K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING AND TECHNOLOGY

Bachelor of Technology (Electrical and Electronics Engineering)

B.Tech (EEE)

Programme Code: 02

2021-25

Approved in the 26th Meeting of Academic Council Held on 11 August 2021

Academic Council
Member Secretary
K.R. Mangalam University

Registrar
K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING

AND

TECHNOLOGY

Bachelor of Technology (Electrical and Electronics Engineering)

B.Tech (EEE)

Programme Code: 02

2021-25

Approved in the 26th Meeting of Academic Council Held on 11 August 2021

PREFACE

The Academic Council in consultation with Deans, Faculty Members, Industry Experts and University Alumni constituted school- wise committees to draft the model curriculum of UG engineering courses. During the meetings held for developing curriculum for undergraduate engineering courses, a concern was shared that the overall credits are too high. It is important to lower the credits to 160 across all departments to lower the burden of syllabi and credits. The respective Head of Committees, Faculty members along with Industry Experts and Alumni discussed the existing system prevalent in various universities, industry requirements and market trends, employability, problem solving approach, need for life-long learning, and after due deliberations, the scheme and syllabus of the B. Tech (EEE) has been formalized.

Salient features of this model curriculum are enumerated below:

1. Curriculum has been designed in such a way that it encourages innovation and research as total numbers of credits have been reduced and many new courses have been incorporated in consultation with industry experts.
2. The revised curriculum has been designed where the students can understand the industry requirements and have hands-on experience. The students will develop a problem-solving approach and will meet the challenges of future.
3. Emerging areas in Electrical and Electronics sectors has been included in sixth and seventh semester.
4. Emphasis on hands-on training has been promoted by including two industrial training of 4 weeks and 6 weeks respectively, and project in seventh semester and six-month Industrial Internship in eighth semester.
5. The School ensures the revision of the curriculum to help students to achieve better employability, start-ups and other avenues for higher studies

About K.R Mangalam University

The K.R. Mangalam Group has made a name for itself in the field of education. The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education.

K.R. Mangalam University is the fastest-growing higher education institute in Gurugram, India. K. R. Mangalam University was established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

Since its inception in 2013, the University has been striving to fulfil its prime objective of transforming young lives through ground-breaking pedagogy, global collaborations, and world-class infrastructure. Resources at K.R Mangalam University have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly interdisciplinary environment where they grow up with integrative skills through interaction with students from engineering, social sciences, management and other study streams.

K.R Mangalam University is unique because of its:

i. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.

ii. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Objectives

i. To impart undergraduate, post graduate and doctoral education in identified areas of higher education.

ii. To undertake research programmes with industrial interface.

iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.

iv. To act as a nodal center for transfer of technology to the industry.

v. To provide job oriented professional education to the Indian student community with particular focus on Haryana.

About School of Engineering & Technology (SOET)

School of Engineering and Technology (SOET), K.R. Mangalam University is dedicated to fostering innovation, excellence, and advancement in engineering and technology. Empowering the new

generation of change-makers by imparting exceptional understanding and intellect to facilitate the creation of highly sophisticated futuristic solutions. Our well-qualified academicians, accomplished

researchers and industry insiders are focused on imparting their extensive knowledge and expertise to students through various lectures, workshops, industrial visits, projects, and competitions throughout the year ensuring that students receive a comprehensive education that blends theory with practical application.

These programs offered at SOET have the distinct objective of equipping the students with knowledge, skills and attitudes in engineering and technology, to make them capable of successfully meeting the present requirements and future challenges in the engineering profession. SOET brings together outstanding academics, industry professionals, and experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

The curriculum of programs has been designed to cater to the ever changing needs and demands of the industry. The curriculum is regularly updated. The school has best infrastructure including domain-specific labs. SOET aims to provide exposure to the principles and practices of Design / Developments and Projects in the area of engineering. SOET is offering Ph.D. programs also.

School Vision

To create, disseminate, and apply knowledge in science and technology to meet the higher education needs of India and the global society, To serve as an institutional model of excellence in scientific and technical education characterized by integration of teaching, research and innovation.

School Mission

M1: To create an environment where teaching and learning are prioritized, with all support activities being held accountable for their success.

M2: To strengthen the institution's position as the school of choice for students across the State & Nation.

M3: To promote creative, immersive, and lifelong learning skills while addressing societal concerns.

M4: To promote co- and extra-curricular activities for overall personality development of the students.

M5: To promote and undertake all-inclusive research and development activities.

M6: To instill in learners an entrepreneurial mindset and principles.

M7: Enhance industrial, institutional, national, and international partnerships for symbiotic relationships.

M8: To help students acquire and develop knowledge, skills and leadership qualities of the 21st Century and beyond.

Programmes offered by the School

School offers undergraduate B. Tech Program, B.Sc. (Hons) Program, postgraduate M. Tech Program, and Doctoral Program. All these programs are designed to impart scientific knowledge to the students

and provide theoretical and practical training in their respective fields.

B.Tech Electrical and Electronics Engineering (B.Tech EEE)

This program prepares the students for conceptualization, design, manufacturing and testing of a wide range of electrical and electronics based devices of mobile and digital computing sectors etc. it also trains the students in the area of power system and its basics, adding the basic electronics part as base subject the knowledge of electrical stream is blended by the expert faculty members of our university.

Eligibility Criteria: The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: Power system designing, basics of network elements, theorems proofing and satisfying, Study related to electrical and electronics subjects required to understand the basics of engineering technology such as: Switchgear and Protection, renewable energy, power system modelling and simulation lab.

Career Options: Construction Industry, Nuclear power plant, automotive, textile, power, renewable energy industry, All government psu's, Indian Defence service.

Program Educational Objectives (PEO)

PEO 1: To develop graduates who have strong foundation of knowledge and skills in the field of computer science and engineering.

PEO 2: To develop graduates who are employable in industries/public sector/research organizations or work as an entrepreneur.

PEO 3: To foster graduates who can provide solutions to challenging problems in their profession by applying computer engineering theory and practices.

PEO 4: To encourage graduates who can provide leadership and are effective in multidisciplinary environment.

PEO 5: To develop ability to demonstrate team work with the ability of leadership, analytical reasoning for solving time critical problems and strong human values for responsible professional.

PEO 6: To impart knowledge and skills to analyze, design, test and implement diverse range of technology.

Program Outcomes (PO)

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

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

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

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

PO 5 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.

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

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

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

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

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

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

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

Program Specific Outcomes (PSO): B. Tech. Electrical and Electronics Engineering

PSO1: Application of Concepts

An ability to specify, design and analyze systems that efficiently generate, transmit, distribute and utilize electrical power.
An ability to analyse and design electrical machinery, electrical/electronic circuits, electrical/solid state drive systems, lighting systems and deliver technological solution by assimilating advances in allied discipline

PSO2: Innovation and Industry Friendly:

An ability to analyze, design and implement the learning in electrical instrumentation, control and automation applications.
An ability to enhance the entrepreneurship skill and thus providing employability of the students.

PSO3: Ethics and Communication Skills

An ability to communicate in both oral and written forms, the work already done and the future plans with necessary road maps, demonstrating the practice of professional ethics and the concerns for social and environmental impact.

Program Duration: 4 Years

The maximum period for the completion of the B.Tech. (EEE), Programme offered by the University shall be four years.

Scheme of Studies and Syllabi

The scheme of studies and syllabi of B. Tech. (EEE) is given in the following pages. These are arranged as (a) common courses (b) degree-specific courses, in numeric order of the last three digits of the course code.

The first line contains; Course Code and Credits (C) of the course for each course.
This is followed by the course objectives, course outcome, a syllabus (Unit I to IV), Textbook, and reference books

Four Years B. Tech (EEE) Programme at a Glance

Semester	1	2	3	4	5	6	7	8	Total
Courses	8	8	10	11	10	8	5	1	**61**
Credits	22	21	24	24	21	20	18	12	**162**

Scheme of Studies as per Learning Outcome Based Curriculum Framework (LOCF) and Choice based cerdits System (CBCS)

YEAR	ODD SEMESTER										EVEN SEMESTER								
	SNo	AICTE Cat	UNIV CAT	COURSE CODE	COURSE TITLE	L	T	P	C		SNo	AICTE Cat	UNIV CAT	COURSE CODE	COURSE TITLE	L	T	P	C
FIRST	1	BSC	skill development	ETMA105A	APPLIED MATHEMATICS-I	3	1	0	4		1	BSC	skill development	ETMA104A	APPLIED MATHEMATICS-II	3	1	0	4
	2	BSC	skill development	ETPH109A	ENGINEERING PHYSICS	3	1	0	4		2	ESC	skill development	ETCS104A	INTRODUCTION TO COMPUTER SCIENCE AND PROGRAMMING IN PYTHON	3	1	0	4
	3	MC	skill development	UCES125A	ENVIRONMENTAL STUDIES	3	0	0	3		3	BSC	skill development	ETCH119A	ENGINEERING CHEMISTRY	3	1	0	4
	4	ESC	Open Elective	ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	1	0	4		4	HSMC	employability/ entrepreneurship / skill development/ Open Elective	UCCS155A	COMMUNICATION SKILLS	4	0	0	4
	5	ESC	skill development	ETME101A	BASICS OF MECHANICAL ENGINEERING	3	1	0	4		5	ESC	skill development	ETME155A	ENGINEERING GRAPHICS LAB	0	0	3	1.5
	6	BSC	skill development	ETPH151A	ENGINEERING PHYSICS LAB	0	0	2	1		6	ESC	skill development	ETCS150A	INTRODUCTION TO COMPUTER SCIENCE AND PROGRA	0	0	2	1

															MMING IN PYTHON LAB				
	7	ESC	Open Elective	ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	0	0	2	1	7	BSC	skill development	ETCH159A	ENGINEERING CHEMISTRY LAB	0	0	2	1
	8	ESC	skill development	ETME151A	BASICS OF MECHANICAL ENGINEERING LAB	0	0	2	1	8	ESC	Open Elective	ETME157A	WORKSHOP PRACTICES	0	0	3	1.5
	TOTAL					**15**	**4**	**6**	**22**	**TOTAL**					**13**	**3**	**10**	**21**
SECOND	1	ESC	skill development	ETMA201A	APPLIED MATHEMATICS-III	3	1	0	4	1	PCC	employability	ETEC311A	MICROPROCESSOR SYSTEMS	3	0	0	3
	2	PCC	employability	ETEC233A	ANALOG ELECTRONICS	3	0	0	3	2	PCC	employability	ETEE206A	ELECTRICAL MACHINES	3	0	0	3
	3	PCC	employability	ETEC202A	SIGNALS & SYSTEMS	3	1	0	4	3	PCC	employability	ETEE208A	POWER SYSTEM-I	3	0	0	3
	4	PCC	employability	ETEE201A	ELECTROMECHANICAL ENERGY CONVERSION	3	0	0	3	4	PCC	employability	ETEC204A	ELECTROMAGNETIC FIELDS THEORY	3	0	0	3
	5	PCC	employability	ETEC263A	ANALOG ELECTRONICS LAB	0	0	2	1	5	PCC	employability	ETEE256A	ELECTRICAL MACHINES LAB	0	0	2	1
	6	PCC	employability	ETEE251A	ELECTROMECHANICAL ENERGY CONVERSION LAB	0	0	2	1	6	PCC	employability	ETEC353A	MICROPROCESSOR SYSTEMS LAB	0	0	2	1
	7	MC	skill development	UCDM301A	DISASTER MANAGEMENT	3	0	0	3	7	PCC	employability	ETEC204A	ADVANCE ANALOG ELECTRONICS	3	0	0	3
	8	PCC	employability	ETEC203A	NETWORK THEORY	3	0	0	3	8	PCC	employability	ETEC264A	ADVANCE ANALOG ELECTRONICS LAB	0	0	2	1
	9	PCC	employability	ETEC255A	NETWORK THEORY LAB	0	0	2	1	9	PCC	employability	ETEC210A	DIGITAL ELECTRONICS	3	1	0	4
	10	HSMC	skill development	ETEL285A	BUSINESS COMMUNICATION SKILLS-I	0	0	2	1	10	PCC	employability	ETEC253A	DIGITAL ELECTRONICS LAB	0	0	2	1
										11	HSMC	skill development	ETEL286A	BUSINESS COMMUNICATION	0	0	2	1

															SKILLS-II					
	TOTAL					**18**	**2**	**8**	**24**		**TOTAL**					**18**	**1**	**10**	**24**
NOTE: PRACTICAL TRAINING WILL BE FOUR WEEKS DURATION AT THE END OF FOURTH SEMESTER DURING SUMMER BREAK AND THE EVALUATION WILL BE DONE AT THE END OF FIFTH SEMESTER.																				
THIRD	1	PCC	employability	ETEE 301A	POWER SYSTEM-II	3	0	0	3		1	PEC	employability		DEPARTMENTAL ELECTIVE	3	0	0	3
	2	PEC	employability	ETEC 314A	DIGITAL SIGNAL PROCESSING	3	1	0	4		2	PEC	employability	ETEE 404A	ELECTRIC DRIVES	3	0	0	3
	3	PEC	employability	ETEC 360A	DIGITAL SIGNAL PROCESSING LAB	0	0	2	1		3	PEC	employability	ETEE 452A	POWER SYSTEMS SIMULATION LAB	0	0	2	1
	4	PCC	employability	ETEE 362A	POWER SYSTEM LAB	0	0	2	1		4	PCC	employability	ETEE 403A	SWITCHGEAR AND PROTECTION	3	1	0	4
	5	PROJ	employability	ETEE 351A	PRACTICAL TRAINING-I	0	0	0	1		5	PEC	employability	ETEC 305A	MEASUREMENT & INSTRUMENTATION	3	0	0	3
	6	PCC	employability	ETEE 316A	POWER ELECTRONICS	3	1	0	4		6	PEC	employability	ETEC 355A	MEASUREMENT & INSTRUMENTATION LAB	0	0	2	1
	7	PCC	employability	ETEE 364A	POWER ELECTRONICS LAB	0	0	2	1		7	OEC	employability	ETEE 401A	RENEWABLE ENERGY SYSTEM	3	1	0	4
	8	PCC	employability	ETEC 313A	CONTROL SYSTEM	3	1	0	4		8	HSMC	skill development	ETEC 372A	QUANTATIVE APTITUDE REASONING -II	0	0	2	1
	9	PCC	employability	ETEC 358A	CONTROL SYSTEM LAB	0	0	2	1										
	10	HSMC	skill development	ETEC 371A	QUANTATIVE APTITUDE REASONING -I	0	0	2	1										
	TOTAL					**12**	**3**	**10**	**21**		**TOTAL**					**15**	**2**	**6**	**20**
NOTE: PRACTICAL TRAINING WILL BE FOUR WEEKS DURATION AT THE END OF SIXTH SEMESTER DURING SUMMER BREAK AND THE EVALUATION WILL BE DONE AT THE END OF SEVENTH SEMESTER.																				
FOURTH	1	PEC	employability	ETEE 422A	SMART ELECTRIC GRID	3	1	0	4		1	PROJ	employability	ETEE 470A	INTERNSHIP	0	0	0	12
	2	OEC	employability	ETEE 425A	ELECTRIC & HYBRID VEHICLES	3	0	0	3		2								
	3	PE	emplo		DEPARTME	3	0	0	3		3								

		C	yabilit y		NTAL ELETIVE															
	4	PR OJ	emplo yabilit y	ETEE 460A	MAJOR PROJECT	0	0	0	6		4									
	5	PR OJ	emplo yabilit y	ETEE 465A	PRACTICAL TRAINING-II	0	0	0	2											
	TOTAL					**9**	**1**	**0**	**18**		**TOTAL**							**0**	**0**	**0**	**12**
											TOTAL CREDITS [C]							**162**		

DEPARTMENTAL ELECTIVE																	
1	PEC		ETEC412A	BIO MEDICAL ELECTRONICS	3	0	0	3	9	PEC		ETEE408A	ELECTRIC TRACTION	3	0	0	3
2			ETEC402A	ROBOTICS	3	0	0	3	10			ETEE410A	SWITCHED MODE POWER CONVERTERS	3	0	0	3
3			ETEC410A	SATELLITE COMMUNICATION	3	0	0	3	11			ETEE413A	DESIGN OF ELECTRICAL SYSTEMS	3	0	0	3
4			ETEC413A	RADAR & SONAR ENGINEERING	3	0	0	3	12			ETEE414A	HIGH VOLTAGE ENEGINEERING	3	0	0	3
5			ETEC414A	INTRODUCTION TO NANO TECHNOLOGY	3	0	0	3	13			ETEE415A	COMPUTER METHODS IN POWER SYSTEM	3	0	0	3
6			ETEC425A	DATA COMMUNICATION NETWORKS	3	0	0	3	14			ETEE418A	POWER QUALITY	3	0	0	3
7			ETEC430A	FUZZY LOGIC AND SYSTEMS	3	0	0	3	15			ETEE421A	POWER SYSTEM OPERATION AND CONTROL	3	0	0	3
8			ETEE407A	HVDC AND FLEXIBLE AC TRANSMISSION SYSTEMS	3	0	0	3	16			ETEE423A	PLC AND SCADA	3	0	0	3
									17			ETEC312A	IoT ARCHITECTURE AND PROTOCOLS	3	0	0	3

OE	**OPEN ELECTIVE**
CC	**CORE COURSE**
SE	**SKILL ENHANCEMENT**
DE	**DEPARTMENTAL ELECTIVE**

First Year (I Sem.)

ETMA105A	APPLIED MATHEMATICS-I	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

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

CO1. Understand and able to apply the basic concept of complex variable.

CO2. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO3. Applied the differential calculus method for curve tracing and radios of curvatures.

CO4. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO5. Explain the qualitative long-term behaviour of the solutions to an ODE or system of ODE's.

