0	0	2	1	50	50	100
8	U20EEP204	Electrical Machines Lab- I	PC	0	0	2	1	50	50	100
9	U20EEP205	Electronics Lab – II	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20EEC2XX	Certification Course – II **	EEC	0	0	4	-	100	-	100
11	U20EES201	Skill Development Course 1: Demonstration of Basic Engineering Science	EEC	0	0	2	-	100	-	100
Mandatory Course										
12	U20EEM202	Environmental Science	MC	2	0	0	-	100	-	100
							21	600	600	1200

 # Professional Electives are to be selected from the list given in Annexure I

$ Open electives are to be selected from the list given in Annexure II

*** Certification courses are to be selected from the list given in Annexure III*

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST320	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U20EST356	Data Structures	ES	2	2	0	3	25	75	100
3	U20EET307	Electrical Machines – II	PC	3	0	0	3	25	75	100
4	U20EET308	Linear Integrated Circuits	PC	3	0	0	3	25	75	100
5	U20EET309	Electromagnetic Theory	PC	3	0	0	3	25	75	100
6	U20EET310	Power Plant Engineering	PC	3	0	0	3	25	75	100
Practical										
7	U20HSP301	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U20ESP357	Data Structures Lab	ES	0	0	2	1	50	50	100
9	U20EEP306	Electrical Machines Lab- II	PC	0	0	2	1	50	50	100
10	U20EEP307	Linear Integrated Circuits Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20EEC3XX	Certification Course – III **	EEC	0	0	4	-	100	-	100
12	U20EES302	Skill Development Course 2*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20EEM303	Physical Education	MC	0	0	2	-	100	-	100
							22	650	650	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST430	Probability and Statistics	BS	2	2	0	3	25	75	100
2	U20EST467	Programming in JAVA	ES	2	2	0	3	25	75	100
3	U20EET411	Measurements and Instrumentation for Electrical Engineering	PC	3	0	0	3	25	75	100
4	U20EET412	Microprocessor and Microcontroller	PC	3	0	0	3	25	75	100
5	U20EEE4XX	Professional Elective - I #	PE	3	0	0	3	25	75	100
6	U20XXO4XX	Open Elective – I $	OE	3	0	0	3	25	75	100
Practical										
7	U20HSP402	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U20ESP468	Programming in JAVA Lab	ES	0	0	2	1	50	50	100
9	U20EEP408	Measurements and Instrumentation Lab	PC	0	0	2	1	50	50	100
10	U20EEP409	Microcontroller and its applications Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20EEC4XX	Certification Course – IV **	EEC	0	0	4	-	100	-	100
12	U20EES403	Skill Development Course 3*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20EEM404	NSS / NCC	MC	0	0	2	-	100	-	100
							22	650	650	1300

**** Skill Development Courses (2 and 3) are to be selected from the list given in Annexure IV***

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST542	Numerical Methods and Optimization	BS	3	0	0	3	25	75	100
2	U20EET513	Power Electronics and Drives	PC	3	0	0	3	25	75	100
3	U20EET514	Control Systems	PC	2	2	0	3	25	75	100
4	U20EET515	Transmission and Distribution	PC	3	0	0	3	25	75	100
5	U20EEE5XX	Professional Elective - II #	PE	3	0	0	3	25	75	100
6	U20XXO5XX	Open Elective-II $	HS	3	0	0	3	25	75	100
Practical										
7	U20BSP543	Numerical Methods and Optimization Lab	BS	0	0	2	1	50	50	100
8	U20EEP510	Power Electronics and Drives Lab	PC	0	0	2	1	50	50	100
9	U20EEP511	Control Systems Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20EEC5XX	Certification Course – V **	EEC	0	0	4	-	100	-	100
11	U20EES504	Skill Development Course 4: Foreign Language/ IELTS - I	EEC	0	0	2	-	100	-	100
12	U20EES505	Skill Development Course 5: Presentation Skill using ICT	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20EEM505	Indian Constitution	MC	2	0	0	-	100	-	100
							21	700	600	1300

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20EET616	Embedded System	PC	3	0	0	3	25	75	100
2	U20EET617	Renewable Energy	PC	3	0	0	3	25	75	100
3	U20EET618	Power System Analysis	PC	3	0	0	3	25	75	100
4	U20EET619	Electrical Machine Design	PC	3	0	0	3	25	75	100
5	U20EEE6XX	Professional Elective - III #	PE	3	0	0	3	25	75	100
6	U20XXO6XX	Open Elective – III $	OE	3	0	0	3	25	75	100
Practical										
7	U20EEP612	Embedded System Lab	PC	0	0	2	1	50	50	100
8	U20EEP613	Renewable Energy Lab	PC	0	0	2	1	50	50	100
9	U20EEP614	Power System Analysis Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
10	U20EEC6XX	Certification Course – VI **	EEC	0	0	4	-	100	-	100
11	U20EES606	Skill Development Course 6: Foreign Language / IELTS - II	EEC	0	0	2	-	100	-	100
12	U20EES607	Skill Development Course 7: Technical Seminar	EEC	0	0	2	-	100	-	100
13	U20EES608	Skill Development Course 8: NPTEL / MOOC - I	EEC	0	0	0	-	100	-	100
Mandatory Course										
14	U20EEM606	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	800	600	1400

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20EET720	Industrial Automation and Control	PC	3	0	0	3	25	75	100
2	U20EET721	Electrical and Hybrid Vehicle	PC	3	0	0	3	25	75	100
3	U20EEE7XX	Professional Elective – IV #	PE	3	0	0	3	25	75	100
4	U20XXO7XX	Open Elective – IV $	OE	3	0	0	3	25	75	100
Practical										
5	U20HSP703	Business Basics for Entrepreneur	HS	0	0	2	1	100	-	100
6	U20EEP715	Industrial Automation and Control Lab	PC	0	0	2	1	50	50	100
7	U20EEP716	Electrical and Hybrid Vehicle Lab	PC	0	0	2	1	50	50	100
8	U20EEP717	Electrical Software Simulation Lab	PC	0	0	2	1	50	50	100
Project Work										
9	U20EEW701	Project Phase – I	PW	0	0	4	2	50	50	100
10	U20EEW702	Internship / Inplant Training	PW	-	-	-	2	100	-	100
Mandatory Course										
11	U20EEM707	Professional Ethics	MC	2	0	0	-	100	-	100
							20	600	500	1100

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20EET822	Protection and Switchgear	PC	3	0	0	3	25	75	100
2	U20EEE8XX	Professional Elective – V #	PE	3	0	0	3	25	75	100
3	U20EEE8XX	Professional Elective – VI #	PE	3	0	0	3	25	75	100
Practical										
4	U20HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
5	U20EEP818	Comprehensive Viva	PC	0	0	2	1	50	50	100
Project Work										
6	U20EEW803	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
7	U20EES809	Skill Development Course 9: NPTEL / MOOC-II	EEC	0	0	0	-	100	-	100
							19	365	335	700

Annexure – I
PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE401	Electrical Safety Engineering
2	U20EEE402	Computer Aided Design for Electrical Apparatus
3	U20EEE403	Sensors and Transducers for Electrical Engineering
4	U20EEE404	Finite Element Analysis
5	U20EEE405	Energy Storage Technology
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE506	Utilization of Electrical Energy
2	U20EEE507	Electrical Traction
3	U20EEE508	Electrical Energy Audit and Conservation
4	U20EEE509	Automotive Electronics for Electrical Engineering
5	U20EEE510	Industrial Electrical System
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE611	Smart Grid
2	U20EEE612	High Voltage Engineering
3	U20EEE613	Modern Power Electronic Converters
4	U20EEE614	Digital Signal Processing
5	U20EEE615	Fuzzy and Neural Systems
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE716	Distributed Generation and Microgrids
2	U20EEE717	Advanced Control Systems
3	U20EEE718	Power Electronics for Renewable Energy Systems
4	U20EEE719	Power System Operation and Control
5	U20EEE720	Special Electrical Machines
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE821	Power System Economics
2	U20EEE822	FACTS
3	U20EEE823	SMPS and UPS
4	U20EEE824	Soft Computing Techniques
5	U20EEE825	Fundamentals of Solar photovoltaic system and applications
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE826	Power Electronics Applications in Power Systems
2	U20EEE827	EHV AC and DC transmission
3	U20EEE828	Restructured Power System
4	U20EEE829	Power System Stability
5	U20EEE830	Robotics and Control

Annexure – II

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester IV)				
1	U20EEO401	Solar Photovoltaic Fundamental and applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
2	U20EEO402	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE, BME, IT, CSE, FT
3	U20ECO401	Engineering Computation with MATLAB	ECE	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, Mechatronics
4	U20ECO402	Consumer Electronics	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U20CSO401	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
6	U20CSO402	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics
7	U20ITO401	Database System: Design & Development	IT	EEE, ECE, ICE, CCE, BME
8	U20ITO402	R programming	IT	EEE, ECE, ICE, CCE, BME, MECH, Mechatronics
9	U20ICO401	Sensors and Transducers	ICE	ECE, CSE, IT, MECH, CIVIL, CCE, AI&DS, FT
10	U20ICO402	Control System Engineering	ICE	CSE, IT, MECH, CCE, AI&DS
11	U20MEO401	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
12	U20MEO402	Material Handling System	MECH	EEE, ICE, CIVIL, Mechatronics
13	U20MEO403	Industrial Engineering for Textile	MECH	FT
14	U20CEO401	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, Mechatronics, FT
15	U20CEO402	Building Science and Engineering	CIVIL	EEE, MECH, BME
16	U20BMO401	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics, AI&DS
17	U20BMO402	Telemedicine	BME	EEE, ECE, CSE, IT, ICE, CCE, AI&DS
18	U20CCO401	Basic DBMS	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
19	U20CCO402	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics

20	U20ADO401	Knowledge Representation and Reasoning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
21	U20ADO402	Introduction to Data Science	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
Open Elective – II / Open Elective – III				
1	U20HSO501/ U20HSO601	Product Development and Design	MBA	**Common to B. Tech** (Offered in Semester V for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**) (Offered in Semester VI for **CSE, IT, MECH, Mechatronics, AI&DS**)
2	U20HSO502/ U20HSO602	Intellectual Property and Rights	MBA	
3	U20HSO503/ U20HSO603	Marketing Management and Research	MBA	
4	U20HSO504/ U20HSO604	Project Management for Engineers	MBA	
5	U20HSO505/ U20HSO605	Finance for Engineers	MBA	
Open Elective – II / Open Elective – III (Offered in Semester V for **CSE, IT, MECH, Mechatronics, AI&DS**) (Offered in Semester VI for **EEE, ECE, ICE, CIVIL, BME, CCE, FT**)				
1	U20EEO503/ U20EEO603	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AI&DS, FT
2	U20EEO504/ U20EEO604	Industrial Drives and Control	EEE	ECE, ICE, MECH, Mechatronics, AI&DS
3	U20ECO503/ U20ECO603	Electronic Product Design and Packaging	ECE	EEE, CSE, IT, ICE, MECH, CCE, BME, Mechatronics
4	U20ECO504/ U20ECO604	Automotive Electronics	ECE	EEE, ECE, ICE, MECH
5	U20CSO503/ U20CSO603	Platform Technology	CSE	EEE, ECE, ICE, MECH, CIVIL, CCE, BME, AI&DS
6	U20CSO504/ U20CSO604	Graphics Designing	CSE	EEE, ECE, ICE, MECH, CIVIL, BME, FT
7	U20ITO503/ U20ITO603	Essentials of Data Science	IT	EEE, ECE, ICE, MECH, CIVIL, BME
8	U20ITO504/ U20ITO604	Mobile App Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics, AI&DS
9	U20ICO503/ U20ICO603	Fuzzy logic and neural networks	ICE	CSE, IT, CIVIL, BME, AI&DS
10	U20ICO504/ U20ICO604	Measurement and Instrumentation	ICE	ECE, Mechatronics
11	U20MEO504/ U20MEO604	Heating, ventilation and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
12	U20MEO505/ U20MEO605	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, Mechatronics
13	U20CEO503/ U20CEO603	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS, FT

14	U20CEO504/ U20CEO604	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS, FT
15	U20BMO503/ U20BMO603	Biometric Systems	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics
16	U20BMO504/ U20BMO604	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, CIVIL , Mechatronics
17	U20CCO503/ U20CCO603	Network Essentials	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME
18	U20CCO504/ U20CCO604	Web Programming	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
19	U20ADO503/ U20ADO603	Principle of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE
20	U20ADO504/ U20ADO604	Data science Application of Vision	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics
21	U20MCO501/ U20MCO601	Industrial Automation for Textile	Mechatronics	FT
Open Elective – IV (Offered in Semester VII)				
1	U20EEO705	Hybrid and Electrical Vehicle	EEE	ECE, Mechatronics , MECH
2	U20EEO706	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AI&DS
3	U20ECO705	IoT and its Applications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, FT
4	U20ECO706	Cellular and Mobile Communications	ECE	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics
5	U20CSO705	Artificial Intelligence	CSE	EEE, ICE, CIVIL, CCE, MECH, FT
6	U20CSO706	Cloud Technology and its Applications	CSE	EEE, ICE, MECH, CIVIL, CCE, BME, Mechatronics
7	U20ITO705	Automation Techniques & Tools- DevOps	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, CCE, BME, Mechatronics, AI&DS
8	U20ITO706	Augmented and Virtual Reality	IT	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS
9	U20ICO705	Process Automation	ICE	EEE, ECE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics
10	U20ICO706	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics
11	U20MEO706	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U20MEO707	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U20CEO705	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH

14	U20CEO706	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS, FT
15	U20MCO702	Building Automation	Mechatronics	MECH, CIVIL
16	U20MCO703	Automation in Manufacturing Systems	Mechatronics	MECH, CIVIL
17	U20BMO705	Internet of Things for Healthcare	BME	EEE, ECE, ICE, CCE
18	U20BMO706	Telehealth Technology	BME	EEE, ECE, ICE, CCE
19	U20CCO705	Data Science using python	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
20	U20CCO706	Mobile Applications Development using Android	CCE	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME
21	U20ADO705	Data Science Application of NLP	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics.
22	U20ADO706	Artificial Intelligence Applications	AI&DS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME
23	U20HSO706	Industrial Safety and Human Resource Management	MBA	FT
24	U20HSO707	Operation Research in Textile Industry	MBA	FT
25	U20HSO708	Global marketing and Sourcing Strategies	MBA	FT
26	U20HSO709	Fashion Advertising and sales promotions	MBA	FT
27	U20HSO710	Luxury Brand management	MBA	FT
28	U20HSO711	Fashion Retail Store Operations	MBA	FT

Annexure – III

EMPLOYABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

Sl. No.	Course Code	Course Title
1	U20EECX01	3ds Max
2	U20EECX02	Advance Structural Analysis of Building using ETABS
3	U20EECX03	Advanced Java Programming
4	U20EECX04	Advanced Python Programming
5	U20EECX05	Analog System Lab Kit

6	U20EECX06	Android Medical App Development
7	U20EECX07	Android Programming
8	U20EECX08	ANSYS -Multiphysics
9	U20EECX09	Artificial Intelligence
10	U20EECX10	Artificial Intelligence and Edge Computing
11	U20EECX11	Artificial Intelligence in Medicines
12	U20EECX12	AutoCAD for Architecture
13	U20EECX13	AutoCAD for Civil
14	U20EECX14	AutoCAD for Electrical
15	U20EECX15	AutoCAD for Mechanical
16	U20EECX16	Azure DevOps
17	U20EECX17	Basic Course on ePLAN
18	U20EECX18	Basic Electro Pneumatics
19	U20EECX19	Basic Hydraulics
20	U20EECX20	Bio Signal and Image Processing Development System
21	U20EECX21	Block chain
22	U20EECX22	Bridge Analysis
23	U20EECX23	Building Analysis and Construction Management
24	U20EECX24	Building Design and Analysis Using AECO Sim Building Designer
25	U20EECX25	CATIA
26	U20EECX26	CCNA (Routing and Switching)
27	U20EECX27	CCNA (Wireless)
28	U20EECX28	Cloud Computing
29	U20EECX29	Computer Programming for Medical Equipments
30	U20EECX30	Corel Draw
31	U20EECX31	Creo (Modeling and Simulation)
32	U20EECX32	Cyber Security
33	U20EECX33	Data Science and Data Analytics
34	U20EECX34	Data Science using Python
35	U20EECX35	Data Science using R
36	U20EECX36	Deep Learning

37	U20EECX37	Design and Documentation using ePLAN Electric P8
38	U20EECX38	Design of Biomedical Devices and Systems
39	U20EECX39	Digital Marketing
40	U20EECX40	Digital Signal Processing Development System
41	U20EECX41	DigSILENT Power Factory
42	U20EECX42	Electro Hydraulic Automation with PLC
43	U20EECX43	Embedded System using Arduino
44	U20EECX44	Embedded System using C
45	U20EECX45	Embedded System with IoT
46	U20EECX46	ePLAN Data Portal
47	U20EECX47	ePLAN Electric P8
48	U20EECX48	ePLAN Fluid
49	U20EECX49	ePLAN PPE
50	U20EECX50	Fusion 360
51	U20EECX51	Fuzzy Logic and Neural Networks
52	U20EECX52	Google Analytics
53	U20EECX53	Hydraulic Automation
54	U20EECX54	Industrial Automation
55	U20EECX55	Industry 4.0
56	U20EECX56	Internet of Things
57	U20EECX57	Introduction to C Programming
58	U20EECX58	Introduction to C++ Programming
59	U20EECX59	IoT using Python
60	U20EECX60	Java Programming
61	U20EECX61	Machine Learning
62	U20EECX62	Machine Learning and Deep Learning
63	U20EECX63	Machine Learning for Medical Diagnosis
64	U20EECX64	Mechatronics
65	U20EECX65	Medical Robotics
66	U20EECX66	Microsoft Dynamics 365 ERP for HR , Marketing and Finance
67	U20EECX67	Mobile Edge Computing

68	U20EECX68	Modeling and Visualization using Micro station
69	U20EECX69	MX Road
70	U20EECX70	Photoshop
71	U20EECX71	PLC
72	U20EECX72	Pneumatics Automation
73	U20EECX73	Project Management
74	U20EECX74	Python Programming
75	U20EECX75	Revit Architecture
76	U20EECX76	Revit Inventor
77	U20EECX77	Revit MEP
78	U20EECX78	Robotics
79	U20EECX79	Search Engine Optimization
80	U20EECX80	Software Testing
81	U20EECX81	Solar and Smart Energy System with IoT
82	U20EECX82	Solid Works
83	U20EECX83	Solid Works with Electrical Schematics
84	U20EECX84	Speech Processing
85	U20EECX85	STAAD PRO V8i
86	U20EECX86	Structural Design and Analysis using Bentley
87	U20EECX87	Total Station
88	U20EECX88	Video and Image Processing Development System
89	U20EECX89	VLSI Design
90	U20EECX90	Web Programming - I
91	U20EECX91	Web Programming - II

Annexure – IV

EMPLOYABILITY ENHANCEMENT COURSES – (B) SKILL DEVELOPMENT COURSES

Sl. No	Course Code	Course Title
1	U20EES201	Skill Development Course 1: Demonstration of Basic Engineering Science
2	U20EES302	Skill Development Course 2 *
		1) Testing of Electronics Devices and PCB Board Designing
		2) Design of Solar power plant and Installation
		3) Demonstration / Troubleshooting of Electrical and Electronics Equipments
3	U20EES403	Skill Development Course 3 *
		1) Mobile Phone Servicing
		2) Autonomous Robotics
		3) Repair and Maintenance of Power Supply, Inverter and UPS
4	U20EES504	Skill Development Course 4 : Foreign Language/ IELTS -I
5	U20EES505	Skill Development Course 5 : Presentation Skills using ICT
6	U20EES606	Skill Development Course 6 : Foreign Language/ IELTS - II
7	U20EES607	Skill Development Course 7 : Technical Seminar
8	U20EES608	Skill Development Course 8 : NPTEL / MOOC - I
9	U20EES809	Skill Development Course 9 : NPTEL / MOOC-II

** Any one course to be selected from the list*

U20BST101

ENGINEERING MATHEMATICS – I
CALCULUS AND LINEAR ALGEBRA

(Common to all branches except CSBS)

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- To familiarize the concept of matrices.
- To introduce mathematical tools to solve first order differential equations.
- To learn linear differential equations of higher order with constant coefficients.
- To understand the concept of partial differentiation.
- To introduce the concepts of curl, divergence and integration of vectors in vector calculus.

Course Outcomes

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

CO1 - Understand the concept of Eigen values and Eigen vectors, Diagonalization of a matrix. **(K2)**
CO2 - Solve differential equations. **(K3)**
CO3 - Solve higher order differential equations. **(K3)**
CO4 - Solve different types of partial differential equation. **(K3)**
CO5 - Understand the use of vector calculus. **(K2)**

UNIT I MATRICES (12 Hrs)

Rank of a Matrix- Consistency of system of equations. Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigen vectors. Cayley-Hamilton Theorem - Diagonalization of matrices.

UNIT II DIFFERENTIAL EQUATIONS (12 Hrs)

Exact equations, First order linear equations, Bernoulli's equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type

UNIT III DIFFERENTIAL EQUATIONS (HIGHER ORDER) (12 Hrs)

Linear differential equations of higher order with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, Solution by variation of parameter method.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Partial derivatives, Total derivatives, Differentiation of implicit functions, Maxima and Minima of two variables. Partial differential equations of higher order with constant coefficients.

UNIT V VECTOR CALCULUS (12 Hrs)

Gradient, divergence and curl - Directional derivative- Irrotational and Solenoidal vector fields - Gauss Divergence Theorem and Stoke's Theorem.

Text Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publication, 10th Edition, 2019.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 6th Edition, 2018.
3. N. P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.

Reference Books

1. C.W. Evans, "Engineering Mathematics: A Programmed Approach", Routledge Publisher, 3rd Edition, 2019.
2. Dr. A. Singaravelu, "Engineering Mathematics for first year", Meenakshi Agencies, Tamil Nadu, Latest New Edition, 2019.
3. M.K. Venkataraman, "Engineering Mathematics (Third Year-Part A)", The National Publishing Company, Madras, 2nd Edition, 2016.
4. S.Narayanan and Manicavachagom T.K. Pillay,"Differential Equations and Its Applications", Paperback, Viswanathan.S, Printers& Publishers Pvt Ltd, 2009.
5. Dr.G Balaji., " Engineering Mathematics-I", G.Balaji publishers, 2017

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra slidessystemsofquationhandout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	-	-	-	-	1	3	-	1
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	1
3	3	2	1	1	-	1	1	-	-	-		1	3	-	1
4	3	2	1	1	-	1	1	-	-	-	-	1	3	-	1
5	2	1	-	-	-	-	1	-	-		-	1	3	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EST101	PROGRAMMING IN C (Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the Fundamentals of Computers and introduction to C language.
- To study about the programs using Control structures.
- To understand the programs using looping and arrays.
- To understand the concepts of Functions and Pointers.
- To study about Structure, Union and File Management Operations in C.

Course Outcomes

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

CO1 - Comprehend the basic constructs of C programming. **(K2)**
CO2 - Illustrate the concepts of sequential, selection and repetition control structures in C program. **(K2)**
CO3 - Implement simple programs using looping structure and arrays. **(K3)**
CO4 - Demonstrate programs using Functions and Pointers. **(K3)**
CO5 - Build programs using Structure, Union and understand the concept of File management Operations. **(K3)**

UNIT I INTRODUCTION TO C (9 Hrs)

C programming: Overview of C – Visual Studio code-Constants – Compiling a C Program – Variables and Data Types – Technical Difference between Keywords and Identifiers – Types of C Qualifiers and format specifies – Operators and Expressions – Operators Precedence – Type conversion – Input-Output Statements.

UNIT II DECISION MAKING (9 Hrs)

Decision Making and Branching – Relational operators – Logical operators – If – If else – If else If – Nested if. Switch-case.

UNIT III LOOPING AND ARRAYS (9 Hrs)

Looping: while - do while – for – break – continue - nested loop Arrays: One Dimensional Arrays-Two-Dimensional Arrays-Multi-Dimensional Array-Dynamic arrays-Character Arrays and String-Sorting - Searching.

UNIT IV FUNCTIONS, POINTERS (9 Hrs)

Functions: Introduction - Definition – Declaration – Categories of Functions - Nesting of Functions, Recursive functions - Passing Arrays to Functions - Strings – String library function. Pointers: Introduction - Declaring Pointer Variables - Initialization of Pointer Variables - Accessing the address of a variable - Accessing a variable thorough Pointer - Chain of Pointers - Pointer Expressions - Pointers and arrays – Pointers and functions – Call by Reference - Pointers and character strings - Array of Pointers - Pointers and Structures.

UNIT V STRUCTURES AND UNIONS, FILE MANAGEMENT (9 Hrs)

User defined data types: Introduction – Structure: definition - declaration - Arrays of Structures – Nested structures – Passing structures to functions — Union - Enumeration and Typedef. Introduction to File Handling in C, Input and Output operations on a file – Error Handling - Random access to files – command line arguments. Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. E.Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 8th Edition, 2019.
2. Herbert Schildt, "C: The Complete Reference", McGraw Hill, 4th Edition, 2014.
3. Yashvant Kanetkar, "Let us C", BPB Publications, 16th Edition, 2017.

Reference Books

1. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd Impression, 2012.
2. Vikas Verma, "A Workbook on C ", Cengage Learning, 2nd Edition, 2012.
3. Dr. P. Rizwan Ahmed, "Office Automation", Margham Publications, 2016.
4. P.Visu, R.Srinivasan and S.Koteeswaran, "Fundamentals of Computing and Programming", Fourth Edition, Sri Krishna Publications, 2012.
5. Pradip Dev, Manas Ghoush, "Programming in C", Oxford University Press, 2nd Edition, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
2	2	1	-	-	3	-	-	-	-	-	-	-	2	1	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EST119 **ENGINEERING MECHANICS**
(Common to EEE, ECE, MECH, Mechatronics)

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- To understand the basics of force and moment, static equilibrium of particles in two and three dimensions.
- To examine the equilibrium of rigid bodies and components of a moment.
- To discuss the properties of surfaces and solids.
- To integrate the relationship between the motion of bodies
- To associate the various structural analysis and load on system of rigid bodies.

