K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING AND TECHNOLOGY

Bachelor of Technology Electrical & Electronics Engineering
B.Tech (EEE)
Program Code: 03

2020-24

Approved in the 23rd Meeting of Academic Council Held on 23 June 2020

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 & Electronics Engineering
B.Tech (EEE)

Program Code: 03

2020-24

Approved in the 23rd Meeting of Academic Council Held on 23 June 2020

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.

Programs 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 in Electrical and Electronics Engineering

This programme enables students to understand the systems of Electrical Machines, Power, Power Electronics & Drives, Microprocessors & Microcontrollers, Digital & Analog Electronics and related areas, etc. An initiative to make the teaching-learning framework better and enhance the student learning outcomes, the school has taken a thoughtful step by introducing the concept of Learning Outcome Based Curriculum Framework (LOCF) and Choice Based Credits System (CBCS) system.

Duration: 4 Years (8 Semesters)

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.

Career Options

For B.Tech (EEE): - Power generation (NTPC, NHPC), Transmission (Power Grid) and Distribution (ABB); Design and Development, Manufacturing, Automation, Production and Maintenance, Operation and Control of any equipment or product which works on electricity (BHEL, ONGC, HPCL, BPCL, ISRO, IOCL, GAIL); Instrumentation Engineering, Communication Engineering and Computer Engineering; Research and Development organizations (CSIR, DRDO, BARC), PSUs, Academics, Defense& Civil Services, etc.

Class Timings

The classes will be held from Monday to Friday from 9.10 am to 4.10 pm.

Scheme of Studies and Syllabi

The scheme of studiesand syllabi of this programme offered by the school is given in the following pages. It is arranged semester wise from 1st to 8th semesters.

For each course, the first line contains; Course Code, Title and Credits (C) of the course. This is followed by the course objectives, course outcome and the syllabus (Unit I to IV), Text book and reference books and modes of evaluation/examination scheme.

Scheme of Studies and Syllabi as per Learning Outcome Based Framework (LOCF) and Choice Based Credit System (CBCS)

SOET	B.Tech (EEE) 2020-2024 (SCHEME OF STUDIES)													
YEAR	ODD SEMESTER								EVEN SEMESTER					
	SN	COURSE CODE	COURSE TITLE				C		SN	COURSE CODE	COURSE TITLE				C
Year	Sno	Course Code	Course Title	L	T	P	C		Sno	Course Code	Course Title	L	T	P	C
FIRST	1	ETMA105A	APPLIED MATHEMATICS-I	3	1	0	4		1	ETMA104A	APPLIED MATHEMATICS-II	3	1	0	4
	2	ETPH109A	ENGINEERING PHYSICS	3	1	0	4		2	ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	1	0	4
	3	ETCH125A	ENVIORMENTAL STUDIES	0	0	0	0		3	ETCH119A	ENGINEERING CHEMISTRY	3	1	0	4
	4	ETCS103A	PROGRAMMING FOR PROBLEM SOLVING	3	1	0	4		4	ETEL101A	COMMUNICATION SKILLS	2	0	0	2
	5	ETME101A	BASICS OF MECHANICAL ENGINEERING	3	1	0	4		5		OPEN ELECTIVE - II	4	0	0	4
	6		OPEN ELECTIVE-I				4		6	ETME155A	ENGINEERING GRAPHICS LAB	0	0	3	1.5
	7	ETPH151A	ENGINEERING PHYSICS LAB	0	0	2	1		7	ETEC151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	0	0	2	1
	8	ETCS153A	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	2	1		8	ETCH159A	ENGINEERING CHEMISTRY LAB	0	0	2	1
	9	ETME151A	BASICS OF MECHANICAL ENGINEERING LAB	0	0	2	1		9	ETEL171A	COMMUNICATION SKILLS LAB	0	0	2	1

									10	ETME157A	WORKSHOP PRACTICE	0	0	2	1.5
	TOTAL			**16**	**4**	**6**	**23**		**TOTAL**			**15**	**3**	**12**	**24**
SECOND	1	ETMA201A	APPLIED MATHEMATICS-III	3	1	0	4		1	ETEC202A	SIGNALS & SYSTEMS	3	1	0	4
	2	ETEC233A	ANALOG ELECTRONICS	3	1	0	4		2	ETEC216A	ADVANCE ANALOG ELECTRONICS	3	1	0	4
	3	ETEC207A	CIRCUITS & SYSTEMS	3	1	0	4		3	ETEE315A	POWER SYSTEM-I	3	1	0	4
	4	ETEC210A	DIGITAL ELECTRONICS	3	1	0	4		4	ETEE206A	ELECTRICAL MACHINES	3	1	0	4
	5	ETEE201A	ELECTROMECHANICAL ENERGY CONVERSION	3	1	0	4		5	ETEC204A	ELECTROMAGNETIC FIELDS THEORY	3	1	0	4
	6	ETEC263A	ANALOG ELECTRONICS LAB	0	0	2	1		6	ETMC226A	FUNDAMENTALS OF MANAGEMENT	3	0	0	3
	7	ETEC253A	CIRCUITS & SYSTEMS LAB	0	0	2	1		7	ETEC264A	ADVANCE ANALOG ELECTRONICS LAB	0	0	2	1
	8	ETEC256A	DIGITAL ELECTRONICS LAB	0	0	2	1		8	ETEE256A	ELECTRICAL MACHINES LAB	0	0	2	1
	9	ETEE251A	ELECTROMECHANICAL ENERGY CONVERSION LAB	0	0	2	1		9	ETEC252A	MATLAB PROJECT LAB	0	0	2	1
	10		ENGINEERING MECHANICS	3	0	0	3								
	TOTAL			**18**	**4**	**8**	**26**		**TOTAL**			**18**	**5**	**6**	**26**

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	ETEC311A	MICROPROCESSOR SYSTEMS	3	1	0	4		1	ETMC123A	BUSINESS APPLICATION OF ECONOMICS	3	0	0	3
	2	ETEC308A	CONTROL SYSTEM	3	1	0	4		2	ETEC314A	DIGITAL SIGNAL PROCESSING	3	1	0	4
	3	ETEC305A	MEASUREMENT & INSTRUMENTATION	3	0	0	3		3	ETEE403A	SWITCHGEAR AND PROTECTION	3	0	0	3
	4	ETEC303A	ANALOG & DIGITAL COMMUNICATION	3	1	0	4		4	ETEE316A	POWER ELECTRONICS	3	1	0	4
	5	ETEE312A	POWER SYSTEM-II	3	1	0	4		5	ETEC320A	IoT ARCHITECTURE AND PROTOCOLS	3	0	0	3
	6	ETEC359A	ANALOG & DIGITAL COMMUNICATION LAB	0	0	2	1		6	ETEC360A	DIGITAL SIGNAL PROCESSING LAB	0	0	2	1
	7	ETEC353A	MICROPROCESSOR SYSTEMS LAB	0	0	2	1		7	ETEE364A	POWER ELECTRONICS LAB	0	0	2	1
	8	ETEC355A	MEASUREMENT & INSTRUMENTATION LAB	0	0	2	1		8	ETEC356A	ELECTRONICS PROJECT DESIGN LAB	0	0	2	1
	9	ETEC358A	CONTROL SYSTEM LAB	0	0	2	1		9	ETEE362A	POWER SYSTEM LAB	0	0	2	1
	10	ETEC311A	MICROPROCESSOR SYSTEMS	3	1	0	4								
	TOTAL			**17**	**4**	**10**	**24**		**TOTAL**			**15**	**2**	**8**	**21**
FOURTH	**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.**														
	1	ETEE401A	RENEWABLE ENERGY SYSTEM	3	1	0	0		1	ETEE422A	SMART ELECTRIC GRID	3	1	0	0
	2	ETEC405A	ARTIFICIAL INTELLIGENCE	3	1	0	4		2	ETEE425A	ELECTRIC & HYBRID VEHICLES	3	1	0	4

3		DEPARTMENTAL ELECTIVE	3	0	0	3	3		DEPARTMENTAL ELECTIVE	3	0	0	3
4	ETEE404A	ELECTRIC DRIVES	3	1	0	4	4	ETEE460A	MAJOR PROJECT	0	0	12	6
5	ETEE452A	POWER SYSTEMS SIMULATION LAB	0	0	2	1							
6	ETEE457A	MINOR PROJECT	0	0	4	2							
7	ETEE463A	PRACTICAL TRAINING-II	0	0	2	1							
TOTAL			**12**	**3**	**10**	**16**	**TOTAL**			**9**	**2**	**12**	**13**