CO6. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and

matrices. The concepts of applied mathematics-I are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10 lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.

2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behaviour of the solutions to an ODE or system of ODE's.	**PO3**
CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA105A	Applied Mathematics - I	3	3	3	3				1					3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Waves & Optics				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon ofnon dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

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

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations. CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helpslearners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **12 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **12 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, The wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **12 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young's double slit experiment, Newton's rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **12 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves
3. E. Hecht, Optics
4. A. Ghatak, Optics
5. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	PO 1
CO2	Solve non-dispersive transverse and longitudinal waves equations.	P O4
CO3	Analyze propagation of light, geometric and wave optics	P O5
CO4	Design different laser source systems.	P O2

		ETPH10
	C o	
	T i	F P hy
Engineering Knowledge	PO1	2
Problem analysis	PO2	[illegible]
Design/development of solutions	PO3	
Conduct investigations of complex problems	PO4	[illegible]
Modern tool usage	PO5	3
The engineer and society	PO6	
Environment and sustainability	PO7	
Ethics	PO8	
Individual or team work	PO9	
Communication	PO10	
Project management and finance	PO11	
Life-long Learning	PO12	
Application of Concepts	PSO1	[illegible]
Innovation and Industry Friendly	PSO2	
Ethics and Communication Skills	PSO3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.

2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.

3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arise from human interactions with the world around them.

4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able
to
CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4. To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.
CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non- renewable resources.

Course Content

UNIT I **8 Lectures**

Environment and Natural Resources:
Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness. Land resources; land use change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **16 Lectures**

Ecosystems and Biodiversity

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.
Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III

15 Lectures

Environmental Pollution and Environmental Policies: Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **11 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in evironmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).
Visit to an area to document environmental assets: river/ forest/ flora/fauna,
etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

1. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.

2. S.E. Manahan, Environmental Chemistry, CRC Press.
3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
4. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	PO7
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	PO8
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	PO10
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	PO6
CO5	Students become consciousness about healthy and safe environment.	PO7

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or teamwork	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
UCES125 A	Environmental Studies						2	3	3		3				1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C
		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behaviour on the DC and AC supply.

2. To analyse the complex circuits using various theorems to resolve it to a simple circuit.

3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyse the circuit response with addition of circuit elements i.e inductor and capacitors.

5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

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

CO1 Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2 Determine an understanding of logic gates.

CO3 Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4 Create an understanding of semiconductor devices application to existing devices

CO5 Learn the basics of electronics devices used in practical application. CO6 Able to determine waveform basics by obtaining it on analyzer devices

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor

introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **14 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **12 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation,Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit III

10 Hour

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit IV **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction,transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations,Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.

2. B L Thareja – A text book of Electrical Technology

3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.

4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals, V.Del Toro

2. Problems in Electrical Engineering – Parker Smith.S.

3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.

4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.

5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3										3	3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETME 101A	Basics of Mechanical Engineering	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

1. Understanding Basic Materials and Manufacturing Processes.
2. Have an understanding of laws of thermodynamics and Thermodynamic processes.
3. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
4. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.
CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.
CO3. Get the knowledge about power transmission method and device with mechanical properties.
CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.
Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: **12 lecture hours**

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychrometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: **12 lecture hours**

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.
Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: **6 lecture hours**

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

1. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
2. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
4. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
5. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

1. Strength of Materials – Popov, Pub. PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics andworkshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**
CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
UCES125 A	Environmen tal Studies						2	3	3		3				1	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**ENGINEERING PHYSICS LAB**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications

2. To learn how interference, diffraction and polarization of lighttake place.

3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.

4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

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

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems. CO2. Better insight aboutwave nature of light.
CO3.Better understanding of data interpretation which enhances problem solving approach.
CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helpslearners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content **10-11 Hours**

LIST OF EXPERIMENTS

1) To determine the value of acceleration due to gravity using Bar pendulum.
2) To determine the value of acceleration due to gravity using Kater's pendulum.
3) To determine the wavelength of sodium light using Newton`s ring apparatus.
4) To determine the wavelength of prominent lines of mercury by plane diffraction grating.
5) To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer.
6) To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.

7) To determine the wavelength of He-Ne LASER using transmission diffraction grating.

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	PO1& PO2
CO2	Better insight aboutwave nature of light.	PO4
CO3	Better understanding of data interpretation which enhances problem solving approach.	PO5
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	PO6

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3		3	3	3							3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the DC and ACcircuit behaviour by application of network theorems.
2. To elaborate complex signals over oscilloscope devices with reading.
3. To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.
4. To analyse the BJT inbuild circuits as per practical application point of view.
5. To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

Course Outcomes

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

- CO1 Get an exposure to common electrical components and their ratings.
- C02 Determines proper electrical connections as per wires of appropriate ratings.
- CO3 Understand the usage of common electrical measuring instruments.
- CO4 Ability to discover applications related to seven segment display type of devices

Catalog Description

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application inreal time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:

   a) Cathode ray oscilloscope (CRO)

   b) Multimeter (Analog and Digital)
   c) Function generator
   d) Power supply

2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem

4. To Verify the Superposition theorem

5. To measure voltage, current and power in an A.C. circuit by LCR impedance method

6. To study the frequency response curve in series and parallel R-L-C circuit

7. a) Plot the forward and reverse V-I characteristics of P-N junction diode

b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region

8. to plot and study the input and output characteristics of BJT in common-emitter configuration.

9. Verification of truth tables of logic gates (OR, AND, NOT, NAND, NOR).

10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro

2. Problems in Electrical Engineering – Parker Smith.S.

3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.

4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson

Education India, New Delhi.

5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2										3	3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME151A	Basics of Mechanical Engineering Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

1. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start

   Worm & Worm Wheel, Differential Wheel & Axle.

2. To study simple screw jack and compound screw jack and determine their efficiency.

3. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)

4. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
5. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.

6. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems. CO2 Understand concepts of screw jack, friction, law of moments.
CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines. CO4 Get the knowledge of various Refrigeration and Air-Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**

8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Projects/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**
CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**
CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air- Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2		3	3								3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

First Year (II Sem.)

ETMA104A	APPLIED MATHEMATICS-II	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

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

CO1. Understand and able to apply the basic concept of Laplace transform.
CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.
CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.
CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.
CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.
CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics- II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students' problem-

solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.

2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.	**PO8**
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**
CO4	Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.	**PO4**
CO5	Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonally about the functions.	**PO3**
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modelling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETMA104A	Applied Mathematics - II	2	3	2	3				2					3		

1= weakly mapped

2= moderately mapped

3= strongly mapped

ETCS104A	INTRODUCTION TO COMPUTERS AND PROGRAMMING IN PYTHON	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

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

CO 1 To learn the syntax and semantics of Python programming
language CO 2 To use the structural programming approach in solving
the problem. CO 3 To use the object oriented programming approach
in solving problems CO 4 To handle exceptions gracefully
CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I 12 **LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types)

variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and

Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, "Core Python Programming", Dreamtech

2. Wesley J. Chun. "Core Python Programming, Second Edition", Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley

4. Kenneth A. Lambert, "Fundamentals of Python,First Programs", CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO 2	PO3	PO4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO 12	PSO1	PSO 2	PSO
ETCS 104A	Introduction to Computer Science and Programming in Python	2	2	2	2						2			3	3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCH119A	Engineering Chemistry	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12th Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry andtheir applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use. CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.
CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.
CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.
CO6: They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **16 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **12 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power a lcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **12 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: **10 lecture hours**

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead- silver,Na_2SO_4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization;

Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.

Text Books

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Develop the understanding of Technology involved in improving qualityof water for its industrial use.	PO2
CO2	Identify instrumental techniques for analysis and analyze the qualityparameters of chemical fuels.	PO1
CO3	Develop the understanding of Chemical structure of polymers and itseffect on their various properties when used as engineering materials.	PO6
CO4	Impart the knowledge of fuels and biofuels with its propertiesand applications.	PO7
CO5	Illustrate the principles involved in thermodynamicsand kinetic theory of gases which are used in daily life.	PO3
CO6	They can predictpotential applications of chemistry and practical utility in order to become goodengineers and entrepreneurs	PO1

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH 119A	Engineering Chemistry	3	3	2			3	2						3	3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCCS 155A	**Communication Skills**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Understand the basics of Grammar to improve written and oral communication skills.
2. Understand the correct form of English with proficiency
3. Improve student's personality and enhance their self-confidence.

4. Improve professional communication.

5. Enhance academic writing skills.

Course Outcomes

On completion of this course, the students will be able to
CO1. Understand the basics of Grammar to improve written and oral communication skills
CO2. Understand the correct form of English with proficiency
CO3. Improve student's personality and enhance their self-confidence
CO4. Improve professional communication
CO5. Enhance academic writing skills

Catalog Description

This learning program with its practice-based learning tasks will facilitate the learners to enhance their communication skills in a modern and globalized context, enhance their linguistic and communicative competence and hone their interpersonal skills.

Course Content

UNIT I **10 lecture hours**

Introduction to Communication: Importance of Communication Skills, Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication (Interpersonal, Intrapersonal and Organizational).

UNIT II **10 lecture hours**

Academic Writing: Précis (Summary – Abstract – Synopsis – Paraphrase – Précis: Methods), Letter & Résumé (Letter Structure & Elements – Types of letter: Application & Cover - Acknowledgement – Recommendation – Appreciation – Acceptance – Apology – Complaint –Inquiry).Writing a proposal and synopsis. Structure of a research paper. Citations and plagiarism.

UNIT III **10 lecture hours**

Technology-Enabled Communication: Using technology in communication tasks, E-mails, tools for constructing messages, Computer tools for gathering and collecting information; Different virtual medium of communication.

UNIT IV **10 lecture hours**

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms &Synonyms, Phrasal Verbs, Idioms & Proverbs (25 each); Commonly used foreign words(15 in number);

UNIT V **10 lecture hours**

Personality Development: Etiquettes& Manners; Attitude, Self-esteem & Self-reliance; Public Speaking; Work habits (punctuality, prioritizing work, bringing solution to problems), Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques.

Text book [TB]:

1. Kumar, Sanjay and Pushplata.CommunicationSkills.Oxford University Press, 2015.

Reference Books/Materials

1. Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press, 2012.
2. Tickoo, M.L., A. E.Subramanian and P.R.Subramaniam.Intermediate Grammar, Usage and Composition. Orient Blackswan, 1976.
3. Bhaskar, W.W.S., AND Prabhu, NS., " English Through Reading", Publisher: MacMillan,1978
4. Business Correspondence and Report Writing" -Sharma, R.C. and Mohan K. Publisher: Tata McGraw Hill1994
5. Communications in Tourism & Hospitality- Lynn Van Der Wagen, Publisher: HospitalityPress
6. Business Communication-K.K.Sinha
7. Essentials of Business Communication By Marey Ellen Guffey, Publisher: ThompsonPress
8. How to win Friends and Influence People By Dale Carnegie, Publisher: Pocket Books
9. Basic Business Communication By Lesikar&Flatley, Publisher Tata McGraw Hills
10. Body Language By Allan Pease, Publisher SheldonPress

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the basics of Grammar to improve written and oral communication skills	**PO10**
CO2	Understand the correct form of English with proficiency	**PO10**
CO3	Improve student's personality and enhance their self-confidence	**PO12**
CO4	Improve professional communication.	**PO10**
CO5	Enhance academic writing skills	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH 119A	Engineering Chemistry	3	3	2			3	2						3	3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETME155A	Engineering Graphics Lab	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing. CO2. Interpret engineering drawings using fundamental technical mathematics.
CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.
CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Projects/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME155A	Engineering Graphics Lab	3	2	3		3								3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS150A	INTRODUCTION TO COMPUTERS AND PROGRAMMING IN PYTHON LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.
Learn core Python scripting elements such as variables and flow control structures. Discover how to work with lists and sequence data.
Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

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

CO 1 To learn the syntax and semantics of Python programming language
CO 2 To use the structural programming approach in solving the problem.
CO 3 To use the object oriented programming approach in solving problems
CO 4 To handle exceptions gracefully
CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**
4	Develop programs to understand the control structures of python	**2 lab hours**
5	Develop programs to implement function with stress on scoping	**2 lab hours**
6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**

8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Projects/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO
ETCS 150A	Introduction to computers and programming in python Lab		2	3		3				3				3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCH159	Engineering Chemistry Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- 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.

Course Outcomes

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

CO1: Analyze & generate experimental skills.

CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.

CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.

CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.

CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.

CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixtureof sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution,given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hyposolution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol formaldehyde resins.	**2 lab hours**
13	Determination of dissolved oxygen in the given sample of water.	**2 lab hours**
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Projects/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analysessuch as volumetric titrations, conductometric,and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record andanalyze the results of such experiments.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

ETCH159	Engineering Chemistry Lab	3	3	2		2				3			3	3		3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need

3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual

practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Projects/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs

	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**
CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3		3	2	3								3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Second Year (III Sem.)

ETMA 201A	APPLIED MATHEMATICS - III	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basic of Mathematics				
Co-requisites	--				

Course Objectives

1. Obtain the Fourier series and Fourier transform for a given function
2. Evaluate real integrals using residue theorem
3. Express analytic functions in terms of Taylor's series and Laurent series
4. Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus
5. Express any periodic function in term of sines and cosines
6. Analyze one dimensional wave and heat equation

Course Outcomes

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

CO1. Obtain the Fourier series and Fourier transform for a given function

CO2. Evaluate real integrals using residue theorem

CO3. Express analytic functions in terms of Taylor's series and Laurent series.

CO4. Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus.

CO5. Express any periodic function in term of sines and cosines

CO6. Analyze one dimensional wave and heat equation

Catalog Description

The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of engineering and technology. The first part of this module extends the theory of Fourier series and Fourier integral transform. The second part of the module covers a complex variable which includes complex variable, analytic function, Cauchy-Riemann equations, and Residue theorem with their application.

Course Content

Unit I: **8 lecture hours**

Fourier series and its applications: Euler's formulae, Dirichlet's conditions, Change of interval, Fourier expansion of even and odd functions, Fourier expansion of square wave, Rectangular wave; Saw-toothed wave; half & full rectified wave functions, Harmonic analysis.

Unit II: **12 lecture hours**

Fourier integrals and Transforms: Fourier integral theorem, Fourier sine integral, Fourier cosine integral, Fourier sine Transform, Fourier cosine transform, Fourier transform and its properties, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier transforms of derivatives.

Unit III: **12 lecture hours Complex**

Numbers and Functions of Complex Variables: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Limit, Continuity and Derivatives of complex functions, Cauchy-Riemann equations, necessary and
sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations.

Harmonic functions, application to flow problems

Unit IV: **8 lecture hours Complex**

Integration and Conformal mapping: Standard mappings (linear, square, inverse and bilinear), Complex line integral, Cauchy's integral theorem, Cauchy's integral formula, Zeroes and Singularities, Taylor series, Laurent's series, Calculation of residues, Residue theorem,
Application of residue theorem to solve real integrals.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.

2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Obtain the Fourier series and Fourier transform for a given function	**PO1**
CO2	Evaluate real integrals using residue theorem	**PO2**
CO3	Express analytic functions in terms of Taylor's series and Laurent series.	**PO3**
CO4	Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus.	**PO4**
CO5	Express any periodic function in term of sines and cosines	**PSO1**
CO6	Analyze one dimensional wave and heat equation	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETMA201A	Applied Mathematics - III	2	3	3	3									2		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC233A	ANALOG ELECTRONICS	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts

Course Outcomes:

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

CO1. Understand the current voltage characteristics of semiconductor devices.

CO2. Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.

CO3. Design and analyze of electronic circuits.

CO4. Evaluate frequency response to understand behaviour of Electronics circuits.

CO5. Observe the effect of positive feedback and able to design and working of different oscillators.

CO6. Develop the skill to build, and troubleshoot Analog circuits.

Catalogue Description

The course is to provide knowledge of Analog Electronics to students of various engineering disciplines. The course module includes basic diodes, basic knowledge of transistors and its biasing techniques and stabilization.

Course Content

UNIT I **8 lecture hours**

Semiconductor Diodes and Rectifiers: Types of semiconductors, energy band diagrams, ideal diode, DC & AC resistance, drift & diffusion currents, transition & diffusion capacitance, reverse recovery time, temperature effects. Some Special Devices: P-N junction diode, zener diode, Light emitting diode, Tunnel Diode, Photodiodes. Rectifiers: Half-Wave Diode Rectifiers, Full-Wave Rectifier, Clippers and clampers circuits

UNIT II **8 lecture hours** Bipolar junction transistor: Introduction, transistor operations & characteristics, CB, CE, CC configurations, comparisons of different configurations, load line concept, leakage currents, modes of operations, Eber-moll's model, transistor applications: as a Switch and Amplifier. Bias stabilization: Need for stabilization, fixed Bias, emitter bias, self-bias, bias stability with respect to variations in Ico, VBE &β, Stabilization factors.

UNIT III **6 lecture hours**

Small signal amplifiers: Hybrid model for transistor at low frequencies, RC coupled amplifiers, frequency response, gain & impedance.

UNIT IV **4 lecture hours**

Field Effect Transistor: Introduction to JFET, MOSFET, FET Biasing, FET characteristics.