Course Outcomes

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

CO1 - Recognize the basics of equilibrium of particles in 2D and 3D. **(K1, K2)**
CO2 - Review the requirements of equilibrium of rigid bodies in 2D and 3D. **(K2)**
CO3 - Compute the center of mass and moment of inertia of surfaces and solids. **(K2, K3)**
CO4 - Predict displacement, velocity and acceleration of dynamic particles. **(K2, K3)**
CO5 - Solve for friction force and rigid body dynamics. **(K2, K3)**

UNIT I BASICS AND STATICS OF PARTICLES (12 Hrs)

Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Resolution and Composition of forces - Equilibrium of a particle - Principle of transmissibility - Single equivalent force - Free body diagram

UNIT II EQUILIBRIUM OF RIGID BODIES (12 Hrs)

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 – Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions – Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS (12 Hrs)

Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.

UNIT IV DYNAMICS OF PARTICLES AND FRICTION (12 Hrs)

Displacements, Velocity and acceleration, their relationship - Relative motion -Curvilinear motion -Newton's law -Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.

Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction- Rolling resistance

UNIT V STRUCTURAL ANALYSIS OF TRUSSES AND RIGID BODY DYNAMICS (12 Hrs)

Trusses: - Definition of a truss - Simple Trusses - Analysis of Trusses - Method of joints- Method of sections. - Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion of simple rigid bodies such as cylinder disc/wheel and sphere.

Text Books

1. F.P. Beer and E. R. Johnston Jr, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd., 11th Edition, 2016. (Unit I,II,III,IV,V)
2. J.L.Meriam & L.G. Karidge, "Engineering Volume I and Engineering Mechanics: Dynamics", 8th Edition, Wiley student edition, 2016. (I,II,III)
3. R. C. Hibbeller, "Engineering Mechanics", Prentice hall, 14th Edition, 2016. (Unit I,II,III,IV,V)

Reference Books

1. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Thomson Asia Private Limited, Singapore, 1st Edition, 2010. (Unit I,II,III,IV,V)

2. D.P.Sharma, "Engineering Mechanics", Dorling Kindersley (India) Pvt. Ltd, 2010. (Unit II,III,IV,V).
3. S. Rajasekaran, G. Sankarasubramanian,"Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt., Ltd., 3rd Edition, 2012. (Unit I,II,III,IV,V)
4. S.S. Bhavikattand K.G. Rajashekarappa, "Engineering Mechanics", New Age International(P) Ltd, New Delhi, 7th Edition, 2019. (Unit I,II,III,IV,V)
5. Dr.I.S. Gujral, "Engineering Mechanical", Lakshmi Publication (P).Ltd., 2nd Edition, 2011. (Unit I,II,III,IV,V)
6. Vela Murali, "Engineering Mechanics", Oxford University Press, 2nd Edition, 2018. (Unit I,II,III,IV,V)

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1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR / engg. mechanics /ui/ Table of Contents.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	-	-	-	-	-	-	1	1	1	1
2	3	2	2	1	1	-	-	-	-	-	-	1	1	1	1
3	3	2	2	1	1	-	-	-	-	-	-	1	1	1	1
4	3	2	2	1	1	-	-	-	-	-	-	1	1	1	1
5	3	2	2	1	1	-	-	-	-	-	-	1	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET101 **ELECTRICAL ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the basic definitions and laws governing electricity, calculation of current, voltage and power for DC circuits.
- To have a clear knowledge about the various definitions of magnetism, concepts related to various effects on magnetic / electrical parameters
- To carry out various analysis on R, L and C circuits and to have a detailed study on their electrical quantities.
- To have an overview of the domestic wiring and electrical safety.
- To understand the fundamental estimation of industrial wiring.

Course Outcomes

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

CO1 - Calculate current, voltage and power using laws for DC circuits. **(K3)**
CO2 - Use various terms, laws and parameters governing the magnetic circuits. **(K3)**
CO3 - Analyze different AC circuits and understand the concepts of poly phase system. **(K4)**
CO4 - Do house wiring schemes with the safety measures. **(K4)**
CO5 - Do wiring and protection schemes for industries. **(K4)**

UNIT I DC CIRCUITS (9 Hrs)

Concept of Potential difference, voltage, current, work, Power, Energy, Electric networks, voltage source and current sources, linear passive and active elements, current-voltage relation, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Simplifications of networks using series-parallel, Star/Delta transformation.

UNIT II MAGNETIC CIRCUITS (9 Hrs)

Basic Definitions of magnetism-Magnetic effect on electric current – Important terms of magnetic circuits – Comparison of Magnetic and Electric circuits - Electromagnetic induction - Lenz law – Induced emf – Self and Mutual Induction – Amperes law- Energy stored in magnetic circuits – Magnetic Hysteresis and Eddy current- Magnetic Material and B-H Curve.

UNIT III AC CIRCUITS (9 Hrs)

AC waveform - definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in Polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Y-Δ and Y-Y), relationship between line and phase values -power measurement – two Wattmeter method.

UNIT IV ELECTRICAL SAFETY AND DOMESTIC WIRING (9 Hrs)

Safety measures in electrical system - Electrical tools and accessories–wiring Standards - Types of domestic wiring - Staircase, doctor's room, fluorescent lamps and corridor wiring- Layout of electrical power system and its functions - Insulators, Cables, Fuses, circuit breaker, Necessity of earthing, Types of earthing - Electrical shock and rescue methods - energy audit - Application – House wiring.

UNIT V INDUSTRIAL WIRING (9 Hrs)

Introduction to Single line diagram - Three phase wiring connections - Factory wiring - Godown wiring – panel wiring - Electrical Estimation and installation - Types of Conductors, Insulators and Cables – Earthing - types of earthing - Introduction to Megger - Introduction to ECAD - Applications – Commercial wiring.

Text Books

1. S. K. Sahdev, "Fundamentals of Electrical Engineering and Electronics", Dhanpat Rai & Co, 2017.
2. S.S. Dash, C. Subramani, K. Vijayakumar, "Basic Electrical Engineering", Vijay Nicole Imprints Pvt. Ltd, 1st Edition, 2013.
3. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, Asian Edition, 2013.
4. D P Kothari and I.J. Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, 3rd Reprint, 2016.

5. B. L. Thereja, "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., Multicolor Edition, 2015.
6. Black and Decker, "The Complete Guide to Wiring", Quarto publishing group, USA, 7th Edition, 2018.

Reference Books

1. Smarajt Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning, 2nd Edition, 2007.
2. V. K. Metha, Rohit Metha, "Basic Electrical Engineering", S. Chand & Co, 5th Edition, 2012.
3. Del Toro, "Electrical Engineering Fundamentals", Pearson Education India, New Delhi, 2nd Edition, 2015.
4. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, 1st Indian Edition, 2006.
5. Stephen L. Herman, "Electrical Wiring", Cengage Learning India, 15th Edition, 2014.
6. S. K. Bhattacharya, S. Chatterji, "Projects in Electrical, Electronics, Instrumentation and Computer Engineering", S. Chand & Co, 2nd Edition, 2010.
7. David Herres, "The Homeowner's DIY Guide to Electrical Wiring", McGraw Hill Professional, 7th Edition, 2015.
8. Gaurav Verma and Matt Weber, "AutoCAD Electrical 2018 Black Book", Ingram short title, 4th Edition, 2018.

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1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://nptel.ac.in/courses/108105112/
4. https://nptel.ac.in/courses/108108076/
5. https://demonstrations.wolfram.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3
5	3	3	3	2	2	-	-	-	2	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET102	ELECTRONIC DEVICES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide a platform for students to understand the characteristics of devices such as Diode, BJT, FET, MOSFET and special devices.
- To introduce biasing techniques for stable operating point in BJT and FET.
- To explain the operation and applications of special diodes and opto electronic devices.
- To explore the application of diode as rectifiers, clipper and clamper circuits.
- To learn the switching characteristics of power devices.

Course Outcomes

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

CO1 - Use the PN junction and Zener diode for applications like rectifiers, clippers, clampers and regulator circuits respectively. **(K3)**
CO2 - Apply CB, CE and CC Configurations of BJT in applications like isolator, amplifier and voltage follower circuit respectively. **(K3)**
CO3 - Use FET as a buffer , voltage variable resistor etc., **(K3)**
CO4 - Use special devices for various application as variable capacitance, oscillator etc., **(K3)**
CO5 - Use optoelectronics devices for isolator, light intensity measurement and display devices. **(K3)**
CO6 - Discriminate the switching characteristics of power devices and to use in suitable power conversion application. **(K4)**

UNIT I PN JUNCTION DEVICES (9 Hrs)

Introduction –Semiconductor– PN junction diode – Mathematical model of PN diode – Effect of temperature on diode operation – Static and Dynamic resistance – Diode equivalent models – Transition and diffusion capacitances – Diode switching Characteristics – Reverse Recovery time – Diode applications: Rectifiers, Clippers and Clampers – Zener diode – VI Characteristics – Zener as regulator – Special devices: Varactor diode – PIN diode – Gunn Diode–Tunnel diode – Schottky diode – SCR – SCS – DIAC and UJT – Selection of devices using specification sheets– Introduction to SiC diodes

UNIT II BIPOLAR JUNCTION TRANSISTORS (9 Hrs)

BJT: NPN and PNP transistors – Ebers - Moll model - CB, CE and CC configurations – Transistor characteristic– Biasing– DC and AC load line – Operating point – Stabilization– Bias compensation techniques – Thermal stability and runaway – Amplification –Transistor switching times – Base width modulation – Early Effect– breakdown voltage – Voltage in open emitter configuration and open base configuration – BJT ratings – Selection of devices using specification sheets– Introduction to HBT and SJT.

UNIT III FIELD EFFECT TRANSISTORS (9 Hrs)

FET: JFET – Drain and transfer characteristics – Shockley's equation – Comparison between JFET and BJT – Biasing– MOSFET: Types and characteristics–MOSFET as a voltage variable resistor and current limiter –FET ratings – Selection of devices using specification sheets– Introduction to SiC MOSFET- HFET..

UNIT IV OPTO ELECTRONIC DEVICES (9 Hrs)

Optical absorption in a semiconductor, photon absorption coefficient – Electron hole pair generation– Homo junction and hetero junction– Optical absorption, loss and gain – Threshold current –LEDs and LCDs – Photo diodes – Photo transistors – Photoconductive cells – PV cells – Applications of photodiode – Opto couplers .

UNIT V POWER DEVICES (9 Hrs)

Power switching devices overview: ideal and real switching characteristics – power diode, BJT, SCR, TRIAC, MOSFET, GTO, IGBT – V-I characteristics – SCR: Two Transistor model, Triggering Methods, Commutation Circuits and Snubber circuits– protection-di/dt, dv/dt, overcurrent, overvoltage – specifications – losses – thermal characteristics – series and parallel operation - Interpretation of power device data sheet.

Text Books

1. David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5th Edition, 2008.
2. Muhammad H. Rashid, "Microelectronic Circuits: Analysis & Design", Cengage learning Inc, 2nd Edition 2011.
3. G.S. Tomar, Ashish Bagwari, "Fundamentals of Electronic Devices and Circuits", Springer Nature, 1st Edition, 2019.
4. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit theory", Pearson Education, 9th Edition, 2007.
5. P.S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi, 6th Edition, 2012.

Reference Books

1. Thomas L. Floyd, "Electronic devices", Pearson prentice hall, 10th Edition, 2017.
2. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
3. Robert L. Boylestad, "Electronic devices and circuit theory", Pearson Prentice Hall, 10th Edition, 2009.
4. Mahesh B. Patil, "Basic electronic devices and circuits", PHI Learning Pvt. Ltd., 1st Edition, 2013.
5. M. D. Singh, K. B. Khanchandani, "Power Electronics", Tata McGraw Hill, New Delhi, 2nd Edition, 2017.
6. Albert C. Beer, Eicke R. Weber, R. K. Willardson, Richard A. Kiehl, T. C.L. Gerhard Sollner, "High Speed Heterostructure Devices", Academic Press, 1994.

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3. https://nptel.ac.in/courses/117106086/
4. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_bjt_1.pdf
5. http://www.iitg.ac.in/apvajpeyi/ph218/Lec-5.pdf
6. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_jfet_1.pdf
7. https://www.elprocus.com/high-electron-mobility-transistor-hemt-construction-applications/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
2	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
6	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: **1 - Low, 2 - Medium, 3 - High**

U20ESP102

PROGRAMMING IN C LAB

(Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To practice the fundamental programming methodologies in the C programming language.
- To apply logical skills for problem solving using control structures and arrays.
- To design, implement, test and debug programs that use different data types, variables, strings, arrays, pointers and structures.
- To design modular programming and provide recursive solution to problems.
- To understand the miscellaneous aspects of C and comprehension of file operations.

Course Outcomes

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

CO1 - Implement logical formulations to solve simple problems leading to specific applications. **(K3)**
CO2 - Execute C programs for simple applications making use of basic constructs, arrays and strings. **(K3)**
CO3 - Experiment C programs involving functions, recursion, pointers, and structures. **(K3)**
CO4 - Demonstrate applications using sequential and random access file processing. **(K3)**
CO5 - Build solutions for online coding challenges. **(K3)**

List of Exercises

1. Simple programming exercises to familiarize the basic C language constructs.
2. Develop programs using identifiers and operators.
3. Develop programs using decision-making and looping constructs.
4. Develop programs using functions as mathematical functions.
5. Develop programs with user defined functions – includes parameter passing.
6. Develop program for one dimensional and two dimensional arrays.
7. Develop program for sorting and searching elements.
8. Develop program to illustrate pointers.
9. Develop program with arrays and pointers.
10. Develop program for dynamic memory allocation.
11. Develop programs for file operations

Reference Books

1. Zed A Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", Addison Wesley, 2016.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and programming in C", Pearson Education, 1st Edition, 2011.
3. Yashvanth Kanethkar, "Let us C", BPB Publications, 13th Edition, 2008.
4. Maureen Sprankle, Jim Hubbard, "Problem Solving and Programming Concepts", Pearson, 9th Edition, 2011.
5. B.W. Kernighan and D.M. Ritchie, "The C Programming language", Pearson Education, 2nd Edition, 2006.

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1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP101 **ELECTRICAL ENGINEERING LAB**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- Make aware of the various safety procedures to be followed when working with electricity and various tools and accessories used for wiring.
- To understand the line diagram representation of any electrical circuits.
- To implement various wiring circuits in domestic and industries.
- To know about the usage of Megger.
- To trouble shooting of various domestic appliances.
- To gain knowledge about the domestic power distribution.

Course Outcomes

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

CO1 -Follow the safety procedures when working with Electricity and various equipments. **(K2)**
CO2 -Use the protection circuits for electrical networks. **(K3)**
CO3 -Do line diagram and wiring for domestic and industries. **(K3)**
CO4 -Design and calculate the domestic power distribution. **(K4)**
CO5-Use megger for earth resistance measurements. **(K3)**
CO6 - Troubleshooting of domestic appliances. **(K4)**

List of Experiments

1. Electrical Safety Precautions and study of tools, accessories, Electrical joints and electrical symbols.
2. Study of different types of Fuses, Circuits breakers, AC and DC meters.
3. Testing of series and parallel lamp circuits.
4. Domestic Wiring Practice
    a. Staircase wiring
    b. Doctor's room wiring
    c. Bed room wiring
    d. Godown wiring
    e. Lamp controlled from three different places
    f. Ceiling fan and fluorescent lamp wiring.
5. Design of Domestic power distribution.
6. Estimation of material requirement for Residential building/Flat wiring
7. Single line diagram for industrial wiring
8. Estimation of material requirement for industrial wiring
9. Measurement of earth resistance using Megger.
10. Characteristics of fluorescent and incandescent lamp.
11. To study and measure the inductance of choke coil.
12. Study of Electric shock phenomenon, precautions, preventions and Earthing
13. Study and Troubleshooting of electrical equipments (Fan, Iron box)

Reference Books

1. S. K. Sahdev, "Fundamentals of Electrical Engineering and Electronics", Dhanpat Rai & Co, 2017.
2. B. L. Thereja, "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., Multicolor Edition, 2015.
3. David Herres, "The Homeowner's DIY Guide to Electrical Wiring", McGraw Hill Professional, 7th Edition, 2015.
4. Del Toro, "Electrical Engineering Fundamentals", Pearson Education India, New Delhi, 2nd Edition, 2015.
5. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, 1st Indian Edition, 2006.
6. Stephen L. Herman, "Electrical Wiring", Cengage Learning India, 15th Edition, 2014.
7. S. K. Bhattacharya, S. Chatterji, "Projects in Electrical, Electronics, Instrumentation and Computer Engineering", S. Chand & Co, 2010.

Web References

1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://nptel.ac.in/courses/108105112/
4. https://nptel.ac.in/courses/108108076/
5. https://demonstrations.wolfram.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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3	3	3	3	2	2	-	-	-	-	-	-	2	3	2	3
4	3	3	3	3	2	-	-	-	-	-	-	-	3	2	3
5	3	3	3	3	2	-	-	-	-	-	-	2	3	2	3
6	3	3	3	3	2	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP102	ELECTRONICS LAB - I	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To test electronic device characteristics and circuits using Bread boards.
- To study and implement diode applications on rectifiers, clippers and clampers.
- To develop the biasing circuits for BJT and FET for proper amplification.
- To impart knowledge on design trade-offs in regulator circuits.
- To study and observe power electronic devices and its characteristics.

Course Outcomes

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

CO1 -Analyze the characteristics of different electronic devices such as diode, BJT, FET etc. **(K4)**
CO2 - Design clippers, clamper, rectifier and regulator circuits using PN and Zener diodes. **(K4)**
CO3 - Demonstrate the characteristics of opto electronic devices. **(K3)**
CO4 - Experiment the characteristics of various special devices. **(K3)**
CO5 - Demonstrate the characteristics of power devices like SCR, MOSFET, IGBT, etc. **(K3)**

List of Experiments

1. Study of operation of Cathode Ray Oscilloscope, signal generator, multi-meter.
2. Obtain the V-I characteristics of PN junction diode and determine its static, dynamic resistances.
3. Design of half wave, full wave rectifier circuits with and without filters and determine the ripple factor.
4. Design of clipping and clamping circuits using PN junction diode.
5. Determine the VI characteristics of zener diode and design series, shunt voltage regulator.
6. Determine the input and output characteristics of BJT and identify cut-off, active and saturation region for CB, CC, CE configurations.
7. Design of voltage follower, inverter switch using NPN transistor.
8. Obtain the transfer and drain characteristics of JFET, MOSFET and determine their drain resistance, mutual conductance.
9. Design of self-bias and fixed bias circuits using transistor and compare their performance.
10. Determine the VI characteristics of LED, varactor diode, tunnel diode and design of current limiting resistors.
11. Determination of intrinsic stand-off ratio of UJT.
12. Obtain the characteristics of GTO and IGBT.
13. Determine the characteristics of SCR and TRIAC.

Reference Books

1. Louis E. Frenzel, "Practical Electronic Design for Experimenters", McGraw Hill Professional, 1st Edition 2020.
2. David A. Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual", Oxford University higher education, 5th Edition, 2009.
3. David A. Bell, "Laboratory Manual for Electronic Devices and Circuits", Oxford University higher education, 4th Edition, 2001.
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5. https://nptel.ac.in/courses/113/106/113106065/

COs/POs/PSOs Mapping

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3	3	3	2	3	2	-	-	-	2	-	-	1	3	3	3
4	3	3	2	3	2	-	-	-	2	-	-	1	3	3	3
5	3	3	2	3	2	-	-	-	2	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEC1XX	**CERTIFICATION COURSE - I**	**L**	**T**	**P**	**C**	**Hrs**
		0	**0**	**4**	**-**	**50**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20EEM101

INDUCTION PROGRAM

Induction program for students to be offered right at the start of the first year

Duration of the Program	3 Weeks
Induction program	• Physical Activity • Creative Arts and Culture • Mentoring and Universal Human Values • Familiarization with College, Dept./Branch • Literary Activity • Proficiency Modules • Lectures and Workshops by Eminent People • Visits in Local Area • Extra-Curricular Activities in College

1. Physical Activity

This would involve a daily routine of physical activity with games and sports. There would be games in the evening or at other suitable times according to the local climate. These would help develop team work besides health. Each student could pick one game and learn it for the duration of the induction program and hopefully, continue with it later.

2. Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

3. Mentoring and Universal Human Values

Mentoring and connecting the students with faculty members is the most important part of student induction. Mentoring takes place in the context and setting of Universal Human Values. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer pressure and take decisions with courage, be aware of relationships and be sensitive to others, understand the role of money in life and experience the feeling of prosperity. Need for character building has been underlined by many thinkers, universal human values provide the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but by getting the students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

4. Other Activity

Activities that are not there on a daily basis, but are conducted for 3-4 days (typically in the afternoons) and change thereafter.

4.1. Familiarization with College, Department/Branch

The incoming students should be told about the credit and grading system, and about the examinations. They should be informed about how study in college differs from study in school. They should also be taken on a tour of the college and shown important points such as library, canteen, and other facilities. They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities. The above should be done right in the first two days, and then over the afternoons thereafter, as appropriate.

4.2. Literary Activity

Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

4.3. Proficiency Modules

The induction program period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

4.4. Lectures and Workshops by Eminent People

Lectures by eminent people should be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well. Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekanand Kendras, S-VYASA, etc. may be organized. Workshops which rejuvenate or bring relief to students would also be welcome, such as, Art of Living workshops (3 sessions, 9 hours).

4.5. Visits in Local Area

A couple of visits to the local landmarks including historical monuments should be organized. This would familiarize the students with the area together with bonding with each other, like in a picnic. Visits should also be organized to a hospital, orphanage or a village. These would expose them to people in suffering or to different lifestyles. This might also sensitize them to engineering needs in these areas.

4.6. Extra-Curricular Activities in College

The new students should be introduced to the extra-curricular activities at the college/university. They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

U20BST215	ENGINEERING MATHEMATICS - II MULTIPLE INTEGRALS AND TRANSFORMS (Common to all branches except CSBS)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To develop logical thinking and analytic skills in evaluating multiple integrals.
- To equip themselves familiar with Laplace, transform and solve the differential equations using Laplace transform techniques.
- To enable the students to expand functions into Fourier series using change of intervals.
- To gain good knowledge in application of Fourier transforms.
- To inculcate the computational knowledge in Z-transforms

Course Outcomes

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

CO1 - Understand the concept of double and triple integrals. **(K2)**
CO2 - Apply Laplace transform and inverse Laplace transform of simple functions. **(K3)**
CO3 - Convert a periodic function into series form. **(K3)**
CO4 - Compute Fourier transforms of various functions. **(K3)**
CO5 - Solve difference equations using Z – transforms. **(K3)**

UNIT I MULTIPLE INTEGRALS (12 Hrs)

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT II LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS (12 Hrs)

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems, Methods for determining inverse Laplace Transforms, Convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT III FOURIER SERIES (12 Hrs)

Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNIT IV FOURIER TRANSFORM (12 Hrs)

Fourier Integral theorem Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, Convolution and Parseval's identity.

UNIT V Z - TRANSFORMS (12 Hrs)

Difference equations, basic definition, z – transform - definition, Standard z – transforms, Damping rule, Shifting rule, Initial value and final value theorems and problems, Inverse z – transform. Applications of z – transforms to solve difference equations.

Text Books

1. Ravish R Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 1st Edition, 2016.
2. P. Sivaramakrishna Das and C. Vijayakumar, "Engineering Mathematics", Pearsons, New Delhi, 2017.
3. M. D. Petale, "A text book on Z- Transforms (Engineering Mathematics)", Bames and Noble, New Edition, 2020

Reference Books

1. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Co. New Delhi, 2019.
2. N. P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.

4. C. B. Gupta, Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2016.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi 2018

Web References

1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/111107119/
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	1	-	1
2	3	2	1	1	-	1	-	-	-	-	-	1	3	-	1
3	3	2	1	1	-	1	-	-	-	-	-	1	3	-	1
4	3	2	1	1	-	1	-	-	-	-	-	1	3	-	1
5	3	2	1	1	-	1	-	-	-	-	-	1	3	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EST238	BASIC ENGINEERING SCIENCE FOR ELECTRICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To identify the fleet of scientific channels exploring the generation of Modern engineering materials.
- To identify, formulate and solve engineering problems in classical thermodynamics involving closed and open systems for both steady state and transient processes.
- To study about the zeroth law, first law and second law of thermodynamics.
- To study the classification of IC engines and its applications.
- To study the various types of pumps and turbines.

Course Outcomes

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

CO1 - Identify, analyze the properties and applications of magnetic and dielectric materials. **(K2)**
CO2 - List the properties and applications of modern engineering materials. **(K1)**
CO3 - Appreciate concepts of conservation of mass, conservation of energy, and the Laws of thermodynamics. **(K2)**
CO4 - Understand the construction and functioning of IC engines, refrigeration system. **(K2)**
CO5 - Attain knowledge about types of pumps and turbines. **(K2)**

UNIT I MAGNETIC AND DIELECTRIC MATERIAL **(9 Hrs)**

Magnetic Materials: Types and Characteristics of magnetic materials – Hysteresis - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature –Domain Theory- Hard and Soft magnetic materials. Applications: Soft Magnets in Power conversion - electrical – mechanical. Hard Magnets in Sensors and Data storage.

Dielectric materials: Characteristics of Dielectric material. Polarization mechanism: Ionic, Electronic and orientation – Local or Internal electric field - Clausius-Mossotti relation -Temperature and frequency dependence of dielectric - Dielectric losses - Dielectric breakdown. Application: Cables and Transformers.

UNIT II MODERN ENGINEERING MATERIALS **(9 Hrs)**

Superconductors: Basic phenomena - excitations and energy gap - Meissener effect - Type-I and Type-II superconductors - High-temperature superconductors- Preparation and Applications.

Advanced materials: Liquid crystals Display (LCD) - types - shape memory alloys (SMA) - properties and applications of SMA – Metallic Glasses - Nanomaterials - methods of synthesis (CVD AND PVD)- properties and applications of nanomaterials - carbon nanotubes (CNT) - synthesis (Electric Arc Discharge and LASER ablation), properties. Applications of nanotechnology: Aerospace components, sensors, medicine.

UNIT III LAWS OF THERMODYNAMICS **(9 Hrs)**

Zeroth law of thermodynamics –Types of thermodynamic system - Equilibrium and quasistatic process –Point and path functions - Comparison between heat and work - Internal energy. First law of thermodynamics: Isochoric, isobaric, isothermal and adiabatic process - work done. Second law of thermodynamics: Entropy – Enthalpy – Refrigerator and Heat pump - Reversible and irreversible process – Carnot cylcle.