DEPARTMENTAL ELECTIVE													
1	ETEC402A	ROBOTICS	3	-	-	3	8	ETEC416A	RF SIGNALS	3	-	-	3
2	ETEC410A	SATELLITE COMMUNICATION	3	-	-	3	9	ETEC418A	NEURAL NETWORKS & FUZZY LOGIC	3	-	-	3
3	ETEC411A	WIRELESS SENSOR NETWORKS	3	-	-	3	10	ETEC419A	MOBILE COMMUNICATION	3	-	-	3
4	ETEC412A	BIO MEDICAL ELECTRONICS	3	-	-	3	11	ETEC421A	SPEECH AND AUDIO PROCESSING	3	-	-	3
5	ETEC413A	RADAR & SONAR ENGINEERING	3	-	-	3	12	ETEC423A	INTELLIGENT INSTRUMENTATION	3	-	-	3
6	ETEC414A	INTRODUCTION TO NANO TECHNOLOGY	3	-	-	3	13	ETEC424A	ADAPTIVE SIGNAL PROCESSING	3	-	-	3
7	ETEC415A	INTRODUCTION TO MEMS	3	-	-	3	14	ETEC425A	DATA COMMUNICATION NETWORKS	3	-	-	3

TOTAL CREDITS [C]				**173**

SEMESTER I

ETCS103A	PROGRAMMING FOR PROBLEM SOLVING	C
		4

Course Overview:

Computer software plays an important role in our daily lives: Our mobile phones, laptop computers, online banking, Internet applications such as YouTube, video games and movies, cars, and almost all aspects of daily life are touched by software. In your personal and professional life, you will utilize computer software. It is also likely that you will select, or even influence the design of, software that is used in your professional or personal life. This thematic sequence will give you a deep understanding of how software works and is created, its limitations, and its potential. You will be able to read software and therefore be able to make informed decisions when selecting or participating in the design of business, scientific, or information systems that utilize computer software. This is a course in which you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

Objectives and Expected Outcomes:

The student will learn

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

		L	T	P	C
ETCS 103A	**PROGRAMMING FOR PROBLEM SOLVING**	**3**	**1**	**-**	**4**

UNIT I

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/Pseudocode 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- Arithmetic expressions and precedence

UNIT II

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function, Quick sort or Merge sort.

UNIT IV

Structure**:** Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Suggested Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

ETCH 125A	ENVIRONMENTAL STUDIES	C 3

Course Overview:

Everything that surrounds and affects living organisms is environment. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living or biotic components like animals, plants or non-living or abiotic components like soil, air and water etc. It belongs to all, influences all and is important to all.

Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living organisms and materials." Environmental studies are important since it deals with the most mundane problems of life like hygienic living conditions, safe and clean drinking water, fresh air, healthy food and sustainable development.

The syllabus for Environmental Studies includes conventional classroom teaching as well as field work. In this course the teacher simply acts as a catalyst to infer what the student observes or discovers in his/her own environment. Involvement of students in project work is one of the most effective learning tools for environmental issues. This syllabus is beyond the scope of textbook teaching and also the realm of real learning by observing the surroundings. The content of this course provides an overview of introduction to environment, concept of an ecosystem, various renewable and non-renewable resources, how various biodiversity occur and different means to conserve these. This course also includes various types of pollution and environmental policies & practices related with environs. Finally, it also highlights the relationship of human population with environment. The course further integrates to project work such as visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds, and study of simple ecosystems. These studies are as imperative as it forms a unique synergistic tool for comprehensive learning process. This will help students to recognize and appreciate how the technological advancement at global level, exponential growth of human population and their unlimited demands has put the environment at stake and has contaminated the environment worldwide.

Objective and expected Outcome:

The main objective of the course is to create consciousness among the students with the idea about healthy and safe environment. This course is aimed to explain students that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels. These changes need the discussion, concern and recognition at national and international level with respect to formulate protection acts and sustainable developments policies. It can be possible only if every citizen of the nation is environmentally educated and gets involved into this matter at the grass root level to mitigate pollution.

After studying the course, the learners will be able to comprehend and become responsive regarding environmental issues. They 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. This is the only inheritance which every genera of specie passes to their future generation.

ETCH 125A	ENVIRONMENTAL STUDIES	L	T	P	C
		3	-	-	3

UNIT I

Introduction of Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Natural Resources: Renewable and Non-renewable Resources

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

Ecosystems: 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: Levels of 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

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.

Environmental Policies and practices: 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. International agreements: Montreal & Koyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wild life conflicts in Indian context.

UNIT IV

Human Communities and the Environment: 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 environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Field work:

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. Erach Bharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India.

2. Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

REFERENCE BOOKS:

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

2. P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.

3. J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.

ETMA105 A	APPLIED MATHEMATICS - I	C 4

Course Overview:

This course shows the modelling process in the context of matrix, and differential calculus, from a number of areas such as, economics, electric circuits, mechanical systems, fluid flow, and physics. Analytic methods from the elementary theory of differential equations and calculus will be provided to allow for the analysis of the various models being investigated.

Topics to be covered include: Matrices and their types: 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), Diagonalization of a matrix.

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, Maxima and Minima.

Partial Differentiation: Partial differentiation, Euler's theorem on homogeneous functions, Composite functions, Jacobians, Taylor's theorem of two variables and its application to approximate errors, Maxima-Minima for two variables, Lagrange's method of undermined multipliers.

Multiple Integration: Beta and Gamma integrals, Differentiation under integral sign, Double and Triple integrals computation of surface areas and volumes, change of variables in double and triple integrals.

Objectives and expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

1. Explain the fundamental concepts of matrix and differential calculus and their role in modern applied mathematics and real-world contexts.
2. Demonstrate accurate and efficient use of techniques involved in solving partial differentiation.
3. Apply problem-solving using techniques in differential calculus in diverse situations in physics, engineering and other mathematical contexts.
4. Student will able to solve improper integrals and evaluate multiple integrals in various coordinate systems.

ETMA105 A	APPLIED MATHEMATICS - I	L	T	P	C
		3	1	-	4

UNIT I

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), Diagonalization of a matrix.

UNIT II

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

Calculus of several Variables: Partial differentiation, Euler's theorem on homogeneous functions, Composite functions, Jacobians, Taylor's theorem of two variables and its application to approximate errors, Maxima-Minima for two variables, Lagrange's method of undermined multipliers.

UNIT IV

Multiple Integration: Beta and Gamma integrals, Differentiation under integral sign, Double and Triple integrals computation of surface areas and volumes, change of variables in double and triple integrals

TEXT BOOKS:

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETME 101A	BASICS OF MECHANICAL ENGINEERING	C
		4

Course Overview:

This is one of the core subjects that introduces the student 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.

Objectives and expected outcomes:

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

- To analyse, design and improve practical thermal and/or mechanical systems.
- To give students practice in applying their knowledge of mathematics, science, and engineering and to expand this knowledge into the vast area of mechanical engineering.
- To enhance students' ability to design by requiring the solution of open ended problems.
- To prepare the students for higher level courses such as courses in Mechanics of Solids, Thermodynamics, Manufacturing, etc.

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

- Know the basics of machine tool and their material properties.
- Understand the basic concepts of thermodynamics and Refrigeration.
- Get the knowledge of application of hydraulic turbines and pumps in various fields.
- Know various Power Transmission Methods and Devices.
- Understand the concept of Stress & Strain which is useful in various streams of engineering.

ETME 101A	BASICS OF MECHANICAL ENGINEERING	L	T	P	C
		3	1	-	4

Unit I

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, 2^{nd} and 3^{rd} 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

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

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

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.Rajput Lakmi 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:

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.

OPEN ELECTIVE - I	C
	6

There are three open electives offered by other departments / schools in first semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

S.No.	Course Code	Course Title
1	IIIT101	Harnessing the Power of the Web as a Knowledge Device
2	IIIT107	Art of Logic & Programming
3	ETCE101	Fundamentals of Civil Engineering

ETPH109A	ENGINEERING PHYSICS	C 4

Course Overview:

Oscillations play an important role in the macro- and micro-world. Oscillation cannot be just mechanical. So, for instance, one can consider the oscillations of an electric current in an oscillatory circuit or a magnetic field strength in a dynamo, etc. These can be described by an equation similar to the one that defines mechanical displacements from a position of equilibrium. In spite of this fact, mechanical oscillations are mostly analyzed, keeping in mind their applicability to other types of oscillation. Oscillations originating from any source propagate further in space. The propagating oscillations are referred to as waves. Different waves exist, such as mechanical, electromagnetic, and acoustic, depending on what physical value is propagated. Mechanical waves can propagate only in an elastic media. If particle vibrations are agitated in a region of an elastic medium (solid, liquid or gaseous), as a consequence of the interaction among particles, this disturbance is transmitted to surrounding particles, which in turn, distributes excitation further. In this manner, the wave appears.

The physics and mathematics of wave motion underlie many important phenomena. The water wave on the sea, the vibration of a violin string, and the quantum mechanical wave associated with an electron can all be described in a similar way. Light too, often displays properties that are wave-like. We will start the course looking at "ray" optics, but then pause for a general treatment of waves of all types. We will start this waves section by reviewing ideas of oscillations and simple harmonic motion, and go on to look at the physics of travelling and standing waves i.e wave motion. We will apply these ideas to various types of wave, and see how all-pervading this topic is in physics.

Optics is the study of light and its uses. Light has long captured the fascination of humankind like Why should light bend upon entering water? Why does light spread out after passing through a narrow gap? How does light travel to us from the sun, through the void of space? These sorts of questions have ensured that optics has a long and engaging history. So in this lecture course we will look at basic ideas of light propagation, interference and diffraction of light, Polarization, and some of the many uses to which light is put.