Text Books:

1. Boylestad & Nashelsky, "Electronic Devices & Circuit Theory" PHI – VI Edition

Reference Books:

1. Sedra & Smith, "Micro Electronic Circuits" Oxford University Press.
2. Salivahanan, Suresh Kumar, Vallavaraj, "Electronic devices and circuits" TMH.
3. J. Millman and Halkias, "Integrated Electronics" TMH.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the current voltage characteristics of semiconductor devices.	**PO4**
CO2	Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.	**PO1**
CO3	Design and analyze of electronic circuits.	**PSO1**
CO4	Evaluate frequency response to understand behaviour of Electronics circuits.	**PSO2**
CO5	Observe the effect of positive feedback and able to design and working of different oscillators.	**PO3**
CO5	Develop the skill to build, and troubleshoot Analog circuits	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC233A	Analog Electronics	3	2	2	2									3	3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC202A	SIGNALS & SYSTEMS	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

- Be able to describe signals mathematically and understand how to perform mathematical operations on signals
- Be familiar with commonly used signals such as the unit step, ramp, impulse function, sinusoidal signals and complex exponentials.
- Be able to classify signals as continuous-time vs. discrete-time, periodic vs. non-periodic, energy signal vs. power signal, odd vs. even, conjugate symmetric vs anti-symmetric
- Be able to compute the output of an LTI system given the input and the impulse response through convolution sum and convolution integral.

Course Outcomes:

CO1 Represent and classify various types of signals and systems.

CO2 Analyze the spectral characteristics of continuous-time and discrete time signals using

Fourier analysis and will be able to find Fourier transform for different signals.

CO3 Classify systems based on their properties and determine the response of LTI systems.

CO4 Analyze the system properties based on impulse response and Fourier analysis.

CO5 Apply the Laplace transform and Z-Transform for analyse of continuous time and discrete time signals and systems.

CO6 Understand the process of sampling and the effects of under sampling.

Catalog Description:

The objective of the course is to provide brief methodologies for analysis of Signals and Systems to the engineering students. The course module includes introduction of signals and their elementary operations, Laplace and Fourier analysis, Systems and their analysis and Z-Transform.

UNIT – I **Lecture Hours: 10**

Types of signals and Elementary operations: Signal Classification: Deterministic and Stochastic, discrete and continuous signals, analog and digital signals, periodic and a periodic, energy and power signals, causal and non-causal signals, one dimensional and multidimensional signals etc., impulse

functional sequences, analog and discrete, singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation.

UNIT – II **Lecture Hours: 10**

Laplace and Fourier analysis: Fourier series, Fourier and Laplace transforms: properties and applications, Signal characterization using fourier and Laplace transform, Convolution theorem: geometrical interpretation and applications. Discretization of Analog Signals: sampling, sampling theorem and its proof. Effect of under Sampling, recovery of analog signals from sampled signal: reconstruction formula.

UNIT – III **Lecture Hours: 12**

Z-Transform: Introduction and properties of Z-transform, Methods of Z-inversion: Inverse Ztransform by Partial fraction, long-division method and C-R Theorem, Applications of Ztransform. System Classification: linear and non-linear, time invariant and time varying, lumped and distributed, Deterministic and Stochastic. Casual and non-causal, Analog and Discrete/Digital, memory and memory less, 1 port and N – port, SISO, SIMO, MISO, MIMO.

UNIT – IV **Lecture Hours: 12**

System Modeling: System Models in terms of differential, equations, state variables, difference equations and transfer functions. System Analysis: Linear time invariant system properties, elementary idea of response determination to deterministic and stochastic signals. Elementary concept of impulse response.

TEXT BOOKS

1. Simon Haykins – “Signal & Systems”, Wiley Eastern
2. REFERENCE BOOKS 1. I J NAGRATH, R. RANJAN, “Signal and Systems”, TMH, New Delhi. 2. Simon Haykin & Barry Van Veen, “ Signals and Systems”, John Wiley &Son.

3. A.V.Oppenheim, A.S.Willsky &A. Nawab, “Signals and Systems” Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Represent and classify various types of signals and systems.	**PSO1**
CO2	Analyze the spectral characteristics of continuous-time and discrete time signals using	**PO4, PSO1**
CO3	Classify systems based on their properties and determine the response of LTI systems.	**PO1, PSO1**
CO4	Analyze the system properties based on impulse response and Fourier analysis.	**PO4**
CO5	Apply the Laplace transform and Z-Transform for analyses of continuous time.	**PO1**
CO6	Understand the process of sampling and the effects of under sampling.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119A	Engineering Chemistry	3	3	2			3	2						3	3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC204A	ELECTROMAGNETIC FIELD THEORY	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

COURSE OBJECTIVE

- The aim of this subject is to acquire the knowledge of Electromagnetic field theory that allows the student to have a solid theoretical foundation to be able in the future to design emission, propagation and reception of electro- magnetic wave systems.
- To identify, formulate and solve fields and electromagnetic waves propagation problems in a multidisciplinary frame individually or as a member of a group.
- To provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies.

COURSE OUTCOME

CO1: Ability to solve the problems in different EM fields.

CO2: Ability to design a programming to generate EM waves subjected to the conditions

CO3: Applications of EM Waves in different domains and to find the time average power density

CO4: Ability to Solve Electromagnetic Relation using Maxwell Formulae

CO5: Ability to Solve Electro Static and Magnetic to Static circuits using Basic relations

CO6: Ability to analyse moving charges on Magnetic fields Ability to Design circuits using Conductors and Dielectrics

Catalog Description:

This course updates student knowledge in the field of basic physics when applied with higher magnetism and electrical work. All basics of magnetic circuits, basic relations and charge conductors all study is carried out.

Course Content

UNIT-I **Hour: 10**

Electric Field and Current: Coulomb's law ,Electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of a sheet of charge, electric flux density, Gauss's law and applications, electric potential, the dipole, current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of images, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance of two wire line, Poisson's and Lap lace's equations, uniqueness theorem.

UNITII **Hour: 06**

Magnetic Field and Maxwell's Equation: Biot - Savart law, Ampere's law, magnetic vector potentials, force on a moving charge, differential current element, force and torque on a closed circuit, the boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials. Faraday's law, Maxwell's equations in point form and integral form Maxwell's equations for sinusoidal variations, retarded potentials.

UNIT-III **Hour: 08**

The Uniform Plane Wave: Wave motion in free space and perfect dielectrics, plane waves in lossy dielectrics. The Pointing vector and power considerations, propagation in good conductors, skin effect, reflection of uniform plane waves, SWR.

UNIT-IV **Hour: 07**

Transmission Lines and Waveguides: The Transmission line equations, graphical methods, Smith chart, time- domain and frequency-domain analysis. TE, TM, TEM waves, TE and TM modes in rectangular and circular waveguides, cut-off and guide wavelength, wave impedance and characteristic impedance, dominant modes, power flow in waveguides, excitation of waveguides, dielectric waveguides.

TEXT
BOOKS

1. M.N.O Sadiku, "Elements of Electromagnetics" Oxford University Press.

REFERENCES:

1. David K. Chang, Field and Waves Electromagnetics, Addison Wesley.

2. Hayt W H, J R Buck., "Engineering Electromagnetics", Tata McGraw Hill, Fifth edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Ability to solve the problems in different EM fields.	PO1
CO2	Ability to design a programming to generate EM waves subjected to the conditions	PO2
CO3	Applications of EM Waves in different domains and to find the time average power density	PSO3
CO4	Ability to Solve Electromagnetic Relation using Maxwell Formulae	PO6
CO5	Ability to Solve Electro Static and Magnetic to Static circuits using Basic relations.	PO2

CO6	Ability to analyse moving charges on Magnetic fields Ability to Design circuits using Conductors and Dielectrics	**PO1, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
ETEC204A	ELECTROMAGN ETIC FIELD THEORY	2	3	2			2							2		

1=weakly mapped,

2= moderately mapped,

3=strongly mapped

ETEE201A	ELECTRO MECHANICAL ENERGY CONVERSION	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

1. Explain construction and operation principle of dc motors and dc generators
2. Explain construction and operation principle of transformers
3. Explain construction and operation principle of ac generators.
4. Explain the construction, features and operation principle of ac motors.

Course Outcomes:

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

CO1 Analyse transformers in the power conversion circuits.
CO2 Understand and use the theory of electromechanical energy conversion to analyse actuators and simple electric machines.
CO3 Analyse AC machines, including motors and generators.
CO4 Analyse DC machines, including motors and generators.
CO5 Understanding of torque production in motors

Catalogue Description

Electric machines are a technology of choice in many modern energy conversion applications, including energy storage systems. Interest in machines is steady increasing due in giant half to the pliability of controls offered by trendy computers and power electronic devices. In this course design of electromechanical energy conversion is developed. Upon completion of the course, a student's engineering talent ought to contain i) associate understanding of the essential principles of static and mechanical device energy conversion, ii) information of the utilization of organization theory applied to the associate analysis of rotating devices and iii) an understanding of the steady-state and dynamic characteristics of induction, static magnet synchronous, and wound rotor synchronous machines

Course Content

UNIT I **10 Hour**

Magnetic Circuit and Induction: Magnetic Circuits, Magnetic Materials and their properties, static and dynamic emfs and force on current carrying conductor, AC operation,

UNIT II **12 Hour**

DC Machine: Basic theory of DC generator, brief idea of construction, emf equation, load characteristics, basic theory of DC motor, concept of back emf, torque and power equations, load characteristics, starting and speed control of DC motors, applications.

UNIT III **10 Hour**

Synchronous Machine: Constructional features, Armature winding, EMF Equation, Winding coefficients, equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage Regulation Synchronous Motor: Starting methods, Effect of varying field current at different loads, V-Curves

UNIT IV **13 Hour**

Three-phase Transformer & Induction Machine: Three Phase Transformer: Review of Single phase transformer. Three Phase transformer: Basics & operation. Induction Machine: Constructional features, Rotating magnetic field, Principle of operation Phasor diagram, equivalent circuit, torque and power equations, Torque- slip characteristics, no load & blocked rotor tests, efficiency, Induction generator & its applications. Introduction of Single phase Induction Motor, Repulsion motor. AC Commutator Motors: Universal motor, single phase a.c. series compensated motor, stepper motors.

TEXT BOOKS:

1. D.P .Kothari & I.J.Nagrath, "Electric Machines", Tata Mc Graw HillB.Tech. (EEE) K.R. Mangalam University, Gurugram Scheme of Studies 2020
2. Ashfaq Hussain "Electric Machines" Dhanpat Rai & Company

REFERENCE BOOKS:

1. P.S.Bimbhra, "Electrical Machines", Khanna Publisher

2. Fitzerald,A.E.,Kingsley and S.D.Umans "Electric Machinery", MC Graw Hill

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze transformers in the power conversion circuits.	**PSO1**
CO2	Understand and use the theory of electromechanical energy conversion to analyze actuators and simple electric machines	**PO1**
CO3	Analyze AC machines, including motors and generators.	**PO2**
CO4	Analyze DC machines, including motors and generators	**PO2, PO3**
CO5	Understanding of torque production in motors	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEE 201A	ELECTRO MECHANICAL ENERGY CONVERSION	3	2	2	2									3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC263A	ANALOG ELECTRONICS LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

1. To understand operation of semiconductor devices.
2. To understand DC analysis and AC models of semiconductor devices.
3. To apply concepts for the design of Regulators and Amplifiers
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To illustrate the students different electronic circuit and their application in practice.
6. To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters.

Course Outcomes:

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

CO1. Identify relevant information to supplement to the Analog Electronic ETEC233A course.

CO2. Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit.

CO3. Choose testing and experimental procedures on different types of electronic circuit and analyse their operation different operating conditions.

CO4. Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.

CO5. Practice different types of wiring and instruments connections keeping in mind technical, Economical, safety issues.

CO6. Prepare professional quality graphical presentations of laboratory data and computation of results incorporating the data analysis.

Catalogue Description:

The course is to provide knowledge of Analog Electronics to students of various engineering disciplines. The course module includes basic diodes, basic knowledge of transistors and its biasing techniques and stabilization.

Course Content

List of experiments:

1	To study and plot the characteristics of a junction diode.	**3-4 Hour**
2	To study Zener diode, I-V characteristics.	
3	To study diode-based clipping and clamping circuits	
4	To study half wave, full wave and bridge rectifier with filters	
5	To study the input and output characteristics of a transistor in its various configurations (CE and CB).	
6	To study and plot the characteristics of a JFET in its various configurations.	**5-6 Hour**
7	To study and plot the characteristics of a MOSFET in its various configurations.	
8	To study various types of Bias Stabilization for a transistor.	
9	To study the gain and plot the frequency response of a single stage transistor amplifier.	
10	To measure gain and plot the frequency response of double stage RC coupled amplifier	
11	To study Half & Full wave rectifier and measurement of ripple factor.	

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Identify relevant information to supplement to the Analog Electronic ETEC233A course.	**PSO1**
CO2	Set up testing strategies and select proper instruments to evaluate performance characteristics of electronic circuit.	**PO2**
CO3	Choose testing and experimental procedures on different types of electronic circuit and analyze their operation different operating conditions.	**PO4**
CO4	Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.	**PO3**
CO5	Practice different types of wiring and instruments connections keeping in mind technical, Economical, safety issues.	**PO8**
CO6	Prepare professional quality graphical presentations of laboratory data and computation of results incorporating the data analysis	**PO5**

COs		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
	E1													

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEE 251A	ELECTRO MECHANICAL ENERGY CONVERSION LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

- Students will learn fundamental material concerning energy and energy conversion.
- Students will perform laboratory experiments on three-phase power and common electric motors.
- Students will perform laboratory experiments as a team.

Course Outcomes:

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

- Analyze Magnetic Circuits.
- Resolve Three-Phase Circuit Problems.
- Learn Single-Phase And Three-Phase Transformers.
- Analyze Basic Dc And Ac Electric Machines.
- Analyze Dc Motors.
- Analyze Synchronous Machines.
- Analyze Induction Motors.

Catalogue Description

This course contributes to the engineering sciences component of the curriculum. Students learn fundamental electrical engineering science concepts related to electric machinery

Course Content

1	To obtain magnetization characteristics of a dc shunt generator	2 Hr.
2	To obtain load characteristics of a dc shunt generator and component generator (a) Cumulatively compounded (b) Differential Compounded.	2 Hr.
3	To obtain efficiently of a dc shunt machine using Swinburn's test.	2Hr.
4	To perform Hopkinson's test and determine losses and efficiently of dc machine.	2Hr.
5	To obtain speed-torque characteristics of a dc shunt motor	2Hr.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze Magnetic Circuits.	**PO1, PSO1**
CO2	Resolve Three-Phase Circuit Problems.	**PO4, PSO1**
CO3	Analyze Single-Phase And Three-Phase Transformers.	**PO4, PSO1**
CO4	Analyze Basic Dc And Ac Electric Machines.	**PO1, PSO1**

CO5	Analyze Dc Motors	**PSO2**
CO6	Analyze Synchronous Machines.	**PO4, PSO1**
CO7	Analyze Induction Motors.	**PO1, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEE251A	ELECTRO MECHANICAL ENERGY CONVERSION LAB	2			3									3	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCDM301A	DISASTER MANAGEMENT	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

- To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
- Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
- To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
- To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

Catalog Description: This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

6 lecture hours

UNIT I Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

6 lecture hours

UNIT- II Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

7 lecture hours

UNIT III Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment
- Post Disaster effects and Remedial Measures.
- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology,
- Long-term Counter Disaster Planning
- Role of Educational Institute.

10 lecture hours

UNIT IV Disaster Management in India

- **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

- **Liability for Mass Disaster**

- Statutory liability
- Contractual liability
- Tortiousliability
- Criminal liability
- Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

- **Project Work**: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- GovernmentfIndia,DepartmentofEnvironment,ManagementofHazardousSubstancesControl
- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability : TheBhopalCase(1986)

- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- AsianRegionalExchangeforProf.Baxi.,NothingtoLoseButourLives:EmpowermenttoOppose
- IndustrialHazardsina Transnationalworld(1989)
- GurudipSingh,EnvironmentalLaw: InternationalandNationalPerspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan,P, TheEnvironmentalLawinIndia, ChaptersVIII,IX andX(1999),Butterworths, NewDelhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PS01**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.	**P03**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**P012**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used**.**	**P06**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics & Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
UCDM 301A	**Disaster Management**			2			3						2	3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

Second Year (IV Sem.)

ETEC311A	MICROPROCESSOR SYSTEMS	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

- To introduce 8085 architecture and programming in assembly language
- To introduce basic concepts of interfacing memory and peripheral devices to a microprocessor.
- To introduce serial and parallel bus standards.
- To introduce 8051 microcontroller.
- To introduce various advanced processor architectures such as 80X86, Pentium and Multicore Processors.

Course Outcomes:

On completion of this course, the students will able to

CO1. Understand the main components and working principals of the Intel 80x86 microprocessor and Intel 80x51 microcontroller

CO2. Program and debug in assembly language

CO3. Understand the memory organization and memory interfacing

CO4. Interface a microprocessor to external input/output devices and perform

CO5. input/output device programming in assembly

CO6. Understand the hardware and software interrupts and their applications

CO7. Understand the properties and interfacing of the parallel and serial port

Catalogue Description

Microprocessor is an essential course for undergraduates in the engineering program. The purpose of this course is to impart the rudiments of microprocessor and microcontroller systems. The student will be able to integrate these notions into their electronic designs for other courses where regulation can be realized via a microprocessor/controller implementation. Topics include
Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, interface design, peripheral devices, data communications, and data acquisition systems.

Course Content

UNIT I: **10 Lecture Hours**

Introduction: Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree, CISC Versus RISC, Applications of Microprocessors.

8086 CPU Architecture: Introduction to 8085, 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU, 8086 Pin diagram descriptions, Generating 8086 CLK and reset signals using 8284, WAIT state generation, Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module

UNIT II: **7 Lecture Hours**

8086 Instruction Set: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.

8086 Programming Techniques: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures; Data tables, modular programming, Macros

UNIT III: **06 Lecture Hours**

Main Memory System Design: Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode, Address decoding techniques, Interfacing SRAMS ROMS/PROMS. nterfacing and refreshing DRAMS, DRAM Controller – TMS4500.