UNIT IV IC ENGINES, POWER CYCLES AND REFRIGERATION SYSTEM **(9 Hrs)**

IC Engine: Classifications - Basic components and terminology of IC engines - working of two stroke/four stroke - SI and CI engine - application of IC engines. Power Cycles: Otto cycle - Diesel cycle - Dual cycle - Brayton cycle – Rankine cycle. Refrigeration system: Vapor compression refrigeration-Vapour absorption refrigeration – Gas refrigeration Cycles.

UNIT V PUMPS AND TURBINES **(9 Hrs)**

Pumps: Functions of pumps - Types of pumps- Pump components – operation - Centrifugal Pumps, Reciprocating Pump - Submergible pumps, Piston pumps - Pump Troubleshooting and Maintenance.

Turbine: Classification of turbines - impulse and reaction -Radial and axial - tangential and mixed flow turbines Working of Pelton wheel, Francis turbine, Kaplan turbine - Selection of turbines - governing of turbines.

Text Books

1. V. Raghavan, "Materials Science and Engineering - A First Course", PHI Learning, 6th Edition, 2015.
2. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Publishing, 6th Edition, 2017.
3. P. N. Modi and S. M. Seth, "Hydraulics and Fluid mechanics", Standard Publishing House, Delhi, 22nd Edition, 2017.
4. V. Ganesan, "Internal Combustion Engines", Tata McGraw Hill Publishing, 6th Edition, 2012.

Reference Books

1. William D. Callister Jr., "Material Science and Engineering", John Wiley and sons, 9th Edition, 2014.
2. Charles Kittel, "Introduction to Solid State Physics", John Wiley & sons, 8th Edition, 2012.
3. C. P. Arora, "Thermodynamics", McGraw Hill Education, 2017.
4. Y. A. Cengel and M. A. Boles, "Thermodynamics - An Engineering Approach", McGraw Hill, 9th Edition, 2019.
5. R. K. Rajput. "Fluid Mechanics and Hydraulic Machines", S. Chand & Company, New Delhi, 6th Edition, 2016.

Web References

1. https://nptel.ac.in/courses/113/104/113104005/
2. https://nptel.ac.in/courses/113/105/113105081/
3. https://nptel.ac.in/courses/112/105/112105123/
4. https://nptel.ac.in/courses/112/103/112103262/
5. https://nptel.ac.in/courses/112/104/112104117/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
2	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
3	2	3	2	3	-	-	-	-	-	-	-	1	1	1	1
4	2	3	2	3	-	-	-	-	-	-	-	1	1	1	1
5	2	2	2	3	-	-	-	-	-	-	-	1	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET203	L	T	P	C	Hrs
	2	2	0	3	60

ELECTRIC CIRCUIT ANALYSIS

Course Objectives

- To gain knowledge on computing electrical parameters like current, voltage and power using various network theorems for AC and DC circuits
- To gain knowledge on three phase circuits using phasor diagram and to apply for different load conditions
- To gain knowledge on analyze electric circuit using Graph theory.
- To gain knowledge on transient response of RL, RC and RLC circuits for DC and AC excitation
- To gain knowledge of R, L, C components for resonance and coupled circuits

Course Outcomes

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

CO1 - Analyze and solve DC network using various network theorems. **(K4)**

CO2 - Analyze and solve AC network using various network theorems. **(K4)**

CO3 - Analyze the behavior of three phase circuits using network topology for different type of loads under balanced and unbalanced conditions. **(K4)**

CO4 - Analyze the steady state and transient behavior of RL, RC and RLC circuit using Laplace transformations for DC and AC excitations. **(K4)**

CO5 - Analyze the resonance and tuned circuits for series and parallel connections. **(K4)**

UNIT I CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR DC CIRCUITS (12 Hrs)

Review - Mesh and Nodal methods for DC circuits. Theorems – Thevenin's, Norton's, Superposition, Compensation, Tellegan's, Reciprocity, Maximum power transfer theorem, Millman's theorem– Application :DC circuit network theorems are used to compute various electrical parameters like current, voltage and power of transmission line in electrical network.

UNIT II CIRCUIT ANALYSIS AND NETWORK THEOREMS FOR AC CIRCUITS (12 Hrs)

Mesh and Nodal methods for AC circuits. Theorems-Thevenin, Norton's, Superposition, Compensation, Tellegan's, Reciprocity, Maximum power transfer theorems, Millman's theorem – Application :AC circuit network theorems are used to compute various electrical parameters like current, voltage and power of transmission line in electrical network.

UNIT III THREE PHASE CIRCUITS AND NETWORK TOPOLOGY (12 Hrs)

Three phase circuits: Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected balanced and unbalanced loads.

Basic concepts of graph theory: Graph, directed graph, branch, chord, Tree, incidence and reduced incidence matrices - application to network solutions - tie set, cut set, duality and dual networks- Introduction to two port networks - Case study of three phase circuit with different types of loads under balanced and unbalanced conditions for the Power generation, Transmission and Distribution.

UNIT IV TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER CIRCUITS (12 Hrs)

Transient response of RL, RC and RLC circuits to DC and AC excitation - Natural and forced oscillations - Laplace transform application to transient solution – Application: design of filter circuit used in power converters and choppers.

UNIT V RESONANCE AND COUPLED CIRCUITS (12 Hrs)

Resonant circuits: series, parallel and series – parallel circuits – effect of variation of Q on resonance. Relations between circuit parameters - Q, resonant frequency and bandwidth.

Coupled circuits: Self-inductance, mutual inductance – coefficient of coupling – dot convention – analysis of simple coupled circuits- Inductively coupled circuits- single tuned and double tuned circuits - Application: design of tuned circuit for Radio Frequency receiver and transmitter section for frequency tuning.

Text Books

1. William H Hayt, J. E. Kemmerly and Steven M Durbin, "Engineering Circuit Analysis", McGraw Hill, 8th Edition, 2013.
2. Charles K. Alexander and Matthew N. Q. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill International Edition, 3rd Edition, 2013.
3. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", John Wiley & Sons, Inc. 7th Edition, 2015.
4. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 5th Edition, 2013.

Reference Books

1. A. Sudhakar, Shyammohan S. Palli , "Circuits and Networks: Analysis and Synthesis", McGraw Hill Publications, 5th Edition, 2015.
2. Mahmood Nahvi, Joseph Edminister, "Electric Circuits (Schaum's Outline series)", McGraw-Hill Publications, 5th Edition, 2017.
3. Sukhija and Nagsarkar, "Circuits and Networks", Oxford University Press, 2nd Edition, 2016.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.youtube.com/watch?v=83IVK6i8EB0&list=PLX2gX-ftPVXUkVZ2eafafDwcs5nDldeBD
4. https://www.youtube.com/watch?v=zDcXt9Vx34o
5. https://www.youtube.com/watch?v=YLGrugmDvc0
6. https://www.academia.edu/35158206/EE8251_CIRCUIT_THEORY_OBJECTIVES

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3
4	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3
5	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET204	ELECTRICAL MACHINES – I	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the performance characteristics of DC machines.
- To equip the students to test and analyze the characteristics of DC machines.
- To get familiar with performance characteristics of single phase transformers and special transformers.
- To learn different types of three phase transformer connections and savings of copper in autotransformer.
- To equip the students to test and analyze the characteristics of Transformers.

Course Outcomes

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

CO1 - Analyze the performance of DC machines under various operating conditions using their characteristics. **(K4)**

CO2 - Interpret the efficiency of DC machines by conducting Suitable tests. **(K4)**

CO3- Inspect the performance of single phase transformers using phasor diagrams and equivalent circuits and understand the characteristics of special transformers. **(K4)**

CO4 - Outline the different types of connections in three phase transformers and savings of copper in autotransformers. **(K2)**

CO5 - Interpret the efficiency of Transformers by conducting Suitable tests.**(K4)**

UNIT I DC MACHINES (9 Hrs)

Electromechanical energy conversion concept–Single and multiple excited systems.

DC Generators: Construction of DC Machine – Principle of operation – Types of Windings – EMF equation - Armature Reaction – Commutation - methods of improving commutation – DC Generators types - Performance characteristics– Applications.

DC Motors: Principle of operation - Back emf - Torque equation – types - Performance characteristics. Starters: Need for starter – types – 2, 3, 4 point starters – electronic soft starters. Speed control: Armature and field Speed control - Solid state speed control. Electric braking – Applications

UNIT II TESTING OF DC MACHINES (9 Hrs)

Testing of DC Machines: Losses – efficiency – Condition for maximum efficiency - Power flow diagram – Testing: Load test – Swinburne's test - Hopkinson's test - Retardation test - Field's test – Separation of losses.

UNIT III SINGLE PHASE TRANSFORMERS AND SPECIAL TRANSFORMERS (9 Hrs)

Single Phase Transformers: Construction - Types – Principle of operation - emf equation - Equivalent circuit - phasor diagram - Parallel operation. Auto transformer: copper savings – Applications.
Special Transformer: Variable frequency transformer– audio frequency Transformer– Instrument transformers– Pulse transformer– Welding transformer – Traction transformer– Isolation transformer – Applications.

UNIT IV POLYPHASE TRANSFORMERS (9 Hrs)

Three Phase Transformers: Construction – Principle of operation – Types of connections – Open delta – Scott connection – three-phase to single phase conversion – three phase to two phase conversion – three phase to six phase conversion – Tap changing transformers – Three winding transformer– Transformers for HVDC applications.

UNIT V TESTING OF TRANSFORMERS (9 Hrs)

Testing of Transformers: Losses - Efficiency - Condition for maximum efficiency - all day efficiency – voltage regulation - Power flow diagram – Testing: Load test – OC and SC test – Polarity test - Sumpner's test – Separation of no load losses.

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
2. J. B. Gupta, "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, New Delhi, 14th Edition, 2010.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology-Vol. II", S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2009.

Reference Books

1. Stephen J. Chapman, “Electric Machinery Fundamentals”, McGraw Hill Education Pvt. Ltd, 5th Edition, 2012.
2. D. P. Kothari and I.J. Nagrath, “Electric Machines”, Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. Vincent Del Toro, “Basic Electric Machines”, Pearson India Education, 1st Edition, 2016.
4. Irving. L. Kosow, “Electrical Machines and Transformers”, PHI, 2nd Edition, 2007.
5. Albert E. Clayton, “The performance and design of direct current machines”, Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

Web References

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2. https://nptel.ac.in/courses/108/105/108105017/
3. https://www.studocu.com/
4. http://electrical-engineering-portal.com/
5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	-	2	-	-	-	-	-	-	1	3	3	3
2	3	2	2	-	2	-	-	-	-	-	-	1	3	3	3
3	3	3	2	-	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	-	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	-	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET205	ELECTRONIC CIRCUITS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge on frequency response of small signal and large signal amplifiers.
- To explore the working of amplifiers with positive and negative feedback systems.
- To familiarize in time base and sweep circuits.
- To impart the importance of multi stage amplifier.
- To introduce stable operating point for BJT on various classes of power amplifiers.

Course Outcomes

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

CO1 - Design the transistor Amplifiers using its small signal model. **(K4)**
CO2 - Design cascade amplifiers and sweep circuits. **(K3)**
CO3 - Evaluate the performance analysis of large signal amplifier. **(K4)**
CO4 - Design the feedback amplifiers and analyze frequency response. **(K4)**
CO5 - Design oscillators for different types of signal generation. **(K3)**

UNIT I SMALL SIGNAL AMPLIFIERS (9 Hrs)

Transistor hybrid model and H-parameters – Determination of H-parameters from transistor characteristics – Analysis of CB, CE and CC circuits using H-parameter model – Voltage follower – Comparison of CB, CE and CC circuits – CE amplifier with unbiased emitter resistance – Transistor R_e model – Small signal equivalent model of HBT – High frequency transistor model – Low frequency FET model – Source follower – Analysis of CS and CD circuits.

UNIT II LARGE SIGNAL AMPLIFIERS (9 Hrs)

Classification of Power amplifiers – Class A power amplifier – Direct coupled and transformer coupled – Class B amplifier – push-pull arrangement and complementary symmetry amplifiers – Conversion efficiency calculations – cross-over distortion – Class AB amplifier – Amplifier distortion – Power transistor heat sinking – Class C , Class D, Class E and Class S amplifiers – Introduction to Doherty power amplifier.

UNIT III MULTISTAGE AMPLIFIERS AND TIME BASE CIRCUIT (9 Hrs)

Cascading amplifier – Direct and RC coupled two stage CE amplifiers – Darlington pair –Cascode amplifier – Tuned amplifier: Single tuned – Double tuned – Stagger tuned amplifiers – Schmitt trigger and Multivibrators circuits: using BJT – UJT sweep circuits – Voltage and current sawtooth sweeps – Fixed amplitude sweep – Miller and bootstrap time base – Multivibrators using negative resistance devices (UJT and Tunnel diodes). BJT Differential amplifiers: Common mode and differential mode – CMRR

UNIT IV FEEDBACK AMPLIFIERS (9 Hrs)

Feedback concept – Gain with feedback – General characteristics of negative feedback amplifiers – Four basic types of feedback and the effect on gain, input and output resistances – Multistage feedback amplifiers –Two stage CE amplifier with series voltage negative feedback – Frequency response and stability.

UNIT V OSCILLATORS (9 Hrs)

Conditions for sustained oscillations – Barkhausen criterion – LC oscillators – Analysis of Hartley, Colpitt, Tuned oscillators, RC Phase shift , Wein-bridge oscillators , Franklin , Armstrong and Twin T oscillators –Analysis– Crystal oscillators and frequency stability – UJT relaxation oscillators.

Text Books

1. David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5th Edition, 2008.
2. Muhammad H. Rashid, "Microelectronic Circuits: Analysis & Design", Cengage learning Inc, 2nd Edition, 2011.
3. G.S. Tomar, Ashish Bagwari, "Fundamentals of Electronic Devices and Circuits", Springer Nature, 2019.
4. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit theory" Pearson Education, 9th Edition, 2007.
5. Bumman Kim, "Doherty Power Amplifiers: From Fundamentals to Advanced Design Methods", Academic press, 2018.

Reference Books

1. Thomas L. Floyd, "Electronic devices", Pearson prentice hall, 10th Edition, 2017.
2. Donald A Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2003.
3. Robert L.Boylestad, "Electronic devices and circuit theory", Pearson Prentice Hall, 10th Edition, 2009.
4. Mahesh B. Patil, "Basic electronic devices and circuits", PHI Learning Pvt. Ltd., 1st Edition, 2013.
5. Battula Tirumala Krishna and Dharma raj cheruku, "Electronic Devices and circuits", Pearson Education India, 2nd Edition, 2008.
6. Andrei Grebennikov, "RF and Microwave Transistor Oscillator Design", John Wiley & Sons, 2007.

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3. https://nptel.ac.in/courses/117106086/
4. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_bjt_1.pdf
5. http://www.iitg.ac.in/apvajpeyi/ph218/Lec-5.pdf
6. https://www.ee.iitb.ac.in/~sequel/ee101/ee101_jfet_1.pdf
7. http://www.ece.ubc.ca/~pulfrey/paper_encyclo.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET206	DIGITAL ELECTRONICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study various number systems and to simplify the logical expressions using Boolean functions.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the design procedures for synchronous and asynchronous sequential circuits.
- To study the various semiconductor memories and its related technology.
- To introduce digital simulation for development of application oriented logic circuits.

Course Outcomes

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

CO1 - Use the Boolean laws to simplify the logical functions. **(K3)**
CO2 - Design 'n' bit counters and shift registers. **(K4)**
CO3 - Design and analyze the synchronous and asynchronous sequential circuits. **(K4)**
CO4 - Gain knowledge on the design and fabrications of semiconductor memories. **(K2)**
CO5 - Design, debug and test digital logic circuits using VHDL. **(K4)**

UNIT I COMBINATIONAL CIRCUITS (9 Hrs)

Number systems: Binary, Decimal, Octal and Hexa decimal – 1s and 2s complement – Binary Arithmetic – BCD addition and subtraction – Boolean theorems – Digital Logic gates – Universal Gates –Design of combination circuits using NAND and NOR gates – POS, SOP simplification – Minterms and Maxterms – Karnaugh map – Don't Care conditions – Design of adders, subtractor – half, full – Multiplexers – Demultiplexers – Application of Multiplexer as Logic function generator – Magnitude comparators – Encoder and Decoders – Priority Encoders – Parity Generator – Code Converters and BCD to Seven Segment Display driver.

UNIT II COUNTERS AND SHIFT REGISTERS (9 Hrs)

Flip flops: SR, D, JK, T and Master Slave – Edge and level triggered– Design of Synchronous counters – Asynchronous counter: UP/Down counter – decade counter – Modulo – n counter – Ring counter – Johnson counter – BCD Counters – Application of counters as frequency divider – Registers – Shift Registers – Application of shift register as Delay line – Bi directional shift registers – Parallel/serial converter.

UNIT III DESIGN OF SEQUENTIAL CIRCUITS (9 Hrs)

Design of Synchronous sequential circuits: Model Selection – State transition diagram – state synthesis table – Design equations and circuit diagram – State reduction technique – Asynchronous sequential circuits – Analysis – Problems with asynchronous sequential circuits – Design of asynchronous sequential circuits State transition diagram, Primitive table, State reduction, state assignment and design equations –Transition stability –flow stability-race conditions, hazards and errors in digital circuits.

UNIT IV MEMORIES AND LOGIC FAMILIES (9 Hrs)

Memory structure: RAM - ROM – PROM – EPROM – EEPROM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – CPLD – FPGA.
Logic families: RTL, DTL, TTL, I^2L and ECL Circuits – Metal Oxide Semiconductor (MOS) – Complementary MOS (CMOS).

UNIT V VHDL (9 Hrs)

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers and De multiplexers).

Text Books

1. Morris. M. Mano and Michael. D. Ciletti, "Digital Design", Pearson Education, 5th Edition, 2013.
2. Floyd and Jain, "Digital Fundamentals", Pearson Education, 11th Edition, 2015.
3. Comer "Digital Logic & State Machine Design", Oxford, 3rd Edition, 2012.
4. John F.Wakerly, "Digital Design Principles & Practices", Prentice Hall, 4th Edition, 2008.
5. M. Morris Mano, "Digital Design with an introduction to the VHDL", Pearson Education, 5th Edition, 2013.

Reference Books

1. D. P. Kothari, J. S. Dhillon, "Digital circuits and Design", Pearson Education, 1st Edition, 2016.
2. Raj Kamal, "Digital systems-Principles and Design", Pearson Education, 2nd Edition, 2007.
3. Roger L.Tokheim, "Digital Electronics: Principles and Applications", McGraw Hill Education, 8th Edition, 2014.
4. William Keitz, "Digital Electronics-A Practical Approach with VHDL", Pearson, 9th Edition, 2013.
5. Charles H. Roth, Jr. LizyLizy Kurian John, "Digital System Design using VHDL", Cengage, 3rd Edition, 2018.

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2. https://nptel.ac.in/courses/117/105/117105080/
3. https://nptel.ac.in/courses/117/108/117108040/
4. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html
5. http://nptel.unipune.ac.in/LocalG/listLectures.php?cid=70cfb15a91cff73d&bid=927d7542627865a3
6. https://www.elprocus.com/what-is-a-shift-register-different-types-counters-and-applications/
7. https://www.allaboutcircuits.com/textbook/digital/chpt-12/ring-counters/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	2	-	-	-	-	-	-	-	2	2	2
2	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
3	2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
4	1	1	1	2	2	-	-	-	-	-	-	-	2	2	2
5	1	1	1	3	3	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP203	ELECTRIC CIRCUIT ANALYSIS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course objectives

- To gain practical experience on electric circuits to measure various electrical parameters like current, voltage and power using various network theorems for DC and AC circuits
- To gain practical experience to evaluate the solution of three phase AC balanced and unbalanced circuits for star and delta connection
- To gain practical experience to evaluate steady state and transient behavior of networks with RL, RC and RLC circuit for DC and AC excitations.
- To gain practical experience to analyze series and parallel resonance circuits
- To simulate various electric circuit using simulation software.

Course Outcomes

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

CO1 - Verify the basic laws and simplify more complicated circuits into simple equivalent circuits using network theorems to compute various parameters of typical DC and AC electrical circuits. **(K4)**
CO2 - Evaluate the solution of three phase AC balanced and unbalanced circuits with different types of loads. **(K4)**
CO3 - Analyze the transient response of RL, RC and RLC circuits with DC and AC input used in power converters, choppers and sweep circuits. **(K4)**
CO4 - Design tuned circuit for given frequency used in radio amplifiers for frequency tuning. **(K5)**
CO5 - Make use of simulation software for simulating various electrical circuits. **(K5)**

List of Experiments

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws
2. Simulation and experimental verification of electrical circuit problems using Superposition theorem
3. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem and Norton's theorem
4. Simulation and experimental verification of electrical circuit problems using Maximum Power Transfer theorem
5. Simulation and experimental verification of electrical circuit problems using Reciprocity theorem
6. Simulation and experimental verification of electrical circuit problems using Compensation and Millman's theorem
7. Simulation and verification in between voltage and current in three phase balanced star and delta connected loads
8. Simulation and experimental validation of time response of R-L circuit
9. Simulation and experimental validation of time response of R-C circuit
10. Simulation and experimental validation of time response of RLC circuit
11. Design and simulation of R-L-C series resonance circuit for $X_L > X_C$ and $X_L < X_C$
12. Design and simulation of R-L-C parallel resonance circuit for $X_L > X_C$ and $X_L < X_C$

Reference Books

1. William H Hayt, J E Kemmerly and Steven M Durbin, "Engineering Circuit Analysis", McGraw Hill, 8th Edition, 2013.
2. Charles K. Alexander and Matthew N. O. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill International Edition, 3rd Edition, 2013.
3. A. Sudhakar, Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill Publications, 5th Edition, 2015.
4. Mahmood Nahvi, Joseph Edminister, "Electric Circuits (Schaum's Outline Series)", McGraw-Hill Publications, 5th Edition, 2017.
5. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 5th Edition, 2013.
6. J. Nagrath and Kothari, "Theory and Problems of Basic Electrical Engineering", PHI Learning Private Limited, Delhi, 2nd Edition, 2016.

Web References

1. https://www.youtube.com/watch?v=CfnBDLL1Rel
2. http://tuttle.merc.iastate.edu/ee201/spice/pspice_transient.pdf
3. https://www.circuitlab.com/
4. https://www.youtube.com/watch?v=VjWliljcDQg
5. http://www.circuit-magic.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	-	-	-	2	-	-	-	3	3	2
2	2	3	2	3	3	-	-	-	2	-	-	-	3	3	2
3	3	3	2	3	3	-	-	-	2	-	-	-	3	2	2
4	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	2	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP204 **ELECTRICAL MACHINES LAB - I**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To equip the students to test and evaluate the performance of various DC machines and transformers by conducting appropriate experiments.
- To learn different methods to predetermine the characteristics of DC machines and transformers.
- To get familiar with different types of speed control of DC motors.
- To understand the parallel operation and load sharing of single phase transformers.
- To learn the assembling of different types of DC machines

Course Outcomes

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

CO1 - Test the performance of any DC machine (shunt, series or compound) and transformer by conducting suitable experiments and report the results. **(K5)**
CO2 - Predetermine the different performance characteristics of DC machines and transformers. **(K5)**
CO3 - Experiment and analyze the various speed control techniques for DC motors. **(K5)**
CO4 - Experiment the parallel operation and analyze the load sharing of single phase transformers. **(K4)**
CO5 - Develop any prototype modules implementing different control techniques in DC machine and transformers for various applications. **(K5)**

List of Experiments

DC Machines

1) (a). Load test on DC shunt Motor
   (b). Load test on DC series Motor
   (c). Load test on DC Compound Motor
2) Speed control of DC Motors: Field control, Armature control
3) Electrical braking in DC shunt motor
4) (a). Open Circuit Characteristics and Load test on separately excited DC Generator
   (b). Open Circuit Characteristics and Load test on DC shunt Generator
   (c). Load test on DC series Generator
5) Swinburne's Test
6) Separation of losses in a DC shunt machine
7) Hopkinson's test on DC Machines
8) Study on Retardation test on DC shunt motor
9) Assembling and Testing of DC machines

Transformers

10) Load test on single phase transformer
11) O.C and S.C test on single phase transformer and separate its losses.
12) Parallel operation of single phase transformers
13) Study of Sumpner's test on single phase transformers
14) Study of three phase transformer connections
15) Load test on three phase transformer
16) O.C and S.C test on three phase transformer

Reference Books

1. D. P. Kothari, B. S. Umre, “Laboratory Manual for Electrical Machines”, I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D. R Kohli and S.K Jain, “A laboratory course in electrical machines”, New Chand and Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, “Electrical Machines Lab Manual with MATLAB Programs”, Laxmi Publications Pvt Limited, 1st Edition, 2015.
4. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, “Electric Machinery”, Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. Albert E. Clayton, “The performance and design of direct current machines”, Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

Web References

1. http://em-coep.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php
3. http://em-iitr.vlabs.ac.in/
4. https://ndl.iitkgp.ac.in
5. https://nptel.ac.in/courses/108/105/108105017/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
2	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
3	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
4	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
5	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP205 **ELECTRONICS LAB - II**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To understand the effects of negative feedback on amplifier circuits
- To provide the basic concepts and design procedure for Combinational circuits.
- To learn the simplification of K-Map
- To design various synchronous and asynchronous counter circuits.
- To acquire knowledge on code converters, multiplexer, de-multiplexer circuits in real time applications.