Objective and Expected Outcome:

The main objective of this subject is to aware the students about various phenomenon of oscillation, waves and optics. This course first deal with the simple harmonic motion, damped and forced simple harmonic oscillator. It deals with the Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion. This course also deals with the propagation of light and geometric optics, wave optics and lasers.

After the completion of the course, Students will be able to understand the physics behind various phenomenon’s in oscillation, waves and optics. Students can understand various phenomenon and the cause or origin of them. They also can understand the physics behind various optical phenomenon and various natural phenomenon which is happening in their surroundings.

ETPH109A	ENGINEERING PHYSICS	L	T	P	C
		3	1	-	4

Unit-I:

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:

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:

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, Farunhofer 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:

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

(i) Ian G. Main, Oscillations and waves in physics
(ii) H.J. Pain, The physics of vibrations and waves
(iii) E. Hecht, Optics
(iv) A. Ghatak, Optics
(v) O. Svelto, Principles of Lasers

ETPH151A	ENGINEERING PHYSICS	L	T	P	C
		-	-	2	1

Course Overview:

This course gives an experimental understanding of the different phenomena of oscillation, waves and optics which students have encountered in theory course. Without experimental understanding it is very difficult to realize the theoretical concepts. This course contains experiments of oscillation, waves and optics.

Objective and Expected Outcome:

The objective of this course is to make students more familiar with the concepts of various phenomenons of oscillation, waves and optics through hands on experience. After this course students can gain knowledge about how we can find the value of acceleration due to gravity, wave length of a give source of light, refractive index of material of a given prism and specific rotation by the concept of polarization of light.

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.

Suggested Reference 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).
- Indu Prakash, Ramakrishna, A Text Book of Practical Physics (Kitab Mahal, New Delhi).

ETME 151A	BASICS OF MECHANICAL ENGINEERING LAB	C
		1

Course Overview:

This is one of the core lab subjects that introduces the student 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.

Objective and Expected Outcome:

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, Aluminum) 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.
7. To study the constructional features and working of Pelton wheel Turbine, Francis Turbine and Kaplan Turbine, etc.

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

1. Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.
2. Understand concepts of screw jack, friction, law of moments.
3. Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
4. Get the knowledge of various Refrigeration and Air- Conditioning Systems.
5. Know about the working of various turbines and pumps.

LIST OF EXPERIMENTS

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.

5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To verify the law of moments using Bell crank lever.
8. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.
9. To Study Two-Stroke & Four-Stroke Diesel Engines.
10. To Study Two-Stroke & Four-Stroke Petrol Engines.
11. To Study the vapor compression Refrigeration System.

ETCS153A	PROGRAMMING FOR PROBLEM SOLVING LAB	L	T	P	C
		-	-	2	1

Course Overview:

This course emphasizes solving problems using the language, and introduces standard programming techniques like alternation, iteration and recursion. It will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams. This course is enabled the students to formulate algorithms for arithmetic and logical problems, convert these algorithms to C language programs. It also aims on using arrays, pointers and structures to formulate algorithms and programs. In addition to that, apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Objectives and Expected Outcomes:

At the end of the course, the students should be able to:

- To understand the various steps in program development
- To learn the syntax and semantics of C programming language
- To use the structural programming approach in solving the problem.

LIST OF EXPERIMENTS

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series

Lab 5: 1D Array manipulation

Lab 6: Matrix problems, String operations

Lab 7: Simple functions

Lab 8 and 9: Programming for solving Numerical methods problems

Lab 10: Recursive functions

Lab 11: Pointers and structures

Lab 12: File operations

SEMESTER - II

ETMA104A	APPLIED MATHEMATICS - II	L	T	P	C
		3	1	-	4

Course Overview:

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. This course is an introduction to Laplace Transformation, vector calculus, ordinary differential equations and Partial Differential Equations.

Topics includes:

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.

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).

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.

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.

Objectives and expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

1. Concepts & properties of Laplace Transforms
2. Solving differential equations using Laplace transform techniques
3. Determine the solution of a PDE by variable separable method
4. Analyze real world scenarios to recognize when ordinary differential equations (ODEs) or systems of ODEs are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches, judge if the results are reasonable, and then interpret and clearly communicate the results.
5. Identify an ordinary differential equation and classify it by order or linearity
6. Determine whether or not a unique solution to a first-order initial-value problem exists.

UNIT I

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

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

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

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.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETEC101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C
		3	1	-	4

Course Overview:

The course is designed to gain the essential knowledge about electrical circuit elements, DC circuits, AC circuits, magnetism, transformers and electrical machines. The undergraduates are familiarized with the basics of installations required for the protection and wiring. The fundamentals of power converters are part of the course.

Learning objectives:

- To understand the circuit behavior on the DC supply
- To analyze the complex circuits using various theorems to resolve it to a simple circuit.
- To understand the circuit behavior on the AC supply
- Analysis of single-phase ac circuits consisting of combinations(series and parallel) elements
- Working and application of transformer
- To analyze the behavior of electrical machines for the losses, efficiency and other parameters.
- To gain basic insight of inverters and boost converters.
- To get acquainted with components of low voltage switchgear

Expected Outcome:

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

UNIT I

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

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

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

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.

ETCH119A	**Engineering Chemistry**	L	T	P	C
		3	1	0	4

Course Overview

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.

Learning Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their 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.

Expected 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.

Unit I:

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:

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 alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III:

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:

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,Na2SO4-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

ETEL101A	COMMUNICATION SKILLS	L	T	P	C
		4	-	-	4

Course Overview:

The world is shrinking into a global village and therefore, communication skills in English have emerged as a major means of empowerment and human resource development. Many professionals fail to make an impact on the global market as they lack the required communicative competence. The course will augment comprehension skills, enhance vocabulary, and enable to acquire impressive writing skills, assist correspondence with others effectively, aid in understanding the non-verbal cues and enrich skills in spoken English through a variety of teaching techniques. The course will be instrumental in acquiring proficiency both in spoken and oral language.

Objectives and Expected Outcomes

The course will help the learners to focus on communication activities in functional and situational contexts as well as enhance the four language skills of reading, writing, listening and speaking through real-life and professional situations. It will build confidence among the students and encourage them to speak fluently. Through practical learning and delivery, the learners will be able to identify their areas of strengths and weaknesses and improvise their personality and soft skills. The learners will be able to strengthen and broaden their communication skills through various insightful ways.

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.

UNIT I

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication; Literature: A Bird Came Down the Walk by Emily Dickinson

UNIT II

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Types of sentences; Reported Speech; Punctuation; Literature: Stopping by Woods on A Snowy Evening by Robert Frost

UNIT III

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); Literature: The Gift of Magi by O'Henry

UNIT IV

Personality Development: Etiquette & Manners; Leadership; Inter & intra personal skills; Attitude, Self-esteem & Self-reliance; Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques; Literature: My Prayer to Thee by Rabindranath Tagore;

TEXT BOOK:

Kumar, Sanjay and Pushplata. Communication Skills. Oxford University Press.

REFERENCE BOOKS / SITES:

1. Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. Intermediate Grammar, Usage and Composition. Orient Blackswan.

2. Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.

3. "Best Poems", http://100.best-poems.net/. 20 July 2016.

4. "Classic English Short Stories", http://www.eastoftheweb.com/short-stories/Collections/ClasEngl.shtml, 20 July 2016.

OPEN ELECTIVE - II	C
	4

There are three open electives offered by other departments / schools in second semester. The department will permit student to opt one open elective based on choice of student and consent of the course advisor.

S.No.	Course Code	Course Title
1	IIIT104	Understanding The Power of Data
2	IIIT102	Fundamentals of Innovation and Entrepreneurship
3	ETCE12	URBAN Engineering

ETEL 171A	COMMUNICATION SKILLS LAB	L	T	P	C
		-	-	2	1

Communication Skills Lab Activity

Activity 1: Self- introduction: Informal introduction & formal introduction; A detailed write up on formal 'Self Introduction'; Formal Introduction of oneself in front of the group.

Activity 2: News Reading: Introduction to 'online News papers'; Browsing and selecting the preferred Newspaper; Browsing through the News Headlines; Selecting interested News items; Comprehending the content, writing down the essence and reading the News in front of the Group. Discuss 5 to 8 new words or terms, 4 to 5 important personalities of that day's news etc.

Activity 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 first.)

Activity 4: News Discussions: Selecting News of the day, Discussing among the group, prepare the news content and prepare the group opinion about the issue and present it in front of the class by the group involving each member; select 5 new words & new usages from the selected news item

Activity 5: 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.

Activity 6: Role Play: Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement.

Activity 7: 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)

Activity 8: Group Discussion: Importance and characteristics; Dos & Don'ts in GD; Demo display; assign topic for the group, Preparation & performance; feedback & suggestions for improvement.

Activity 9: 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.

Activity 10: .Interview: Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.