UNIT IV: **6 Lecture Hours**

Basic I/O Interface: Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086, ADCs and DACs, types, operation and interfacing with 8086, Interfacing Keyboards, alphanumeric displays, multiplexed displays, and high power devices with 8086

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the main components and working principals of the Intel 80x86 microprocessor and Intel 80x51 microcontroller	**PO1**
CO2	Program and debug in assembly language	**PO5**
CO3	Understand the memory organization and memory interfacing	**PSO1**
CO4	Interface a microprocessor to external input/output devices and perform input/output device programming in assembly	**PO6**
CO5	Understand the hardware and software interrupts and their applications	**PO4**
CO6	Understand the properties and interfacing of the parallel and serial ports	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 311A	MICROPROCESSOR SYSTEMS	3			1	3	2							2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC206A	**ELECTRICAL MACHINES**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Must be revise with Basics Network Theorems				
Co-requisites	--				

COURSE OVERVIEW:

This course teaches the principles which are fundamental to AC machines. The aim of this course is to provide students with an understanding of the physical principles that governs electro-mechanical motion and transformation of electrical energy. By applying this knowledge, students learn techniques that enable them to understand operation of AC electrical machines and analyze their performance.

COURSE OBJECTIVE:

- The objective of the course is to provide a brief knowledge of AC machines to students of electrical engineering discipline.
- The course provides knowledge of Poly phase Induction, Three phase transformer and Synchronous Machines. This course will provide in detail construction and working, phasor diagram, equivalent circuit,
- Course carries out study of different types of tests performed on all AC machines such as thee phase Induction generator, three phase Induction motor, three phase synchronous generator, three phase synchronous motor and three phase transformers.

EXPECTED OUTCOME:

CO1 Apply concepts of basic polyphase type motors there construction and working problems including the use of computer simulation.

CO2 Understand the starting and speed control mechanism of induction motor.

CO3 Apply time and speed based calculation to check speed control of motors.

CO4 Learn the various parameters theory responsible for rotating machines with practical application of work carried.

Catalog Description:

The objective of the course is to introduce basics of machines and to identify its characteristics. Various theories governing the action is also briefed.

UNITI **Hours: 6**

Poly phase Induction Machines – I: Construction features, production of rotating magnetic field, phasor diagram, equivalent circuit, torque and power equations, torque-slip characteristics, no load and blocked rotor test efficiency. Induction generator.

UNITII **Hours: 7**

Poly phase Induction Machines – II: Starting and speed control (with and without e.m.f. injection in the rotor circuit), deep bar and double cage induction motors, cogging and crawling. UNIT II Three Phase Transformer : Construction and working principle, three phase transformer connections and phasor groups , parallel operation, polarity test, open delta , three phase to two phase conversion (scott connection), three phase to six phase conversion , harmonics , inrush of magnetizing current. Applications of scott connection, open delta system.

UNITIII **Hours: 8**

Synchronous Machines I: Constructional features, armature windings, E.M.F. equation, winding coefficients, harmonics in the induced E.M.F., armature reaction, O.C. and S.C. tests, voltage regulation-Synchronous impedance method, MMF Method, Potier's triangle method and parallel operation, operation on infinite bus and cooling.

UNIT IV **Hours: 8**

Synchronous Machines II: Two reaction theory, power expressions for cylindrical and salient pole machines, performance characteristics. Synchronous Motor-Principle of operation, starting methods, phasor diagram torque-angle characteristics, V-curves hunting and damping, synchronous condenser, reluctance motor.

TEXT BOOKS:

1. M.G.Say, “Alternating Current machines”, CBS Publishers.

2. P.S. Bimbhra, “Electric Machinery”, Khanna Publishers.

REFERENCE BOOKS:

1. P.S. Bimbhra, “Generalized Theory of Electrical Machines”, Khanna Publishers.

2. I.J. Nagrath and D.P. Kothari, “Electrical Machines”, Tata McGraw Hill.

3. Ashfaq Hussain – Electric Machines, Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Apply concepts of basic polyphase type motors there construction and working problems including the use of computer simulation.	PO1
CO2	Understand the starting and speed control mechanism of induction motor.	PO2
CO3	Apply time and speed based calculation to check speed control of motors.	PSO1
CO4	Learn the various parameters theory responsible for rotating machines with practical application of work carried.	PO4

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC206A	ELECTRICAL MACHINES	3	3		3									2		

1=weakly mapped,
2= moderately mapped,
3=strongly mapped

ETEE256A	**ELECTRICAL MACHINES LAB**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Must be revise with Basics Network Theorems				
Co-requisites	--				

COURSE OBJECTIVES:

- To learn basics of No load & Blocked rotor test on three-phase squirrel cage Induction Motor
- Identify Load test on single phase and three phase Induction Motor
- Execute operations related to Study of speed control of Induction Motor
- Identification of Pre-determination of voltage regulation of three phase Alternator by EMF/MMF/ZPF Method.

COURSE OUTCOMES:

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

CO1 Acquire hands on experience of conducting various tests on ac machines and obtaining their performance indices using standard analytical as well as graphical methods.

CO2 Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods.

CO3 Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices using standard analytical as well as graphical methods.

CO4 Formulation of electrodynamics equations of all electric machines and analyse the performance characteristics.

CO5 Knowledge of transformations for the dynamic analysis of machines.

CO6 Knowledge of determination of stability of the machines under small signal and transient conditions

Catalogue Description

The course provides the basics of electrical machine, as it is the major part of industries so experiments involving its controlling, testing and operations would be studied by students.

Course Content

Basic performing of lab practical enables to relate to the course contents with the practical aspect by performing the given experimental list below:

INDUCTION MACHINES Lab Hours: 5-6

1. Load test on 3 phase squirrel cage/ slip ring Induction Motor

2. No load & Blocked rotor test on 3-phase squirrel cage Induction Motor (Performance 3.determination using equivalent circuit and circle diagram)

3. Load test on 1 phase Induction Motor 4. Load test on 3 phase Induction Generator 5. Study of speed control of Induction Motor

SYNCHRONOUS MACHINES Lab Hours: 7-8

1. Load test on 1/3 phase Alternator

2. Pre-determination of voltage regulation of 3 phase Alternator by EMF/MMF/ZPF Method.

3. Synchronization/parallel operation of Alternators.

4. V and inverted V curve of an auto synchronous motor and observation on reactive power

5. Determination Direct axis reactance and quadrature axis reactance of a salient pole

6. Alternator by slip test.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire hands on experience of conducting various tests on ac machines and obtaining their performance indices using standard analytical as well as graphical methods.	**PO1**
CO2	Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods.	**PO2**
CO3	Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices using standard analytical as well as graphical methods.	**PO3, PSO1**
CO4	Formulation of electrodynamics equations of all electric machines and analyse the performance characteristics.	**PO2,PSO2**
CO5	Knowledge of transformations for the dynamic analysis of machines.	**PO3,PO4**
CO6	Knowledge of determination of stability of the machines under small signal and transient conditions	**PO1, PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 256A	ELECTRICAL MACHINES LAB	3	3	3	2									3	2	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEE208A	POWER SYSTEMS I	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

COURSE OBJECTIVE:

The aim of this course is

- To introduce the concepts and phenomenon of different sources of Power Generation,
- To give an idea about the fundamental concepts of electrical power distribution, both AC & DC, to familiarize the students with the Tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy
- To impart the knowledge of different turbines used in the generating stations with the analytical methods.

COURSE OUTCOME:

The outcome of this course is

CO 1. Articulate power system concepts required to engineering problems.
CO 2 Design power system components for a specified system and application
CO 3 Ability to discuss various power sources for generation of power Merit/Demerits. CO 4 Formulate A.C and D.C distribution networks for necessary variable calculation. CO 5 Ability to calculate usage of electrical power
CO 6 Ability to plot the power /Energy demand in the form of graph. CO 7 Ability to discuss functions of Substation.

Catalogue Description

Electrical Power plays significant role in day to day life of entire mankind. This course concerns the generation and distribution of power along with the economic aspects.

Course Content

UNIT I **Lecture Hours: 8**

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line

diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

UNIT II **Lecture Hours: 8**

Overhead Transmission Lines:

Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance
and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines.

UNIT III **Lecture Hours: 8**

Overhead Lines Insulators: Types of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential. **Mechanical Design of Transmission Line:** Catenary curve, calculation of sag and tension, effects of wing and ice loadings, sag template, vibration dampers. **Insulated Cables:** Types of cables, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.

UNIT IV **Lecture Hours: 6**

Introduction to DC Transmission & Renewable Energy Systems
DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC).
LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid.

TEXT BOOKS:

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. C.L.Wadhava, “Electrical Power Systems”, New Age International.

3. M. L. Soni, P. V. Gupta and U. S. Bhatnagar, “A course in Electrical Power”, Dhanpat Rai& Sons, 1st
edition.
4. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

REFERENCE BOOKS:

1. S. L. Uppal, “Electrical Power”, Khanna Publishers, 13th edition.
2. W. H. Stevension, ”Elements of Power System Analysis”, McGraw Hill.
3. Ashfaq Hussain, “Electrical Power System” CBS Publishers and Distributors

Text/References:

1. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 1999.
2. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Articulate power system concepts required to engineering problems.	**PO1**
CO2	Design power system components for a specified system and application	**PO1**
CO3	Ability to discuss various power sources for generation of power Merit/Demerits.	**PO2, PSO1**
CO4	Formulate A.C and D.C distribution networks for necessary variable calculation.	**PO2**
CO5	Ability to calculate usage of electrical power	**PO3**
CO6	Ability to plot the power /Energy demand in the form of graph.	**PO4**
CO7	Ability to discuss functions of Substation.	**PO4, PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and	Environment and sustainability	E	Individual or team work	Communicati	Project management	Life-long	Application of	Innovation and	Ethics and
Course Code		PO	PO	PO	PO	PO	PO	PO		PO	PO1	PO1	PO1	PSO	PSO	PS O3
ETEE																

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC353A	**MICROPROCESSOR SYSTEMS LAB**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectves:

- Outline the history of computing devices.
- Describe the architecture of 8086 microprocessors.
- Develop programs for microprocessor and microcontrollers
- Compare microprocessors and microcontrollers
- Understand 8051 microcontroller concepts, architecture and programming

Course Outcomes:

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

CO1. Design and implement programs on 8085 microprocessor.
CO2. Design and implement programs on 8086 microprocessor.
CO3. Design interfacing circuits with 8085
CO4. Design interfacing circuits with 8086.
CO5. Design and implement 8051 microcontroller-based systems
CO6. To Understand the concepts related to I/O and memory interfacing

Catalogue Description

1. Familiarization with 8085 & 8086 Trainer Kit.
2. Familiarization with Digital I/O, ADC and DAC Cards
3. Familiarization with Turbo Assembler and Debugger S/Ws.
4. Write a program to arrange block of data in
5. Ascending (ii) descending order
6. Write a program to find out any power of a number such that Z = Xn , .

   Where n is programmable and X is unsigned number.

b. Ramp Waveform

c. Triangular Waveform Using DAC

7. Write a program to measure frequency/Time period of the following functions.
   a. Sine Waveform

   b. Square Waveform

   c. Triangular Waveform using ADC Card.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and implement programs on 8085 microprocessors.	**PSO1,PO1**
CO2	Design and implement programs on 8086 microprocessors.	**PSO1,PO1**
CO3	Design interfacing circuits with 8085	**PO2, PSO1**
CO4	Design interfacing circuits with 8086.	**PO2,PSO1**
CO5	Design and implement 8051 microcontroller-based systems	**PO3,PO4**
CO6	To Understand the concepts related to I/O and memory interfacing	**PO4, PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 353A	MICROPROC ESSOR SYSTEMS LAB	3	2	2	2									3	3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC203A	NETWORK THEORY	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Must be revise with Basics Network Theorems				
Co-requisites	--				

Course Objectives:

- To explain the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal after successful completion of the course student will be able to apply concepts of electric network topology, analysis techniques.
- To introduce students with the fundamental concepts in graph theory.
- To analyze circuits in time and frequency domain.
- To explain concepts of driving point and transfer functions, poles and zeroes of network functions and their stability.

Course Outcomes:

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

CO1. Explain network elements, types of networks and network topology

CO2. Analysis complex circuits using mesh current & amp; nodal voltage method

CO3. Compute AC and DC Parameters in the circuits.

CO4. Analyze RLC circuits and coupled circuits.

CO5. Apply the concept of two port network in circuit analysis

CO6. Explain fundamentals of filters

CO7. Apply time and frequency concepts of analysis and understand various functions of network and also the stability of network.

Catalogue Description

The objective of the course is to provide brief methodologies for analysis of Electrical Circuits and Networks to the students of various engineering disciplines. The course module includes introduction of signals, Circuit theory, Two - Port Networks, Network Synthesis

Course Content

UNIT I **7 Hours**

Network Topology:

Principles of network topology, graph matrices, network analysis using graph theory. Transient Response: Review of properties and applications of Laplace transform; Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

UNIT II **8 Hours**

Network Functions: Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behavior from the pole-zero plot.

UNIT III **8 Hours**

Characteristics and Parameters of Two Port Networks: Relationship of two-port variables, short- circuit Admittance parameters, open circuit impedance, parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks, concept of transform impedance.

UNIT IV **7 Hours**

Types of Filters and Their Characteristics: Filter fundamentals, high-pass, low-pass, band-pass, and band-reject Filters. **Network Synthesis:** Positive real functions, synthesis of one port and two port networks, elementary idea of Active networks.

TEXT BOOKS

- Van Valkenburg, "Network analysis" PHI, 2000

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Explain network elements, types of networks and network topology	**PO6**
CO2	Analysis complex circuits using mesh current & nodal voltage method	**PO1**
CO3	Compute AC and DC Parameters in the circuits.	**PO4**
CO4	Analyze RLC circuits and coupled circuits.	**PO2**
CO5	Apply the concept of two port network in circuit analysis	**PO3**
CO6	Explain fundamentals of filters	**PSO1**
CO7	Apply time and frequency concepts of analysis and understand various functions of network and also the stability of network	**PO5**

Course Code	Course	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Innovation and Industry Friendly	PSO2 Ethics and Communication Skills
ETEC20	NETWO	2	2	2	2	2	2							2		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC255A	NETWORK THEORY LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

- To make the students capable of analyzing any given electrical network.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.

Course Outcomes:

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

CO1 Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation.

CO2 Understand the basic concepts of graph and analyze the basic electrical circuits using graph theory.

CO3 Apply time and frequency concepts of analysis and understand various functions of network and also the stability of network.

CO4 Learn the various parameters and their interrelationship, able to solve numerical with series, cascade, and parallel connection using two port parameters.

Catalogue Description

The objective of the course is to provide brief methodologies for analysis of Electrical Circuits and Networks to the students of various engineering disciplines. The course module includes introduction of signals, Circuit theory, Two - Port Networks, Network Synthesis

Course Content

A. Simulation based **4-5 Hour**

- Introduction of circuit creation & simulation software like TINAPRO, P-Spice, Dr.- Spice/other relevant Software.
- Transient response of RC, RL circuit on any of above software
- To find the resonance frequency, Band width of RLC series circuit using any of above software.
- To plot the frequency response of low pass filter and determine half-power frequency.
- To plot the frequency responses of high pass filter and determine the half-power frequency.

B. Hardware Based **5-6 Hour**

- To calculate and verify "Z" & “Y” parameters of a two port network.
- To determine equivalent parameter of parallel connections of two port network and study loading effect.
- To calculate and verify "ABCD" parameters of a two port network.
- To synthesize a network of a given network function and verify its response

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation.	**PO1**
CO2	Understand the basic concepts of graph and analyze the basic electrical circuits using graph theory.	**PO2**
CO3	Apply time and frequency concepts of analysis and understand various functions of network and also the stability of network.	**PO3**
CO4	Learn the various parameters and their interrelationship, able to solve numerical with series, cascade, and parallel connection using two port parameters.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 255A	NETWORK THEORY LAB	3	3	2	2											

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC 210A	**DIGITAL ELECTRONICS**	L	T	P	C

Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To understand number representation and conversion between different representation in digital electronic circuits.
- To analyze logic processes and implement logical operations using combinational logic circuits.
- To understand characteristics of memory and their classification.

Course Outcomes

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

CO1. Create the appropriate truth table from a description of a combinational logic function.

CO2. Create a gate-level implementation of a combinational logic function described by a truth table using and/or/not gates, multiplexers or ROMs, and analyse its timing behaviour.

CO3. Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.

CO4. Describe the operation and timing constraints for latches and registers.

CO5. Draw a circuit diagram for a sequential logic circuit and analyse its timing properties (input setup and hold times, minimum clock period, output propagation delays).

CO6. Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.

Catalogue Description

This course helps the student to develop a digital logic and apply it to solve real life problems and will able to analyze, design and implement combinational logic circuits and sequential logic circuits.

Course Content

UNIT – I **12 lecture hours**

Number Systems and Codes: Review of number systems, BCD codes and arithmetic, Gray code, self- complimenting codes, Error detection and correction principles.
Digital Circuits: Switching algebra & simplification of Boolean expressions. De Morgan‘s Theorem.

Implementations of Boolean expressions using logic gates

Unit II: **12 lecture hours**

Combinational Logic Design: Combinational circuit analysis and synthesis, Techniques for minimization of Boolean functions such as Karnaugh map, VEM and Quine-Mc Cluskey methods. Design of arithmetic circuits, code convertors, multiplexers, demultiplexers, encoders, decoders & comparators. Parity generators and checker.
Introduction to Sequential Logic: Need for sequential circuits, Binary cell, Latches and flip-flops. RS, JK, Master-Slave JK, D & T flip flops.