Course Outcomes

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

CO1 - Evaluate the frequency response of amplifier circuits.**(K4)**
CO2 - Design oscillator circuits for different types of signal generation. **(K3)**
CO3 - Implement projects using amplifiers and oscillator circuits. **(K4)**
CO4 - Design and verify the combinational circuits using K-Map. **(K3)**
CO5 - Design and verify the different sequential circuits. **(K3)**
CO6 - Design and verify counters, shift registers and display devices. **(K3)**

List of Experiments

1. Assemble and observe Characteristics of clipping and clamping circuits using diodes and zener diodes.
2. Rectifiers and filters with and without shunt capacitors - Characteristics of half-wave, full wave and bridge rectifiers- Ripple factor, Rectification efficiency and % regulation.
3. Design the common emitter BJT amplifier and analyze the frequency response characteristics.
4. Design the common source FET amplifier and analyze the frequency response characteristics.
5. Design a UJT relaxation oscillator.
6. Design a wein bridge and Phase shift oscillators using BJT and verify its performance.
7. Design and verify the Schmitt trigger using BJT.
8. Design and analysis of wave shaping circuits using RC, RL and RLC components.
9. Study of logic gates, verification of De Morgan laws using logic gates, implementation of basic gates using universal gates
10. Design and testing of adders, subtractors, Simplification of logic function using K-map.
11. Design and testing of SR, D, JK (Master-slave configuration) and T flip-flops using universal gates.
12. Design and testing of Encoder and Decoder
13. Design of Multiplexer and Demultiplexer using logic gates and ICs
14. Design of Parity generator and Checker using logic gates and ICs
15. Design of Code Converters: BCD to Binary, Binary to BCD using logic gates.
16. Implementation of BCD to Seven Segment Display using ICs
17. Design and implementation of 4-bit shift registers in SISO, SIPO, PISO,PIPO modes using ICs
18. Design and implementation of synchronous and Asynchronous Counters using ICs
19. Implementation of Ring and Johnson counters using ICs.
20. Using UP DOWN COUNTER and a DAC ICs, generate triangular waveform
    a. Using CD 4047 IC, design and set up gated/ungated astable and monostable multivibrators
    b. Using CD 4093 Schmitt NAND IC, design and set up astable and monostable multivibraors

Reference Books

1. David A Bell, "Fundamentals of Electronic Devices and Circuits", Oxford University Press, Incorporated, 2009.
2. Muhammad H. Rashid, "Microelectronic Circuits: Analysis & Design", Cengage learning Inc, 2nd Edition 2011.
3. William Kleitz, "Lab Experiments--Digital Electronics, a Practical Approach", Prentice Hall, 2nd Edition, 2009.
4. Norman Ahlhelm, "Lab Experiments in Digital Electronics", Createspace Independent Pub, 2010.

5. Abraham Michelen, "Digital Electronics Lab Manual", Prentice Hall, 2000.
6. Ulrich Tietze, Christoph Schenk, Eberhard Gamm, "Electronic Circuits: Handbook for Design and Application", Springer, 2nd Edition, 2015.
7. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2007.
8. Robert L. Boylestad, "Electronic devices and circuit theory", Pearson Prentice Hall, 10th Edition, 2009.
9. P. Kothari, J. S. Dhillon, 'Digital circuits and Design', Pearson Education, 2016.
10. Raj Kamal, "Digital systems-Principles and Design", Pearson education, 2nd Edition, 2007.

Web References

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2. https://learnabout-electronics.org/Oscillators/osc21.php
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5. https://nptel.ac.in/courses/117103064/
6. https://nptel.ac.in/courses/117/106/117106086/
7. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/
8. https://nptel.ac.in/courses/108/102/108102095/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3
2	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3
3	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3
4	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3
5	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3
6	2	2	3	3	3	-	-	-	2	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEC2XX **CERTIFICATION COURSE - II**

L	T	P	C	Hrs
0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20EES201	SKILL DEVELOPMENT COURSE 1: DEMONSTRATION OF BASIC ENGINEERING SCIENCE	L	T	P	C	Hrs
		0	0	2	-	30

Course Objectives

- To provide exposure to the students with hands on experience on basic engineering practices in Mechanical Engineering.
- To impart knowledge and skill on various basic engineering process and tools used in it.
- To educate students on machine assembly practices of pumps and air conditioners.
- To handling tools used in carpentry and preparation.
- To use of tools in casting and preparation, greens and dry sand moulding process.

Course Outcomes

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

CO1 - Distinguish between tools of various trades such as carpentry, fitting, sheet metal, welding, and foundry. **(K2)**

CO2 - Describe the use of carpentry and fitting joints such as lap, butt, mortise joint, various sheet metal models and casting processes. **(K2)**

CO3 - Illustrate on centrifugal pump, Air conditioner. **(K2)**

CO4 - Apply on hand tools used in carpentry and preparation. **(K4)**

CO5 - Analyze of machine tools used in sheet metal work and fabrication work. **(K5)**

List of Experiments

1. Demonstration on use of hand tools used in fitting and preparation of acute angle fitting and Symmetric fitting experiments.
2. Demonstration of arc and gas welding tools and equipments and preparation of Simple lap welding and Single V butt welding experiments.
3. Demonstration on use of hand tools used in carpentry and preparation of Butt joint, Lap joint and T - joint experiments.
4. Demonstration on use of tools and machineries used in sheet metal work and fabrication of truncated tray and cone and frustum of cone.
5. Demonstration on use of tools in casting and preparation of green sand and dry sand moulding experiment.
6. Demonstration on machine assembly practice of centrifugal pump.
7. Demonstration on machine assembly practice of air conditioner.

Reference Books

1. H. S. Bawa, "Workshop Practices", Tata McGraw Hill Publishing Co Ltd, 2015.
2. S.K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology, Volume I: Manufacturing Processes", Media Promoters & Publishers Pvt Ltd., 15th Edition Reprinted, 2013.
3. D. Sathish, "Engineering Workshop Practices Laboratory Manual", Notion press publisher, 2019.
4. R. K. Rajput, "Workshop Practice", Laxmi Publications Pvt. Ltd., 2011.
5. R. S. Khurmi and J. K. Gupta, "Basics of Workshop Practice", S Chand Publisher, 2011.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	1	1	2	1
2	3	1	-	-	3	-	-	-	3	-	-	1	1	2	1
3	3	1	-	-	3	-	-	-	3	-	-	1	3	2	3
4	3	1	-	-	3	-	-	-	3	-	-	1	3	2	3
5	3	1	-	-	3	-	-	-	3	-	-	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

U20EEM202 ENVIRONMENTAL SCIENCE

L	T	P	C	Hrs
2	0	0	-	30

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

i. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii. Slogan making event
iii. Poster making event
iv. Cycle rally
v. Lectures from experts

(b) Actual Activities:

i. Plantation
ii. Gifting a tree to see its full growth
iii. Cleanliness drive
iv. Drive for segregation of waste
v. To live some big environmentalist for a week or so to understand his work
vi. To work in kitchen garden for mess
vii. To know about the different varieties of plants
viii. Shutting down the fans and ACs of the campus for an hour or so

U20BST320	COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (Common to EEE, ICE, MECH, Mechatronics)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose to the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two-dimensional heat flow equations.

Course Outcomes

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

CO1 - Understand the concepts of function of a complex variable. **(K2)**
CO2 - Transform complex functions from one plane to another plane. **(K3)**
CO3 - Apply the concepts of complex integration over contour. **(K3)**
CO4 - Understand the concept of initial and boundary value problems **(K2)**
CO5 - Solve the one and two dimensional heat equation using Fourier series. **(K3)**

UNIT I FUNCTION OF A COMPLEX VARIABLE **(12 Hrs)**

Continuity, derivative and analytic functions – Necessary conditions – Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function

UNIT II CONFORMAL MAPPINGS **(12 Hrs)**

Conformal mapping – Simple and standard transformations like $w = z+c, cz, z^2, e^z, \sin z, \cosh z, z + \frac{1}{z}$ –Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem – Series expansion of complex valued functions – classification of singularities.

UNIT III COMPLEX INTEGRATION **(12 Hrs)**

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma – Application of residue theorem to evaluate real integrals – unit circle and semicircular contour.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **(12 Hrs)**

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one-dimensional wave equation – Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS **(12 Hrs)**

Fourier series solutions of one-dimensional heat flow equation – Fourier series solutions of two-dimensional heat flow equation under steady state conditions.

Text Books

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2020.
2. N. P. Bali and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearsons Publication, New Delhi, 4th Edition, 2017.

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1. C. Gupta, B. Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 1st Edition, 2015.
2. H. K. Dass and Dr. Rama Verma, "Introduction to Engineering Mathematics-volume II", S. Chand and Co., New Delhi, 9th Edition, 2019.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, New Delhi, 10th Edition,2019.
4. Ravish R. Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 1st Edition, 2016.
5. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2018.

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	2	2	2
2	3	2	1	1	-	-	-	-	-	-	-	1	2	2	2
3	3	2	1	1	-	-	-	-	-	-	-	1	2	2	2
4	2	1	-	-	-	1	-	-	-	-	-	1	2	2	2
5	3	2	1	1	-	1	-	-	-	-	-	1	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EST356	DATA STRUCTURES (Common to ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)	L	T	P	C	Hrs
		2	2	0	3	45

Course Objectives

- To impart the basic concepts of data structures and its terminologies.
- To understand concepts about stack and queue operations.
- To understand basic concepts about linked list and its various operations.
- To understand concepts about Tree and its applications.
- To understand basic concepts about Sorting, Hashing and Graph.

Course Outcomes

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

CO1 - Compute time and space complexity for given problems **(K3)**
CO2 - Demonstrate stack, queue and its operation. **(K3)**
CO3 - Illustrate the various operations of linked list. **(K3)**
CO4 - Use the concepts of tree for various applications. **(K3)**
CO5 - Outline the various sorting, hashing and graph techniques. **(K3)**

UNIT I BASIC TERMINOLOGIES OF DATA STRUCTURES (9 Hrs)

Introduction: Basic Terminologies – Elementary Data Organizations. Data Structure Operations: Insertion – Deletion – Traversal. Analysis of an Algorithm. Asymptotic Notations. Time-Space trade off. Array and its operations. Searching: Linear Search and Binary Search Techniques – Complexity analysis.

UNIT II STACK AND QUEUE OPERATIONS (9 Hrs)

Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.

UNIT III LINKED LIST OPERATIONS (9 Hrs)

Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.

UNIT IV TREES (9 Hrs)

Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree. Introduction to B-Tree and B+ Tree.

UNIT V SORTING, HASHING AND GRAPHS (9 Hrs)

Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort and Radix Sort. Performance and Comparison among the sorting methods. Hashing: Hash Table – Hash Function and its characteristics. Graph: Basic Terminologies and Representations – Graph traversal algorithms.

Text Books

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Computer Science Press, Illustrated Edition, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, 3rd Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009.

Reference Books

1. Balagurusamy, “Data Structures”, Tata McGraw-Hill Education, 2019.
2. D.Samanta, “Classic Data Structures”, Prentice-Hall of India, Second Edition, 2012.
3. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in c”, Prentice-Hall of India, Second Edition, 2007.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education”, Second Edition, 2006.
5. Mark Allen Weiss, “Algorithms, Data Structures and Problem Solving with C++”, Addison-Wesley Publishing Company, Illustrated Edition, 1995.

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1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1	2
2	3	2	1	1	-	-	-	-	-	-	-	-	2	1	2
3	3	2	1	1	-	-	-	-	-	-	-	-	2	1	2
4	3	2	1	1	-	-	-	-	-	-	-	-	2	1	2
5	3	2	1	1	-	-	-	-	-	-	-	-	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET307 **ELECTRICAL MACHINES – II**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To equip the students to understand and analyze the characteristics of three phase induction motor.
- To learn different types of starters and speed control of three phase induction motor.
- To equip the students to understand and analyze the characteristics of alternator.
- To learn characteristics of synchronous motor and effect of varying load and excitation.
- To get familiar with performance characteristics of single phase induction motors and special machines.

Course Outcomes

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

CO1 - Evaluate and analyze the performance of three phase induction motor using equivalent circuits and circle diagram. **(K3)**

CO2 - Apply suitable starting and speed control methods to enhance the performance of three phase induction motors. **(K3)**

CO3 - Analyze the performance characteristics of alternator and compute voltage regulation with different methods. **(K4)**

CO4 - Analyze the characteristics of synchronous motor and its performance with effect of varying load and excitation. **(K4)**

CO5 - Recognize the characteristics of single phase induction motors and special machines as well as choose an appropriate motor for any industrial application. **(K3)**

UNIT I INDUCTION MOTOR (9 Hrs)

Single phase Induction Motors: Construction – Principle of operation - Double revolving field theory - Torque-speed characteristics – starting methods – Applications.

Three phase Induction Motors: Construction – principle of operation – Types - Effect of slip on rotor parameters – Torque equation - phasor diagram - effect of voltage variation and rotor resistance on torque slip characteristics - Power Stages - equivalent circuit – no load and blocked rotor test - circle diagram – Separation of no load losses - Losses and efficiency – Applications.

UNIT II STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR (9 Hrs)

Starters: Need for starters – Starting methods. Speed control: Stator side – Rotor side – Solid state control. Cogging and Crawling - Electric Braking - deep bar and double cage rotor – Synchronous induction motor – Induction generator – Applications.

UNIT III ALTERNATOR (9 Hrs)

Alternator: Construction – operation – Types of rotors – EMF equation – Synchronous reactance – Armature reaction - Alternator on load – phasor diagram. Voltage regulation: EMF, MMF, ZPF. Synchronizing and parallel operation – effect of change of excitation and prime mover inputs – automatic voltage regulators – Two reaction theory of Salient pole machines – slip test - power angle diagram – Applications.

UNIT IV SYNCHRONOUS MOTOR (9 Hrs)

Construction - principle of operation - starting methods - Torque and power equations - speed control– phasor diagram – effect of varying load and excitation - 'V' and inverted 'V' curves - hunting – synchronous condenser – Applications.

UNIT V SPECIAL MACHINES (9 Hrs)

Stepper motors - Reluctance motor - Hysteresis motor– Servo motor– Linear induction motor– AC series motor - switched reluctance motor - Brushless DC motors– PMSM – Applications.

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
2. R. K. Rajput, "Electrical Machines", Laxmi publications Pvt. Ltd, New Delhi, 6th Edition, 2008.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology", Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Edition, 2009.

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1. M. G. Say, "Alternating Current Machines", Pitman Publishing, 5^{th} Edition, 2002.
2. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3^{rd} Edition, 2013.
3. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2^{nd} Edition, 2001.
4. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5^{th} Edition, 2017.
5. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6^{th} Edition, 2006.

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2. https://nptel.ac.in/courses/108/105/108105131/
3. http://electrical-engineering-portal.com/
4. http://shodhganga.inflibnet.ac.in/
5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET308	LINEAR INTEGRATED CIRCUITS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce IC fabrication process and basic building blocks of linear integrated circuits.
- To familiarize the AC and DC characteristics of OP AMP 741 and its basic application circuits.
- To outline the design procedure of active filters and waveform generation using operational amplifiers.
- To illustrate the design procedure of various Regulator ICs for power supply circuits.
- To impart knowledge on the fundamental blocks and applications of special ICs like 555 and 565 ICs.

Course Outcomes

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

CO1 - Describe the IC fabrication process for any circuits. **(K2)**
CO2 - Design and analyze OP AMP based circuits for different applications like A/D and D/A conversion. **(K3)**
CO3 - Design filters and waveform generators using OP AMP. **(K3)**
CO4 - Design regulators for power supply circuits. **(K3)**
CO5 - Design multi-vibrators using 555 timer and demodulators using 565 PLL. **(K3)**

UNIT I IC FABRICATION (9 Hrs)

IC classification – Fundamental of monolithic IC technology – Epitaxial growth, masking and etching, diffusion of impurities – Realization of monolithic ICs and packaging: Fabrication of resistance, diode, capacitance and PV cells –BJT – FET – HFET – CMOS technology.

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS (9 Hrs)

OP-AMP equivalent circuit – CMRR – AC and DC characteristics – Open and closed loop configuration – Properties of practical op-amps (LM741, LM124, OP07, TL082) – Interpretation of OP-AMP data sheet – Applications – Instrumentation amplifier – Clipper and Clamper – D/A converters– A/D converter – TLC0820 and TLC7524 ICs–S/H circuit.

UNIT III ACTIVE FILTERS AND WAVEFORM GENERATOR USING OP AMP (9 Hrs)

Ist and IInd order Active filter – Low pass, high pass, wide band pass and band stop Butterworth filters –Narrow band pass and notch filters – State variable filter – Switched capacitor filter – Waveform generator: RC Phase shift and Wienbridge oscillators – Triangular and saw tooth wave generator – Effect of Slew Rate on waveform generation – Schmitt trigger and Multivibrators – Applications

UNIT IV ANALOG IC APPLICATIONS (9 Hrs)

Series op-amp regulator – IC voltage regulators: LM78XX, LM79XX Dual tracking regulators – Positive and Negative voltage regulators IC 723 – Adjustable voltage regulators: LM117, LM317 – Switching regulator – SMPS – LM2524 – V/F converter – F/V converter – Analog Multiplier MPY634– AGC and AVC– INA121 Instrumentation Amplifier – LM 380 Power amplifier – Comparator IC LM311

UNIT V PHASE LOCKED LOOP AND TIMER (9 Hrs)

PLL: 74HCT7046 – phase comparator – PLL Applications: Frequency synthesis, AM and FM detection, FSK demodulator and Motor speed control – IC555 timer – Functional diagram – Multivibrators – Schmitt trigger – Application as Missing pulse detector, Frequency counter – Dual timer SN74AH – CD4093 ICs.

Text Books

1. Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, Pearson Education, 5th Edition, 2015.
2. J. Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Prentice Hall of India, New Delhi, 2nd Edition, 2010.
3. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, McGraw Hill, 1st Edition, 2018.
4. Muhammad H. Rashid, “Microelectronic Circuits: Analysis and Design”, Cengage learning Inc, 2nd Edition, 2011.
5. D. Roy Choudhary, Sheil. B. Jani, “Linear Integrated Circuits”, New Age Publication, 5th Edition, 2018.
6. David A. Bell, “Op-amp and Linear ICs”, Oxford Higher Education, 3rd Edition, 2013.

Reference Books

1. James M. Fiore, "Opamps and Linear Integrated Circuits Concepts and Applications", Cengage learning, 1st Edition, 2010.
2. Bruce Carter, Ron Mancini, "Op Amps for Everyone", Newnes Publication, 5th Edition, 2017.
3. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson Education, 2nd Edition, 2013.
4. Jacob Millman, Christos C. Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2nd Edition, 2009.
5. Robert F. Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2012.

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1. https://nptel.ac.in/courses/108/108/108108111/
2. https://nptel.ac.in/courses/117/107/117107094/
3. https://nptel.ac.in/courses/108/108/108108114/
4. https://www.electronics-tutorials.ws/opamp/opamp_1.html
5. https://www.tutorialspoint.com/semiconductor_devices/semiconductor_devices_operational_amplifiers.htm
6. https://www.allaboutcircuits.com/video-lectures/op-amp-applications/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	-	-	-	-	-	-	-	-	-	-	1	1	3
2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET309 **ELECTROMAGNETIC THEORY**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To introduce the basic mathematical concepts related to electrostatic vector fields.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To familiarize the students with the different concepts of magneto-statics, magnetic flux density, scalar and vector potential and their applications.
- To impart knowledge on the application of magnetic field.
- To expose concepts of electromagnetic waves and wave propogation.

Course Outcomes

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

CO1 - Apply the mathematical concepts to electrostatic vector fields. **(K3)**
CO2 - Analyze the distribution of the charges in electric field applications. **(K4)**
CO3 - Calculate the magnetic field for the analysis of all electrical machines. **(K4)**
CO4 - Design an inductor to produce magnetic field. **(K4)**
CO5 - Compute Maxwell equation for electromagnetic field applications. **(K3)**

UNIT I ELECTROSTATIC FIELD (9 Hrs)

Co-ordinate Systems: Cartesian, Cylindrical and Spherical – Scalar and vector product - Coulomb's law - Electric field – Electric field intensity(E) due to point, line, surface and volume charge distribution - Electric flux density (D) - gradient and Curl of a field, Gauss Law and its applications, Divergence of a vector field - Testing equipment to electrostatic discharge. Case study - communication cables.

UNIT II ELECTRIC FIELDS IN MATERIAL SPACE (9 Hrs)

Electric potential and potential gradient - Electric dipole and dipole moment - Nature of Dielectrics and Conductors - Polarization in dielectrics - Electric field in multiple dielectrics - Boundary conditions for electrostatic field - Poisson's and Laplace's Equations – Capacitance-Energy density - Applications - Electrostatic Precipitators, Xerography.

UNIT III MAGNETOSTATIC FIELDS (9 Hrs)

Biot-Savart law - Magnetic field intensity (H) and magnetic flux density (B) - Ampere's Circuital Law, magnetic flux density in a finite and infinite conductor, solenoid and toroid - Magnetic field in multiple media - Magnetic dipole - Scalar and vector magnetic potential – Stoke's theorem - Micro magnetics, Application: LF Magnetic shielding.

UNIT IV APPLICATION OF MAGNETIC FIELD (9 Hrs)

Boundary condition for magneto static fields - Magnetic field in matter and magnetic circuits. Magnetic Forces and torque on current carrying conductors – potential energy and force on magnetic energy - Inductance of solenoids, toroid's and transmission lines – Application of magnetic field in induction heating, Helmholtz coil.

UNIT V ELECTROMAGNETIC AND WAVE PROPAGATIONS (9 Hrs)

Maxwell's equation: displacement current - continuity equation, Differential and integral forms - Wave equation-Wave propagation in lossless media, good conductor and dielectrics - Flow of electromagnetic Power and Poynting vector: instantaneous and average power densities. Applications of electromagnetic waves –Antennas and radiation of electromagnetic energy, Case study: Effects of Electromagnetic fields (EMF) near high voltage transmission line.

Text Books

1. Mathew N. O. Sadiku, "Principles of Electromagnetics", Oxford University Press Inc., 6th Edition, 2015.
2. Ashutosh Pramanik, "Electromagnetism Applications - Vol. 2: Magnetic Diffusion and Electromagnetic Waves", PHI Learning Private Limited, New Delhi, 2014.
3. K.A. Gangadhar, P.M. Ramanthan "Electromagnetic Field Theory (including Antennas and wave propagation", Khanna Publications, 16th Edition, 1997.

Reference Books

1. Joseph. A. Edminister, Schaum's, "Outline of Electromagnetics", (Schaum's Outline Series), Tata McGraw Hill, 4th Edition, 2014
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 9th Edition, 2018.
3. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, 5th Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu, "Electromagnetic field theory Fundamentals", Cambridge University Press, 2nd Revised Edition, 2009.

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2. https://www.youtube.com/watch?v=9Tm2c6NJH4Y
3. https://www.youtube.com/watch?v=HcPDc23ZLEs
4. http://scienceworld.wolfram.com/physics/ElectromagneticForce.html
5. http://www.unitconversion.org/unit_converter/magnetic-field-strength.html
6. http://www.wolfsonelectrostatics.com/04_news/index.html#can-shocks-from-static-electricity-damage-your-health

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
2	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET310 **POWER PLANT ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the basic knowledge of various types of power plants and the factors considered for site selection
- To have a clear idea about the operation of Steam Power Plants with detailed study of the associated equipments and machineries
- To know the working principle, basic components and various modern reactors of the nuclear power plants
- To get a clear knowledge about how power is generated using diesel, gas and combined cycle power plants
- To know the importance in selection of equipments and various tariff structures involved with power plants.

Course Outcomes

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

CO1 - Relate the various conventional energy systems and factors affecting their site selection. **(K2)**
CO2 - Illustrate power generation using steam power plants along with the detailed review on its equipments used. **(K3)**
CO3 - Explain about the nuclear energy production, its equipments and reactors model inside the plant. **(K2)**
CO4 - Express and compare the construction, working principle of various equipments used with diesel, gas turbine and combined cycle power plants. **(K2)**
CO5 - Evaluate economic feasibility and importance of equipment selection to formulate tariff structure for power generating units.**(K4)**

UNIT I INTRODUCTION TO POWER PLANTS (9 Hrs)

Conventional and Non-Conventional Sources of Energy and their availability in India - Different Types of Power Plants - Choice of Power Generation - Basic schemes and constituents of Steam, Nuclear, Diesel and Gas Turbine power stations - Factors to be considered for selection of site - Power Plants in India.

UNIT II STEAM POWER PLANT (9 Hrs)

Layout and types of Steam Power Plants - Fuel and Ash handling systems - Dust collectors – combustion equipment for steam boilers – Economizer and Air pre heater - Mechanical stokers – Pulverizes – Electrostatic precipitator – Draughts – Steam condensers - Cooling Ponds and Cooling Towers - Pollution Controls - Methods of Feed water treatment – Generating efficiency - Power generation capacities of various plants in India.

UNIT III NUCLEAR POWER PLANTS (9 Hrs)

Nuclear energy - Fission and Fusion reaction - Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors - Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium - Uranium reactor (CANDU), Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors - Safety measures for Nuclear Power plants - Case study: Comparison of various nuclear power plants in India.

UNIT IV DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS (9 Hrs)

Layout of Diesel power plants and components - Selection of engine – types and applications - Gas Turbine power plant – Classifications - Layout – Merits – fuels – Combined Cycle Power Plants -Integrated Gasified based Combined Cycle systems - Introduction to Energy storage – Case study: Decentralized Power technologies.

UNIT V POWER PLANT ECONOMICS (9 Hrs)

Economics of Power generation - Cost of Electrical Energy, Expression for cost of electrical energy, interest, depreciation - Power tariff - types - Load distribution parameters - Load curve - load duration Curve – Effect of load on power plant design – Load forecasting – Peak load pricing - Comparison of site selection criteria - Relative merits and demerits - Capital and Operating Cost of different power plants.

Text Books

1. El-Wakil, "Power Plant Technology", McGraw-Hill, 1st Edition, 2010.
2. Frederick T. Morse, "Power Plant Engineering", Affiliated East-West Press Pvt Ltd, 7th Edition, 2008.
3. R. K. Rajput, "Power Plant Engineering", Laxmi Publications, 4th Edition, 2016.

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1. Leonjard L. Grigsby, "Electric Power Generation, Transmission and Distribution", CRC Press, 3rd Edition, 2012.
2. Bernhardt G.A. Skrotzki, "Power Station Engineering and Economy", Tata McGraw Hill, Indian Edition, 2001.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Standard Handbook of Power Plant Engineering", McGraw Hill, 2nd Edition, 2012.
4. P.K. Nag, "Power plant Engineering", Tata McGraw-Hill, 4th Edition, 2017.