ETEC151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C
			-	2	1

Course Overview:

The course is designed to gain the essential knowledge about electrical circuit elements, DC circuits, AC circuits, magnetism, transformers and electrical machines. The undergraduates are familiarized with the basics of installations required for the protection and wiring. The fundamentals of power converters are part of the course.

Learning objectives:

- To understand the circuit behavior on the DC supply
- To analyze the complex circuits using various theorems to resolve it to a simple circuit.
- To understand the circuit behavior on the AC supply
- Analysis of single-phase ac circuits consisting of combinations(series and parallel) elements
- Working and application of transformer
- To analyze the behavior of electrical machines for the losses, efficiency and other parameters.
- To gain basic insight of inverters and boost converters.
- To get acquainted with components of low voltage switchgear

Laboratory Outcomes:

The students are expected to

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters

LIST OF EXPERIMENTS

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.

ETME 158A	ENGINEERING GRAPHICS LAB	L	T	P	C
		-	-	3	1.5

Course Overview:

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.

Objective and Expected Outcome:

Course Objectives: The Basic aim of this subject is to: -

- Increase ability to communicate with people
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions for designing

Course Outcomes: After learning the course the students should be able to: -

- To know and understand the conventions and the method of engineering drawing.
- Interpret engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- To improve their visualization skills so that they can apply these skill in developing new products.
- To improve their technical communication skill in the form of communicative drawings.
- Comprehend the theory of projection.

ETME 158A	ENGINEERING GRAPHICS LAB	L	T	P	C
		-	-	3	1.5

UNIT I

Introduction: Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes, Definitions of 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, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.

Orthographic Projections:

Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.

UNIT II

Orthographic Projections of Plane Surfaces (First Angle Projection Only):

Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only.

UNIT III

Projections of Solids (First Angle Projection Only):

Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

Sections and Development of Lateral Surfaces of Solids:

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

UNIT IV

Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.

TEXT BOOKS:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat

2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, - I.K. International Publishing House Pvt. Ltd., New Delhi, revised edition.

REFERENCE BOOKS:

1. Engineering Graphics - K.R. Gopala Krishna, edition Subash Publishers Bangalore.
2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, -Prentice-Hall of India Pvt. Ltd., New Delhi.

ETME 157A	WORKSHOP PRACTICE	C
		4

Course Overview:

Manufacturing is fundamental to the development of any engineering product. 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 weightage, some lectures and video clips available on different methods of manufacturing are also included.

Objective and Expected Outcome:

Course Objective:

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

- Introduction to different manufacturing methods in different fields of engineering
- Practical exposure to different fabrication techniques
- Creation of simple components using different materials
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

ETME 157 A	WORKSHOP PRACTICE	L	T	P	C
		-	-	3	1.

					5

UNIT I

Materials: Spectrography method for finding composition of materials.

Wood Working Shop: Making of various joints, Pattern making.

UNIT II

Foundry Shop: Bench molding with single piece pattern and two piece pattern. Floor moulding - Making of bend pipe mould etc. Machine moulding - Making of mould using Match-plate pattern. Core making- Making and baking of dry sand cores for placing in horizontal, vertical and hanging positions in the mould cavity

Fitting Shop: Learning use of fitting hand tools, marking tools, marking gauge. Exercises: Jobs made out of MS Flats, making saw - cut filling V-cut taper at the corners, circular cut, fitting square in square, triangle in square.

UNIT III

Welding Shop: Electric Arc Welding, Edge Preparations, Exercises making of various joints. Bead Formation in horizontal, Vertical and Overhead positions.

Gas Welding: Oxy-Acetylene welding and cutting of ferrous metals.

Soldering: Dip soldering.

Brazing: With Oxy-Acetylene gas.

UNIT IV

Sheet Metal Shop: Learning use of sheet-metal tools, Exercises: Making jobs out of GI sheet metal. Cylindrical, Conical and Prismatic shapes. Project Shop: Extrusion of soft metals, Plastic coating of copper wires, Plastic.

SEMESTER III

ETMA 201A	APPLIED MATHEMATICS - III	C
		4

Course Overview:

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.

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.

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.

Functions of Complex Variables: Introduction to complex number, Limit, Continuity and Derivatives of complex functions, Analytic functions, Cauchy-Riemann equations, Harmonic functions, 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.

Objectives and Expected outcomes:

Upon successful completion, students will have the knowledge and skills to:

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

		3	**1**	**-**	**4**

UNIT I

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

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

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

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.

REFERENCES BOOKS:

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

ETEC 233A	ANALOG ELECTRONICS	C
		4

Course Overview:

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.

Objectives and Expected outcomes:

Course Objective:

- 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

Expected Outcome:

- Understand the current voltage characteristics of semiconductor devices.
- Analyze dc circuits and relate ac models of semiconductor devices with their physical Operation.
- Design and analyze of electronic circuits.
- Evaluate frequency response to understand behavior of Electronics circuits.

ETEC 233A	ANALOG ELECTRONICS	L	T	P	C
		3	1	-	4

UNIT I

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

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 $I_{co,}$ V_{BE} &β, Stabilization factors.

UNIT III

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

UNIT IV

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

1. **Text Books:** 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.

ETEC 263A	ANALOG ELECTRONICS LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC233A by performing experiments as given below:

- 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.

ETEC 210A	DIGITAL ELECTRONICS	C 4

Course Overview:

Lectures and 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.

Objectives and Expected outcomes:

Course Objective:

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 OUTCOME:

1. Create the appropriate truth table from a description of a combinational logic function.
2. 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.
3. 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.
4. Describe the operation and timing constraints for latches and registers.
5. 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).
6. Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power
7. Properly incorporate synchronous and asynchronous memories into a circuit design.
8. Discuss how to interface digital circuits with analog components (ADC, DAC, sensors, etc.)

ETEC 210A	DIGITAL ELECTRONICS	L	T	P	C
		3	1	-	4

UNIT – I

Number Systems and Codes: Review of number systems, BCD codes and arithmetic, Gray code, self-complimenting codes, Error detection and correction.

Digital Circuits: Switching algebra & simplification of Boolean expressions, De Morgan's Theorem, Implementation of Boolean expressions (using logic gates)

UNIT – II

Combinational Logic Design: Combinational circuit designing, Minimization Techniques of Boolean functions such as Karnaugh map and Quine-Mc Cluskey methods, Arithmetic circuits, code convertors, multiplexers, demultiplexers, encoders, decoders & comparators. Parity generators and checkers.

Introduction to Sequential Logic: Need for sequential circuits, Binary cell, Latches and different types of Flip-Flop and their Conversions.

UNIT – III

Synchronous Sequential Circuit : Fundamentals of Synchronous sequential circuits, Analysis of Synchronous Sequential circuits, Design of Synchronous and Asynchronous Counters, Shift registers & Ring counters, Timing issues in synchronous circuits.

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.

UNIT – IV

Synchronous Machines: Classification of synchronous machines, Analysis and design of Finite State Machines.

Logic Families: Performance metrics of logic gates, Basic Transistor-Transistor Logic and CMOS logic.

Converters: A/D and D/A converters and their types.

TEXT BOOKS:

1. G.K. Kharate -Digital Electronics, Oxford University Press

2. Aanand Kumar -Fundamentals of Digital Circuits, Prentice Hall of India

REFERENCE BOOKS:

1. Morris Mano, ―Digital design, Prentice Hall of India

2. R.P. Jain- Modern Digital Electronics, Tata Mc Graw Publishers

3. Floyd- Digital Fundamentals, Pearson Publication

ETEC256A	DIGITAL ELECTRONICS LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC256A by performing experiments as given below:

- 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.
- Implementation of the given Boolean function using logic gates in both SOP and POS forms.
- Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
- Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
- Implementation of 4x1 multiplexer using logic gates.
- Implementation of 4-bit parallel adder using 7483 IC.
- Design, and verify the 4-bit synchronous counter.
- Design, and verify the 4-bit asynchronous counter.
- Static and Dynamic Characteristic of NAND and Schmitt-NAND gate(both TTL and MOS)
- Study of Arithmetic Logic Unit

ETEC 207A	CIRCUITS AND SYSTEMS	C
		4

COURSE OVERVIEW:

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 OBJECTIVE:

- 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.
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.
- To synthesize the network using passive elements.

COURSE OUTCOME:

After successful completion of the course student will be able to

- Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation.
- Understand the basic concepts of graph and analyze the basic electrical circuits using graph theory.
- Apply time and frequency concepts of analysis and understand various functions of network and also the stability of network.
- Learn the various parameters and their interrelationship, able to solve numerical with series, cascade, and parallel connection using two port parameters.

ETEC207A	CIRCUITS AND SYSTEMS	L	T	P	C
		3	1	-	4

UNIT I

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

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

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

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

1. Van Valkenburg, “Network analysis” PHI, 2000.
2. F.F.Kuo, “Network Analysis & Synthesis” John Wiley & Sons Inc.

REFERENCE BOOKS:

1. Bhise, Chadda, Kulshreshtha, “Engineering network analysis and filter design” Umesh Publication, 2000.
2. D. R. Choudhary, “Networks and Systems” New Age International, 1999.
3. A. Chakrabarti, "Circuit Theory: Analysis and Synthesis", S. Chand Publications.