Unit III: **10 lecture hours** Synchronous Sequential Circuit Design : Fundamentals of Synchronous sequential circuits, Classification of synchronous machines, Analysis of Synchronous Sequential circuits, Design of Synchronous and Asynchronous Counters, Shift registers & Ring counters, Analysis and design of Finite State Machines. Timing issues in synchronous circuits.
Logic Families**:** Performance metrics of logic gates, Basic Transistor-Transistor Logic and CMOS logic.

Unit IV: **10 lecture hours**
Asynchronous Sequential Circuits: Fundamentals of Asynchronous Sequential circuits. Analysis and design of Asynchronous Sequential circuits. Pulse mode and Fundamental-mode Circuits. Cycles, Races and Hazards in asynchronous circuits.

Text Books

1. William I. Fletcher, ―An Engineering approach to Digital Design‖, Prentice Hall of India
2. C.H.Roth, ―Fundamentals of Logic Design, Thomson
3. Morris Mano, “Digital Design”, PHI, 2nd Ed.

Reference Books/Materials

1. J. Nagrath, “Electronics, Analog & Digital”, PHI.
2. B. S. Nai, “Digital Electronics and Logic Design”, PHI.
3. Balabanian and Carlson, “Digital Logic Design Principles”, Wiley Pub.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create the appropriate truth table from a description of a combinational logic function.	**PO1**
CO2	Create a gate-level implementation of a combinational logic function described by a truth table using and/or/not gates, multiplexers or ROMs, and analyze its timing behavior.	**PO2**
CO3	Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.	**PO3**
CO4	Describe the operation and timing constraints for latches and registers.	**PO4**
CO5	Draw a circuit diagram for a sequential logic circuit and analyze its timing properties (input setup and hold times, minimum clock period, output propagation delays).	**PO5**
CO6	Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC210A	Digital Electronics	2	2	3	3	3								2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC253A	DIGITAL ELECTRONICS LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

1. Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolean algebra, state elements and finite state machine (FSMs).
2. Design simple digital systems based on these digital abstractions, using the "digital paradigm" including discrete sampled information.
3. Use the "tools of the trade": basic instruments, devices and design tools.

4. Work in a design team that can propose, design, successfully implement and report on a digital systems project.
5. Communicate the purpose and results of a design project in written and oral presentations.

Course Outcomes:

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

CO1. Identify relevant information to supplement to the Digital Electronic ETEC210A course.

CO2. Construct basic combinational circuits and verify their functionalities
CO3. To understand the basic digital circuits and to verify their operation.
CO4. To understand the concepts of flipflops, registers and counters.
CO5. To understand how gates are the basic building blocks for digital world.

Catalogue Description:

Labs on digital logic, PALs, flip-flops, timing, counters, synchronization, and finite-state machines prepare students for the design and implementation of a final project of their choice, e.g., games, music, digital filters, wireless communications, graphics, etc. Extensive use of Verilog for describing and implementing digital logic designs. Students engage in extensive written and oral communication exercises

Course Content

List of experiments:

1	Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.	**2 Hr**
2	Implementation of the given Boolean function using logic gates in both SOP and POS forms.	**1 Hr.**
3	Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.	**1 Hr.**
4	Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.	**2 Hr**
5	Implementation of 4x1 multiplexer using logic gates.	**1 Hr.**
6	Implementation of 4-bit parallel adder using 7483 IC.	**1 Hr.**
7	Design, and verify the 4-bit synchronous counter.	**1 Hr.**
8	Design, and verify the 4-bit asynchronous counter.	**1 Hr.**
9	Static and Dynamic Characteristic of NAND and Schmitt-NAND gate (both TTL and MOS).	**1 Hr.**
10	Study of Arithmetic Logic Unit.	**1 Hr.**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**QUIZ**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Identify relevant information to supplement to the Digital Electronic ETEC210A course	**PSO1**
CO2	Construct basic combinational circuits and verify their functionalities	**PO2**

CO3	To understand the basic digital circuits and to verify their operation.	**PO1**
CO4	To understand the concepts of flipflops, registers and counters.	**PO4**
CO5	To understand how gates are the basic building blocks for digital world.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC253A	Digital Electronics Lab	2	2	3	2									3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC204A	ADVANCE ANALOG ELECTRONICS	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	ANALOG ELECTRONICS				
Co-requisites					

Course Objective:

In this course student will be

- Introduction to multistage amplifier, its designing, hybrid modelling of various amplifiers like RC coupled amplifier.
- Study of Feedback amplifiers and necessary condition for establishing feedback connections,
- Study of Calculation of impedance of various feedback circuits.
- Study of Various oscillator circuits like sine oscillator, RC oscillator, crystal oscillator will be studied using hybrid modelling at low and high frequencies.
- Study of Calculation of resonant frequencies for studying large signal amplifiers, powers amplifiers
- Study of Different types of power amplifiers like class A, B, AB and C Push-Pull amplifiers

Course Outcomes:

CO1. Understand Multi stage amplification and calculation of gain.
CO2. Importance of feedback system.
CO3. Formulate hybrid model foramplifiers.
CO4. Calculation of stability parameters.
CO5. Effect of negative feedback.
CO6. Design an oscillatory circuit.
CO7. Regulation of power supply using diodes and transistors.

Catalog Description:

This course is designed to teach and acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier. The student will develop the ability to analyze and design analog electronic circuits. Students learn how BJT work at low and high frequencies, Power amplifiers and feedback amplifiers, different types of oscillators and their working, studying of various types of tuned amplifiers. The student will be able to design amplifier circuits and also can

design amplifier circuits in the projects. Student will also be acquainted with the different types of feedback circuits and types of feedback circuit. He also gets to learn why feedback is so important in designing.

Course Content

UNIT I **Hour: 6**

Multistage Amplifiers: Classification of amplifiers, distortion in amplifiers, step response of an amplifier, Cascaded amplifiers, Design of multistage amplifiers, Calculation of gain Impedance and bandwidth.

UNIT II **Hour: 8**

Feedback amplifiers: Introduction, feedback parameters, types of feedback: negative and positive, characteristics of feedback amplifiers, input & output resistance, types of feedback connections and their analysis.

UNIT III **Hour: 8**

Oscillators: Sinusoidal oscillators, Barkhausen criteria, R-C oscillators, crystal oscillator, Analysis &

design – crystal oscillator.

Power Supplies: Switched mode power supplies, Voltage Regulators, Introduction to Inverters, power conditioners, UPS, A.C. Voltage stabilizers

UNIT IV **Hour: 8**

Power amplifiers: Classification of large signal amplifiers, Analysis and design with respect to efficiency, linearity and harmonic distortions of class A , class B and AB push-pull amplifiers, single ended power amplifiers.

Text Book:

1. R.L. Boylestad & L. Nashelsky ―Electronic Devices and Circuit Theory

Reference Books:

1. Spencer and Ghausi, Introduction to Electronic Circuit Design, Pearson Education.
2. Dutta, Semiconductor Devices and Circuits, Oxford University Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	**20**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand Multi stage amplification and calculation of gain.	**PO1, PSO1**
CO2	Importance of feedback system.	**PO2**
CO3	Formulate hybrid model for amplifiers.	**PO3**
CO4	Calculation of stability parameters.	**PO4**
CO5	Effect of negative feedback.	**PO3, PO4**
CO6	Design an oscillatory circuit.	**PO1,PO 2**
CO7	Regulation of power supply using diodes and transistors.	**PSO1,PO 2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC253A	Digital Electronics Lab	2	2	3	2									3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC264A	ADVANCE ANALOG ELECTRONICS LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	**ANALOG ELECTRONICS**				
Co-requisites					

Course Objective:

1. To understand the importance of op-amp in various applications like Precision Rectifiers, Filters, and DAC.
2. To design the non-linear application of op-amp such as Schmitt circuit.
3. To study and design the application of 555 timer like mono-stable Multivibrator.
4. Familiarize the conversion of data from Analog to Digital and Digital to Analog.
6. Design and construct waveform generation circuits using op-amp.

Course Outcomes:

CO1. Define significance of Op Amps and their importance.

CO2. Build circuits using Analog IC's.

CO3. In-depth knowledge of applying the concepts in real time applications.

CO4. Ability to use OP Amp as Summation, Subtractor.

CO5. Able to use OP Amp to generate sine, square and triangular wave forms.

CO6. Able to use OP Amp as analog to digital and digital to analog converter.

Catalog Description:

This course continues investigation of single and cascaded BJT and MOSFET amplifiers. In addition, mid-band gains, impedances, and frequency responses of multi-transistor amplifiers are studied. The effects of classic feedback configurations on amplifier characteristics are included.

Course Content **Hours: 10-12**

- To study and plot the characteristics of a junction diode.
- To study Zener diode I-V characteristics.
- To study diode based clipping and clamping circuits
- To study half wave, full wave and bridge rectifier with filters
- To study the input and output characteristics of a transistor in its various configurations (CE and CB).
- To study and plot the characteristics of a JFET in its various configurations.
- To study and plot the characteristics of a MOSFET in its various configurations.
- To study various types of Bias Stabilization for a transistor.
- To study the gain and plot the frequency response of a single stage transistor amplifier.
- To measure gain and plot the frequency response of double stage RC coupled amplifier
- To study Half & Full wave rectifier and measurement of ripple factor.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Define significance of Op Amps and their importance.	**PO1, PO9, PSO3**
CO2	Build circuits using Analog IC's.	**PO2, PO9, PSO3**

CO3	In-depth knowledge of applying the concepts in real time applications.	**PSO1, PO9, PSO3**
CO4	Ability to use OP Amp as Summation, Subtractor.	**PO1, PO9, PSO3**
CO5	Able to use OP Amp to generate sine, square and triangular wave forms.	**PO1, PO9, PSO3**
CO6	Able to use OP Amp as analog to digital and digital to analog converter	**PSO1, PO9, PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or teamwork	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics & Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 264A	ADVANCE ANALOG ELECTRONICS LAB	2	2							2				3		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Third Year (V Sem.)

ETEE 301A	POWER SYSTEM II	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Power System-I				
Co-requisites	--				

Course Objectives:

- This introductory course begins with the simple representation of power system as per unit system.
- A review of three-phase power calculations, the per-unit system, and phasor algebra—basic tools used in modelling and how to solve nearly all types of power system problems.
- The course is designed to earn symmetrical components and use them to calculate balanced and unbalanced short-circuit faults, and open-circuit faults on three-phase power systems.
- In addition, students will learn load flow analysis of load flow equations using Gauss Seidel, Newton Raphson and Fast Decoupled method.
- This course linked power systems for a better understanding of symmetrical components at the 'real-world' utility level.
- The course provides an awareness to check the stability by equal area criterion

Course Outcomes:

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

CO1. To develop mathematical model of a given power system.
CO2. To perform power flow analysis using numerical techniques.
CO3. To analyze the behavior of the power system under faulted condition.
CO4. To study the stability status of power system under steady state and transient condition

CO5. To gain practical aspects on power system analysis problems.

Catalogue Description

This course is a maiden subject in the field of electric power systems. Electric power has become progressively vital as a way of transmitting and transforming energy in manufacturing and in daily usage. Electric power systems are also at the heart of alternative energy systems, including wind and solar electric as renewable energy sources and conventional power generation from fossil fuels.

Course Content

UNIT I **Lecture Hours 6**

Power Flow Analysis Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node-Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations –Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large- scale Power Systems.

UNIT II **Lecture Hours 8**

Stability Constraints in synchronous grids Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three-phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

UNIT III **Lecture Hours 8**

Control of Frequency and Voltage Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters.

UNIT IV **Lecture Hours 8**

Power System Economics and Management Basic Pricing Principles: Generator Cost Curves, Utility Functions Power Exchanges Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

Text Books:

1. Wadhwa C.L.” Electrical Power Systems”, Sixth Edition, New Age International Publishers, New Delhi.

2. Nagarath I.J. and Kothari D.P. “Modern Power System Analysis”, Fourth Edition, Tata McGraw Hill Publishing company, New Delhi. Reference Books:

3. Hadi Sadat, “Power System Analysis”, Tata McGraw Hill Publishing company, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop mathematical model of a given power system.	**PSO1, PO1**
CO2	To perform power flow analysis using numerical techniques	**PO2**
CO3	To analyze the behavior of the power system under faulted condition	**PO3**
CO4	To study the stability status of power system under steady state and transient condition	**PO4**
CO5	To gain practical aspects on power system analysis problems.	**PO4, PSO1**

	Course Code	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
			Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
	E 3	P S	3	2	2	2									2		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC314A	DIGITAL SIGNAL PROCESSING	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objective:

- Understand basic tradeoffs in digital representation of signals: sampling rate, bandwidth, bit rate, fidelity
- Analyse minimum phase, linear phase, and all-pass discrete-time systems
- Check the stability of filters

- Choose filter structures according to their performance characteristics: sensitivity, complexity, delay, etc
- Program digital signal processors to perform DSP in real-time
- Analyse and design filters based on pole/zero placement.
- Design linear phase FIR filters using windows and equip ripple technique
- Design IIR filters from continuous-time filters
- Design filters using Matlab and exploit more sophisticated design tools in Matlab
- Analyse signal spectra using DFT/FFT
- Apply FFT to filtering applications

Course Outcomes:

CO1 Classify discrete time signals/systems.

CO2 Apply Z-transform and Fourier transform for different type of signals and systems.

CO3 Determine the convolution of discrete time signals using graphical and analytical methods.
CO4 Compute DFT/IDFT for discrete time signals and find circular convolution.
CO5 Develop FFT algorithms and design of analog/digital filters.

CO6 Compute the frequency response of digital filters and hence apply for different signal processing applications e.g. DSP processors/FPGA platform.

Catalog Description:

The main objective of this subject is to help the students to mathematically analyze different types of signals and their associated systems. Applications of DSP include audio signal Processing, audio compression, digital image processing, video compression. With good knowledge of this subject, students can work on various real time projects.

Course Content

UNIT I **10 Lecture Hours**

Discrete Transforms: Review of Z- and Inverse Z-transform and Inversion of Z-transform and solution of difference equations. Analysis of LTI systems in Z-domain, causality, stability, schurcohn stability test relationship between Z-transform and Fourier transform.
DFT and FFT Computation: Properties of DFT, Linear filtering using DFT, Frequency analysis of signals using DFT, Frequency selective filters; all pass filters, minimum phase, and maximum-phase and mixed-phase systems.

UNIT II: **9 Lecture Hours**

Implementation of Discrete Time Systems: Direct form, cascade form, frequency sampling and lattice

structures for FIR systems. Direct forms, transposed form, cascade form parallel form. Lattice and lattice ladder structures for IIR systems, Quantization of filter co-efficient structures for all pass filters.

UNIT III: 10 Lecture Hours

Design of FIR Filters: Characteristics of practical frequency selective filters. Filters design and specifications: Peak pass band ripple, minimum stop band attenuation.

Design of FIR Filters using windows: Kaiser Window methods, comparison of design methods for FIR filters, Gibbs phenomenon, and design of FIR filters by frequency sampling method, design of optimum equi ripple FIR filters, alternation theorem.

UNIT IV: 11 Lecture Hours

Design of IIR Filters: Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse invariance method, Bilinear transformation method, characteristics of Butterworth filters, Frequency transformation, least square methods.

Design of IIR Filters in Frequency Domain: Chebyshev, and Elliptical analog filters and their design, Frequency transformation, least square methods, design of IIR filters in frequency domain.

Text books:

- John G. Proakis, "Digital Signal Processing" PHI – 3rd Edition.

Reference books:

- S. K. Mitra, "Digital Signal Processing" (PHI)
- Johny Johnson, "Introduction to Digital Signal Processing" PHI.
- Salivahan, "Digital Signal Processing" , TMH
- Oppenheim A.V.and Schafer R.W.**, "**Discrete Time Signal Processing", Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Classify discrete time signals/systems.	**PO1**
CO2	Apply Z-transform and Fourier transform for different type of signals and systems.	**PO2**
CO3	Determine the convolution of discrete time signals using graphical and analytical methods.	**PO3**
CO4	Compute DFT/IDFT for discrete time signals and find circular convolution.	**PO1**
CO5	Develop FFT algorithms and design of analog/digital filters.	**PSO1**
CO6	Compute the frequency response of digital filters and hence apply for different signal processing applications e.g. DSP processors/FPGA platform	**PSO1,PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	[illegible]	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics & Communication Skills
[illegible]	Tit [illegible]	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
[illegible]	I [illegible] P [illegible] E A [illegible]	2		2										3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC360A	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objective:

1. Understand basic tradeoffs in digital representation of signals: sampling rate, bandwidth, bit rate, fidelity
2. Analyse minimum phase, linear phase, and all-pass discrete-time systems
3. Check the stability of filters
4. Choose filter structures according to their performance characteristics: sensitivity, complexity, delay, etc
5. Program digital signal processors to perform DSP in real-time
6. Analyse and design filters based on pole/zero placement.
7. Design linear phase FIR filters using windows and equipripple technique
8. Design IIR filters from continuous-time filters
9. Design filters using Matlab and exploit more sophisticated design tools in Matlab
10. Analyse signal spectra using DFT/FFT
11. Apply FFT to filtering applications

Course Outcomes:

CO1 Analyze various discrete time signals.

CO2 Examine the properties of convolution, Z transform and twiddle factors.

CO3 Determine the circular convolution of two sequences.

CO4 Prepare different algorithms for filtering long data Sequences.

CO5 Compute the magnitude and phase response of Butterworth filter and FIR filter with different specifications

Catalog Description:

The main objective of this subject is to help the students to mathematically analyze different types of signals and their associated systems. Applications of DSP include audio signal Processing, audio compression, digital image processing, video compression. With good knowledge of this subject, students can work on various real time projects.