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2. https://swayam.gov.in/nd1_noc20_me87/preview
3. https://swayam.gov.in/nd1_noc20_me40/preview
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5. https://swayam.gov.in/nd1_noc20_ee86/preview
6. https://sga-site.yolasite.com/resources/books/MET401-Power%20Plant%20Engineering.pdf
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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
2	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
3	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
4	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
5	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20HSP301

GENERAL PROFICIENCY – I

(Common to all branches except CSBS)

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To enrich strong vocabulary and decoding skills through comprehension analysis.
- To advance communication and leadership skills pragmatically.
- To pronounce English sounds in isolation and in connected speech.
- To expand effective written communication skills to meet organizational goals.
- To extend knowledge on verbal aptitude and prepare for interviews

Course Outcomes

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

CO1 - Interpret meaning and apply reading strategies in technical and non-technical context. **(K2)**
CO2 - Develop interpersonal communication skills professionally.**(K3)**
CO3 - Infer the distinct speech sounds and overcome native language influence. **(K2)**
CO4 - Demonstrate various forms of formal writing. **(K2)**
CO5 - Apply the techniques of verbal aptitude in competitive exams. **(K3)**

UNIT I COMPREHENSION ANALYSIS (6 Hrs)

Listening: Listening Comprehension (IELTS based) – **Speaking**: Break the iceberg - **Reading:** Reading technical passage (IELTS based) - **Writing:** Writing Task: 1 (IELTS: Graph/ Process /Chart Description) **Vocabulary:** Synonyms (IELTS)

UNIT II PERSONALITY DEVELOPMENT (6 Hrs)

Listening: Interview Videos - **Speaking:** Extempore and Presentation (Soft Skills) - **Reading:** British and American Vocabulary, Read and review (Books, Magazines) - **Writing**: SWOT Analysis **Vocabulary:** Idioms (IELTS)

UNIT III INFERENTIAL LEARNING (6 Hrs)

Listening: Listening Speech sounds to overcome Mother Tongue Influence, Anecdotes– **Speaking**: Interpersonal Interaction and Situational attribution – **Reading**: Distinguish between facts and opinions - **Writing:** Writing Conversation to different context **Vocabulary:** Phrasal Verbs (IELTS)

UNIT IV INTERPRETATION AND FUNCTIONAL WRITING (6 Hrs)

Listening: Group Discussion videos - **Speaking:** Group Discussion Practice - **Reading:** Interpretation of data - Graph, table, chart, diagram (IELTS based) - **Writing**: Writing Task: 2 (IELTS) **Vocabulary:** Collocations (IELTS)

UNIT V APTITUDE (6 Hrs)

Language Enhancement: Articles**,** Preposition, Tenses
Verbal Ability Enhancement: Blood Relation, Completing Statements- Cloze test, Spotting Errors –Sentence Improvement, One Word Substitution, Word Analogy, Word Groups(**GATE**).

Reference Books

1. Jeff Butterfield, “Soft Skills for Everyone”, Cengage Learning, New Delhi, 2012.
2. Mn.Taylor and Grant Taylor. “English Conversation Practice”. Tata McGraw-Hill Education, 1975.
3. Bailey, Stephen. “Academic writing: A practical guide for students”. Psychology Press, 2003.
4. Aggarwal, R. S. “A Modern Approach to Verbal & Non Verbal Reasoning”. S. Chand, 2010.
5. Wren, Percival Christopher, and Wren Martin. “High School English Grammar and Composition”. S Chand, 2005.

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2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
2	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20ESP357	DATA STRUCTURES LAB (Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To understand the basic concepts of Data Structures.
- To learn about the concepts of Searching Techniques.
- To explore about the concepts of Sorting Techniques.
- To know about the linear Data Structures.
- To study about non-linear Data Structures.

Course Outcomes

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

CO1 - Analyze the algorithm's / program's efficiency in terms of time and space complexity.**(K3)**
CO2 - Solve the given problem by identifying the appropriate Data Structure.**(K3)**
CO3 - Solve the problems of searching and sorting techniques. **(K3)**
CO4 - Solve problems in linear Data Structures.**(K4)**
CO5 - Solve problems in non-linear Data Structures. **(K4)**

List of Exercises

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list.
   a)Delete an element from list c) Search for a key element in list d) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder b) Inorder and c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India, 1st Edition, 2017.
4. Reema Thareja,"Data structures using C", Oxford University, 2nd Edition, 2014.
5. Tenebaum Aaron M, "Data Structures using C", Pearson Publisher, 1st Edition, 2019.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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1	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
3	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
4	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2
5	3	2	1	1	3	-	-	-	-	-	-	-	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP306 ELECTRICAL MACHINES LAB - II

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To equip the students to test and evaluate the performance of induction and synchronous machines by conducting appropriate experiments.
- To learn different methods to predetermine the characteristics of single phase and three phase induction motors
- To get familiar with different types of speed control of three phase induction motor.
- To understand the synchronization of three phase alternator with infinite bus bar.
- To learn the assembling of different types of AC machines.

Course Outcomes

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

CO1 - Test the performance of induction and synchronous machines by conducting suitable experiments and report the results. **(K4)**

CO2 - Predetermine the different performance characteristics of single phase and three phase induction motors. **(K4)**

CO3 - Analyze the speed control techniques and electrical braking of induction motor. **(K4)**

CO4 - Experiment the synchronization of alternators and analyze the power exchange with the grid. **(K3)**

CO5 - Develop any prototype modules implementing different control techniques in Induction and Synchronous machines for various applications. **(K5)**

List of Experiments

1. Load test on single phase induction motor
2. No load and blocked rotor tests on single phase induction motor
3. Load test on three phase squirrel cage and slip ring induction motors
4. No load and blocked rotor tests on three phase induction motor and Separate its no load losses
5. Speed control of induction motor
   (i). Stator voltage control
   (ii). Rotor resistance control
6. Electrical Braking of Induction motor
   (i). Dynamic Braking
   (ii). Plugging
   (iii). Regenerative Braking
7. Load test on induction generator
8. Load test on Single phase alternator
9. Load test on three-phase alternator
10. Voltage regulation of alternator (emf, mmf, zpf)
11. Slip test on three phase salient pole alternator
12. Synchronization of three phase alternator with infinite bus bar
13. V and inverted V curves of synchronous motor
14. Performance Characteristics of Universal Motor
15. Assembling and Testing of AC machines

Reference Books

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D.R. Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand & Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, "Electrical Machines Lab Manual with MATLAB Programs", Laxmi Publications Pvt Limited, 1st Edition, 2015.

4. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. M. G. Say, "Alternating Current Machines", Pitman Publishing, 5th Edition, 2002.
6. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3rd Edition, 2013.
7. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2nd Edition, 2001.
8. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6th Edition, 2006.

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1. http://em-coep.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php
3. http://em-iitr.vlabs.ac.in/
4. http://vem-iitg.vlabs.ac.in/
5. https://nptel.ac.in/courses/108/105/108105131/

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
2	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
3	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
4	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3
5	3	3	2	3	1	-	-	-	3	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP307 **LINEAR INTEGRATED CIRCUITS LAB**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To learn design, testing and characterizing of circuit behavior with analog ICs.
- To familiarize the AC and DC characteristics of OPAMP 741.
- To outline the design procedure of the different applications of OPAMP 741.
- To introduce the design of filters and waveform generators using OPAMP 741.
- To impart knowledge on the design and realization of multivibrator circuits using 555 Timer.

Course Outcomes

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

CO1 - Design and use the OPAMP for various applications. **(K4)**

CO2 - Design the application circuits like A/D, D/A filters using OPAMP and special ICs. **(K4)**

CO3 - Design and test various waveform generation circuits using OPAMPS and special ICs. **(K4)**

CO4 - Design and test regulator circuits for power supplies using voltage regulator ICs. **(K4)**

CO5 - Verify and demonstrate V/F, frequency multiplier and SMPS. **(K4)**

List of Experiments

1. Obtain various characteristic parameters of IC 741
2. Design and analysis of Inverting, non-inverting amplifiers, Voltage follower, Adder and subtractor using OPAMP 741
3. Design and analysis of Integrator, Differentiator, Log and Antilog amplifier using OPAMP 741.
4. Design and analysis of comparator circuits (PWM and SPWM) and instrumentation amplifier using OPAMP 741.
5. a. Design and analysis of D/A and A/D converters using OPAMP 741.
   b. Verification of A/D conversion and D/A conversion using TLC0820 and TLC7524
6. Design and analysis of schmitt trigger and filter circuit (Ist order and IInd order) using OPAMP 741.
7. Design and analysis of wein-bridge and RC phase shift oscillator.
8. Design and verification of waveform generator using OPAMP 741
9. a. Design and analysis of low and high voltage regulators using IC 723 and variable voltage regulator using IC LM317.
   b. Design and verification of power source using LM2524 IC.
10. a. Design and analysis of Monostable and Astable multivibrator using IC555.
    b. Design and verification of Monostable and Astable multivibrator using SN74AH.
11. Implementation of Frequency multiplication using 74HCT7046
12. Design and analysis of FSK MOD/DEMOD using 74HCT7046

Reference Books

1. R. M. Marston, "Op-Amp Circuits Manual", Elsevier, 2016.
2. Ron Mancini, "Op Amps for Everyone: Design Reference", Newnes, 2nd Edition, 2003.
3. Walt Jung, "Op Amp Applications Handbook", Newnes, 1st Edition, 2005.
4. Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, 5th Edition, 2015.
5. James M. Fiore, "Opamps and Linear Integrated Circuits Concepts and Applications", Cengage learning, 1st Edition, 2010.
6. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson Education, 2nd Edition, 2013.
7. Jacob Millman, Christos C. Halkias, "Integrated Electronics - Analog and Digital circuits system", Tata McGraw Hill, 2nd Edition, 2009.
8. Robert F. Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2012.

Web References

1. https://nptel.ac.in/courses/108/108/108108114/
2. http://musicfromouterspace.com/analogsynth_new/ELECTRONICS/TECHBENCH/TECHBENCH.php
3. https://www.circuitlab.com/circuit/bkg2qg/op-amp-inverting-amplifier/
4. https://electrosome.com/723-voltage-regulator/
5. https://www.electronicshub.org/how-555-timer-ic-testing-circuit-works/
6. http://www.infocobuild.com/education/audio-video-courses/electronics/op-amp-practical-applications-iisc-bangalore.html

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2	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	3	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEC3XX	CERTIFICATION COURSE - III	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20EES302

SKILL DEVELOPMENT COURSE 2

(Choose anyone of the below three courses)

L	T	P	C	Hrs
0	0	2	-	30

1. TESTING OF ELECTRONICS DEVICES AND PCB BOARD DESIGNING

Course Content:

1. Identification of different component and its symbols.
2. To study and operation of multimeter, function generator and regulated power supply.
3. Testing of electronic component by CRO and their measurement by LCR bridges.
4. Identify the value and test different types of resistors, capacitors and inductors.
5. Make use of resister, capacitor, inductor in series and parallel connection
6. Identify different types of cables, connectors, fuse, switches, relays and discover their application
7. Read and interpret data sheet of various junction diodes and Transistors.
8. Measure amplitude and frequencies of different sine waveform using CRO and Function Generator.
9. Develop fabrication and mount components on PCB for Doorbell/cordless bell
10. Develop fabrication and mount components on PCB for Clapping switch and IR switch
11. Develop fabrication and mount components on PCB for Cell charger, battery charger, mobile charger
12. Develop fabrication and mount components on PCB for Fire/smoke/intruder alarm

2. DESIGN OF SOLAR POWER PLANT AND INSTALLATION

Course Content:

1. Selection of site/location and shadow analysis
2. Selection of PV module technology
3. Connection of PV Module (Series and Parallel Circuit)
4. Design and sizing of panel capacity for suitable loads
5. Preparation of single line diagram and plant array layout.
6. Design of Power converters (for ON/Off Grid)
7. Solar power plant string combiner box/ ACDB/ MDB/Metering cubical
8. Selection and sizing of AC and DC Cables
9. Selection and sizing of AC/DC side earthing along with lightning protection
10. Plant Installation and Commissioning
11. Maintenance and Troubleshooting of the solar power plant
12. Costing and Tendering of solar power plant
13. Net Metering and Introduction to Smart grid
14. Plant visit and Report Preparation

3. DEMONSTRATION / TROUBLESHOOTING OF ELECTRICAL AND ELECTRONICS EQUIPMENTS

Course Content:

1. Demonstration of electrical safety and electricity tariff calculation for household appliances.
2. Single phase house wiring, Fuse calculation and Extension box installation
3. Demonstration of electrical measuring instruments (Ammeter, Voltmeter, CRO, DSO and Multimeter)
4. a) Electrical wiring for fan and tube light.
   b) Demonstration of coil rewinding of ceiling fan
5. Practical approach towards testing of semiconductor devices using multimeter.
6. Troubleshooting of electrical and electronic home appliances (Electric water heater, Induction stove, Iron box, Mixer, Hair dryer, Mosquito bat and Aquarium water pump)
7. Study of practical approach on audrino board.
8. Demonstration of water level indicator for domestic purpose.
9. Construction of series and parallel connection of LED for decoration purpose.
10. Design of Regulated Power Supply circuit.
11. Demonstration of coil design for specific inductance.

U20EEM303	PHYSICAL EDUCATION	L	T	P	C	Hrs
		0	0	2	-	30

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 30 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

U20BST430	**PROBABILITY AND STATISTICS** (Common to EEE and ICE)	**L**	**T**	**P**	**C**	**Hrs**
		2	**2**	**0**	**3**	**60**

Course Objectives

- To acquire skills in handling situation including more than one random variable.
- To familiarize the student about the continuous random variables and their applications.
- To study the basic concepts of Statistics.
- To learn the concept of testing of hypothesis using statistical analysis.
- To learn the concept of Small sampling

Course Outcomes

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

CO1 - Apply the concept of probability in random variables.**(K3)**
CO2 - Apply the basic rules of continuous random variables.**(K3)**
CO3 - Understand the basic concepts of Statistics.**(K2)**
CO4 - Derive the inference for various problems using testing of hypothesis in large samples. **(K3)**
CO5 - Solve the problems related to testing of hypothesis in small samples. **(K3)**

UNIT I DISCRETE RANDOM VARIABLES **(12 Hrs)**

Random Variables and their event spaces – The probability mass function – Distribution functions – Binomial – Geometric – Negative Binomial and Poisson.

UNIT II CONTINUOUS RANDOM VARIABLES **(12 Hrs)**

Some important distributions – Exponential distribution – Gamma – Weibull – Gaussian distributions. Application of distribution – Reliability – Failure density and Hazard function.

UNIT III STATISTICS **(12 Hrs)**

Measures of central tendency– Arithmetic Mean, Median and Mode – Measures of dispersion and Standard deviation – Skewness and Measures of Skewness – Pearson's coefficient of skewness – Moments – Correlation – Rank correlation and regression.

UNIT IV LARGE SAMPLES **(12 Hrs)**

Curve fitting by the method of least squares – fitting of straight lines – second degree parabolas and more general curves – Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V SMALL SAMPLES **(12 Hrs)**

Test for single mean – Difference of means and correlations of coefficients – Test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books

1. B.S.Grewal, "Higher Engineering Mathematics",Khanna Publishers, Paperback,3rd Edition, 2017.
2. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 2008.
3. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback- I, 2019.

Reference Books

1. Ravish R. Singh, Mukul Bhatt, "Engineering Mathematics", McGraw-Hill, 1st Edition, 2017.
2. William Mendenhall, Robert J. Beaver, Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning, 15th Edition, 2019.
3. Richard.A. Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, "An Introduction to Probability and Statistics", Wiley, 2008.
5. E. Rukmangadachari, "Probability and Statistics", Pearson Education India ,2012

Web References

1. http:// www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

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1	3	2	1	1	-	-	-	-	-	-	-	1	3	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	3	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	3	1	1
4	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EST467	PROGRAMMING IN JAVA (Common to CSE, ECE, EEE, IT, ICE, MECH, CIVIL, BME, Mechatronics, CCE)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To gain and explore the knowledge of java programming
- To know the principles of inheritances, packages, interfaces
- To get familiarized to generic programming, multithreading concepts.
- To gain and explore the advanced concepts in Java.
- To explore database connectivity

Course Outcomes

After completion of the course, students will be able to

CO1 - Write a maintainable java Program for a given algorithm and implement the same. **(K2)**
CO2 - Demonstrate the use of inheritance, interface and package in relevant applications. **(K3)**
CO3 - Create java applications using exception handling, thread and generic programming. **(K3)**
CO4 - Build java distributed applications using Collections and IO streams.**(K3)**
CO5 - Exemplify simple graphical user interfaces using GUI components and database programs. **(K3)**

UNIT I INTRODUCTION TO JAVA PROGRAMMING (12 Hrs)

The History and Evolution of Java - Byte code - Java buzzwords - Data types – Variables – Arrays – operators - Control statements - Type conversion and casting. Concepts of classes and objects: Basic Concepts of OOPs, constructors, static keyword, Final with data, Access control, This key word - Garbage collection- Nested classes and inner classes - String class

UNIT II INHERITANCE, PACKAGES AND INTERFACES (12 Hrs)

Inheritance: Basic concepts - forms of inheritance - super key word – method overriding, abstract classes, dynamic method dispatch - the Object class. Packages: Defining, Creating and Accessing, importing packages. Interfaces: Defining, implementing, applying, variables and extending interfaces

UNIT III EXCEPTION HANDLING, MULTITHREADING (12 Hrs)

Concepts of Exception handling, types of exceptions, creating own exception, Concepts of Multithreading, creating multiple threads, Synchronization, inter thread communication. Enumeration - Autoboxing - Generics.

UNIT IV COLLECTIONS, I/O STREAMS (12 Hrs)

Collections: List –Vector – Stack - Queue – Dequeue –Set – Sorted Set. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT V EVENT DRIVEN PROGRAMMING AND JDBC (12 Hrs)

Events - Delegation event model - Event handling - Adapter classes. AWT: Concepts of components - Font class, Color class and Graphics. - Introduction to Swing – layout management - Swing Components. Java Database Connectivity- Develop real time applications.

Text Books

1. Herbert Schildt, "Java: The Complete Reference", TMH Publishing Company Ltd, 11th Edition, 2018.
2. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018
3. Herbert Schildt, "The Complete Reference JAVA 2", TMH, 7th Edition, 2006.

Reference Books

1. H.M.Dietel and P.J.Dietel, "Java How to Program", 11th Edition, Pearson Education/PHI, 2017.
2. Nageshvar rao, "Core Java and Integrated Approach", 1st Edition, Dreamtech, 2016.
3. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", Prentice Hall, 9th Edition, 2013.
4. P.J. Dietel and H.M Dietel, "Java for Programmers", Pearson Education, 9th Edition, 2011.
5. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Pearson Education, 8th Edition, 2008.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM's tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

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2	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET411	MEASUREMENTS AND INSTRUMENTATION FOR ELECTRICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To give the students an insight into the constructional details and working principles of various measuring instruments.
- To provide the use of different types of analog and digital meters for measuring electrical and physical quantities.
- To demonstrate various Bridges for the measurement of resistance, inductance and capacitance.
- To provide the procedure to calibrate an energy meter.
- To understand and apply different types of sensors for the measurement of physical quantities such as speed, torque, pressure, displacement, temperature, etc.

Course Outcomes

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

CO1 - Acquire knowledge of the characteristics of measuring instruments and their classification. **(K2)**
CO2 - Conversant in construction, working of measuring A.C and D.C meters and their proficient use. **(K3)**
CO3 - Acquire knowledge in various methods of digital meters and its measurement. **(K3)**
CO4 - Acquire knowledge of construction and working principle of various types of display devices and bridge comparison methods for R, L and C measurement. **(K3)**
CO5 - Demonstrate the various types of transducers used for physical measurements. **(K3)**

UNIT I INTRODUCTION TO MEASUREMENT (9 Hrs)

Functional elements of Generalized measurement system - Types of measurement - Classification of instruments - Static and Dynamic characteristics of instruments - Mean, Standard deviation - error - Accuracy, Precision, Sensitivity, Linearity, Resolution, Hysteresis, Threshold, Input impedance - loading effects - Probability of errors- Errors in Measurements - Systematic and random errors, propagation of errors, Limiting errors of instruments.

UNIT II ELECTRICAL INSTRUMENTS (9 Hrs)

Essential requirements of an instrument - Ammeter and voltmeter - Moving coil - Moving Iron - Extension of voltmeter and ammeter range - Electro dynamo meter type Wattmeter - Induction type Energy meter - Principle of operation, construction, Torque equation, types, testing and Calibration using direct and phantom loading - Measurement of active and reactive powers in balanced and unbalanced systems - Instrument Transformers - Construction, phasor diagrams, testing, application of measuring CT and VT - Magnetic measurements – Determination of B-H curve and measurements of iron loss.

UNIT III DIGITAL INSTRUMENTS (9 Hrs)

Digital Volt Meter and its design - Voltage ratio measurement techniques - Digital ohmmeter, capacitance meter - impedance meters (polar and cartesin types) - Decibel meters - Q meter - tan-delta meter - Modulation index meter - Sampling theory and its applications in current, voltage, power, energy measurements - Signal analyzers: wave, network, harmonic distortion, spectrum and logic analyzers - Digital Frequency Meter - Measurement of Frequency - Study of Phasor Measurement Units (PMU).

UNIT IV BRIDGES AND DISPLAY DEVICES (9 Hrs)

Bridges: Measurement of low and high resistances – D.C potentiometer - Wheat stone, Kelvin and Kelvin Double bridge - A.C bridges for measurement of L and C - General principles, sensitivity analysis, Maxwell, Anderson bridge, Hay, Owen and Heavy side Campbell bridges for inductance; Maxwell, De Sauty and Wein bridges for capacitance - Measurement of earth resistance - localization of cable faults by Murray and Varley loop test - Methods of reducing bridge errors - Wagner Earthing Device.

Display Devices: CRT display, analog and digital CRO, LED, and LCD.

UNIT V TRANSDUCERS (9 Hrs)

Transducers - Definition and classification - Linear Displacement: Resistive Potentiometers, stain gauge, LVDT, Capacitive Piezoelectric - Rotational Displacement: magnetic, stroboscope, gyroscope – Force: Strain gauge – Torque: magnetostricitive, strain gauge – Position: synchro Transmitter and receiver – speed: Magnetic and photo electric pickup transducer - Pressure: Manometers, Bourdon – Temperature: Thermistors, thermocouple – Flow: Electromagnetic, Ultrasonic – Level: DP cell, Ultrasonic – Density: Hydrometer - Voltage, current and power: Hall Effect transducer

Text Books

1. A.K. Sawhney, “A Course in Electrical & Electronic Measurements and Instrumentation”, Dhanpat Rai and Co., New Delhi, 19th Edition, 2015.
2. J. B. Gupta, “A Course in Electronic and Electrical Measurements”, S. K. Kataria & Sons, Delhi, 12th Edition, 2009.
3. E. O. Doebelin and D. N. Manik, “Measurement Systems – Applications and Design”, Tata McGraw Hill Education Pvt. Ltd., Special Indian Edition, 2007.

Reference Books

1. David Bell, “Electronic Instrumentation and Measurements”, Oxford University Press, 1st Edition, 2013.
2. A. J. Bouwens, “Digital Instrumentation”, Tata McGraw Hill Publications, 16th Reprint Edition, 2008.
3. H.S. Kalsi, “Electronic Instrumentation”, Tata McGraw Hill Education, 4th Edition, 2019.
4. C.S. Rangan, G.R. Sharma and V. S. V. Mani, “Instrumentation Devices and Systems”, Tata McGraw Hill Book Co., New Delhi, 1st Edition, 2004.

Web References

1. https://www.omega.de/green/pdf/CAP_LEV_MEAS.PDF
2. https://nptel.ac.in/courses/108/105/108105153/
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. http://vlabs.iitkgp.ernet.in/asnm/
5. https://www.youtube.com/watch?v=xLjk5DrScEU
6. http://www.wisegeek.com/what-are-transducers.htm-

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	-	-		-	-	-	-	-	1	2	3	3
2	2	2	2	-	-		-	-	-			1	2	3	3
3	2	2	2	-	-		-	-	-			-	2	3	3
4	2	2	2	-	-		-	-	-			2	2	3	3
5	2	2	2	-	-		-	-	-			2	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET412 **MICROPROCESSOR AND MICROCONTROLLER**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To get familiar with basic architecture and programming techniques of microprocessor 8085.
- To learn interfacing of memory and data transfer techniques using microcontroller.
- To understand the interfacing of input/output devices required for real time applications.
- To introduce the basic concepts of embedded system design using microcontroller.
- To equip the student with ability to design PWM control for various application such as AC-DC, DC-DC converter, etc.

Course Outcomes

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

CO1 - Illustrate the architecture of microprocessor and develop skill in writing assembly language program. **(K3)**
CO2 -Have a clear understanding of microcontroller architecture with functional details of each pin. **(K3)**
CO3 - Write and debug Assembly and C programs for 8 bit AVR ATMega32 Microcontroller. **(K3)**
CO4 -Interface input/output peripheral devices and implement advance communication protocol like I^2C and SPI using AVR ATMega32 Microcontroller. **(K4)**
CO5 - Design and develop microcontroller based real-time applications. **(K4)**

UNIT I ARCHITECTURE AND PROGRAMMING OF 8085 MICROPROCESSOR (9 Hrs)

8085 Microprocessor: Architecture, Addressing modes, Instruction set, Need for Assembly language – Development of Assembly language programs – Machine cycles and Timing diagrams, Programming and Interfacing. Application: Interfacing of stepper motor control with 8085 microprocessor.

UNIT II INTRODUCTION TO 8 BIT AVR ATMega32 MICROCONTROLLER (9 Hrs)

Microprocessor and Microcontroller difference, RISC and CISC programmer's model, Criteria for selecting microcontroller. Overview of AVR family, AVR Microcontroller architecture, status register, Special function registers, RAM, ROM and EEPROM space, On-Chip peripherals, ATmega32 pin configuration and function of each pin, Fuse bits of AVR – Case study on traffic light control using microprocessor and AVR Microcontroller

UNIT III AVR ASSEMBLY LANGUAGE PROGRAMMING ANDPROGRAMMING IN C (9 Hrs)

AVR data types and assembler directives, Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, AVR studio setup for assembly language programming, AVR I/O Port Programming, Time delay loop, Look-up table, Bit addressability, MACROs, Intel HEX file.

Timer programming, Input capture and Wave Generator, PWM programming External Interrupt programming, ADC programming, EEPROM programming – Program using ATMega32 Timer to generate waveforms.