4. G.K. Mithal, “Circuit Analysis”, Khanna Publication.

ETEC253A	CIRCUITS AND SYSTEMS LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC207A by performing experiments as given below:

A. Simulation based

- 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

- 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.

ETEE 201A	ELECTRO MECHANICAL ENERGY CONVERSION	L	T	P	C
		3	1	-	4

COURSE OVERVIEW:

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 OBJECTIVE:

To provide a basic background in static and electromechanical energy conversion devices; intended for students with interests in the control of electrical and electromechanical systems with applications to electric energy systems.

COURSE OUTCOMES:

Students who successfully complete this course will have the ability to:

- Analyze transformers in the power conversion circuits.
- Understand and use the theory of electromechanical energy conversion to analyze actuators and simple electric machines.
- Analyze AC machines, including motors and generators.
- Analyze DC machines, including motors and generators.
- Understanding of torque production in motors.

UNIT I

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

UNIT II

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

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

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 Hill
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

ETEE 251A	ELECTRO MECHANICAL ENERGY CONVERSION LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEE201A by performing experiments as given below:

- To obtain magnetization characteristics of a dc shunt generator.
- To obtain load characteristics of a dc shunt generator and component generator (a) Cumulatively compounded (b) Differential Compounded.
- To obtain efficiently of a dc shunt machine using Swinburn's test.
- To perform Hopkinson's test and determine losses and efficiently of dc machine.
- To obtain speed-torque characteristics of a dc shunt motor.
- To obtain speed control of dc separately excited motor using conventional Ward-Leonard/Static Ward-Leonard method.
- To study polarity and ratio test of single phase and 3-phase transformers.
- To obtain efficiently and voltage regulation of a single phase transformer by Sumpner's test.
- To obtain 3-phase to 2-phase conversion by Scott connection.
- To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O.

SEMESTER IV

ETEC 216 A	ADVANCED ANALOG ELECTRONICS	C
		4

COURSE OVERVIEW

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 OBJECTIVE

In this course student will be introduced to multistage amplifier, its designing, hybrid modelling of various amplifiers like RC coupled amplifier etc. Feedback amplifiers and necessary condition for establishing feedback connections, Calculation of impedance of various feedback circuits. Various oscillator circuits like sine oscillator, RC oscillator, crystal oscillator will be studied using hybrid modelling at low and high frequencies. Calculation of resonant frequencies will also be done. For studying large signal amplifiers, powers amplifiers are needed to be taught. Different types of power amplifiers like class A, B, AB and C Push-Pull amplifiers will also be studied. To have regulated power, different types of power supplies are required.

LEARNING OBJECTIVES:

While the students are involved with enjoyable lab experience, the educational pedagogy is pinpointed on vital learning objectives. After the effective finish of the course, learners should be able to recognize the advance analog electronics.

Students will be able to –

- Understand Multi stage amplification and calculation of gain.
- Importance of feedback system.
- Formulate hybrid model for amplifiers.
- Calculation of stability parameters.
- Effect of negative feedback.
- Design an oscillatory circuit.
- Regulation of power supply using diodes and transistors.

ETEC 216 A	ADVANCED ANALOG ELECTRONICS	L	T	P	C
		3	1	-	4

UNIT I

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

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

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

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. A. Dutta, Semiconductor Devices and Circuits, Oxford University Press.

ETEC 305 A	ELECTROMAGNETIC FIELD THEORY	C
		4

COURSE OVERVIEW

To enable the students, to have a fair knowledge about the theory and problems of electro-magnetism and waveguides.

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, 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 system ,to identify , formulate and solve fields and electromagnetic waves propagation problems in a multidisciplinary frame individually or as a member of a group and to provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies.

COURSE OUTCOME

- Ability to solve the problems in different EM fields.
- Ability to design a programming to generate EM waves subjected to the conditions
- Applications of EM Waves in different domains and to find the time average power density
- Ability to Solve Electromagnetic Relation using Maxwell Formulae
- Ability to Solve Electro Static and Magnetic to Static circuits using Basic relations
- Ability to Analyze moving charges on Magnetic fields

Ability to Design circuits using Conductors and Dielectrics.

ETEC 305 A	ELECTROMAGNETIC FIELD THEORY	L	T	P	C
		3	1	-	4

UNIT I

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.

UNIT II

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

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

UNIT-IV

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.

ETEC 301 A	DIGITAL CIRCUIT AND DESIGNING	C 4

COURSE OVERVIEW

Digital circuits are integral parts of many areas of engineering and technology such as personal computers, digital signal processing, telecommunications, and speech analysis and recognition, and control systems. The first half of the course will focus on the analysis and design of combinational and sequential logic circuits. Verilog Hardware Description Language, arithmetic circuits, computer design fundamentals and CMOS and TTL technologies will be covered in the second half of the course.

COURSE OBJECTIVE

Students will try to learn:

- The necessary fundamental knowledge and skill that enable them to understand analyze and design digital circuits in the real world.
- The steps involved in designing a digital logic circuit
- Boolean algebra problem solving skills
- The fundamentals of how a computer works
- Computer hardware development skills
- Ability to interpret existing digital logic circuits
- Knowledge to be able to design your own digital logic circuits
- To simulate and verify your own digital logic circuits

COURSE OUTCOMES

After successful completion of the course student will be able to

- Analyze and design combinational circuits
- Design and optimize simple synchronous sequential circuits
- Understand the fundamentals of the central processing unit (CPU) in a computer.
- Demonstrate knowledge in practical aspects of digital circuits and systems, and their use in more complex systems.
- Demonstrate the understanding of the various hardware realizations of the basic digital circuit elements.
- Demonstrate basic skills in working with computer-aided design tools, including knowing the rudiments of a hardware description language (Verilog)
- Implement simple designs at various levels from discrete components to programmable logic devices.

ETEC 301 A	DIGITAL CIRCUIT AND DESIGNING	L	T	P	C
		3	1	-	4

UNIT - I

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral, dataflow and structural models

UNIT - II

VHDL statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modeling, component declaration, structural layout and generics.

UNIT - III

Combinational & sequential circuit design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT – IV

Design of microcomputer & programmable device: Basic components of a computer, specifications, architecture of a simple microcomputer system, and implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

TEXT BOOKS:

1. "A VHDL Primmer": Bhasker; Prentice Hall.
2. "VHDL-Analysis & Modeling of Digital Systems": Navabi Z; McGraw Hill

REFERENCE BOOKS:

1. "Digital System Design using VHDL": Charles. H.Roth; PWS
2. IEEE Standard VHDL Language Reference Manual
3. Digital Design and Modeling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press.
4. VHDL-IV Edition: Perry; TMH

ETEC 351 A	DIGITAL CIRCUITS DESIGNING LAB	L	T	P	C
		-	-	2	1

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

LIST OF EXPERIMENTS:

ANY FIVE EXPERIMENTS: VHDL

1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
    a. half adder
    b. full adder
3. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
    a. multiplexer
    b. de-multiplexer
4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
    a. decoder
    b. encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated
6. Write a VHDL program for a code converter and check the wave forms and the hardware generated
7. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
8. Write a VHDL program for a counter and check the wave forms and the hardware generated
9. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
    a. register
    b. shift register

ANY FIVE EXPERIMENTS USING: using FPGA (Spartan 3) & CPLD

1. Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
2. Design a parity generator
3. Design a 4 Bit comparator
4. Design a RS & JK Flip flop
5. Design a 4: 1 Multiplexer
6. Design a 4 Bit Up / Down Counter with Loadable Count
7. Design a 3: 8 decoder
8. Design an 8 bit shift register
9. Design an arithmetic unit
10. Implement ADC & DAC interface with FPGA
11. Implement a serial communication interface with FPGA
12. Implement a Telephone keypad interface with FPGA
13. Implement a VGA interface with FPGA
14. Implement a PS2 keypad interface with FPGA
15. Implement a 4 digit seven segment display

ETEC 264A	ADVANCED ANALOG ELECTRONICS LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC233A by performing experiments as given below:

- 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.

ETEC 202 A	SIGNALS & SYSTEMS	C
		4

COURSE OVERVIEW

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.

COURSE OBJECTIVE

The aim of the course is for:

- Understanding the fundamental characteristics of commonly used signals and systems and their properties. At the end of the course the student should be able to describe signals mathematically and understand how to perform operations on signals.
- Development of mathematical skills to solve problems involving convolution and sampling and its reconstruction.
- Understanding sampling theorem, with time domain and frequency domain analysis of discrete time signals with DTFT, DTFT and Z-Transform.
- Understanding the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transform and Laplace transform.
- Introducing students with various methods of inversion of Z-Transform such partial fraction, Long division and C-R method.

COURSE OUTCOMES

After successful completion of the course students will be able to

- Represent and classify various types of signals and systems.
- 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.
- Classify systems based on their properties and determine the response of LTI systems.
- Analyze the system properties based on impulse response and Fourier analysis.
- Apply the Laplace transform and Z-Transform for analyse of continuous time and discrete time signals and systems.
- Understand the process of sampling and the effects of under sampling.