Course Content

Hands-on experiments related to the course contents ETEC 314A by performing experiments as given below:

Perform the experiments using MATLAB:

To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).	**5-6 Hours**
To develop program for discrete convolution	
To develop program for discrete correlation.	
To understand stability test.	
To understand sampling theorem.	
To design analog filter (low-pass, high pass, band-pass, band-stop).	
To design digital IIR filters (low-pass, high pass, band-pass, band-stop).	**5-6 Hours**
To design FIR filters using windows technique	
To design a program to compare direct realization values of IIR digital filter	
To develop a program for computing parallel realization values of IIR digital filter.	
To develop a program for computing cascade realization values of IIR digital filter.	
To develop a program for computing inverse Z-transform of a rational transfer function	

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Projects/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze various discrete time signals.	**PO1**
CO2	Examine the properties of convolution, Z transform and twiddle factors	**PO3**
CO3	Determine the circular convolution of two sequences.	**PO2**
CO4	Prepare different algorithms for filtering long data Sequences.	**PO4**
CO5	Compute the magnitude and phase response of Butterworth filter and FIR filter with different specifications	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics & Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
ETEC 360 A	DIGITAL SIGNAL PROCESSING LAB	2	2	2	2											

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE362A	POWER SYSTEM LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Power System -II				
Co-requisites	--				

Course Objectives:

- To analyse the performance of power system networks by conducting various experiments.
- To study different power system protective equipment by conducting suitable experiments.
- To develop computer programs for analysis of power systems

Course Outcomes:

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

Hands-on experience related to the course contents ETEE403A by performing experiments as given below: CO1. Acquire the knowledge of various abnormal conditions that could occur in power system.
CO2. Ability to design various protective devices in power system for protecting equipment and personnel.
CO3. Knowledge of various types of existing circuit breakers, their design and constructional details. CO4 Knowledge of various conventional relays, their design and latest developments.
CO5. Knowledge of standards and specifications related to switchgear and protection

Catalogue Description

To analyse the various faults and protection schemes.

Course Content

List of experiments: **Lab Hours : 10 to 11**

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient pole alternator.

2. To determine negative and zero sequence reactance's of an alternator.

3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator.

4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.

5. To study the IDMT over current relay and determine the time current characteristics.

6. To study percentage differential relay

7. To study Impedance, MHO and Reactance type distance relays.

8. To determine location of fault in a cable using cable fault locator.

9. To study Ferranti effect and voltage distribution in H.V. Long transmission line Transmission

10. To study operation of oil testing set. Simulation Based Experiments (using MATLAB or any other software).

11. To determine transmission line performance.

12. To obtain steady state, transient and sub-transient short circuit currents in an alternator.

13. To obtain formation of Y-bus and perform load flow analysis.

14. To perform symmetrical fault analysis in a power system.

15. To perform unsymmetrical fault analysis in a power system

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**QUIZ**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire the knowledge of various abnormal conditions that could occur in power system.	**PO1, PO2**
CO2	Ability to design various protective devices in power system for protecting equipment and personnel.	**PO1, PO3, PO5**
CO3	Knowledge of various types of existing circuit breakers, their design and constructional details	**PO2, PSO1**
CO4	Knowledge of various conventional relays, their design and latest developments.	**PO2, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 362A	POWER SYSTEM LAB	3	2	2	2	2								3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEE351A	PRACTICAL TRAINING-I	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

The object of practical training-I is to enable the student to the investigative study taken up under core branch, involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

Course Outcomes:

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

CO1: In depth study of the topic assigned in the light of the Report prepared under practical training-I. CO2: Review and finalization of the Approach to the Problem relating to the assigned topic

CO3: Preparing an Action Plan for conducting the investigation, including team work

CO4: Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed

CO5: Final development of product/process, testing, results, conclusions and future directions

Catalogue Description

Students apply the engineering knowledge to prepare the project.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	In depth study of the topic assigned in the light of the Report prepared under practical training-I.	**PO12, PSO3, PO10**
CO2	Review and finalization of the Approach to the Problem relating to the assigned topic	**PO2, PO3**
CO3	Preparing an Action Plan for conducting the investigation, including team work	**PO4, PO9**
CO4	Detailed Analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed	**PO1, PO5**
CO5	Final development of product/ process, testing, results, conclusions and future directions	**PO4, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

ETEC 357A	PRACTICAL TRAINING -I	3	2	2	2	2				3	3		3	2		2

1=weakly mapped,
2= moderately mapped,
3=strongly mapped

ETEE316A	**POWER ELECTRONICS**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

COURSE OBJECTIVE

The main objective of this subject is :

- To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
- To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
- To provide strong foundation for further study of power electronic circuits and systems.
- The objective of the course is to learn the characteristics of different types of power electronic devices such as thyristors, MOSFET, IGBT, DIAC, TRIAC etc,

Course Outcomes:

On completion of this course, the students will be able to perform, hands-on experience related to the course contents ETEE316A by performing experiments as given below:

CO1. Acquire the knowledge of principle of operation, design and synthesis of different power conversion circuits and their applications.

CO2. Ability to study characteristics of different types of power electronic devices

CO3. Knowledge of voltage and current commutated choppers along with knowledge of speed control of dc motor.

CO4 To learn the basic of utilization of cycloconvertors.

CO5 Able to demonstrate use of DC Converters,

CO6 To learn basics of inverters and thyristor technology utilized.

Catalogue Description

By studying this subject student of Electrical Engineering will have detailed knowledge of various solid state devices and various converters as most of the equipment's and machines uses power electronic devices as by the use of power electronic devices the overall cost and size of machine and equipment is reduced.

Course Content

UNIT I **Hour: 10**

Characteristics and switching behavior of different solid - state devices namely Power diodes, SCR, UJT TRAIC DAIC, MOSFET, GTO, IGBT, MCT and Power Transistors. Two transistor analogy SCR, Firing circuits of SCR and TRAIC, SCR gate characteristics. SCR ratings, protection of SCR against over current.

UNIT II **Hour: 10**

Classification of rectifiers, phase controlled rectifier: Single phase half wave controlled. Fully controlled and half controlled rectifiers and their performance parameters. Three phase half wave, full wave and half controlled rectifiers and their performance parameters. Effect of source impedance on the performance of single phase and three phase controlled rectifier. Dual converter.

UNIT III

Hour: 10

DC to DC converter: principle of chopper operation, step up choppers, types of chopper circuits. AC to AC converters: principle of operation of step up and step down cycloconverter, three phase to single phase cycloconverter, three phase to three phase cycloconverter

UNIT IV **Hour: 10**

Single phase voltage source inverter, three phase bridge inverters, voltage control in single phase inverters, PWM inverters, current source inverters.

Text Books:

1. Dr. P. S. Bimhra "Power Electronics", Khanna Publishing, 4th edition.

Reference Books:

1. J. Michael Jakob, Power Electronics: Principles & Applications, Vikas Publishing House Pvt.Ltd.

2. Vithayathis, J, Power Electronics : Principles and Applications, TMH

3. M.D. Singh & K.B. Khnachandani, "Power Electronics", Tata Mcgraw Hill.

4. P. C. Sen – Power Electronics, TMH. 5. M. H. Rashid, "Power Electronics Circuits, Devices & Applications", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire the knowledge of principle of operation, design and synthesis of different power conversion circuits and their applications.	**PO1**
CO2	Ability to study characteristics of different types of power electronic devices	**PO2**
CO3	Knowledge of voltage and current commutated choppers along with knowledge of speed control of dc motor.	**PO3**
CO4	To learn the basic of utilization of cycloconvertors.	**PO6**
CO5	Able to demonstrate use of DC Converters	**PO1**
CO6	To learn basics of inverters and thyristor technology utilized.	**PO2**

Ethics and Communication Skills	PSO3	
Innovation and Industry Friendly	PSO2	
Application of Concepts	PSO1	
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	2
Modern tool usage	PO5	
Conduct investigations of complex	PO4	
Design/development of solutions	PO3	3
Problem analysis	PO2	2
Engineering Knowledge	PO1	2
	Course	POWER
	Course Code	ETEC31

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE364A	POWER ELECTRONICS LAB	L	T	P	C
Version 1.0		0	0	2	1
Co-requisites	--				

Course Objectives:

- To analyse the course contents ETEE316A by performing experiments.
- To study R, RC & UJT Triggering circuits.

Course Outcomes:

On completion of this course, the students will be able to perform, hands-on experience related to the course contents ETEE316A by performing experiments as given below:

CO1. Acquire the knowledge of various power electronics components.

CO2. Ability to study R, RC and UJT triggering circuits.

CO3. Knowledge of voltage and current commutated choppers along with knowledge of speed control of dc motor.

CO4. To learn the basic of utilization of cycloconvertors.

Catalogue Description

To analyse the various triggering circuits, cycloconverters. Basics of Voltage and Current commutated choppers, Speed control of DC shunt motor (using Rectifier & Chopper) , Speed control of TPIM using PWM inverter and Single phase Cyclo-converter

Course Content

List of experiments: **Lab Hours : 10 to 11**

1. R, RC & UJT Triggering circuits
2. Single phase Semi & Full converter
3. Single phase AC voltage controller using Triac and SCRs
4. Speed control of TPIM using PWM inverter
5. Single phase Cyclo-converter

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Acquire the knowledge of various power electronics components.	PO1
CO2	Ability to study R, RC and UJT triggering circuits.	PO2
CO3	Knowledge of voltage and current commutated choppers along with knowledge of speed control of dc motor.	PO3
CO4	To learn the basic of utilization of cycloconvertors.	PO6

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC364A	POWER ELECTRONICS LAB	2	2	3			2									

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC313A	**CONTROL SYSTEM**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Applied Mathematics -III				
Co-requisites	--				

Course Objectives

1. To design the mathematical model of electrical and electromechanically systems.

2. To analyse the response of the systems with feedback and without feedback

3. To analyse the time response of the first and second order system.

4. To analyse the frequency response of the system.

5. To analyse and implement the stability methods.

6. To use Lead, Lag and Lead – Lag compensator using frequency domain method.

7. To design the P, PI, PID controllers.

Course Outcomes

CO1. Formulate the mathematical models of electrical and electromechanical systems

CO2. Analyse the response of the systems with feedback and without feedback

CO3. Understand the time response of first and second order system at various inputs

CO4. Check the stability of the system

CO5. Analyse the P, PI, PID controllers

CO6. Understand the frequency response of the system

Catalog Description

This is a course in which you learn the various controlling techniques. The course helps us to understand the system and the behaviour of the system along with its stability. The time and frequency domains give the system behaviour in different domains.

Course Content

Unit I: **12 lecture hours**

Definitions of Control Systems, Closed Loop and Open Loop Control system, Examples of Control Systems. Mathematical modelling of physical systems, differential equations of physical systems, transfer functions. Armature controlled and field-controlled DC servomotors; AC servomotors and deriving their transfer functions; Transfer function from block diagrams and signal flow graphs.

Unit II: **12 lecture hours**

Basic Control Actions: Proportional, integral and Derivative controllers, effect of feedback on control system; Transient and steady state response of first order system; Second order system, Routh's Stability criterion, relative stability analysis; Static error co-efficient, position, velocity and acceleration error co-efficient.

Unit III: **10 lecture hours**

Root Locus Techniques Bode Diagram, Minimum and Non-Minimum phase systems; Determination of Transfer from Bode Diagram; Polar Plots; Nyquist Plot; Stability Analysis using; Constant M & N Loci.

Unit IV: **10 lecture hours**

Introduction to Compensators; lead, lag, lead-lag compensators, Concept of state- state variable and state model, Solution of time invariant, homogeneous state equation, controllability and observability, state transition matrix and its properties.

Text Books

1. 1I. J. Nagrath, M. Gopal, "Control System Engineering" New Age International.
2. N. K. Jain, "Automatic Control System Engineering" Dhanpat Rai

Reference Books/Materials

1. Ogata, "Modern Control Engineering" EEE
2. Kuo, "Automatic Control Systems" PHI

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Formulate the mathematical models of electrical and electromechanical systems	**PO1**
CO2	Analyse the response of the systems with feedback and without feedback	**PO2**

CO3	Understand the time response of first and second order system at various inputs	**PO3**
CO4	Check the stability of the system	**PO6**
CO5	Analyse the P, PI, PID controllers	**PO7**
CO6	Understand the frequency response of the system	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC313A	Control System	2	2	3	3		2	2								

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC358A	CONTROL SYSTEM LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	-				
Co-requisites	--				

Course Objectives:

Will have a strong knowledge on MATLAB software.

- To study the concept of time response and frequency response of the system
- Students get the basic knowledge on practical control system applications on machines & electronic devices.
- This course aims to familiarize with the modelling of dynamical systems, to simulate and analyze the stability of the system using MATLAB.

Course Outcomes:

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

Catalogue Description

Students will design, implement, and test controllers for a variety of systems. This will enhance their understanding of feedback control familiarize them with the characteristics and limitations of real control devices.

Course Content

Hands-on experience enables to relate to the course contents ETEC308A with the practical aspect by performing the given experimental list below:

- To study a stepper motor & to execute microprocessor or computer-based control of the same

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Discuss the need of software tools to illustrate modeling and simulation of any system.	**PO5**
CO2	Classify and evaluate the performance parameters of a system and then with simulation prepare an advance tool to modify the values of the parameter of the system in order to meet the desired need.	**PO4, PSO1**
CO3	Prepare professionals in laboratory to compute or to predict the characteristics of a system by visualizing experimental data and its graphical representation.	**PO3**
CO4	Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory by introducing the concepts of different stability theorems.	**PO3, PO4**
CO5	Primarily via team-based laboratory activities, students will demonstrate the ability to interact effectively on a social and interpersonal level with fellow students, and will develop the ability to divide up and share task responsibilities to complete assignments	**PSO2, PO9**
CO6	Develop professional quality textual and graphical presentations of laboratory data and computational results, incorporating accepted data analysis and synthesis methods, mathematical software, and word-processing tools	**PO5, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEC 358A	CONTROL SYSTEM LAB	3		2	3	2				3				3	2	

1=weakly mapped

2= moderately mapped

3=strongly mapped

Third Year (VI Sem.)

ETEE404A	ELECTRIC DRIVES	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

- The objective of the course is to understand the stable steady state operation and transient dynamics of motor-load system,
- To learn characteristics and control of DC motors drives, induction motor drives & Synchronous motor drive, learn digital control of AC and DC drives.
- Students will learn basic concept of solid state controlled electric drive, permanent magnet machines, control of D.C. drives, control of A.C. motor drives and microprocessor control of drive.
- To obtain detailed knowledge of various drive systems used in field of traction, braking and motoring used in field of railways, aeronautics etc.

COURSE OUTCOME: The outcome of this course is

CO1 Articulate information about electric drives for engineering problems.

CO2 Design power system components for a specified system and application

CO3 Ability to discuss various industrial motors controlling with drives utilization. CO4 Formulate solid state controlled electric drive, with microprocessor application. CO5 Ability to calculate drives to be uses as per industry applications

Catalogue Description

The objective of this course is to provide advanced knowledge and understanding of power electronics devices. Modern power electronics and drives are used in electrical as well as mechanical industry. The power converter or power modulator circuits are used with electrical motor drives, providing both DC or AC outputs and working from either a DC (battery) supply or from the conventional AC supply.

Course Content

UNIT I

Hour: 10

DC motor characteristics: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor Speed, flux weakening for high speed operation.

UNIT II

Hour: 6

Closed-loop control of DC Drive : Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design. Multi-quadrant DC drive Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two- quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

UNIT III **Hour: 6**

Chopper fed DC drive: Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting. Induction motor characteristics: Review of induction motor equivalent circuit and torque speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

UNIT IV **Hour: 8**

Scalar control or constant V/f control of induction motor :Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady state performance analysis based on equivalent circuit, speed drop with loading, slip regulation. Control of slip ring induction motor: Impact of rotor resistance of the induction motor torque speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs

	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Articulate information about electric drives for engineering problems.	**PO1**
CO2	Design power system components for a specified system and application	**PO2**
CO3	Ability to discuss various industrial motors controlling with drives utilization .	**PO4**
CO4	Formulate solid state controlled electric drive, with microprocessor application .	**PO2**
CO5	Ability to calculate drives to be uses as per industry applications	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEE 404A	ELECTRIC DRIVES	2	2		3											

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE403A	SWITCHGEAR AND PROTECTION	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Power System - I and Power System - II				
Co-requisites	--				

Course Objectives:

In spite of all care and precautions taken in the design, installation and operation of Power system and power equipment, abnormal conditions and faults do occur in the system. Some fault such as short circuits can prove highly damaging, not only to the components but also to the entire power system. However continuity of power supply is needed in day to day life. So study of switchgear and protection is essential. It is expected that the understanding of operational principles, selection and testing aspects of switchgear and protection system must be known by students which ultimately help them to maintain the reliability of electric supplying discharging their duties as a supervisor or a technician in substation, manufacturing industries and public service utilities

Course Outcomes:

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

CO1. Acquire the knowledge of various abnormal conditions that could occur in power system

CO2. Test the performance of different protective relays; maintain protection systems used forof protection alternators and transformers.

CO3. Ability to design various protective devices in power system for protecting equipment and personnel.

CO4. Knowledge of various types of existing circuit breakers, their design and constructional details.

CO5. Knowledge of various conventional relays, their design and latest developments.

CO6. Knowledge of standards and specifications related to switchgear and protection **Catalogue Description**

To introduce the students with basic concepts of Relays, Protection schemes, Switch gear and

modern trends in protection for protecting the power system equipment

Course Content

UNIT I **Lecture Hours**

INTRODUCTION TO PROTECTION SCHEME: Need for Protective systems -Nature and causes of Faults - Types of faults -Effect of faults -fault statistics -Evolution of protective relays -Zones of protection -Primary and Back -up Protection -Essential qualities of Protection -Classification of Protective schemes –Automatic reclosing -current transformer for Protection -potential transformer - summation transformer -phase –sequence current -segregating network -basic relay terminology

UNIT II **Lecture Hours 10**

RELAYS: General considerations -sensing of faults -construction of electro-magnetic attraction and induction types relays -Buchholz and negative sequence relay -concept of reset, pick up, inverse time and definite time characteristics, overcurrent, over voltage, directional, differential and distance relays on R-X diagram. Static Relays: Introduction, advantage and limitation of static relays, static overcurrent, directional, distance and differential relays.