UNIT IV SERIAL COMMUNICATION PROTOCOLS AND PERIPHERAL INTERFACING (9 Hrs)

Serial communication protocols: introduction to UART protocol, I^2C protocol and its Programming, SPI protocol and its Programming, Serial Port programming using polling and interrupt.

Peripheral interfacing and its programming : LCD and Keyboard Interfacing, Relay interfacing, Stepper and DC Motor control, RTC Interfacing, LM35 Temperature sensor interfacing, MAX7219 display controller interfacing – Program using ATMega32 microcontroller for interfacing ultrasonic sensors.

UNIT V ADVANCED MICROCONTROLLER (9 Hrs)

dsPIC33EV: Block diagram, Clock Distribution System, interrupt, Timer, PWMX control registers, high-speed PWMX module register- interconnection diagram, ADC-signal processing and conditioning.

Text Books

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, "The AVR Microcontroller and Embedded Systems Using Assembly and C", Micro Digital Education, Illustrated Edition, 2017.
2. Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", McGraw Hill Education, 2nd Edition, 2003.
3. Ramesh S Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Prentice Hall of India, New Delhi, 5th Edition, 2011.

Reference Books

1. Sunil Mathur, Jeebananda Panda, "Microprocessor and microcontroller", PHI Learning Private Limited, New Delhi, 1st Edition, 2016.
2. AVR ATmega32 data sheet
3. dsPIC33EV data sheet

Web References

1. https://swayam.gov.in/nd1_noc20_ee42/preview
2. https://www.microchip.com ›
3. https://www.microchip.com/design-centers/microcontrollers
4. https://www.microchip.com/design-centers/8-bit
5. https://www.youtube.com/watch?v=S1QCZW92fU4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20HSP402	GENERAL PROFICIENCY – II (Common to all branches except CSBS)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To examine various standardized test in English language.
- To recognize the key features of various technical writing.
- To integrate LSRW skills to endorse multifarious skill set in practical situation.
- To understand the factors that influences the usage of grammar.
- To understand the basic concepts of logical reasoning skills.

Course Outcomes

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

CO1 - Infer ideas to attend international standardized test by broadening receptive and productive skills. **(K2)**
CO2 - Interpret the types of writing in different state of affairs. **(K2)**
CO3 - Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation. **(K3)**
CO4 - Identify the rules of grammar in academic discourse settings. **(K3)**
CO5 - Extend the skills to compete in various competitive exams like GATE, GRE, CAT, UPSC, etc. **(K2)**

UNIT I CAREER SKILLS **(6 Hrs)**

Listening: Listening at specific contexts **Speaking:** Mock interview (Personal and Telephonic) - **Reading**: Read and Review - Newspaper, Advertisement, Company Handbooks and Guidelines (IELTS based) **Writing:** Essay Writing (TOEFL) **Vocabulary:** Words at specified context (IELTS)

UNIT II CORPORATE SKILLS **(6 Hrs)**

Listening: Listening and replicating **Speaking**: Team Presentation (Work Place Etiquettes) **Reading:** Short texts (signs, emoticons, messages) **Writing:** E-mail writing- Hard skills - Resume Writing, Job Application Letter, Formal Letter - **Vocabulary:** Glossary (IELTS).

UNIT III FUNCTIONAL SKILLS **(6 Hrs)**

Listening: Listening TED Talks – **Speaking:** Brainstorming and Individual Presentation, Persuasive Communication - **Reading:** Text Completion (GRE Based) - **Writing:** Expansion of Compound Words **Vocabulary:** Expansion of vocabulary (IELTS).

UNIT IV TRANSFERABLE SKILLS **(6 Hrs)**

Listening: Listening Documentaries and making notes – **Speaking:** Conversation practice at formal and informal context - **Reading:** Read and transform - report, memo, notice and advertisement, **Writing:** Euphemism, Redundancy and Intensifiers **Vocabulary:** Refinement of vocabulary (IELTS).

UNIT V APTITUDE **(6 Hrs)**

Transformational Grammar: Phrases and Clauses, Concord, Conditional Clauses, Voice, Modals
Verbal Ability Enhancement: Letter Series, Coding and Decoding, Sentence Completion (GATE), Critical Reasoning and Verbal Deduction (GATE), Syllogism.

Reference Books

1. Lougheed, Lin. "Barron's Writing for the TOEFL IBT: With Audio CD". Barron's Educational series, 2008.
2. Tulgan, Bruce. "Bridging the soft skills gap: How to teach the missing basics to today's young talent". John Wiley & Sons, 2015.
3. Sherfield, Robert M. "Cornerstone: Developing Soft Skills". Pearson Education India, 2009.
4. Cullen, Pauline, Amanda French, and Vanessa Jakeman. "The official Cambridge guide to IELTS for academic & general training", Cambridge, 2014.
5. Ramesh, Gopalaswamy. "The ace of soft skills: attitude, communication and etiquette for success". Pearson Education India, 2010.

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1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	1	-	-	1
2	1	-	-	-	-	-	-	1	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	1
4	1	-	-	-	-	-	-	1	-	3	-	1	-	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20ESP468	PROGRAMMING IN JAVA LAB (Common to CSE, ECE,EEE,IT,ICE, MECH,CIVIL,BME, Mechatronics, CCE)	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To acquire programming skill in core java.
- To learn how to design java program and applications.
- To acquire object oriented skills in java.
- To develop the skill of designing applications.
- To explore database connectivity.

Course Outcomes

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

CO1 - Apply and practice logical formulations to solve simple problems leading to specific applications. **(K3)**
CO2 - Demonstrate the use of inheritance, interface and package in relevant applications. **(K3)**
CO3 - Create java applications using exception handling, multithread. **(K3)**
CO4 - Build java distributed applications using Collections and IO streams. **(K3)**
CO5 - Develop simple database programs. **(K3)**

List of Exercises

1. Develop simple programs using java technologies and testing tools.
2. Develop a java program that implements class and object.
3. Write a java program to demonstrate inheritance.
4. Develop a simple real life application program to illustrate the use of Multi Threads.
5. Implement simple applications using Collections.
6. Develop a simple application and use JDBC to connect to a back-end database.
7. Create a student application with Add, Edit, Delete, Show functions using JDBC.
8. Create a Bill Application to store sales details using JDBC.
9. Create java applications using Exception Handling for error handling.
10. Develop a java program that implements the Packages.

Reference Books

1. E. Balaguruswamy, "Programming with Java", TMH Publ, 2nd Edition, 2005.
2. JAVA How to programming by DIETEL & DIETEL.
3. Herbert Schil dt, "The Complete Reference JAVA 2", TMH, Seventh Edition, 2006.
4. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Vol 2, Advanced Features, Pearson Education, Seventh Edition, 2010.
5. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM's tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
2	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
3	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
4	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2
5	3	2	1	1	3	-	-	-	-	-	-	-	-	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP408	MEASUREMENTS AND INSTRUMENTATION LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To give the students an insight into the constructional details of various measuring instruments for better understanding of their working principles.
- To demonstrate various Bridges for the measurement of resistance, inductance and capacitance using simulation and hardware set ups.
- To understand the concept of magnetism and to determine the B-H curve for magnetic material specimen.
- To provide the procedure to calibrate an energy meter.
- To test and apply different types of sensors for the measurement of physical quantities such as speed, torque, pressure, displacement, temperature, etc. by conducting an appropriate experiment.

Course Outcomes

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

CO1 -Realize the advantages and the necessity of measurement systems in all Engineering and Scientific works. **(K2)**
CO2 - Measure Resistance, Inductance and capacitance using AC and DC bridges. **(K3)**
CO3 -Determine the magnetization characteristics and hysteresis loss of Iron specimen using BH curve. **(K3)**
CO4 -Calibrate single phase and three phase energy meters used in domestic and commercial applications. **(K3)**
CO5 - Determine ratio error and phase errors in CTs and PTs. **(K2)**
CO6 - Determine the characteristics of RTD, thermostat, strain gauge and LVDT transducers and to apply for the physical quantities measurements. **(K3)**

List of Experiments

1. (a) Measurement of resistance using Wheatstone bridge
   (b) Measurement of insulation resistance.
2. (a) Measurement of capacitance and loss angle of capacitor using Schering Bridge.
   (b) Measurement of inductance and Q-factor using Owen Bridge.
3. Extension of voltmeter and ammeter.
4. Calibration of single phase and three phase Energy meter using loading method.
5. Determination of B-H Curve for the magnetic material specimen.
6. Calibrate Current Transformer and Potential Transformer to determine ratio error and phase errors.
7. Characteristic of Temperature transducers (LDR, thermistor and thermocouple).
8. Measurement of Displacement using capacitive transducer, LVDT, inductive transducer and potentiometric transducer.
9. Measurement of strain, Load and Level using strain gauges
10. Measurement of torque and Pressure using strain gauges
11. Measurement of Voltage, current and power using Hall Effect transducer.
12. Characteristics of Optical Transducers (LDR, Phototransistor, Photovoltaic and photoconductive cells)
13. Measurement of speed using Magnetic and photo electric pickup transducers.
14. Measurement of Position using synchro Transmitter and receiver
15. Spectrum analyser and its use for analysing frequency spectra of periodic and non-periodic signals.

Reference Books

1. A. K. Sawhney, "A course in Electrical and Electronics Measurement and Instrumentation", Dhanpat Rai and Sons, 19th Edition, 2015.
2. William D. Coopers and Albert D. Helfrick, "Modern Electronic instrumentation and Measurements Techniques", Pearson Education India, 1st Edition, 2002.
3. E. W. Golding and F. C. Widdis, "Electrical Measurements and Measuring Instruments", Medtech Publication, 6th Edition, 2019.
4. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill Education, 4th Edition, 2019.
5. C. D. Johnson, "Process Control Instrumentation Technology", Pearson Education India, 8th Edition, 2015.

6. Electrical Business Magazine, (Online edition of Electrical Industry Magazine)
7. Instrumentation and Measurement Magazine, IEEE.
8. Instrumentation and Measurement, IEEE Transactions.
9. Science, Measurement and Technology, IET Journal.
10. Measurements, Elsevier Journal.

Web References

1. https://www.omega.de/green/pdf/CAP_LEV_MEAS.PDF
2. https://nptel.ac.in/courses/108/105/108105153/
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. http://vlabs.iitkgp.ernet.in/asnm/
5. http://www.wisegeek.com/what-are-transducers.htm-

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	2
2	3	2	2	-	-	-	-	-	-	-	-	-	2	2	2
3	2	2	2	-	-	-	-	-	-	-	-	-	2	2	2
4	2	2	2	-	-	-	-	-	-	-	-	-	2	2	2
5	2	2	2	-	-	-	-	-	-	-	-	-	2	2	2
6	2	2	2	-	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP409	MICROCONTROLLER AND ITS APPLICATIONS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To become familiar with architecture and instruction set for 8085.
- To provide hands-on training of interfacing external sensors and actuators with microcontroller
- To impart knowledge for on-chip peripheral programs
- To impart knowledge to generate pulses for electrical applications.
- To impart knowledge to do minor projects using microcontroller for solving real world engineering problems

Course Outcomes

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

CO1 - Develop assembly language program for microprocessor 8085. **(K3)**
CO2 - Analyze various platforms for programming by knowing the complete hardware configurations. **(K4)**
CO3 - Analyze abstract problems and apply a combination of hardware and software to address the problem. **(K4)**
CO4 - Design a control algorithm for various applications using microcontrollers. **(K3)**
CO5 - Design and generate pulses for real time electrical applications. **(K3)**

List of Experiments

Microprocessor Experiments using 8085:

1. 8 bit - Addition, Subtraction, Multiplication and Division
2. Assembly Language Programming: Subroutines, parameter passing to subroutines

Microcontroller Experiments using AVR:

3. AVR Assembly language- Programming using the AVR Instruction Set.
4. a) ATMega32 Timer to generate accurate delay using polling and interrupt
   b) ATMega32 Timer to generate waveforms
   c) Seven Segment Display interfacing with ATMega32
5. a) 16x2 LCD interfacing with ATMega32
   b) 4x4 matrix keyboard interfacing with ATMega32
6. ATMega32 USART programming
7. ATMega32 on-chip ADC for interfacing analog sensors

Application of Microcontroller using AVR

8. Experimentation of DC Motor Interfacing And Speed/Direction Control With Atmega32
9. Stepper motor interfacing with ATMega32
10. DS1307 RTC Interfacing with ATMega32
11. MAX7219 LED matrix driver Interfacing with ATMega32 using SPI protocol
12. Interface to peripherals and use of the I2C bus
13. Design of zero crossing detector
14. a.) Design Frequency Counter which displays frequency of unknown pulse on 16x2 LCD using ATMega32 on-chip Timer.
    b.) Design Pulse period meter which displays ON-time of unknown pulse on 16x2 LCD using ATMega32 on-chip Timer
15. Design Bluetooth controlled 2-ch variable frequency square wave generator using ATMega32 UART and on-chip Timer.
16. Design 4 Channel Data Logger which measures Voltage between 0-5V on 4 ADC Channels of ATMega32 and transmit it to Host PC at every 1 second where it stored in excel sheet with timestamp for future analysis.

Reference Books

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, "The AVR Microcontroller and Embedded Systems Using Assembly and C", Micro Digital Education, Illustrated Edition, 2017.
2. Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", McGraw Hill Education, 2nd Edition, 2003.
3. Ramesh S Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Prentice Hall of India, New Delhi, 5th Edition, 2011.
4. Sunil Mathur, Jeebananda Panda, "Microprocessor and microcontroller", PHI Learning Private Limited, New Delhi, 1st Edition, 2016.
5. AVR ATmega32 data sheet
6. dsPIC33EVdata sheet.

Web References

1. https://www.microchip.com ›
2. https://atmega32-avr.com/projects/
3. https://www.youtube.com/watch?v=S1QCZW92fU4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	2	-	-	-	-	-	-	2	2	2	3
2	2	3	3	3	2	-	-	-	-	-	-	2	2	2	3
3	2	3	3	3	2	-	-	-	-	-	-	2	2	2	3
4	2	3	3	3	2	-	-	-	-	-	-	2	2	2	3
5	2	3	3	3	2	-	-	-	-	-	-	2	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEC4XX	CERTIFICATION COURSE - IV	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

U20EES403	SKILL DEVELOPMENT COURSE 3 (Choose anyone of the below three courses)	L	T	P	C	Hrs
		0	0	2	-	30

1. MOBILE PHONE SERVICING

Course Content:

1. Fundamentals of Mobile Phone Technology
2. Assembling and disassembling of various models of mobile phones.
3. Study of various tools and equipment used in mobile phone repairs.
4. Study of Printed Circuit Board (Motherboard) and various components on PCB
5. Study and testing of various parts, components and different ICs (chips) used on the motherboard.
6. Reheating and mounting of various BGA and SMD chips.
7. Detailed study of various faults arising due to corrupt software.
8. Introduction of various flasher boxes and software.
9. Flashing of various brands of handsets.
10. Procedure to remove virus from infected phones.
11. Unlocking of handsets through codes and/or software.
12. Use of various secret codes
13. Water damaged repair techniques.
14. Circuit tracing, jumper techniques and solutions.
15. Use of internet for troubleshooting faults.
16. Advanced troubleshooting techniques.

2. AUTONOMOUS ROBOTICS

Course Content:

1. Introduction, features and applications to Robotics
2. Building the PC Controlled Robot
3. Programming the PC Controlled Robot and testing it
4. Building the Line Follower Robot
5. Programming the Line Follower Robot and testing it
6. Building the Obstacle Avoiding Robot
7. Programming the Obstacle Avoiding Robot and testing it
8. Building the Pit Avoiding Robot
9. Programming the Pit Avoiding Robot and testing it
10. Building the Light Following Robot
11. Programming the Light Following Robot and testing it
12. Troubleshooting of Robotics.

3. REPAIR AND MAINTENANCE OF POWER SUPPLY, INVERTER AND UPS

Course Content:

1. Study on use of appropriate repair tools and Equipments
2. Identify, place, solder, de-solder and test different SMD discrete components
3. Rework on PCB after identifying defects from SMD soldering and de-soldering
4. Identify different front panel controls and connectors of the given power supply.
5. Open the power supply and identify major sections and power components with heat sinks.
6. Identify various input and output sockets/ connectors of the given SMPS and measure its outputs using a multimeter
7. Identify and replace the faulty components in SMPS used in TVs and PCs
8. Identify front panel control and indicators of Inverter and also understand the use of back panel sockets and connections.
9. Testing of battery mode (Battery – Inverter – Load) in interconnected system
10. Open Top cover and identify various circuit boards in Inverter and also monitor voltages at various test points.
11. Troubleshooting of inverter
12. Identify front and back panel control, indicators, sockets and connections of UPS
13. Identify various circuit boards in UPS and monitor voltages at various test points
14. Troubleshooting of UPS

U20EEM404	NSS / NCC	L	T	P	C	Hrs
		0	0	2	-	30

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 30 hours.
4. The above activities will be monitored by the respective faculty in-charge.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree

ELECTIVE PAPERS

U20EEE401	ELECTRICAL SAFETY ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To familiarize the Indian Electricity Rules and Act related with electrical safety.
- To provide a knowledge about electrical shocks and safety precautions.
- To create awareness of the electrical safety associated with installation of electrical equipment.
- To analyze different Hazardous areas for electrical safety.
- To expose knowledge about necessity of safety policy and safety management.

Course Outcomes

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

CO1 - Describe the Indian Electricity (IE) acts and various rules for electrical safety.**(K1)**
CO2 - Expose safety measures to prevent electrical shock in handling of domestic electrical appliances. **(K2)**
CO3 - Evaluate the safety aspects during installation of plant and equipment. **(K3)**
CO4 - Describe the various hazardous area and application of electrical safety in various places. **(K1)**
CO5 - Acquire knowledge about importance of electrical safety training to improve quality management in electrical systems. **(K2)**

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS (9 Hrs)

Objective and scope of electrical safety - National electrical Safety code - Statutory requirements – Indian Electricity acts related to electrical Safety - Safety electrical one line diagram - International standards on electrical safety safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement

UNITII ELECTRICAL SHOCKS AND THEIR PREVENTION (9 Hrs)

Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Shocks due to flash/ Spark over's - Firing shock - Multi storied building - Prevention of shocks - Safety precautions - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Case studies on electrical causes of fire and explosion

UNIT III SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE (9 Hrs)

Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Safe guards for operators - Safety equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation– Agricultural pump installation

UNIT IV HAZARDOUS ZONES (9 Hrs)

Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I(Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations-Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- calculating the required level of arc protection

UNIT V SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS (9 Hrs)

Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical workplace safety practices.

Text books

1. John Cadick, Mary Capelli Schellpfeffer, Dennis Neitzel, Al Winfield, “Electrical Safety Handbook”, McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, “Electrical Safety and the Law: A Guide to Compliance”, Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, “Electric Safety: Practice and Standards”, CRC Press; 1st Edition, 2013.

Reference books

1. Rob Zachariason, “Electrical Safety”, Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, “Principles of Electrical Safety”, Wiley-IEEE Press; 1st Edition, 2014.

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1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/
6. https://www.constellation.com/energy-101/electrical-safety-tips.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
2	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
3	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3
4	3	3	3	2	-	-	-	-	-	-	-	-	3	2	3
5	3	3	-	2	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE402

COMPUTER AIDED DESIGN FOR ELECTRICAL APPARATUS

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To introduce the basic concepts of MagNet software for the design of Electrical Machine.
- To get familiar with various design procedure and type of solver used in MagNet software.
- To acquire the knowledge about design procedure of core type and shell type transformer using MagNet software.
- To equip the students with design procedure and analysis of DC Machines using MagNet software.
- To educate the design procedure and analysis of induction machine using MagNet software.

Course Outcomes

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

CO1 - Illustrate the purpose and various components of MagNet software in the design of electrical machines.**(K3)**

CO2 -Develop a basic FEM model, 1D, 2D, 3D using MagNet software. **(K4)**

CO3 - Analyze the various characteristic of DC Machines in magnet software under different loading condition. **(K4)**

CO4 - Evaluate the performance of the core type and shell type transformer design using MagNet software. **(K4)**

CO5 - Interpret and validate the performance characteristic of induction machine using MagNet software. **(K4)**

UNIT I INTRODUCTION TO FINITE ELEMENT ANALYSIS (FEA) (9 Hrs)

History – Purpose of FEA – Discretization model – Mesh refinement – Types of Finite elements Boundary condition – General procedure for FEA (Preprocessing, solution, post processing) – Application of FEA

UNIT II BASICS OF MAGNET SOFTWARE (9 Hrs)

Introduction – Design of Object – Elements – Nodes – Make component in a line – One dimension design of line – Two dimension design of Cylinder, rectangular, cube – three dimension design of fan, wheel, spanner – Initial 2D mesh – Types of solvers.

UNIT III DC MACHINE (9 Hrs)

Principle – EMF equation – speed torque equation – Electrical/Mechanical characteristics starters – Applications – Design of series DC motor: Wireframe model – Solid model – Transient 2D with motion analysis.

UNIT IV TRANSFORMER (9 Hrs)

Principle and operation – EMF equation – Phasor diagram, equivalent circuit – Application – Design of core and shell type transformer: Wireframe model – Solid model – Static analysis.

UNIT V THREE PHASE INDUCTION MOTOR (9 Hrs)

Three phase Induction Motor types and constructional features – Torque equation – Star delta and DOL starter – Applications, design of Squirrel cage Motor: Wireframe model – Solid model Transient 2D with motion analysis.

Text Books

1. J. N. Reddy, "An introduction to the Finite Element Method", Tata McGraw Hill, 3rd Edition, 2005.
2. P. Seshu, "Test book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 10th Edition, 2012.
3. Dr. P. S. Bhimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2007.
4. I. J. Nagrath and D. P. Kothari, "Electrical Machines", Tata McGraw Hill Education, 4th Edition, 2010.
5. M. G. Say, "Performance and design of Alternating Current Machines", John Wiley and Sons Publications, 3rd Edition, 1983.

Reference Books

1. S. S. Rao, "The Finite Element Method in Engineering", Butterworth Heinemann, 3rd Edition, 2004.
2. D. L. Logan, "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002.
3. Arthur Eugene Fitzgerald and Charles Kingsley, "Electric Machinery", Tata McGraw Hill Education Publications, 6th Edition, 2002.

4. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice hall Publications, 2nd Edition, 2003.
5. N. N. Parkar Smith, "Problems in Electrical Engineering", CBS Publishers and Distributers, 9th Edition 1984.

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3. https://nptel.ac.in/courses/108/101/108101090/
4. http://www.nptelvideos.in/2012/12/finite-element-method.html
5. http://www.motor-engineer.net/engineering-center/learn/tutorial-electric-machine-design-hendershot/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
2	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE403	SENSORS AND TRANSDUCERS FOR ELECTRICAL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course objectives

- To expose the students to various sensors and transducers for measuring physical quantities
- To identify the various resistance based transducers for the measurement of pressure, force, vibration etc.,
- To study about various types of inductive and capacitive transducer for the measurement of strain, motion, position and light
- To study about Sensors used to measure viscosity, humidity , moisture and temperature in industrial applications

Course outcomes

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

CO1 - Familiarize with the fundamentals of Sensors and transducers. **(K2)**
CO2 - Design the signal conditioning circuits using resistive transducers. **(K4)**
CO3 - Identify a specific measurement application for measurement of strain, motion, position and light. **(K3)**
CO4 - Study the electro-chemical sensors and transducers used for density and viscosity measurement. **(K2)**
CO5 - Classify and describe the resistive, inductive and capacitive transducers which are used for measuring various parameters like displacement, temperature, humidity etc., **(K3)**

UNIT I INTRODUCTION (9 Hrs)

General concepts and terminology of measurement systems, general input - output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data – Definition - principle of sensing - classification Mechanical and Electromechanical sensors - Transducers and sensors, classification, emerging fields of sensor technologies.

UNIT II RESISTIVE TRANSDUCERS (9 Hrs)

Resistive transducers: Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge and its signal conditioning circuits, strain gauge applications: Load and torque measurement, Resistance temperature detector (RTD), design of LDR, thermistor, hot-wire anemometer and humidity sensor.

UNIT III INDUCTIVE AND CAPACITIVE TRANSDUCERS (9 Hrs)

Induction potentiometer - Variable reluctance transducers - LVDT - tacho generators and stroboscope, Proximity transducers - Capacitive transducer and types - Capacitor 14 microphone – capacitive thickness Transducers, capacitive strain transducers. Piezoelectric transducer, magnetostrictive transducer - Digital transducers - Fiber optic transducer - Hall Effect transducer - Photo electric transducer - I/P and P/I transducer-Points to be considered for selecting a transducer

UNIT IV DIGITAL AND SEMICONDUCTOR SENSORS (9 Hrs)

Sensors Based On Semiconductor Junctions - Sensors Based On MOSFET Transistors – Charge - Coupled And CMOS Image Sensors, Fiber-Optic Sensors, Ultrasonic Based Sensors, Biosensors - Proximity Sensors: Typical Sensor Characteristics, Technologies For Proximity Sensing, Electro-Optical Sensors, Capacitive Sensors, Magnetic Sensors - real time capacitive senor for automatically measuring liquid level-Current sensor Heading Sensors-MEMS and Nano Sensors, LASER sensors-Tactile sensors- Smart sensors.

UNIT V SPECIAL TRANSDUCER (9 Hrs)

Viscosity: Saybolt viscometer – Rotameter type and Torque type viscometers, Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers Moisture: Different methods of moisture measurements – Microwave, IR and NMR sensors, Application of moisture measurement – Moisture measurement in solids - Temperature sensor selection, Installation and Calibration - humidity measurement using capacitive sensor

Text Books

1. D.Patranabis, „Sensors and Transducers", Prentice Hall of India, 2nd Edition, 2004.
2. S. Ranganathan, „Transducer Engineering", Allied Publishers Pvt. Ltd., 1st Edition, 2003.
3. D.V.S. Murthy, „Transducers and Instrumentation", Prentice Hall of India, 2nd Edition, 2011.

Reference Books

1. Ramon Pallas & John G. Webster, "Sensors and Signal Conditioning", John Wiley & Sons, 2nd Edition, 2001.
2. S.M. Sze, "Semiconductor sensors", John Wiley & Sons Inc., 3rd Edition, 2006.
3. John P. Bentley, "Principles of Measurement Systems", Pearson Education, 4th Edition, 2005.