ETEC 202 A	SIGNALS & SYSTEMS	L	T	P	C
		3	1	-	4

UNIT – I

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

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

Z-Transform: Introduction and properties of Z-transform, Methods of Z-inversion: Inverse Z-transform by Partial fraction, long-division method and C-R Theorem, Applications of Z-transform.

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

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

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.

ETEC 309 A	INFORMATION THEORY & CODING	C
		3

COURSE OVERVIEW: The objective of this course to have a basic understanding of various coding techniques and methods to process information which is needed to pursue their engineering degree.

COURSE OBJECTIVE:

The aim of this course is to teach the student Probability and Random Processes, elements of Information Theory and Source Coding, Linear Block Codes, Introduced to error control coding, Types of codes, Maximum Likelihood decoding, Types of errors and error control strategies, Convolutional Codes and ARQ

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to

- Understand representation of random signals.
- Investigate characteristics of random processes.
- Make use of theorems related to random signals.
- To understand propagation of random signals in LTI systems.
- Linear block codes, convolution codes etc.
- Error control strategies.

ETEC 309 A	INFORMATION THEORY & CODING	L	T	P	C
		3	-	-	3

UNIT I

Probability and Random Processes : Probability-Conditional Probability, Baye's Theorem, random variables, Probability distribution and density functions, Joint Statistics, Conditional Statistics, independence, Functions of random variables & random vectors, Expectation, moments, Characteristic Functions, Convergence of a sequence of random variables, Central Limit Theorem, Random Processes, mean and Auto Correlation, Stationary ergodicity, Power Spectral density, Response of memory- less and linear systems, Gaussian Poisson distribution.

UNIT II

Elements of Information Theory and Source Coding: Introduction, information as a measure of uncertainty, Entropy, its properties, discrete memoryless channels, Mutual information, its properties, BSC, BEC. Channel capacity, Shannon's theorem on coding for memoryless noisy channels, Separable binary codes, Shannon–Fano encoding, Noiseless coding, Theorem of decodability, Average length of encoded message, Shanon's binary encoding, Fundamental theorem of discrete noiseless coding, Huffman's minimum redundancy codes.

UNIT III

Linear Block Codes: Introduction to error control coding, Types of codes, Maximum Likelihood decoding, Types of errors and error control strategies, Galois fields, Linear block codes, Error detecting and correcting capabilities of a block code, Hamming code, cyclic code, B.C.H. codes.

UNIT IV

Convolutional Codes and ARQ: Transfer function of a convolutional code, Syndrome decoding, Majority logic decodable codes, Viterbi decoding, distance properties of binary convolutional codes, Burst error correcting convolutional codes, general description of basic ARQ strategies, Hybrid ARQ schemes.

TEXT BOOKS:

1. Papoulis A. "Probability, Random Variables and Stochastic Processes", MGH.
2. R.P .Singh & Saprey, "Communication Systems" TMH Edition-1999.

REFERENCE BOOKS:

1. F. M. Reza, "Information Theory", McGraw Hill.
2. Das, Mullick and Chatterjee, "Digital Communication", Wiley Eastern Ltd.
3. Gray R.M., Davission L.D "Introduction to Statistical Signal Processing Web

ETEC 252A	MATLAB PROJECT LAB	C 1

COURSE OVERVIEW:

The course provides a gentle introduction to the MATLAB computing environment, and is intended for beginning users and those looking for a review. It is designed to give students a basic understanding of MATLAB, including popular toolboxes. The course consists of interactive lectures and sample MATLAB problems given as assignments and discussed in class. No prior programming experience or knowledge of MATLAB is assumed. Concepts covered include basic use, graphical representations and tips for designing and implementing MATLAB code.

COURSE OBJECTIVE:

- On completion of this Subject/Course the student shall be able to
- Familiarize the student in introducing and exploring MATLAB software.
- Enable the student on how to approach for solving Engineering problems using simulation tools.
- Prepare the students to use MATLAB/LABVIEW in their project works.
- Provide a foundation in use of this software for real time applications.

COURSE OUTCOMES:

At the end of the course student will have ability to

- Express programming & simulation for engineering problems.
- Find importance of this software for Lab Experimentation.
- Articulate importance of software's in research by simulation work.
- Have in-depth knowledge of providing virtual instruments on MATLAB
- Environment.
- Write basic mathematical, electrical, electronic problems in MATLAB
- Simulate basic electrical circuit in Simulink.
- Connect programming files with GUI Simulink.

Objectives:

• Understand the MATLAB Desktop, Command window and the Graph Window.

• Be able to do simple and complex calculation using MATLAB.

• Be able to carry out numerical computations and analyses.

• Understand the mathematical concepts upon which numerical methods rely.

• Ensure you can competently use the MATLAB programming environment.

• Understand the tools that are essential in solving engineering problems.

ETEC 252A	MATLAB PROJECT LAB	L	T	P	C
		-	-	2	1

UNIT I

Introduction to MATLAB: Matlab Interactive Sessions, Menus and the toolbar, computing with Matlab, Script files and the Editor Debugger Matlab Help System, commands.

UNIT II

Programming in MATLAB: Introduction, programming with two variables, input and output: user defined input, output options, and functions: syntax, local variables, naming functions M-files, Rules for writing and using function M files.

Statement level control structures: Symbolic Algebra: Symbolic expressions, relational and logical operators, bitwise operations, selection structures, loops in control flow**,** symbolic plotting, simplification of mathematical expressions, operations on symbolic expressions, Equation solving, differentiation and integration, zeros, ones.

UNIT III

Plotting: Introduction, two dimensional plots, basic plotting, line, color and mark style, axes scaling, annotating plots, other types of two dimensional plots, subplots.

Three dimensional plotting: Three dimensional line plots, surface plot, editing plots from menu bar, creating plots from the workspace windows.

UNIT IV

Simulation of signals and systems: Basics operations on signals; Time Shift, Time reversal/Signal folding, Time scaling, Periodic signals and sequences, even and odd signals, decomposition of arbitrary signal decomposition into its even and odd components, Real exponential signals, periodic complex signals, sinusoidal signal,

Discrete time signals: Unit Impulse and Unit Step Functions and Sequences. Basic properties of a system: memory, invertibility, causality, stability, Time invariance, Linearity, Convolution integral

TEXT BOOKS:

1. Jaydeep Chakravorty, “Introduction to MATLAB programming, toolbox and Simulink”
2. Delores M. Etter, David C. Kuncicky, Holly Moore “Introduction to MATLAB 7”, Pearson Publications.

REFERENCE BOOKS:

1. "David F. Griffiths", An introduction to MATLAB
2. "Rudra Pratap", Getting started with MATLAB, Oxford university press.

LIST OF EXPERIMENTS

1. If X=[1,3,4], Y=[4,5,6] perform following operations :

(a) X+Y (b) X*Y' (c) X.*Y

2. Plot the sampling function S_a =sin t/t using MATLAB.

3. One cycle of a periodic waveform is given by: f(x)=cos x, for 0<x<π, and –cos x, for $-\pi < x < 0$.Obtain the average value (DC) of the signal by using mean(.) function in MATLAB.
4. Simulate the operation of a full wave bridge rectifier. Assume a diode drop of 0.6 V per diode.
5. Simulate the operation of a clamping circuit.
6. Evaluate the convolution of any two signals using MATLAB.
7. Sketch using MATLAB, a periodic function given by f(x) =$|sin(x)|$
   for –π <x<π.Determine whether it is odd or even function.

ETMC 226A	FUNDAMENTALS OF MANAGEMENT	C
		3

COURSE OVERVIEW

Technical skills alone do not meet the real world work and the business requirements; they have to be supplemented by management training. In fact, most of the people find that their success depends as much on general management skills and understanding operational systems as on their technical expertise. To become complete professional, students need a firm foundation in these basic managerial skills.

Fundamentals of Management are a basic introductory and foundational management course for under graduates. This course is designed for students to equip themselves with key knowledge, skills and competencies in various aspects of management. This course enables the students to develop an understanding of management and organization and focuses on important management functions such as planning, organizing, leading and controlling for successful managerial activities. The students will learn how successful managers use organizational resources through organizational functions in order to effectively and efficiently achieve organizational objectives.

Specific techniques related to managerial functions are explored as well as the broad issues and trends influence the practice of contemporary management, globalization, technology, diversity, and competitive advantage. Special emphasis is on basics of all the departments in the organization like Human Resource Management, Marketing Management, Productions and Operations Management and Financial Management.

COURSE OBJECTIVE

The objective of this course is for each student to be able to know, comprehend, apply, analyze, synthesize and evaluate the basic fundamentals of managing organizations. Through the learning of this course on fundamentals of management, students will gain fundamental knowledge and skills for management in contemporary organizations. These include the “How to” and “Why”. Students will also develop analytical and critical thinking skills in the context of contemporary organizations. This focuses on the entire organization from both a short term and long term perspective for strategic vision, objectives, crafting a strategy and implementing it.