UNIT III **Lecture Hours 6**

PROTECTION: Types & detection of faults and their effects, alternator protection scheme (stator, Rotor, reverse power protection etc.) -Power transformer protection (external and internal faults protection), generator- transformer unit protection scheme, bus bar protection -Transmission line protection (current/time grading, distance), Pilot relaying schemes, power line carrier protection

UNIT IV **Lecture Hours 7**

SWITCHGEAR: Theory of current interruption-energy balance and recovery rate theory, arc quenching, recovery and restriking voltages -Types of circuit breakers. bulk oil and minimum oil, air break and air blast, Sulphur hexafluoride (SF6) and vacuum circuit breakers -Rating selection and testing of circuit breakers/operating mechanisms -LT switchgear, HRC fuses, types construction and applications.

TEXT BOOKS:

1.Badriram & Vishwakarma, “Power System Protection”, Tata McGraw-Hill Education

2.Paithankar Y. G., S. R. Bhide., “Fundamentals of power system protection” PHI Learning Pvt. Ltd.

REFERENCES BOOKS:

1.The Elementary Council “Power System Protection”, Vol.1,2 &3, Peter Peregrinus Ltd. Tata McGraw-Hill Education.

2.Ravindra Nath, and Chandra, “Power systems protection and switchgear”, New age international (P) Ltd.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire the knowledge of various abnormal conditions that could occur in power system	**PO1, PSO1**
CO2	Test the performance of different protective relays, maintain protection systems used for protection of alternators and transformers.	**PO2**
CO3	Ability to design various protective devices in power system for protecting equipment and personnel.	**PO5, PO3**
CO4	Knowledge of various types of existing circuit breakers, their design and constructional details.	**PO2**
CO5	Knowledge of various conventional relays, their design and latest developments	**PO2, PO4**
CO6	Knowledge of standards and specifications related to switchgear and protection	**PSO1, PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
ETEE 404A	ELECTRIC DRIVES	2	2		3											

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEC305A	MEASUREMENT & INSTRUMENTATION	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic concepts of R, L and C parameters				
Co-requisites	--				

Course Objectives:

- To study the methods of analog measurement and digital measurement of electrical quantities.
- The measurement can be done by analog meters, which point toward electrodynamic, thermocouple electrostatic & rectifier type ammeters & voltmeters.
- Measurement of voltage, current, power, energy, flux and iron losses with the various meters.
- AC and DC bridges for the measurement of low, medium and high resistances, Inductance & Capacitance.

- To measure frequency and phase differences by Lissajous Patterns formed on the cathode ray oscilloscope.
- To study digital meter, pulse generators, signal generators, function generators, wave analysers, distortion analysers, spectrum analyser, Harmonic analyser, FFT analyser and decade counting Assembly (DCA) for the measurement of frequency and time.

Course Outcomes:

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

CO1. Measure low, medium & high resistances using suitable bridges.

CO2. Determine the value of inductor & Capacitor with the help of AC Bridges.
CO3 Test & Calibrate ammeter, voltmeter and wattmeter.
CO4. Understand the principles of various electronic instruments and transducers.
CO5. Measure frequency and phase in CRO.

Catalogue Description

The objective of the course is to study the basic concepts and definitions in measurement, oscilloscope, electronic instruments, generation & analysis of waveforms, frequency & time

measurement and transducers & signal conditioning. It discusses about the importance of signal generators, analyzers in measurement and the importance and functioning of transducers & signal conditioning system.

Course Content

UNIT I **Hours 10**

Measurement & Errors: Methods of Measurement, Measurement System, Classification of instrument system, Characteristic of instrument & measurement system Errors in Measurement & its Analysis, Standards. Principles, Construction and application of moving coil, moving iron, electro-dynamometer type, induction type instruments and extension of range of ammeter, voltmeter (shunt and multiplier).

UNIT II **Hours 10**

AC & DC Bridges: Different methods of measuring low, medium and high resistances, Measurement of Inductance & Capacitance with the help of various DC & AC Bridges, Q Meter. Magnetic Measurement: Ballistic Galvanometer, Flux meter, Determination of Hysteresis loop, Measurement of iron losses. Measurement of power, Energy, phase and frequency. Radio frequency power measurements

UNIT III **Hours 12**

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component, Application of CRO in measurement, Lissajous Pattern., Dual trace &dual beam

Oscilloscope. Sampling and storage oscilloscope. Introduction to digital meter, $3\frac{1}{2}$ bit (very low-price concept) to $1\frac{1}{2}$ bit (very high price concept).

UNIT – IV **Hours 12**

Transducers: Introduction and classification of transducers, strain gauges and their types, Resistance thermometers, thermistors , thermocouples, Linear variable differential transformer Rotary variable differential transformer, capacitive transducer, Piezo-electric transducer, Opto-electronic transducers

TEXT BOOK:

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India.

2. A.K. Sawhney: "Electrical & Electronic Measurement & Instrument ",DhanpatRai& Sons , India .

REFERENCE BOOKS:

1. Forest K. Harries, "Electrical Measurement "Willey Eastern Pvt. Ltd. India.

2. M.B. Stout, "Basic Electrical Measurement" Prentice Hall of India, India.

3. W.D. Cooper," Electronic Instrument & Measurement Technique "Prentice Hall International.

4. J.B. Gupta, "Electrical Measurements and Measuring Instruments" S.K. Kataria & Son

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Measure low, medium & high resistances using suitable bridges.	**PSO2, PO4**
CO2	Determine the value of inductor & Capacitor with the help of AC Bridges.	**PSO2, PO3**
CO3	Test & Calibrate ammeter, voltmeter and wattmeter.	**PO1**

CO4	Understand the principles of various electronic instruments and transducers	**PO2, PSO2**
CO5	Measure frequency and phase in CRO.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEE 404A	ELECTRIC DRIVES	2	2		3											

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC355A	MEASUREMENT & INSTRUMENTATION LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of R, L and C parameters				
Co-requisites	--				

Course Objectives:

The objective of the course is to study the basic concepts and definitions in measurement, oscilloscope, electronic instruments, generation & analysis of waveforms, frequency & time measurement and transducers & signal conditioning. It discusses about the importance of signal generators, analyzers in measurement and the importance and functioning of transducers & signal conditioning system

Course Outcomes:

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

CO1. Measure low, medium & high resistances using suitable bridges.

CO2. Determine the value of inductor & Capacitor with the help of AC Bridges.
CO3 Test & Calibrate ammeter, voltmeter and wattmeter.
CO4. Understand the principles of various electronic instruments and transducers.
CO5. Measure frequency and phase in CRO.

Catalogue Description

The objective of the course is to study the basic concepts and definitions in measurement, oscilloscope, electronic instruments, generation & analysis of waveforms, frequency & time measurement and transducers & signal conditioning. It discusses about the importance of signal generators, analyzers in measurement and the importance and functioning of transducers & signal conditioning system.

Course Content

Hands-on experience enables to relate to the course contents ETEC305A with the practical aspect by performing the given experimental list below:

- Study blocks wise construction of an Analog Oscilloscope & Function generator.
- Study blocks wise construction of a Multimeter & frequency counter.
- Study Measurement of different components & parameters like Q of a coil etc. using LCRQ meter.
- Study of distortion factor meter and determination of the % distortion of the given oscillator

- Determine output characteristics of a LVDT and Measure displacement using LVDT
- Study characteristics of temperature transducer like Thermocouple, Thermistor & RTD with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
- Measurement of Strain using Strain Gauge
- To study differential pressure transducer & signal conditioning of output signal.
- Measurement of level using capacitive transducer.
- Study of Distance measurement using ultrasonic transducer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Measure low, medium & high resistances using suitable bridges.	**PSO2, PO4**
CO2	Determine the value of inductor & Capacitor with the help of AC Bridges.	**PSO2, PO3**
CO3	Test & Calibrate ammeter, voltmeter and wattmeter.	**PO1**
CO4	Understand the principles of various electronic instruments and transducers	**PO2, PSO2**
CO5	Measure frequency and phase in CRO.	**PO5**

ETEE452A	POWER SYSTEM SIMULATION LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of R, L and C parameters				
Co-requisites	--				

Course Objectives:

The objective of the course is

- To study the basic concepts of MATLAB software and its implementation to the power system networks.
- It discusses about the utilizing of parameters considers during modeling of power system elements,

Course Outcomes:

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

CO1: Exposure to the modelling of individual power system components like transmission lines and generators
CO2: Enable the students to do load flow and short circuit calculations
CO3: Enable the students to do analysis of economic dispatch of thermal generators, load sharing and governor control
CO4: To impart the knowledge of automatic generation control and voltage regulation
CO5: To make students capable of analysis of power system stability, security and reliability
CO6: Awareness of deregulated power system

Catalogue Description

The aim of this course is to introduce MATLAB application its various toolboxes to be used for modelling real time power system network.

Course Content

LIST OF EXPERIMENTS: **Lab Hours- 10-11**

Use of MATLAB for the following

1. Formation of Y-Bus by inspection method and analytical method.

2. Formation of Z-Bus matrix.

3. Power flow analysis by GS, NR and FDLF methods.

4. Performance of transmission lines

5. Economic Dispatch Problem-without losses

6. Economic Dispatch Problem-with losses

7. Automatic load frequency control

8. Automatic voltage regulation.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources	**PO1, PSO1**
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles	**PO2, PSO2**
CO3	Choose proper energy storage systems for vehicle applications	**PO1, PO4**
CO4	Identify various communication protocols and technologies used in vehicle networks	**PO5**
CO5	Selecting sustainability power solutions be reducing carbon emission levels.	**PO3, PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 425A	POWER SYSTEM SIMULATION LAB	3	2	3	2	2								2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE401A	**RENEWABLE ENERGY SYSTEM**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of power system I				
Co-requisites	--				

COURSE OBJECTIVES

To impart knowledge on the following Topics:

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

COURSE OUTCOMES:

CO1 Understand the basic physics of wind and solar power generation.

CO2 Understand the power electronic interfaces for wind and solar generation

CO3 Understand the issues related to the grid-integration of solar and wind energy systems.

CO4 Understand the energy scenario and the consequent growth of the power generation from Renewable energy sources

Catalogue Description

The aim of this course is to introduce about renewable sources of energy. Basics of wind and power generation techniques utilized along with primary discussion of related statistics. All is to be discussed with details.

Course Content

UNIT I **Hours: 8**

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II **Hours:8**

Wind Energy: Power in the Wind – Types of Wind Power Plants (WPPs)–Components of WPPs-Working of WPPs- Siting of WPPs-Grid integration issues of WPPs.

UNIT III **Hours: 8**

Solar PV And Thermal Systems **:** Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT IV **Hours:6**

Biomass Energy**:** Introduction-Bio mass resources –Energy from Bio mas: conversion processes- Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

TEXT BOOKS:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press.
2. D. Mukherjee, S. Chakrabarti, Fundamentals of Renewable Energy Systems.

3. Renewable and Efficient Electric Power Systems by Gilbert M. Masters, 2d edition, Wiley, 2004 ISBN 0- 471-28060-7.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources	**PO1, PSO1**
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles	**PO2, PSO2**
CO3	Choose proper energy storage systems for vehicle applications	**PO1, PO4**
CO4	Identify various communication protocols and technologies used in vehicle networks	**PO5**
CO5	Selecting sustainability power solutions be reducing carbon emission levels.	**PO3, PO4, PO5**

Fourth Year (VII Sem.)

ETEE422A	SMART ELECTRIC GRID	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Power Electronics				
Co-requisites	--				

COURSE OBJECTIVES

The objectives of this course are to:

- Understand the challenging issues and architecture of smart grid.
- Understand the communication and wide area monitoring in smart grid.
- Rudimentary energy management issues in smart grid.
- Acquire the knowledge in computational intelligence and security issues in smart grid.
- Know the role of Power electronics and energy storage in smart grid

COURSE OUTCOMES:

CO1 Know, list and classify the basic terms of a Power System Grid; explain the importance and objectives of the various dispersed generation units as well as that of the various energy management policies; distinguish them according to their priorities.

CO2 Know, name, describe and classify the modern and innovative application fields of dispersed generation units; discuss relative merits

CO3 Know, describe by drawing a block diagram and explain the operation of the basic part of a smart grid (namely the Microgrid); quantify its operational, financial and environmental advantages using charts.

CO4 Know, understand and explain the concept of a smart grid; identify the telecommunication.

Catalogue Description

The aim of this course is to introduce about the smart grid technologies, their applications and control issues covering Smart Generation (Renewable and Microgrid), Smart Transmission (Integration of Renewable Energy Sources, Wide Area Measurements) and Smart Distribution (Demand Response Management and Power Quality Management)

Course Content

UNIT-I **Lecture Hours: 10**

Introduction to Smart Grid: Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions- Traditional Power Grid and Smart Grid –New Technologies for Smart Grid -Advantages – Indian Smart Grid –Key Challenges for Smart Grid.

UNIT II **Hours10**

Smart Grid Architecture: Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration Tools and Techniques for Smart Grid: Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence

UNIT III **Hours: 10**

Distribution Generation Technologies: Introduction to Renewable Energy Technologies – Micro grids – Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues.

UNIT IV **Hours: 10**

Communication Technologies and Smart Grid: Introduction to Communication Technology – Synchro Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS). Control of Smart Power Grid System: Load Frequency Control (LFC) in Micro Grid System – Voltage Control in Micro Grid System –Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press.
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press.
REFERENCE BOOKS:
1. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer Edition. 2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources	**PO1, PSO1**
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles	**PO2, PSO2**
CO3	Choose proper energy storage systems for vehicle applications	**PO1, PO4**
CO4	Identify various communication protocols and technologies used in vehicle networks	**PO5**
CO5	Selecting sustainability power solutions be reducing carbon emission levels.	**PO3, PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 422A	SMART ELECTRIC GRID	3	2	2	2	2								2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE425A	ELECTRIC & HYBRID VEHICLES	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

COURSE OBJECTIVES:

- Introduction to Hybrid Electric Vehicles, Conventional Vehicles, Hybrid Electric Drive-trains, Electric Propulsion unit,
- Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor,
- Energy Storage Requirements in Hybrid and Electric Vehicles, Sizing the drive system,
- Design of a Hybrid Electric Vehicle, Energy Management Strategies.

COURSE OUTCOMES:

CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles
CO3	Choose proper energy storage systems for vehicle applications
CO4	Identify various communication protocols and technologies used in vehicle networks
CO5	Selecting sustainability power solutions by reducing carbon emission levels.

Catalogue Description

Hybrid vehicle combines any two power (energy) sources. Possible combinations include diesel/electric, gasoline/fly wheel, and fuel cell (FC)/battery. Typically, one energy source is storage, and the other is conversion of a fuel to energy. The combination of two power sources may support two separate propulsion systems. All have been briefed in the course content.

Course Content

UNIT-I **Lecture Hours: 10**

Introduction to Electric Vehicles: EV System - Components of an EV ; EV History ; EV Advantages - Efficiency Comparison , Pollution Comparison, Capital and Operating Cost Comparison ; EV Market. Vehicle Mechanics : Laws of Motion , Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power , Velocity and Acceleration , Constant FTR, Level Road , Propulsion System Design.

UNIT-II **Lecture Hours: 12**

Energy Source: Battery , Battery Basics, Lead-Acid Battery, Alternative Batteries, Battery Parameters, Technical Characteristics, Targets and Properties of Batteries, Battery Modelling , Alternative Energy Sources: Fuel Cells Characteristics & types , Fuel Cell EV, Supercapacitors and Ultracapacitors , Flywheels.

UNIT-III **Lecture Hours: 10**

Electric Vehicle Drivetrain: EV Transmission Configurations, Transmission Components, Ideal Gearbox: Steady State Model, EV Motor Sizing: Initial Acceleration, Rated Vehicle Velocity, Maximum Velocity, Maximum Gradability

UNIT-IV **Lecture Hours: 10**

Hybrid Electric Vehicles: Types of Hybrids: Series and Parallel HEVs , Internal Combustion Engines, Reciprocating Engines , Gas Turbine Engine, Design of an HEV, Hybrid Drivetrains, Sizing of Components.

Text Books :

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

References:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources	PO1, PSO1

CO2	Design and develop basic schemes of electric vehicles and hybrid electric vehicles	**PO2, PSO2**
CO3	Choose proper energy storage systems for vehicle applications	**PO1**
CO4	Identify various communication protocols and technologies used in vehicle networks	**PO5**
CO5	Selecting sustainability power solutions be reducing carbon emission levels.	**PO3, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 425A	ELECTRIC & HYBRID VEHICLES	3	2	3		2								2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE407A	HVDC AND FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Power Electronics				
Co-requisites	--				

Course Objectives:

- To introduce students with the concept of HVDC Transmission system.
- To familiarize the students with the HVDC converters and their control system.
- To expose the students to the harmonics and faults occur in the system and their prevention.

Course Outcomes:

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

CO1. Develop the knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.
CO2. Formulate and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links
CO3. Analyze the different harmonics generated by the converters and their variation with the change in firing angles.
CO4. Develop harmonic models and use the knowledge of circuit theory to develop filters and assess the requirement and type of protection for the filters.
CO5. Study and understand the nature of faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same.
CO6. Review the existing HVDC systems along with MTDC systems and their controls and recognize the need to follow the advancements in both the existing systems and HVDC systems and determine the most economic coexistence of both.