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2. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
3. https://nptel.ac.in/courses/108/108/108108147/
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.1721&rep=rep1&type=pdf
5. https://www.researchgate.net/journal/1726-5479_Sensors_and_Transducers

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
2	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
3	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
4	3	3	3	2	1	2	2	-	-	-	-	-	3	3	3
5	3	3	3	2	2	2	2	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE404	FINITE ELEMENT ANALYSIS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the basic principles of finite element analysis.
- To gain knowledge on the methods for solving field equations.
- To derive the system equations in one and two dimensions using finite element methods.
- To compute the basic electrical quantities using FEM analysis.
- To provide the basic skills to design and analyze the electrical apparatus using FEM software.

Course Outcomes

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

CO1 - Formulate and compute Electromagnetic Fields from Maxwell's equations. **(K3)**
CO2 - Apply the various solution methods to solve field equations. **(K3)**
CO3 - Apply finite element formulations to solve one and two dimensional problems. **(K3)**
CO4 - Compute the basic quantities like flux and torque using FEM packages. **(K4)**
CO5 - Design and analyze the performance of electrical apparatus by Finite Element Method. **(K4)**

UNIT I INTRODUCTION **(9 Hrs)**

Review of basic field theory – Maxwell's equations – Constitutive relationships and Continuity equations – Laplace – Poisson and Helmholtz equation – principle of energy conversion –force/torque calculation.

UNIT II BASIC SOLUTION METHODS FOR FIELD EQUATIONS **(9 Hrs)**

Limitations of the conventional design procedure – need for the field analysis based design problem definition – boundary conditions – Solution by analytical methods: direct integration method –variable separable method – method of images – solution by numerical methods – solution for matrix equations – finite difference method.

UNIT III FORMULATION OF FINITE ELEMENT METHOD **(9 Hrs)**

Variational formulation – energy minimization – discretisation – shape functions – stiffness matrix –1D and 2D planar and axial symmetry problems – mesh generation in 2D – axi-symmetric applications.

UNIT IV COMPUTATION OF BASIC QUANTITIES USING FEM PACKAGES **(9 Hrs)**

Basic quantities – energy stored in electric field – capacitance – magnetic field – linked flux – inductance – force – torque – skin effect – resistance – computation of electric field, magnetic field intensity.

UNIT V DESIGN APPLICATIONS **(9 Hrs)**

Introduction to software packages of finite element analysis – applications to magnetic circuit design – modeling and design of insulators – magnetic actuators – transformers – rotating machines.

Text Books

1. J. N. Reddy, "An Introduction to the Finite Element Method", Tata McGraw-Hill, 3rd Edition, 2005.
2. P. Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., 10th Edition, 2012.

Reference Books

1. Matthew. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 4th Edition 2007.
2. Charles W. Steels, "Numerical Computation of Electric and Magnetic fields", Van Nostrand Reinhold Company, 2nd Edition, 2012.
3. Silvester and Ferrari, "Finite Elements for Electrical Engineers", Cambridge University press, 3rd Edition, 1996.
4. S. J. Salon, "Finite Element Analysis of Electrical Machines", Kluwer Academic Publishers, 1st Edition, 1995.
5. Nicola Biyanchi, "Electrical Machine analysis using Finite Elements", Taylor and Francis Group, CRC Publishers, 1st Edition, 2005.

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2. https://nptel.ac.in/courses/108/106/108106152
3. https://nptel.ac.in/courses/108/101/108101090
4. https://www.youtube.com/watch?v=4c-sPXolD0w
5. https://nptel.ac.in/courses/112/104/112104116/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE405	ENERGY STORAGE TECHNOLOGY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the purpose of energy storage systems.
- To learn the different energy storage techniques.
- To learn about the different types of batteries available for energy storage.
- To impart knowledge regarding on the advanced energy storage systems.
- To learn about the different vehicular energy storage schemes.

Course Outcomes

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

CO1 - Familiarize the need for energy storing.**(K2)**

CO2 - Analyze the various energy storage techniques in the form of electrical, magnetic and chemical systems. **(K3)**

CO3 - Analyze the different batteries and its characteristics used for storing the energy in electric vehicles, nano-tubes etc.**(K4)**

CO4 - Impart the concepts of Superconducting Magnet Energy Storage Systems and super-capacitors in digital cameras, PC cards, electric vehicles, medical applications etc.**(K3)**

CO5 - Analyze the various energy storage techniques used in Electric vehicles and its hybridization concepts, power grid stabilization, rail-system power models etc.**(K4)**

UNIT I ENERGY STORAGE NEEDS **(9 Hrs)**

Energy Storage Need of energy storage - Different modes of Energy Storage - Potential energy - Pumped hydro storage - Kinetic Energy and Compressed gas system - Flywheel storage, compressed air energy storage - Demand for Portable Energy - Demand and scale requirements - Environmental and sustainability issues.

UNIT II ENERGY STORAGE TYPES **(9 Hrs)**

Electrical and Magnetic energy storage, Capacitors, electromagnets - Chemical Energy storage - Thermo-chemical, photo-chemical, bio-chemical, electro-chemical, fossil fuels and synthetic fuels - Hydrogen for energy storage, Solar Ponds for energy storage. Electrochemical Energy Storage Systems, Case study on perovskite solar cell.

UNIT III BATTERIES **(9 Hrs)**

Batteries - Primary, Secondary, Lithium, Solid-state and molten solvent batteries - Lead acid batteries - Nickel Cadmium Batteries - Advanced Batteries - Role of carbon nano-tubes in electrodes - Flow battery operation - Case study on Flexible fiber - shaped metal - air batteries

UNIT IV SUPERCONDUCTING MAGNET ENERGY STORAGE SYSTEMS **(9 Hrs)**

Superconducting Magnet Energy Storage(SMES) systems - Capacitor and Batteries: Comparison and application - Super capacitor - Electrochemical Double Layer Capacitor (EDLC), principle of working, structure, performance and application, role of activated carbon and carbon nano-tube - Super Capacitors - power calculation – operation and design.

UNIT V VEHICULAR ENERGY STORAGE SYSTEMS **(9 Hrs)**

Energy storage technologies in hybrid vehicles – flywheel, hydraulic, fuel cell and hybrid fuel cell energy storage system – ultra capacitors – comparison – battery charging control – Case study on Hybridization of different energy storage devices.

Text Books

1. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, "Electrochemical Technologies for Energy Storage and Conversion-2 Volume set", John Wiley and Sons, 1st Edition, 2011.
2. Detlef Stolten, "Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications", Wiley, 1st Edition, 2010.
3. Robert Huggins, "Energy Storage: Fundamentals, Materials and Applications", Springer, 2nd Edition, 2016.
4. Andrei G. Ter-Gazarian, "Energy Storage for Power Systems", Institution of Engineering and Technology, 3rd Edition, 2020.

Reference Books

1. Francois Beguin and Elzbieta Frackowiak, "Super capacitors: Materials, Systems and Applications", Wiley-VCH, 1st Edition, 2013.
2. Doughty Liaw, Narayan and Srinivasan, "Batteries for Renewable Energy Storage", The Electrochemical Society, New Jersy, 2010.
3. Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles", CRC Press, 1st Edition, 2003.
4. Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", Wiley, 1st Edition, 2011.

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4. https://www.sciencedirect.com/topics/engineering/energy-storage-technology
5. https://en.wikipedia.org/wiki/Energy_storage
6. https://www.energy.gov/oe/activities/technology-development/energy-storage

COs/POs/PSOs Mapping

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2	3	3	-	2	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

OPEN ELECTIVE

U20ECO401	ENGINEERING COMPUTATION WITH MATLAB (Common to EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand basic representation of Matrices and vectors in MATLAB.
- To learn various programming structures in MATLAB.
- To study built in and user defined functions in MATLAB.
- To become conversant with 2D as well as 3D graphics in MATLAB.
- To make a Graphical User Interface (GUI) in MATLAB in order to achieve interactivity.

Course Outcomes

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

CO1 - State the basics of MATLAB. **(K1)**

CO2 - Explain how to work with matrices, and their operations. **(K2)**

CO3 - Use the MATLAB functions relevant to communication engineering. **(K3)**

CO4 - Demonstrates various file operations in MATLAB. **(K3)**

CO5 - Applying the plotting capabilities of MATLAB effectively to various systems. **(K3)**

UNIT I INTRODUCTION TO MATLAB (9 Hrs)

Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions – User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files.

UNIT II LOOPS & CONTROL STATEMENTS (9 Hrs)

Introduction; Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval & lastern commands.

UNIT III PLOTS IN MATLAB & GUI (9 Hrs)

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG - POLARCOMET, Grid axis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions.

UNIT IV MISCELLANEOUS TOPICS (9 Hrs)

File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time – Format Conversions - Date & Time, Functions - Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation

UNIT V SIMULINK & APPLICATIONS (9 Hrs)

How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2nd order systems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs - Frequency response of filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration.

Text Books

1. Rudra Pratap, "Getting Started with MATLAB 6.0",1st Edition, Oxford University Press, 2004.
2. Duane Hanselman ,Bruce LittleFIeld, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J. Palm, "Introduction to MATLAB 6.0 for Engineers", McGraw Hill & Co, 2001.

Reference Books

1. M. Herniter, "Programming in MATLAB", Thomson Learning, 2001
2. John OkyereAltla, "Electronics and circuit analysis using MATLAB", CRC press, 1999
3. K.K.Sharma, "MATLAB Demustifyied", Vikas Publishing House Pvt Ltd. 2004

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1. https://www.mathworks.com/products/matlab.html
2. https://www.tutorialspoint.com/matlab/index.htm
3. https://www.cmu.edu/computing/software/all/matlab/
4. https://ctms.engin.umich.edu/CTMS/index.php?aux=Home

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2
2	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2
3	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2
4	2	2	-	2	3	-	-	-	-	-	-	-	-	1	1
5	2	2	-	2	3	-	-	-	-	-	-	-	-	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

CONSUMER ELECTRONICS

U20ECO402 (Common to EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To enable the troubleshoot of different types of microphones and loudspeakers.
- To make the students to analyze the working of digital console, digital FM tuner and troubleshoot audio systems.
- To train and test the working of various colour TV.
- To empower them to troubleshoot colour TV receivers.
- To equip them to maintain various electronic home and office appliances.

Course Outcomes

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

CO1 - Describe the fundamental audio characteristics and measurements, operating principles of microphone and loudspeaker. **(K1)**
CO2 - Explain the working of digital console, digital FM tuner and troubleshoot the audio systems. **(K2)**
CO3 - Distinguish the salient features of colour TV and Monochrome and troubleshoot TV camera. **(K2)**
CO4 - Demonstrate various interfaces in digital TV, the working of DTH receiver, CD/DVD players. **(K3)**
CO5 - Explain the working of FAX, Microwave oven, Washing machine, Air conditioner, Refrigerators and camera. **(K2)**

UNIT I AUDIO FUNDAMENTALS AND DEVICES (9 Hrs)

Basic characteristics of sound signal, Microphone - working principle, sensitivity, nature of response. Types of Microphone, Loud speaker - working principle, Woofers and Tweeters, characteristics. Types of Loudspeaker. Sound recording.

UNIT II AUDIO SYSTEMS (9 Hrs)

Introduction to audio system, Digital Console- Block diagram, working principle, applications, FM tuner- concepts of digital tuning, ICs used in FM tuner TD702IT, PA address system- Planning, speaker impedance matching, characteristics, power amplifier specification.

UNIT III TELEVISION SYSTEMS (9 Hrs)

Monochrome TV standards, Components of TV system, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal, Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera.

UNIT IV TELEVISION RECEIVERS AND VIDEO STANDARDS (9 Hrs)

Colour TV receiver- block diagram, Digital TVs- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI, Digital Video Interface, CD and DVD player: working principles, interfaces

UNIT V HOME AND OFFICE APPLIANCES (9 Hrs)

Microwave Oven: Types, technical specifications. Washing Machine: hardware and software. Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices, picture processing, picture storage

Text Books

1. Bali S.P., "Consumer Electronics", copyright 2008, Pearson Education India
2. Bali R and Bali S.P. "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd.
3. Gulati R.R., "Modern Television practices", 5th Edition, 2015, New Age International Publication (P) Ltd

Reference Books

1. Gupta R.G., 'Audio video systems', 2nd edition,2017, Tata Mcgraw Hill, New Delhi, India
2. Whitaker Jerry & Benson Blair, 'Mastering Digital Television', McGraw-Hill Professional, 2006
3. Whitaker Jerry & Benson Blair, 'Standard handbook of Audio engineering', 2nd edition,2002, McGraw-Hill Professional

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1. http://www.scientificamerican.com/article.cfm?id = experts.bluetooth-work
2. http://www.cosc.brocku.ca/Offerings/3P92/seminars/HDTV.ppt
3. http://www.circuitstoday.com/blu-ray-technology-working
4. http://www.freevideolectures.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
2	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
3	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
4	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3
5	2	-	2	1	-	1	-	-	-	-	-	-	3	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

WEB DEVELOPMENT

U20CSO401

(Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To study the fundamentals of web application development.
- To understand the design components and tools using CSS.
- To learn the concepts Java Script and programming fundamentals.
- To study about advance scripting and Ajax applications.
- To understand the working procedure of XML.

Course Outcomes

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

CO1 - Develop basic web applications. **(K5)**
CO2 - Design the web applications using CSS. **(K5)**
CO3 - Validate the web pages using java scripts functions. **(K5)**
CO4 - Demonstrate the web 2.0 application to advance scripts. **(K3)**
CO5 - Update the knowledge of XML Data. **(K4)**

UNIT I INTRODUCTION TO WWW & HTML (9 Hrs)

Protocols – Secure Connections – Application and development tools – Web browser – Server definition – Dynamic IP. Web Design: Web site design principles – Planning the site and navigation. HTML: Development process – Html tags and simple HTML forms – Web site structure.

UNIT II STYLE SHEETS (9 Hrs)

Introduction to CSS: Need for CSS – Basic syntax and structure using CSS – Background images – Colors and properties – Manipulating texts using fonts, borders and boxes – Margins, padding lists, positioning using CSS – CSS2

UNIT III JAVA SCRIPTS (9 Hrs)

Client side scripting: Basic JavaScript – Variables – Functions – Conditions – Loops. Applications: Page Validation – Reporting.

UNIT IV ADVANCE SCRIPT (9 Hrs)

JavaScript and objects – DOM and Web browser environments – Forms and Validations – DHTML. AJAX: Introduction – Web applications – Alternatives of AJAX.

UNIT V XML (9 Hrs)

Introduction to XML – Uses of XML – Simple XML – XML key components – DTD and Schemas – Well-formed XML document – Applications of XML – XSL and XSLT.

Text Books

1. Keith Wald, Jason Lengstorf," Pro PHP and jQuery", Paperback, 2016.
2. Semmy Purewal, "Learning Web App Development", O'Reilly Media, 2014.
3. P.J. Deitel and H.M. Deitel, "Internet and World Wide Web - How to Program", Pearson Education, 2009.

Reference Books

1. Yakov Fain, Victor Rasputnis, Anatole Tartakovsky and Viktor Gamov, "Enterprise Web Development ", O'Reilly Media, 2014.
2. Steven Suehring, Janet Valade, "PHP, MySQL, JavaScript & HTML5 All-in-One", John Wiley & Sons, Inc, 2013.
3. Uttam K. Roy, "Web Technologies", Oxford University Press, 2010.
4. Rajkamal, "Web Technology", Tata McGraw-Hill, 2009.
5. Shklar, Leon, Rosen, Rich, "Web Application Architecture: Principles, Protocols and Practices", Wiley Publication, 2009.

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2. https://www.geeksforgeeks.org/web-technology/
3. https://www.guru99.com/cakephp-tutorial.html
4. https://www.ithands.com/blog/cms-or-php-framework-which-technology-is-better-for-my-business
5. http://Oriel.ly/learning-web-app

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	-	-	3	-	-	-	2
2	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2
3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	2
4	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2
5	2	2	2	2	-	2	-	2	-	2	-	2	-	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20CSO402

ANALYSIS OF ALGORITHMS

(Common to EEE, ECE, ICE, MECH, CIVIL, BME, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To analyze the performance of algorithms in terms of time and space complexity.
- To understand the performance of the algorithms such as divide and conquer, greedy method
- To solve problems using Dynamic Programming and derive the time complexity.
- To solve problems using Backtracking technique and derive the time complexity.
- To solve problems using Branch and Bound technique and derive the time complexity.

Course Outcomes

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

CO1 - Choose the appropriate data structure and algorithm design method for a specified application. **(K2)**
CO2 - Understand the design technique such as divide and conquer, greedy method applied to realistic problems and analyse them. **(K3)**
CO3 - Understand the dynamic programming design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO4 - Understand the backtracking design technique and how it is applied to realistic problems and analyze them. **(K3)**
CO5 - Understand Branch and Bound design technique and how it is applied to realistic problems and analyze them. **(K2)**

UNIT I INTRODUCTION **(9 Hrs)**

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis – Time complexity, Space complexity, Asymptotic Notation – Big oh notation, Omega notation, Theta notation and Little oh notation.

UNIT II DIVIDE AND CONQUER METHOD AND GREEDY METHOD **(9 Hrs)**

Divide and Conquer method: Applications – Binary search, Merge sort, Quick sort. Greedy method: General method, applications – Knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT III DYNAMIC PROGRAMMING **(9 Hrs)**

Dynamic Programming: Applications - Multistage graphs, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT IV BACKTRACKING **(9 Hrs)**

Backtracking: General method, Applications – N-queen problem, Sum of subsets problem, Graph Coloring – Hamiltonian Cycles.

UNIT V BRANCH AND BOUND **(9 Hrs)**

Branch and Bound**:** General method, Applications – Traveling sales person problem, 0/1 Knapsack problem, LC Branch and Bound solution, FIFO Branch and Bound solution.

Text Books

1. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", Galgotia Publications, 2nd Edition, 2010.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms", PHI/Pearson Education, 3rdEdition, 2009.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.

Reference Books

1. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley India, 2006.
2. Sara Baase and Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", Pearson Education Asia, 3rd Edition, 2010.
3. Donald E Knuth, "The Art of Computer Programming, Volume I & II", Addison Wessely, Third Edition, 2011.

4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2006.
5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.

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1. https://swayam.gov.in/nd1_noc20_cs71/preview
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
3. https://www.javatpoint.com/daa-tutorial
4. https://www.guru99.com/design-analysis-algorithms-tutorial.html
5. https://www.geeksforgeeks.org/fundamentals-of-algorithms/

COs/POs/PSOs Mapping

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1	3	3	2	3	2	2	1	-	-	-	-	-	2	1	2
2	3	2	3	3	2	2	1	-	-	-	-	-	2	1	2
3	3	3	3	3	2	2	2	-	2	-	-	-	2	1	2
4	3	2	3	3	3	2	2	-	-	-	3	-	2	1	2
5	3	3	3	3	2	2	2	-	-	-	3	2	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20ITO401

DATABASE SYSTEM: DESIGN & DEVELOPMENT

(Common to EEE, ECE, ICE, CCE, BME)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

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

CO1 - Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application. **(K2)**
CO2 - Manipulate and build database queries using Structured Query Language and relational algebra. **(K2)**
CO3 - Apply data normalization principles to develop a normalized database for a given application. **(K3)**
CO4 - Explain various storage & indexing techniques, transactions and recovery techniques. **(K2)**
CO5 - Apply tools like NoSQL, MongoDB, Cassandra on real time applications. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Database Systems– Data Models – Database System Architecture - Entity-Relationship Model - ER Diagram-Extended ER Model –ER into Relational Model - **Relational Model**: Structure of Relational Databases, Database Schema, Keys, Tables

UNIT II DATABASE LANGUAGES (9 Hrs)

Relational Algebra – Extended-Relational Algebra Operations – **SQL**: Introduction – DDL – DML –Integrity Constraints-Set Operations-Joins – Nested Queries -View- Trigger - Stored Procedures

UNIT III RELATIONAL - DATA BASE DESIGN (9 Hrs)

Introduction to Schema Refinement – Decomposition – Lossless Decomposition – Functional Dependencies – Normal Forms - First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form.

UNIT IV DATA STORAGE (9 Hrs)

RAID - File Organization - Indexing, Ordered Index, Index files, Hashing - Static and dynamic hashing.
Transactions: Transaction concepts and states– Concurrent Execution-Serializability-Concurrency Control: Lock based Protocol - Timestamp based Protocol - **Recovery System**: – Log-Based Recovery – Shadow Paging

UNIT V CASE STUDY (9 Hrs)

NoSQL – Document Database : MongoDB - Multi-dimensional: Cassandra

Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7thEdition – McGraw-Hill Higher Education, International Edition, 2019.
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson, 2016

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1. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, —An Introduction to Database Systems‖, 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O'Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1st Edition, Kindle Edition

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	1
4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

R PROGRAMMING

U20ITO402	(Common to EEE, ECE, ICE, CCE, BME, MECH, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of data frames and tables
- To able to appreciate and apply the R programming from a statistical perspective
- To understand the interface model

Course Outcomes

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

CO1 - Create artful graphs to visualize complex data sets and functions. **(K3)**
CO2 - Write more efficient code using parallel R and vectorization. **(K3)**
CO3 - Create data frames and working with tables. **(K3)**
CO4 - Interface R with C/C++ and Python for increased speed or functionality. **(K2)**
CO5 - Find new packages for text analysis, image manipulation &perform statistical analysis. **(K3)**

UNIT I INTRODUCTION **(9 Hrs)**
Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT II MATRICES AND ARRAYS **(9 Hrs)**
Matrices, Arrays And Lists Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III DATA FRAMES **(9 Hrs)**
Data Frames Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions

UNIT IV FUNCTIONS AND ARGUMENTS **(9 Hrs)**
Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots

UNIT V INTERFACING **(9 Hrs)**
Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering.

Text Books

1. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Books

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

Web References

1. https://www.coursera.org/learn/r-programming
2. https://www.r-project.org/

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1	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
2	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
3	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1
4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
5	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20MEO401

RAPID PROTOTYPING

(Common to EEE, ECE, ICE, CIVIL, BME, FT)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the development of RP systems.
- To learn the classification of liquid based and solid based rapid prototyping systems.
- To understand the powder based rapid prototyping systems.
- To learn about the materials for rapid prototyping systems.
- To discuss about the reverse engineering and new technologies.

Course Outcomes

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

CO1 - Acquire knowledge about the product development. **(K1)**
CO2 - Analyse the classification of liquid based and solid based rapid prototyping systems. **(K4)**
CO3 - Analyse the powder based rapid prototyping systems. **(K4)**
CO4 - Acquire knowledge about the materials for rapid prototyping systems. **(K1)**
CO5 - Acquire knowledge about reverse engineering and new technologies. **(K1)**

UNIT I INTRODUCTION (9 Hrs)

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format– Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Classification – Liquid based system – Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system- Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing.

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS (9 Hrs)

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS (9 Hrs)

Nature of material – type of material – polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES (9 Hrs)

Introduction, measuring device - contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Text Books

1. Rafiq I. Noorani, Rapid Prototyping, "Principles and Applications", Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", World Scientific, 2nd Edition, 2003.
3. Amitav Ghosh, "Introduction to Rapid Prototyping", North West Publication, New Delhi, 2008.

Reference Books

1. Hopkinson N, R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
2. Ian gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
3. Paul F. Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereo lithography", McGraw Hill 1993.
4. Pham D.T and Dimov, "Rapid Manufacturing", Springer Verlog, 2001.
5. Liou W. Liou, Frank W. Liou, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.

Web References

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2. https://www.digimat.in/nptel/courses/video/112104265/L01.html
3. https://nptel.ac.in/courses/112/107/112107078/
4. https://www.youtube.com/watch?v=oDdOqLblmVQ
5. https://www.youtube.com/watch?v=OhNnKTaciVI

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3	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
4	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3
5	3	3	3	3	1	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20MEO402

MATERIAL HANDLING SYSTEM

(Common to EEE, ICE, CIVIL, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the various data models, conceptualize E-R diagram and depict using relational model
- Gain knowledge about database languages and frame query using Relational Algebra and SQL
- Understand and design an efficient database schema using the various normal forms
- Impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures
- Explore knowledge on tools and practice case studies

Course Outcomes

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

CO1 - Describe the principal groups of material handling equipments. **(K2)**
CO2 - Describe about the flexible hosting appliances. **(K2)**
CO3 - Explains about the material handling attachments, hook bearings, crane attachment. **(K1)**
CO4 - Illustrate the basic material handling system, selection. **(K1)**
CO5 - Define theergonomics related to material handling equipment. **(K1)**

UNIT I MATERIAL HANDLING EQUIPMENTS (9 Hrs)

Types of intraplant transporting facility - principal groups of material handling equipments - choice of material handling equipment - hoisting equipment, screw type, hydraulic and pneumatic conveyors - general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications - Introduction to control of hoisting equipments.

UNIT II FLEXIBLE HOSTING APPLIANCES (9 Hrs)

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains - selection of hemp rope chains and steel wire rope - selection of ropes - fastening of chain sand ropes - different types of load suspension appliances - fixed and movable pulleys, different types of pulley systems, multiple pulley systems - Chain and rope sheaves and sprockets.

UNIT III MATERIAL HANDLING ATTACHMENTS (9 Hrs)

Load handling attachments - standard forged hook, hook weights, hook bearings, cross piece and casing of hook - crane grab for unit and piece loads - carrier beams and clamps - load platforms and side dump buckets- electric lifting magnets - grabbing attachments for loose materials - crane attachments for handling liquid materials.

UNIT IV MATERIAL HANDLING SYSTEMS (9 Hrs)

Basic Material Handling systems - Selection, Material Handling method - path, Equipment - function oriented systems.

UNIT V METHODS TO MINIMIZE COST OF MATERIAL HANDLING (9 Hrs)

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments - Safety in handling - Ergonomics of Material Handling equipment - Design, Miscellaneous equipment

Text Books

1. Rudenko N, "Materials Handling Equipment" , Envee Publishers, New Delhi, 2017.
2. Alexandrov M. P, "Materials Handling Equipment", Mie publications, Moscow, 2013.
3. White, John A., Pence, Ira W, "Materials handling and logistics", Envee Publishers, New Delhi, 2016.