COURSE OUTCOMES

Specifically the learning objectives for the students are:

- Demonstrate basic knowledge of management and organization.
- Demonstrate a basic understanding of management functions such as planning, organizing, leading and controlling; and how successful managers effectively and efficiently use these functions and their business resources to achieve organizational objectives.
- Develop knowledge of fundamental management concepts and skills.
- Identify the key competencies needed to be an effective manager.
- Identify the most important components of human resource planning; outline a model of organizational staffing; recruitment; selection; orientation; human resource planning and training.

ETMC 226A	FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		3	-	-	3

UNIT I

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions.

Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

UNIT II

Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods.

UNIT III

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

UNIT IV

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

TEXT BOOKS:

1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla. (Kalyani Publishers)
2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

REFERENCE BOOKS:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)
2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).
3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).
4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)

5. Management - James A.F. Stoner & R.Edward Freeman, PHI.

SEMESTER V

ETEC 311 A	MICROPROCESSOR SYSTEMS	C
		4

COURSE OVERVIEW

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.

LEARNING 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 OUTCOME

- Understand the main components and working principals of the Intel 80x86 microprocessor and Intel 80x51 microcontroller
- Program and debug in assembly language
- Understand the memory organization and memory interfacing
- Interface a microprocessor to external input/output devices and perform input/output device programming in assembly
- Understand the hardware and software interrupts and their applications
- Understand the properties and interfacing of the parallel and serial ports.

ETEC 311 A	MICROPROCESSOR SYSTEMS	L	T	P	C
		3	1	-	4

UNIT I:

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:

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:

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. Interfacing and refreshing DRAMS, DRAM Controller – TMS4500.

UNIT IV:

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.

Interrupts and DMA: Interrupt driven I/O. 8086 Interrupt mechanism; interrupt types and interrupt vector table, Intel's 8259, DMA operation, Intel's 8237, Microcomputer video displays.

TEXT BOOKS:

1. D.V.Hall , Microprocessors and Interfacing , McGraw Hill
2. J Uffenbeck , The 8086/8088 family , (PHI).
3. Liu,Gibson , Microcomputer Systems – The 8086/8088 family

REFERENCE BOOKS:

1. B.Ram, “Fundamentals of microprocessors and microcomputer” Dhanpat Rai
2. M. Rafiquzzaman, “Microprocessor Theory and Application” PHI.
3. Naresh Grover, “Microprocessor comprehensive studies Architecture, Programming and Interfacing” Dhanpat Rai
4. Vaneet Singh and Gurmeet Singh, “Microprocessor and Interfacing” Satyaprakashan

ETEC 353 A	MICROPROCESSOR SYSTEMS LAB	C 1

Hands-on experiments related to the course contents ETEC 311A by performing experiments as given below:

List of Experiments using 8086 Micro-processor

ANY TEN EXPERIMENTS SHOULD BE PERFORMED:

1. a) Familiarization with 8086 Trainer Kit.
   b) Familiarization with Digital I/O, ADC and DAC Cards
   c) Familiarization with Turbo Assembler and Debugger S/Ws.
2. Write a program to arrange block of data in
   (i) Ascending
   (ii) descending order
3. Write a program to find out any power of a number such that Z = X .
   Where N is programmable and X is unsigned number.
4. Write a program to generate.
   (i) Sine Waveform (ii) Ramp Waveform (iii) Triangular Waveform Using DAC Card.
5. Write a program to measure frequency/Time period of the following functions.
   (i) Sine Waveform (ii) Square Waveform (iii) Triangular Waveform using ADC Card.
6. Write a program to increase, decrease the speed of a stepper motor and reverse its direction of rotation using stepper motor controller card.
7. Write a programmable delay routine to cause a minimum delay = 2MS and a maximum delay = 20 minutes in the increments of 2 MS
8. a) Use DOS interrupt to read keyboard string/character.
   b) Use BIOS interrupt to send a string/character to printer.
9. Write a program to :
   (i) Create disk file
   (ii) Open, write to and close- a disk file.
   (iii) Open, read from and close a disk file.
   (iv) Reading data stamp of a file using BIOS interrupt.
10. i) Erasing UVPROMs and EEPROMs
    ii) Reprogramming PROMs using computer compatible EPROM Programmer.
11. Studying and Using 8086 In-Circuit Emulator
12. Write a Program to perform 8 Bit addition and subtraction using 8085

ETEC 308 A	CONTROL SYSTEM	C
		4

COURSE OVERVIEW:

This course is designed to provide essential knowledge **t**o give an outline for the analysis of linear control systems. This will provide a student time and frequency domain tools to design and study linear control systems. The various control systems like closed loop and open loop are studied with the help of real time examples. These systems can be represented by the mathematical differential equations advantages to provide the mathematical modelling of physical systems. The transfer function gives the behavior of the output of the system. The various methods of finding the transfer function block diagrams reduction and signal flow graph can be used. The study of AC servo motors, armature controlled and field controlled DC servomotors by deriving their transfer functions has been done in the course. A system can be fully utilized with the proper use of basic control actions- proportional, integral and derivative controllers, with the feedback effect to analyze the transient and steady state response of first and second order systems. A control system designed must be stable and controllable. The stability of the system is the basic necessity for the sustainability of the system, to keep a check on the stability - Routh's Stability criterion, root locus techniques, bode diagram, polar plots and other methods can be used. For studying the output of the system concept of state- state variable and state model with the time invariant and homogeneous state equations are taken for checking the controllability and observability of the system.

COURSE OBJECTIVES:

While the students are involved with a enjoyable lab experience, the educational pedagogy is pinpointed on vital learning objectives. After the effective finish of the course, learners should be able to recognize the basic of control system,.

COURSE OUTCOME:

- Identify open and closed loop control system
- Importance of feedback system.
- Formulate mathematical model for physical systems.
- Simplify representation of complex systems using reduction techniques.
- Use standard test signals to identify performance characteristics of first and second-order systems.
- Apply different techniques for stability analysis.

ETEC 308 A	CONTROL SYSTEM	L	T	P	C

		3	**1**	**-**	**4**

UNIT - I

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

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

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

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. I. J. Nagrath, M. Gopal, "Control System Engineering" New Age International.
2. N. K. Jain, "Automatic Control System Engineering" Dhanpat Rai

REFERENCE BOOKS:

1. Ogata, "Modern Control Engineering" EEE
2. Kuo, "Automatic Control Systems" PHI

ETEC 358 A	CONTROL SYSTEM LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 308A by performing experiments as given below:

Objective: The objective of the course is to study DC and AC motors, lead-lag compensators and different controllers (P, I, PID).

List of experiments:

Any six experiments

1. To study speed Torque characteristics of

a. A.C. servo motor

b. DC servo motor.

2.a. To demonstrate simple motor driven closed loop DC position control system.

b. To study and demonstrate simple closed loop speed control system.

3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.

4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.

5. To optimize Ki, Kp, Kd for best control of temperature.

6. To study behavior of 1 order, 2 order type 0, type 1 system.

7. To study control action of light control device.

8. To study water level control using an industrial PLC.

9. To study motion control of a conveyor belt using industrial PLC

Matlab based (any four expt.)

10. Introduction to MATLAB (Control System Toolbox), Implement at least any FOUR.

i. Different Toolboxes in MATLAB,

ii. Introduction to Control Systems Toolbox.

iii. Determine transpose, inverse values of given matrix.

iv. Plot the pole-zero configuration in s-plane for the given transfer function.

v. Plot unit step response of given transfer function and find peak overshoot, peak time.

vi. Plot unit step response and to find rise time and delay time.

vii. Plot locus of given transfer function, locate closed loop poles for different values of k.

viii. Plot root locus of given transfer function and to find out S, WD, Wn at given root & to discuss stability.

ix. Plot bode plot of given transfer function and find gain and phase margins

x. Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & setup by the course coordinator as per the scope of the syllabus.

ETEC 304 A	ANTENNA AND WAVE PROPAGATION	C
		4

COURSE

OVERVIEW

The purpose of this course is to enable the students to the basics of antennas and various types of antenna arrays and its radiation patterns. The main objective of this subject is to help students to identify the different latest antennas available for specific communication.

COURSE OBJECTIVES

- Introduction to transmission line.
- Practical application of impedance matching.
- Detail study of different types of antennas and their applications.
- Basic of various kinds of wave propagation modes.

COURSE OUTCOMES

- Define various antenna parameters
- Analyze radiation patterns of antennas
- Evaluate antennas for given specifications.
- Illustrate techniques for antenna parameter measurements
- To understand the various applications of antennas
- Discuss radio wave propagation.

ETEC 304 A	ANTENNA AND WAVE PROPAGATION	L	T	P	C
		3	1	-	4

UNIT I

Retarded potential, field of short dipole, Antenna pattern, Antenna parameters: Gain, Directivity, Radiation resistance, Aperture, Beam-width etc., Reciprocity theorem for antennas, Wave equation for radiated fields from current and voltage sources in terms of electric scalar potential and magnetic vector potential, Fields and pattern of an infinitesimal dipole. Definition of various potentials used in antenna theory.

UNIT II

Relation between current distribution and field pattern of an antenna, linear antenna, half wave dipole, loop antenna, Antenna impedance, Directivity, Radiation resistance, Directional properties, Effect of ground on antenna pattern, Input impedance Broad band matching, balloons.