Catalogue Description

The objective of this course is to provide advanced knowledge and understanding of power electronics applications in power transmission systems

Course Content

UNIT-I **Hours: 8**

Introduction: comparison of AC and DC Transmission systems, Application of D.C. Transmission, Types of DC links, typical layout of a HVDC converter station. HVDC converters, pulse number, Analysis of phase Bridge circuit with and without overlap, converter Bridge characteristics, equivalent circuits of Rectifier and inverter configurations Twelve pulse converters.

UNIT- II

Lecture Hours : 8

Converter and HVDC system control: Principles of DC links control, converter control characteristics, system control Hierarchy, Firing angle control, current and extinction Angle control starting and stopping of DC link.

Harmonics, Filters and Reactive Power Control: Introduction, generation of Harmonics, AC and DC Filters, Reactive power requirements at steady state, sources of Reactive power static VAR systems.

UNIT- III

Lecture Hours : 7

Power Flow Analysis in AC/DC Systems: Introduction, Modeling of DC/AC converters, controller equations, solutions of AD/DC load flow- simultaneous approach and sequential approach.

UNIT –IV **Lecture Hours : 7**

FACTS Concepts: Flow of power in AC parallel paths and Meshed systems, Basic types of FACTS controllers, Brief description and Definitions of FACTS controllers, objectives of shunt compensation, Methods of controllable VAR generation, Static VAR compensators, SVC and STATCOM, comparison. Objectives of series compensation, variable impedance type-thyristor switched series capacitors (TCSC).

Text Books:

1. K.R. Padiyar," HVDC Power Transmission Systems", Wiley Eastern Limited

2. N.G. Hingorani & L. Gyugyi," Understanding of FACTS", IEEE Press.

References Books:

1. S.Rao ,"EHV - AC, HVDC Transmission & Distribution Engineering" ,Khanna publishers, 3rd edition 2003.

2. Abhijit Chakrabarti, D. P. Kothari, A. K. Mukhopadhyay and Abhinandan De,"An Introduction to: Reactive Power Control and Voltage Stability in Power Transmission Systems", Eastern Economy Edition, 2010.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.	**PO1, PSO1**
CO2	Formulate and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links	**PO2, PSO2**
CO3	Analyze the different harmonics generated by the converters and their variation with the change in firing angles	**PO1, PO4**
CO4	Develop harmonic models and use the knowledge of circuit theory to develop filters and assess the requirement and type of protection for the filters	**PO5**
CO5	Study and understand the nature of faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same	**PO3, PO4, PO5**
CO6	Review the existing HVDC systems along with MTDC systems and their controls and recognize the need to follow the advancements in both the existing systems and	**PO2, PSO1**

	HVDC systems and determine the most economic coexistence of both.	

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 407A	HVDC AND FLEXIBLE AC TRANSMISSION SYSTEMS	3	2	3	2	2								2	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEE460A	MAJOR PROJECT	L	T	P	C
Version 1.0		0	0	0	6
Pre-requisites/Exposure					
Co-requisites	--				

COURSE OBJECTIVE

- The objective of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
- This is expected to provide a good training for the student(s) in R&D work and technical leadership.

COURSE OUTCOMES

CO1 In depth study of the topic assigned in the light of the Report prepared under minor project.

CO2 Review and finalization of the Approach to the Problem relating to the assigned topic.

CO3 Preparing an Action Plan for conducting the investigation, including team work.

CO4 Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.

CO5 Final development of product/process, testing, results, conclusions and future directions.

CO6 Preparing a paper for Conference presentation/Publication in Journals, if possible.

COURSE OVERVIEW: The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The major-project is a team activity having 1-4 students in a team. This is simulation based/electronic product design work with a focusing on electrical & electronic circuit.	**PO9, PO5**
CO2	The major project may be a complete hardware or a combination of hardware and software. This part is the extension of minor project	**PSO1, PSO2**
CO3	Major Project should design a system required in real life. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.	**PO6, PO12**
CO4	After interactions with coordinator/supervisors and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of major-project in extension with minor project.	**PSO3, PO2**
CO5	Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.	**PO3, PO4**
CO6	The student is expected to exert on design, development and testing of the proposed	**PO3,**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEE 460A	MAJOR PROJEC T	3	2	3		2							2	2	2	

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETEE465A	PRACTICAL TRAINING-II	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

The object of practical training-II is to enable the student to the investigative study taken up under core branch, involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

Course Outcomes:

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

CO1: In depth study of the topic assigned in the light of the Report prepared under practical training-I.
CO2: Review and finalization of the Approach to the Problem relating to the assigned topic
CO3: Preparing an Action Plan for conducting the investigation, including team work
CO4: Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
CO5: Final development of product/process, testing, results, conclusions and future directions

Catalogue Description

Students apply the engineering knowledge to prepare the project.

Course Content

Student visit the industry and get the hand on experience.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	QUIZ	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	In depth study of the topic assigned in the light of the Report prepared under practical training-I.	**PO12, PSO3, PO10**
CO2	Review and finalization of the Approach to the Problem relating to the assigned topic	**PO2, PO3**
CO3	Preparing an Action Plan for conducting the investigation, including team work	**PO4, PO9**
CO4	Detailed Analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed	**PO1, PO5**
CO5	Final development of product/ process, testing, results, conclusions and future directions	**PO4, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEC 463A	PRACTICAL TRAINING -II	3	2	2	2	2				3	3		3	2		2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Fourth Year (VIII

ETEC470A	INTERNSHIP	L	T	P	C
Version 1.0		0	0	0	12
Pre-requisites/ Exposure					
Co-requisites	--				

Course Objectives:

- Assist the student's development of employer-valued skills such as teamwork, communications and attention to detail.
- Expose the student to the environment and expectations of performance on the part of engineering in professional practice, private/public companies or government entities.
- Enhance and/or expand the student's knowledge of a particular area(s) of engineering

- To Increase self-confidence of students and helps in finding their own proficiency.

- To provide an exposure to real life industry environment

Course Outcomes:

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

CO1. Experience of applying existing engineering knowledge in similar or new situations

CO2. Ability to identify when new engineering knowledge is required, and apply it

CO3. Ability to integrate existing and new technical knowledge for industrial application

CO4. Understanding of lifelong learning processes through critical reflection of internship experiences

CO5. To develop and improve business skills in communication, technology, quantitative reasoning, and teamwork.

CO6. Develop a solid work ethic and professional behaviour, as well as a commitment to ethical conduct and social responsibility.

CO7. Expand network of professional relationships and contacts.

CO8. Observe and participate in business operations and decision-making.

Catalogue Description

The students are required to undergo industrial training/ internship in the last semester of the degree from a reputed organization.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Experience of applying existing engineering knowledge in similar or new situations	**PO1, PSO2**
CO2	Ability to identify when new engineering knowledge is required, and apply it	**PSO1, PO5 , PO2**
CO3	Ability to integrate existing and new technical knowledge for industrial application	**PO4, PO6, PO3**
CO4	Understanding of lifelong learning processes through critical reflection of internship experiences	**PO6**
CO5	To develop and improve business skills in communication, technology, quantitative reasoning, and teamwork.	**PSO3, PO10**
CO6	Develop a solid work ethic and professional behaviour, as well as a commitment to ethical conduct and social responsibility	**PSO3, PO6 , PO8**
CO7	Expand network of professional relationships and contacts.	**PO9**
CO8	Observe and participate in business operations and decision-making.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEC 470A	INTERNSHI P	3	3	2	2	2	2		3	3	3	2	2	3	2	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEL285A	Buisness Communication Skills-I	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To provide an overview of Prerequisites to Business Communication.
2. To put in use the basic mechanics of Grammar.
3. To provide an outline to effective Organizational Communication.
4. To underline the nuances of Business communication.
5. To impart the correct practices of the strategies of Effective Business writing.

Course Outcomes

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

CO1. To be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments

CO2. Understand the correct form of English with proficiency.

CO3. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.

CO4. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.

Catalog Description

In this course, the focus will be on improving LSRW skills, i.e. listening, speaking, reading and writing. Students will learn how to communicate effectively though prescribed syllabus as well as classroom assignments/activities specifically designed to encourage students to play an active role for enhancing their knowledge and developing learning strategies.

List of Experiments (Indicative)

1	**Self- introduction:** Informal introduction & formal introduction'; Formal Introduction of oneself in front of the group.	**2 lab hours**
2	**Personal Branding:**Social media presence (Facebook, twitter and LinkedIn)**,**Networking**,** Digital Etiquettes	**2 lab hours**

3	**JAM:** Introduction to 'Just A Minute speech' and the 'Extempore speech'; Preparation of speech on given topic (different topic for each student); delivery of the speech; Feedback (on content, time management, body language etc. highlighting the positive aspects.)	**2 lab hours**
4	**Listening Comprehension:** Listen to online / downloaded oration by renowned Orators; write down the content in a precise form and give an oral presentation of that write up following all the etiquettes of public speaking.	**2 lab hours**
5	**Academic Language Skills,**Identify ways of emphasizing, signposting, organising, etc used in spoken (academic) English, Read and comprehend authentic English language publications, both print and electronic, such as newspapers, journals, brochures and catalogues, course materials and online blogs.	**2 lab hours**
6	**Turn Coat**: Speaking for and against on a topic by the same person with time specification; topics to assigned from the current events; feedback & suggestions for improvement.	**2 lab hours**
7	**Turn Coat**: Speaking for and against on a topic by the same person with time specification; topics to assigned from the current events; feedback & suggestions for improvement.	**2 lab hours**
8	**Conversation ability:** Characteristics of effective conversation; Listening to a few sample conversations; preparing conversation based on the given situation; enacting the situation through effective delivery of the script; feedback & suggestions for improvement	**2 lab hours**
9	**Role Play:** Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement	**2 lab hours**
10	**Etiquettes and Manners:** Etiquette Basics: Emails and Spoken Words**,** Professional Appearance and Grooming**,** Office Etiquette: Workplace Behaviour	**2 lab hours**
11	**Public Speaking:** Characteristics of effective Public speaking; possible barriers; watching demo online; topic assignment, information gathering & recording; delivery in front of the class; feedback & suggestions for improvement. . (Different topic for each student)	**2 lab hours**
12	**Group Discussion:** Importance and characteristics; Dos & Don'ts in GD; Demo display; assign topic for the group,	**2 lab hours**

	Preparation & performance; feedback & suggestions for improvement.	
13	**Debate**: Difference between Group Discussion & Debating; Watching demo of Debating; Topic for the group of 2 or 4; preparation and performance; feedback & suggestions for improvement	**2 lab hours**
14	**Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.	**3 lab hours**
15	**Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.	**2 lab hours**

Text book [TB]:

Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.

Reference Books

1. Professional Speaking Skills by Aruna Koneru, Oxford Publications, 2015 2. Soft Skills for everyone by Jeff Butterfield Cengage Learning 2011

E Books

1. https://www.britishcouncil.in/english/courses-business 27
2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3. http://www.bbc.co.uk/learningenglish/english/
4. http://www.antimoon.com/how/pronunc-soundsipa.htm
5. http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Projects/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs) Mapping between COs and POs

	Course Outcomes (COs)	Mapped Program Outcomes
CO1	To be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments	**P010, PSO3**
CO2	Understand the correct form of English with proficiency.	**P09, PSO3**
CO3	To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.	**P09, PSO3**
CO4	To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.	**P010, PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Buisness Communication I									3	3					3

1=weakly mapped

2= moderately mapped

ETEL286A	Buisness Communication Skills-II	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To apply business communication theory to solve workplace communication issues.
2. To demonstrate the communication skills required in the workplace.
3. To understand complex ideas in written and spoken formats.
4. To express complex ideas accurately in written and spoken formats.

Course Outcomes

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

CO1. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.
CO2. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.
CO3. To draft effective business correspondence with brevity and clarity.
CO4. To stimulate their Critical thinking by designing and developing clean and lucid writing skills.

Catalog Description

In this course, the focus will be on improving LSRW skills, i.e. listening, speaking, reading and writing. Students will learn how to communicate effectively though prescribed syllabus as well as classroom assignments/activities specifically designed to encourage students to play an active role for enhancing their knowledge and developing learning strategies.

List of Experiments (Indicative)

1	Interpersonal Communication and Building Vocabulary	**2 lab hours**
2	Interpersonal Communication and Building Vocabulary	**2 lab hours**
3	Activities on Reading Comprehension	**2 lab hours**
4	Activities on Reading Comprehension	**2 lab hours**

5	Activities on Writing Skills	**2 lab hours**
6	Activities on Writing Skills	**2 lab hours**
7	Activities on Presentation Skills	**2 lab hours**
8	Activities on Presentation Skills	**2 lab hours**
9	Activities on Group Discussion and Interview Skills	**2 lab hours**
10	Activities on Group Discussion and Interview Skills	**2 lab hours**
11	Conflict Management	**2 lab hours**
12	Conflict Management	**2 lab hours**
13	Leadership Skills	**2 lab hours**
14	Team Building	**3 lab hours**
15	Social Media Engagement	**2 lab hours**

Text book [TB]:

Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.

Reference Books

1. Professional Speaking Skills by Aruna Koneru, Oxford Publications, 2015 2. Soft Skills for everyone by Jeff Butterfield Cengage Learning 2011

E Books

1. https://www.britishcouncil.in/english/courses-business 27
2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3. http://www.bbc.co.uk/learningenglish/english/
4. http://www.antimoon.com/how/pronunc-soundsipa.htm
5. http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Projects/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.	P010, PSO3
CO2	To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.	P09, PSO3
CO3	To draft effective business correspondence with brevity and clarity.	P09, PSO3
CO4	To stimulate their Critical thinking by designing and developing clean and lucid writing skills.	P010, PSO3

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Buisness Communication II									3	3					3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 371A	Quantitative Aptitude Reasoning-I	L	T	P	C
Version 1.0		**-**	**-**	**2**	**1**
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives:

1. To develop critical thinking skills
2. To develop the ability to analyze ideas, question assumptions and assess arguments
3. To clarify and interpret concepts and propositions.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Understand and analyze the costs and benefits associated with various Information Systems projects.

CO2 Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.

CO3 Understand the various reasoning concepts to apply in practical life.

Catalog Description

Quantitative Aptitude Reasoning-I is designed for students who have basic knowledge of simple mathematical calculations and Collegiate Learning skills.

Course Content

Unit I: 10 hours

Numbers, H.C.F. & L.C.M. of Numbers, Decimal Fractions Simplification, Square Roots &

Cube Roots, Whole numbers problems, Permutations and Combination, Decimals problems, Problems on Trains, Fractions problems, Numbers and Ages, Percentage problems.

Unit II: 8 hours

Boats and Streams, Ratio & Proportion, Pipes and Cistern, Square roots, Surds and Indices,

Averages, Interest, Heights and Distances, Profit and Loss, Discount, Partnership.

Unit III: 8 hours

Business, Permutations and Combination, Mixture and Alligation, Time and distance Series,

Time & Work, The Data Interpretation part covers Tabulation, Volume & Surface Areas, Races & Games of Skill, Calendar, Clocks.

Unit IV: 10 hours

Stocks & Shares, Permutations & Combinations, Probability, True Discount, Banker's Discount, Heights & Distances, Odd Man Out & Series, Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graph.

Textbooks:

1. Quantitative Aptitude for Competitive Examination by R S Agrawal, S. Chand publications.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand and analyze the costs and benefits associated with various Information Systems projects.	PO2
CO2	Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.	PO3
CO3	Understand the various reasoning concepts to apply in practical life.	PO4

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 371A	Quantitative Aptitude Reasoning-I		3	2	3									3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 372A	Quantitative Aptitude Reasoning-II	L	T	P	C
Version 1.0		**-**	**-**	**2**	**1**
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives:

1. To develop critical thinking skills
2. To develop the ability to analyze ideas, question assumptions and assess arguments
3. To clarify and interpret concepts and propositions.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Understand and analyze the costs and benefits associated with various Information Systems projects.

CO2 Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.

CO3 Understand the various reasoning concepts to apply in practical life.

Catalog Description

Quantitative Aptitude Reasoning-II is designed for students who have completed Foundations of Mathematical Reasoning and the co-requisite Frameworks for Mathematics and Collegiate Learning

Course Content

Unit I: 10 hours

Verbal Reasoning: General Mental Ability, Series Completion, Analogy, Classification, Coding-

Decoding, Blood Relations, Puzzle Test, Sequential Output Tracing, Direction Sense Test, Logical

Venn Diagrams, Alphabet Test, Alpha - Numeric Sequence Puzzle,
Number.

Unit II: 10 hours

Ranking & Time Sequence Test, Mathematical Operations, Logical Sequence of Words, Arithmetical Reasoning, Inserting the Missing Character, Data Sufficiency, Eligibility Test, Assertion and Reasoning, Situation Reaction Test, Verification of Truth of the Statement.

Unit III: **8 hours**

Logical Deduction, Logic, Statement – Arguments, Statement-Assumptions, Statement - Courses of Action, Statement – Conclusions, Deriving Conclusions from Passages, Theme Detection, Cause and Effect Reasoning.

Unit IV: **12 hours**

Non-Verbal Reasoning: Series Analogy, Classification, Analytical Reasoning, Mirror-Images, Water-Images, Spotting Out the Embedded Figures, Completion of Incomplete Pattern, Figure Matrix, Paper Folding, Paper Cutting, Rule Detection, Grouping of Identical Figures, Cubes and Dice, Dot Situation, Construction of Squares and Triangles, Figure Formation & Analysis.

Textbooks:

1. Quantitative Aptitude for Competitive Examination by R S Agrawal, S. Chand publications.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.

3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and analyze the costs and benefits associated with various Information Systems projects.	**PO2**
CO2	Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.	**PO3**
CO3	Understand the various reasoning concepts to apply in practical life.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 372A	Quantitative Aptitude Reasoning-II		3	2	3									3		

1=weakly mapped

2= moderately mapped

3=strongly mapped