Reference Books

1. Arora K.C, Vikas V. Shinde, "Aspects of Material handling", Laxmi Publications; First edition, 2015.
2. Siddhartha Ray, "Introduction to Material Handling", New Age International, 2nd Edition, 2017.
3. Chowdary RB, G. R. N. Tagore, "Plant Layout and Material Handling", Khanna publishers; 2nd Edition, 2016.
4. James A Apple, "Plant layout and Material Handling", Krieger Pub Co, 2016.
5. Mahapatra P.B, "Operations Management", PHI, 2016

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1. https://nptel.ac.in/courses/112/102/112102011/
2. https://nptel.ac.in/courses/112/107/112107142/
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://www.youtube.com/watch?v=WXmldbVDJqE
5. https://www.youtube.com/watch?v=BBWPIByOEfl

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	1	2
4	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
5	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20CEO401

ENERGY AND ENVIRONMENT

(Common to EEE, ECE, MECH, BME, IT, Mechatronics, FT)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Explain the importance of energy, classifications of energy sources and energy demand scenario
- Analyze the impacts of energy on environment & sustainability energy options
- Outline the harness of various renewable energy sources
- Discuss the positive and negative aspects of renewable energy along with hybrid technologies
- Explain the importance of biomass energy and its applications

Course Outcomes

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

CO1 - Apply the knowledge of science & engineering to the contemporary issues of Energy for better humankind & environment. **(K3)**

CO2 - Identify, review & analyze the complex problems of Energy crises. **(K4)**

CO3 - Designing solutions for the energy crises in the form of renewable energy systems to meet the needs by understanding the limitations. **(K4)**

CO4 - Understanding the complex problems of impact of energy on environment providing Solutions for sustainable development. **(K5)**

CO5 - Apply biomass energy under relevant technologies. **(K3)**

UNIT I ENERGY **(9 Hrs)**

Introduction, Importance of energy, role of energy consumption in economic and social transformation, Energy needs and crisis. Energy production, utilization. Global energy scenario, Indian energy scenario, Codes, standards and legislation, Types and classification of energy sources, Conventional & unconventional energy, Renewable sources & Nonrenewable sources of energy advantages, limitations, comparisons

UNIT II ENVIRONMENT **(9 Hrs)**

Impact of energy on economy & environment, Concerns about change in global temperature, Regional impacts of temperature change, Global warming, Greenhouse effect, Acid rain, Ozone layer depletion, International agreements on environment, Indian environment degradation, Environmental laws , Water Act 1974 (Prevention & control of pollution), The environment protection act 1986 , Air act ,Energy for sustainable development.

UNIT III HYDROPOWER ENERGY **(9 Hrs)**

Introduction, Advantages of hydropower generation, Site selection, layout of hydro power plant, components & working, classifications, power station, structure and control, case study, Numerical Nuclear Energy - Introduction, Site selection, layout of power plant, components & working, reactors, adverse effects, safety measures, disposal of nuclear waste, case study, Numerical.

UNIT IV SOLAR ENERGY **(9 Hrs)**

Introduction, Advantages, Sun as source of energy, Site selection, layout of power plant components & working, classifications, Types of collectors, collection systems efficiency, Solar cells, cell technology, PV technology characteristics of PV, case study, Numerical Wind Energy - Introduction, advantages/limitations, history of wind energy, global & Indian wind energy scenario Site selection, layout of power plant, components &working, classifications, case study.

UNIT V BIOMASS ENERGY **(9 Hrs)**

Introduction, advantages/limitations, Photosynthesis, biomass fuel, biomass conversion technologies, biomass gasification, biogas from waste biomass, factors affecting biogas generation, types of biogas plant – KVIC & janata model , Biomass programme in India, case study, Numerical Hybrid / Unconventional Energy Technologies: Introduction, need, advantages, Technologies.

Text Books

1. Trivedi R.R. and Jalka K.R, “Energy Management”, Commonwealth Publication, 2017.
2. Diamant R.M.E., “Total Energy”, Pergamon, Oxford Publishers, 2017.
3. N.G. Ajjanna “ Energy auditing & demand side management” first edition, Gouthami Publications, Shimoga
4. Chakrabarti, M.L.Soni, P.V. Gupta,U.S. Bhatnagar “ Power system Engineering” 2001, Dhanpat Rai & Co, New Delhi.
5. D. P. Kothari, K.C Singal, Rajesh Ranjan, “Renewable Energy sources and Emerging Technologies”, second edition , PHI , India

Reference Books

1. Boyle G, Everett B and Ramett J, “Energy systems and sustainability”, Oxford University Press, 2018
2. "Pollution Control Acts, Rules and Notifications", CPCB, Pollution Control series, PC/2/2014, Vol.I,2014
3. Peavy.H, Rowe.D and Tchobanoglous, G., Environmental Engineering, Tata McGraw-Hill, 2013
4. S.Rao, Dr. BB Parulekar “Energy Technologies” Khanna Publications , New Delhi
5. David M Buchla, Thomas E Kissel, Thomas L Floyd “Renewable Energy systems” Pearson, India
6. Godfrey Boyle, “Renewable Energy power for sustainable future” oxford Publications , New Delhi

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1. https://onlinecourses.nptel.ac.in/noc20_ce23/announcements
2. https://swayam.gov.in/nd1_noc20_ce23/preview
3. www.iucn.org
4. www.cites.org
5. www.thesummitbali.com/
6. http://engineering geology.gov.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
2	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
3	3	3	3	3	2	3	3	3	2	3	2	3	3	3	3
4	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3
5	3	3	2	3	2	3	2	3	2	3	2	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20CEO402

BUILDING SCIENCE AND ENGINEERING

(Common to EEE, MECH, BME)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the basic materials in civil engineering and Have an insight to different types of doors, windows.
- Analyze the types of foundation.
- Gain the knowledge of bylaws for the planning of a public/private building.
- Understand the different methods and materials of interiors for building.
- Understand the concept of landscaping.

Course Outcomes

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

CO1 - Apply the knowledge of engineering fundamentals to understand, the characteristics of basic civil engineering materials. **(K2)**

CO2 - Apply the knowledge of engineering fundamentals and analyze the types of foundation **(K2)**

CO3 - Develop plan, section and apply bylaws and investigate causes and remedies for cracks, have an insight to cost effective construction. **(K3)**

CO4 - Understand, design and work in a team and develop the interiors. **(K5)**

CO5 - Understand, design and work in a team and develop landscaping for buildings as per design guidelines. **(K5)**

UNIT I MATERIALS FOR CONSTRUCTION (9 Hrs)

Cement concrete: introduction, ingredients of cement, grade of concrete, properties. Steel :definition , types of steel, uses of steel, market forms of steel used in construction Doors and windows : location of doors and windows, types of doors, types of windows, Stairs : requirements of good stairs, types , stairs of different materials

UNIT II FOUNDATION AND STRUCTURAL MEMBERS (9 Hrs)

Selection of site, substructure, objectives of foundation, site inspection, soils, loads on foundations, essential requirements of good foundation, types of foundation, failure of foundation and remedial measures. Structural members: columns, lintels, roofing (flat roof and sloped roof), flooring (types of floors and floor covering), damp proofing, plastering.

UNIT III BUILDING PLANNING AND MAINTAINENCE (9 Hrs)

Plan, section and elevation .Introduction, classification of buildings, components of buildings, building bylaws, orientation of buildings, ventilation, acoustic requirements, Superstructure: introduction, brick masonry, stone masonry and RCC. Building maintenance Deterioration of concrete, deterioration of masonry works, prevention of cracks and leaks, cost effective construction, anti-termite treatment in building.

UNIT IV INTERIOR DESIGN (9 Hrs)

Functional requirement of interior designer, basic elements of interior design, design problems :Interior design for spacious rooms, comfortable rooms, theme rooms, living area, cooking area, drinking area dining area, home offices, sleeping area, bathrooms, public/private buildings

UNIT V LANDSCAPING (9 Hrs)

Elements of Landscape architecture, specialization in landscape, landscape products, landscape materials, and water efficient landscaping, design guidelines for interior landscape

Text Books

1. Basic civil engineering : M.S.palanichamy, fourth edition Tata mcgraw hill limited, 2005
2. Basic civil engineering : sateesh gopi ,pearson, 2010
3. Building Science: Concepts and Applications: Jens Pohl, Wiley-Blackwell, 2011

Reference Books

1. Basic civil engineering : Dr.B.C.Punmia, Ashok kumar jain, Arun kumar jain Laxmi publications year of publication, 2004
2. Basic civil engineering : S.S.Bhavikatti New Age International Limited, 2010
3. Interior Design and Decoration: Seetharaman P.2019

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1. https://www.youtube.com/watch?v=XsFeVuVQE-E
2. https://www.youtube.com/watch?v=LYvDoy7MtkE
3. https://www.youtube.com/watch?v=zjZVlFt3WQY
4. https://www.youtube.com/watch?v=pYAXsbsFBC8
5. https://www.youtube.com/watch?v=PIY63QacRTc

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	3	3	3	2	3	3	3	3	3	3
2	3	3	2	3	1	3	3	3	2	3	3	3	3	3	3
3	3	3	2	3	1	3	3	3	2	3	3	3	3	3	3
4	3	3	2	3	2	3	3	3	2	3	3	3	3	3	3
5	3	3	2	3	2	3	2	3	2	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20BMO401	MEDICAL ELECTRONICS (Common to EEE, ECE, CSE, IT, ICE, CCE, MECH, Mechatronics, AI&DS)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To gain knowledge about the various physiological parameters measurements.
- To understand the various biochemical and nonelectrical sensors.
- To study about the assist devices.
- To gain knowledge on surgical equipments and telemetry in healthcare.
- To understand the concepts of recent advancements in healthcare.

Course Outcomes

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

CO1 - Explain the electro- physiological parameters and bio-potentials recording. **(K2)**
CO2 - Measure the biochemical and non-electrical physiological parameters. **(K2)**
CO3 - Interpret the various assist devices used in the hospitals. **(K3)**
CO4 - Identify physical medicine methods and biotelemetry. **(K3)**
CO5 - Analyse recent trends in medical instrumentation. **(K3)**

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9 Hrs)

Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT (9 Hrs)

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES (9 Hrs)

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY (9 Hrs)

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION (9 Hrs)

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip, Cryogenic Technique.

Text Books

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2011.
2. R. S. Khandpur, “Handbook of Biomedical Instrumentation”, TATA Mc Graw-Hill, New Delhi, 2017.
3. John G. Webster, “Medical Instrumentation Application and Design”, Third Edition, Wiley India, 2012

Reference Books

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2011.
2. R. Anandanatarajan, “Biomedical Instrumentation and Measurements”, Second Edition, PHI Learning, 2016.
3. Mandeep singh, “Introduction to Biomedical Instrumentation”, Second Edition, Prentice Hall of India, New Delhi, 2014.
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Cengage Learning, 2012
5. C.Raja Rao, Sujoy K.Guha, “Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2010.

Web References

1. https://www.nap.edu/read/21794/chapter/7
2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/diagnostic-therapetic systems
3. https://nptel.ac.in/courses/127/106/127106136/
4. medicinenet.com/script/main/art.asp?articlekey=6414
5. https://www.verywellhealth.com/cardiopulmonary-bypass-machine-used-for-surgery-3157220

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	2	2	2	-	1	-	-	-	-	1	-	1
2	3	2	-	2	2	2	-	1	-	-	-	-	1	-	1
3	3	-	-	2	3	3	-	1	-	-	-	-	1	-	1
4	3	-	2	2	3	2	-	1	-	-	-	-	1	-	1
5	3	2	2	3	3	2	-	1	-	-	-	-	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20BMO402 **TELEMEDICINE**
(Common to EEE, ECE, CSE, IT, ICE, CCE, AI&DS)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the classification of telemetry.
- To gain knowledge about biotelemetry principles.
- To know about the applications of telemetry in various fields.
- To provide the idea about the value of telemedicine.
- To know the various applications in telemedicine.

Course Outcomes

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

CO1 - Categorize the telemetry systems. **(K2)**
CO2 - Understand the principles of biotelemetry in transmission of biological signals. **(K3)**
CO3 - Apply the various Biotelemetry applications for diagnostics. **(K3)**
CO4 - Acquire clear idea about the fundamentals of telemedicine. **(K2)**
CO5 - Know about various applications of telemedicine. **(K3)**

UNIT I INTRODUCTION TO TELEMETRY (9 Hrs)

Basic system, Classification, Non electrical telemetry systems, Mechanical and Pneumatic type, Voltage and Current telemetry systems, Local transmitters and Converters, Frequency telemetry system, Power Line carrier communication (PLCC).

UNIT II BIOTELEMETRY (9 Hrs)

Radio Telemetry principles, FM, AM, PCM, Transmission of biological data through radio telemetry.

UNIT III APPLICATION OF BIOTELEMETRY (9 Hrs)

Wireless Telemetry - Single Channel and Multi-channel Telemetry systems, Multi Patient Telemetry, Implantable Telemetry Systems, Ambulatory patient monitoring.

UNIT IV FUNDAMENTALS OF TELEMEDICINE (9 Hrs)

History and advancements in telemedicine, Benefits of telemedicine, Functional Block of a telemedicine system, Use of computers in distance mode of healthcare delivery, Familiarizing with technology of telemedicine, scanner, electro stethoscope, data reception equipment, Scope for telemedicine, Limitations of telemedicine.

UNIT V APPLICATIONS OF TELEMEDICINE (9 Hrs)

Telemedicine in Neuroscience, Telecardiology, Telepathology, Telepediatrics, Telepharmacy, Telepsychiatry and mental health, Veterinary.

Text Books

1. Marilyn J. Field, "A Guide to Assessing Telecommunications in Health Care", Academy Press, 4th Edition, 2011.
2. R. L. Bashshur, J. H. Sanders and G. Shannon, "Telemedicine: Theory and Practice", Springer, 8th Edition, 2014.
3. Olga (EDT), Ferre Roca, M. Sosa, "Handbook of Telemedicine", IOS press, 3rd Edition, 2009.

Reference Books

1. Bemmel, J.H. van, Musen, M.A. (Eds.), "Handbook of Medical Informatics", Springer, 2nd Edition, 2010.
2. W. Simpson, "Video over IP. A practical guide to technology and applications", Focal Press, Elsevier, 9th Edition, 2009.
3. Ferrer-Roca, O., Sosa-Iudicissa, "Handbook of Telemedicine", IOS Press, 2012
4. A. C. Norris, "Essentials of Telemedicine and Telecare", Wiley, 8th Edition, 2017.
5. R. Wotton, J. Craig, V. Patterson (Eds.), "Introduction to Telemedicine", Royal Society of Medicine Press Ltd., 5th Edition, 2014.

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1. https://en.wikipedia.org/wiki/Biotelemetry
2. https://www.who.int/goe/publications/goe_telemedicine_2010.pdf
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5927731/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	2	1	-	1	-	2	-	-	-	-	-
2	3	2	-	-	2	1	-	1	-	2	-	-	-	-	-
3	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-
4	3	2	-	2	2	1	-	1	-	2	-	-	-	-	1
5	3	2	3	2	2	1	-	1	-	2	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

BASIC DBMS

U20CCO401

(Common to EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand about basics of Database Management System.
- To provide a general introduction to relational model and relational algebra.
- To study about normalization and SQL.
- To acquire knowledge about storage indexing and transaction management.
- To gain knowledge about the backup and recovery in database.

Course Outcomes

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

CO1 – Explain the concept of database management system. (**K2**)
CO2 – Create conceptual data model using entity relationship diagram. (**K2**)
CO3 – Analyze the various normalization. (**K4**)
CO4 – Describe the concept of storage indexing and transactions. (**K2**)
CO5 – Explain the database recovery and security. (**K2**)

UNIT I INTRODUCTION TO DATABASE MANAGEMENT (9 Hrs)

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture-Entity - relationship data model

UNIT II THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA (9 Hrs)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT III STRUCTURED QUERY LANGUAGE AND NORMALIZATION (9 Hrs)

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security. Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT IV STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 Hrs)

Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree. Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT V DATABASE BACKUP, RECOVERY AND SECURITY (9 Hrs)

Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

Text Books

1. Gupta.G.K, "Database Management Systems", Tata McGraw Hill, 2011
2. Abraham Silberschatz, Henry F Korth, S Sudharshan, Database System Concepts 7th Edition, McGraw-Hill International Edition, 2019.
3. Ramez Elmasri and Shamkant Navathe, Durvasula V L N Somayajulu, Shyam K Gupta, "Fundamentals of Database Systems", Pearson Education, USA, 2018.

Reference Books

1. Silberschatz, Korth.H and Sudarshan.S, "Database System Concepts", 6th Edition, McGraw-Hill International, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, "Database System The Complete Book, 1st Edition, Pearson 2002.
3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System, 8th Edition, Pearson Education-2006.

4. Raghu Ramakrishna, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill, 2014.
5. Ramez Elmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.

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2. http://dev.mysql.com/doc/
3. http://www.rjspm.com/PDF/BCA-428%20Oracle.pdf
4. http://www.w3schools.com/
5. https://www.codecademy.com/learn/learn-

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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2	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1
3	3	3	1	-	1	-	-	-	-	-	1	1	-	-	1
4	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1
5	3	1	1	-	1	-	-	-	-	-	1	1	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20CCO402 INTRODUCTION TO COMMUNICATION SYSTEMS

(Common to EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To provide basic knowledge of signals
- To study the various analog and digital modulation techniques
- To study the pulse modulation and multiplexing
- To infer Digital transmission techniques
- To provide knowledge about various multiple access technology and advanced communication techniques

Course Outcomes

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

CO1 - Comprehend the basic Characteristics of the signals. (**K2**)
CO2 - Comprehend needs of modulation and various analog modulation techniques. (**K2**)
CO3 - Illustrate pulse modulation and multiplexing. (**K3**)
CO4 - Explain Digital transmission techniques. (**K2**)
CO5 - Describe multiple access techniques and advanced communication systems. (**K2**)

UNIT I SIGNAL ANALYSIS (9 Hrs)

Introduction to Signals- Representation and classification of Signals, Representation of signal in frequency domain, introduction to Spectrum of signal- Introduction to Fourier series and Fourier Transform

UNIT II ANALOG COMMUNICATION (9 Hrs)

Need for Modulation— Block diagram of analog communication System- Amplitude Modulation – AM, DSBSC, SSBSC, modulators and demodulators – Angle modulation – PM and FM – modulators and demodulators – Superheterodyne receivers

UNIT III PULSE COMMUNICATION (9 Hrs)

Low pass sampling theorem – Quantization – PAM – PCM, DPCM, DM, and ADPCM And ADM - Time Division Multiplexing, Frequency Division Multiplexing

UNIT IV DIGITAL COMMUNICATION (9 Hrs)

Comparison of digital and analog communication system- Block diagram of digital communication system Phase shift keying – BPSK, DPSK, QPSK

UNIT V MULTIPLE ACCESS TECHNIQUES AND ADVANCED COMMUNICATION (9 Hrs)

Multiple Access techniques- FDMA, TDMA, CDMA- Frequency reuse, Handoff- Block diagram of advanced communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.

Text Books

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", 3rd edition, TMH 2007
2. S. Haykin, "Digital Communications", John Wiley, 2005
3. B.P.Lathi," Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2007

Reference Books

1. H P Hsu, Schaum Outline Series, "Analog and Digital Communications", TMH 2006
2. B.Sklar," Digital Communications Fundamentals and Applications", 2nd edition Pearson Education 2007.
3. A.Bource Carson and Paul B.Crilly, "Communication Systems", 5th Edition, Mc Graw Hill, 2010
4. Torrieri, Don, "Principles of Spread Spectrum Communication Systems", Springer, 2015
5. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001.

Web References

1. www.allaboutcircuits.com
2. https://nptel.ac.in/courses/108/102/108102096/
3. http://www.electronics-tutorials.ws
4. www.tutorialspoint.com
5. https://nptel.ac.in/courses/108/104/108104091/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	1
4	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

KNOWLEDGE REPRESENTATION AND REASONING

U20ADO401	KNOWLEDGE REPRESENTATION AND REASONING (Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To investigate the key concepts of knowledge representation (KR) techniques and different notations.
- To integrate the KR view as knowledge engineering approach to model organizational knowledge.
- To introduce the study of ontologies as a KR paradigm and applications of ontologies.
- To understand various KR techniques.
- To understand process, knowledge acquisition and sharing of ontology.

Course Outcomes

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

CO1 - Analyse and design knowledge based systems intended for computer implementation. **(K3)**
CO2 - Acquire theoretical knowledge about principles for logic-based representation and reasoning. **(K2)**
CO3 - Understand knowledge-engineering process. **(K2)**
CO4 - Implement production systems, frames, inheritance systems and approaches to handle uncertain or incomplete knowledge. **(K3)**
CO5 - Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making. **(K2)**

UNIT I **(9 Hrs)**

The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic. Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

UNIT II **(9 Hrs)**

Ontology: Ontological categories, Philosophical background, Top-level categories, Describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time.

UNIT III **(9 Hrs)**

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation.

UNIT IV INDUSTRIALIZATION, OPPURTUNITIES AND APPLICATIONS **(9 Hrs)**

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

UNIT V ETHICS AND RECENT TRENDS **(9 Hrs)**

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics. Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition.

Text Books

1. John F. Sowa, Thomson Learning "Knowledge Representation logical, Philosophical, and Computational Foundations", Course Technology Inc. publication, 1999.
2. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning", Morgan Kaufmann; 1st edition, 2004.
3. Eileen Cornell Way "Knowledge Representation and Metaphor" Springer; 1991st edition, 1991.

Reference Books

1. Trevor Bench-Capon, "Knowledge representation: an approach to artificial intelligence", Academic Press, 2014.
2. Yulia Kahl, Michael Gelfond "Knowledge Representation, Reasoning, and the Design of Intelligent Agents The Answer-Set Programming Approach", Cambridge University Press; 1st edition, 2014.

3. Arthur B. Markman, “Knowledge representation” Psychology Press; 1st edition, 1998.
4. Sanida Omerović, Grega Jakus, V. Milutinovic, Sašo Tomažič “Concepts, Ontologies, and Knowledge Representation” Springer; 2013.
5. Bernhard Nebel, Gerhard Lakemeyer “Foundations of Knowledge Representation and Reasoning” Springer, 1994.

Web References

1. https://www.javatpoint.com/knowledge-representation-in-ai
2. https://nptel.ac.in/courses/106/106/106106140/
3. https://www.youtube.com/watch?v=kXIr6ydiPAQ

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	3	-	-	-	-	-	-	-	1	1	-
2	2	3	2	3	2	-	-	-	-	-	-	-	-	1	-
3	1	3	1	2	2	-	-	-	-	-	-	-	-	1	-
4	1	2	1	2	1	-	-	-	-	-	-	-	-	-	1
5	2	1	3	1	3	-	-	2	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20ADO402

INTRODUCTION TO DATA SCIENCE

(Common to EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, Mechatronics)

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To learn the basics of data science
- To enable the students to understand the statistics and probability.
- To understand the tools in developing and visualizing data.
- To gain good knowledge in the application areas of data science.
- To inculcate the perceiving, ethics surrounding privacy and acting of data science applications.

Course Outcomes

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

CO1 - Explore the fundamental concepts of data science. **(K2)**

CO2 - Understand the Mathematical Knowledge for Data Science. **(K2)**

CO3 - Visualize and present the inference using various tools. **(K3)**

CO4 - Expose the different opportunities in Industries. **(K3)**

CO5 - Learn to think through the ethics surrounding privacy, data sharing and decision-making. **(K2)**

UNIT I INTRODUCTION TO DATA SCIENCE (9 Hrs)

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

UNIT II MATHEMATICAL PRELIMINARIES (9 Hrs)

Probability: Probability vs. Statistics – Compound Events and Independence – Conditional Probability – Probability Distribution. Descriptive Statistics: Centrality Measures – Variability Measures - Interpreting Variance – Characterizing Distributions. Correlation Analysis: Correlation Coefficient – The Power and Significance – Detection Periodicities. Logarithms: Logarithms and Multiplying Probabilities – Logarithms and Ratios – Logarithms and Normalizing Skewed Distributions.

UNIT III DATA SCIENCE TOOLS (9 Hrs)

Introduction to Data Science Tool – Data Cleaning Tools – Data Munging and Modelling Tools – Data Visualization Tools – Tools for Data Science.

UNIT IV INDUSTRIALIZATION, OPPURTUNITIES AND APPLICATIONS (9 Hrs)

Data Economy and Industrialization – Introduction: Data Economy, Data Industry, Data Services – Data Science Application: Introduction, General Application Guidance - Different Domain – Advertising – Aerospace and Astronomy – Arts, Creative Design and Humanities – Bioinformatics – Consulting Services – Ecology and Environment – Ecommerce and Retail - Education – Engineering – Finance and Economy – Gaming.

UNIT V ETHICS AND RECENT TRENDS (9 Hrs)

Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Text Books

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications Co., 1st edition, 2016.
2. Chirag Shah, "A Hands on Introduction to Data Science", Cambridge University Press, 2020.
3. Sinan Ozdemir, "Principles of Data Science", Packt Publication, 2016.
4. D J Patil, Hilary Mason, Mike Loukides, "Ethics and Data Science", O' Reilly, 1st edition, 2018.

Reference Books

1. Hector Guerrero, "Excel Data Analysis: Modeling and Simulation", Springer International Publishing, 2nd Edition, 2019.
2. Paul Curzon, Peter W. Mc Owan, "The Power of Computational Thinking", World Scientific Publishing, 2017.
3. Steven S. Skiena, "Data Science Design Manual", Spring International Publication, 2017.

4. Rajendra Akerkar, Priti Srinivas Sajja, "Intelligence Techniques for Data Science", Spring International Publication, 2016.
5. Longbing Cao "Data Science Thinking: The Next Scientific, Technological and Economic Revolution", Spring International Publication, 2018.

Web References

1. https://www.youtube.com/watch?v=-ETQ97mXXF0&ab_channel=edureka%21
2. https://www.javatpoint.com/data-science
3. https://www.coursera.org/browse/data-science /

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1	1	2	3	2	2	-	-	-	-	-	-	-	-	1	-
2	2	2	2	1	1	-	-	-	-	-	-	-	1	1	-
3	2	1	3	2	3	-	-	-	-	-	-	-	-	2	-
4	1	2	2	1	1	-	-	-	-	-	-	-	-	-	1
5	2	1	1	2	1	-	-	1	-	-	-	-	-	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 - High

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Department of ELECTRICAL AND ELECTRONICS ENGINEERING

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