UNIT III

Two element array, broad side, End fired pattern, Beam width pattern multiplication, multi element array and their properties, Synthesis of an array, types of feed, polarization of electromagnetic waves, parabolic feed antenna, conical, helix, log periodic, horn, Microwave antenna, ground waves propagation, Space waves propagation, Effect of Earth, Duct formation, Ionosphere, and sky wave.

UNIT IV

Transmission Lines: The Transmission-line Analogy, Transmission Line equation, characteristic impedance, propagation constant, attenuation and phase constant, computation of primary and secondary constants, line distortion, Loading of line, artificial lines, reflection loss, reflection coefficient, transmission coefficient, efficiency of transmission, generation of standing waves, VSWR, U.H.F. Lines, U.H.F. lines as circuit elements, Smith chart, Quarter wave transformer, single and double stub matching, Practical applications of impedance matching.

TEXT BOOKS:

1. Antennas by J.D. Kraus, TMH.
2. Constantine A. Balanis “Antenna Theory: Analysis and Design”,Wiley India Pvt. Ltd., Constantine A. Balanis

REFERENCE BOOKS:

1. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
2. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
4. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
5. R.E. Crompton, Adaptive Antennas, John Wiley.

ETEC 310 A	LINEAR INTEGRATED CIRCUITS	C 4

COURSE OVERVIEW

This is a course on the design and applications of operational amplifiers(op-amp) and analog integrated circuits.

It introduces basic op-amp principles and show how the op-amp can be used to solve a variety of application problems. Much attention is given to basic op-amp configurations, linear and non-linear applications of op-amp and active filter synthesis, including switched capacitor configurations. It also deals with oscillators, waveform generators and data converters.

COURSE OBJECTIVE

- Students will try to learn:
- The basic principles, configurations and practical limitations of op-amp.
- The various linear and non-linear applications of op-amp
- To analyze and deign op-amp oscillators, single chip oscillators and frequency generators
- To analyze, design and explain the characteristics and applications of active filters, including the switched capacitor filter
- To understand the operation of the most commonly used D/A and A/D converter types and its applications

COURSE OUTCOME

After successful completion of the course student will be able to

- Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve engineering problems
- Develop skills to design simple circuits using OP-AMP.
- Gain knowledge about various multiplier circuits, modulators and demodulators.
- Gain knowledge about PLL.
- Learn about various techniques to develop A/D and D/A convertors and develop skills to develop simple filter circuits and various amplifiers and can solve problems related to it.

ETEC 310 A	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	1	-	4

UNIT I

Operational amplifiers: Ideal and practical operational amplifiers, compensating and non-compensating op-amps, inverting and non-inverting amplifier, differential amplifier, emitter coupled differential amplifier, transfer characteristics of a differential amplifier, offset error: voltage and current, common mode rejection ratio (CMRR), Op-amp Model, op-amp DC & AC parameters, virtual ground, Current mirrors, Active loads, Level shifters and output stages.

UNIT II

Linear applications of operational amplifiers : Differential amplifier,Scale changer, phase shifter, adder, integrator, differentiator , voltage to current converter, current to voltage converter, DC voltage follower, Bridge amplifier, AC coupled amplifier, AC voltage follower, , Peak to peak detector and voltage multiplier circuits.

UNIT III

Non-linear applications of operational amplifiers: Comparators, sample & hold circuits, Logarithmic amplifier, anti-log amplifier, logarithmic multiplier, waveform generators, Astable multi Vibrators, Miller & Bootstrap sweep generators, regenerative comparator (Schmitt Trigger), multi-vibrators, ADC.

UNIT IV

Applications of IC Analog Multiplier&Some Special ICs: IC phase locked loops, IC voltage regulators, IC function generators, Operational trans-conductance amplifier (OTA)-C filters,IC-555 and its applications, Universal Active Filter FLT-U2.

TEXT BOOKS:

1. R. A. Gayakward, "Op-Amps and Linear Integrated Circuit" PHI

2. D. Roy Chaudhary, S. B. Jain, "Linear Integrated Circuits" New Age International.

REFERENCE BOOKS:

1. Sedra Smith, "Microelectronics Circuit" Oxford University Press

2. J. B. Gupta, "Electronic Devices & Circuits" S. K. Kataria

ETEC 303A	ANALOG AND DIGITAL COMMUNICATION	C
		4

COURSE OVERVIEW

The objective of the course is to study Communication Systems in detail by understanding the baseband and band pass modulation.

COURSE OBJECTIVE

In students will analyze and compare different analog modulation schemes for their efficiency and Band width, the behavior of a communication system in presence of noise, investigate pulse modulation system and analyze their system performance and analyze different digital modulation schemes and can compute the bit error performance

COURSE OUTCOMES

- After successful completion of the course student will be able to
- Analyze and compare different analog modulation schemes for their efficiency and
- bandwidth
- Analyze the behavior of a communication system in presence of noise
- Investigate pulsed modulation system and analyze their system performance
- Analyze different digital modulation schemes and can compute the bit error performance
- Aim is to identify the functions of different components
- Learn about theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods It also focuses on pulse modulation and demodulation

ETEC 303A	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	1	-	4

UNIT I

Review of signals and systems, Frequency domain representation of signals, Principles of

Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals, Noise in amplitude modulation systems, Frequency modulation systems. Pre-emphasis and De-emphasis,

UNIT II

Digital Modulation : Introduction to ASK, FSK, PSK(BPSK,QPSK,M-ary PSK), Constellation Diagram, , coherent and non-coherent detection of ASK, FSK, PSK , Probability of bit error for coherently detected BPSK , FSK and comparison of bit error performance for various modulation types, Error performance degradation in communication system.

UNIT III

Baseband Detection: Maximum likelihood receiver structure, matched filters, error performance of binary signaling, inter-symbol interference, Nyquist criterion for zero ISI & raised cosine spectrum, demodulation and detection of shaped pulses, channel characterization, eye pattern, Basis function and Grahm Schmitt Procedure. Matched filter receiver, derivation of its, impulse response and peak pulse signal to noise, correlation detector decision threshold and error probability for binary Unipolar (on – off) signaling.

UNIT - IV

Digital multiplexing : Fundamentals of time division multiplexing, electronic commutator, bit, byte interleaving E1 Carrier system, Synchronization and signaling of E1, TDM, PCM hierarchy.

Spread Spectrum Modulation: Introduction of spread spectrum, direct sequence spread spectrum with coherent BPSK, frequency spread spectrum techniques in CDMA. pseudo noise sequence, signal space dimensionality & processing gain, probability of error.

TEXT BOOKS:

1. B. P. Lathi, "Modern Digital and Analog Communication System" Oxford University Press – 3rd Edition.

REFERENCE BOOKS:

1. Simon Haykin, "Communication Systems" John Wiley & Sons Inc, 4th Edition
2. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition
3. Taub Schilling, "Principles of Communication Systems" TMH, 2nd Edition.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley,1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000

ETEC 359 A	ANALOG AND DIGITAL COMMUNICATION LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 303A by performing experiments as given below

LIST OF EXPERIMENTS

A. Software based

1. Generation of DSB-SC AM signal using balanced modulator.
2. Generation of SSB AM signal.

3. Frequency modulation using voltage controlled oscillator.
4. To generate a FM Signal using Varactor & reactance modulation.
5. Detection of FM Signal using PLL & foster seelay method.
6. Generation & Detection of PAM,PWM, PPM
7. To Study Super heterodyne AM receiver and measurement of receiver parameters viz.sensitivity, selectivity & fidelity.

B. Hardware Based

1. Study of pulse code modulation and demodulation with parity & Hamming code.
2. Study pulse data coding & decoding techniques for various formats.
3. Study of ASK, FSK modulator and demodulator.
4. Study of PSK & QPSK modulator and demodulator.
5. To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
6. To study the circuit of PAM/PWM/PPM modulator & Demodulator.
7. Study of Frequency Division Multiplexing/Demultiplexing with sinusoidal & audio inputs.
8. Study of 4 channel Time Division Multiplexing system.

ETEC 305A	MEASUREMENT & INSTRUMENTATION	C
		4

COURSE OVERVIEW

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 OBJECTIVE

The course objective is to explain different stages of high frequency CRO for the measurement of phase &frequency. The working principle and construction of different types of measuring instruments are discussed. Instruments for measurement of power at R.F, Q factor, voltage, current & other circuit parameters are covered in the course. The course contains digital meter, pulse generators, signal generators, function generators, wave analyzers, distortion analyzers, spectrum analyzer, Harmonic analyzer, FFT analyzer and decade counting Assembly (DCA) for the measurement of frequency and time; and for analyzing the waveforms. Automation is the major contribution of engineering in the today's scenario and transducers play important role in this.

COURSE OUTCOMES

- Identify the various parameters that are measurable in electronic instrumentation.
- Employ appropriate instruments to measure given set of parameters.
- Practice the construction of testing and measuring set up for electronic systems.
- To have a deep understanding about instrumentation concepts that can be applied to Control systems.
- Relate the usage of various instrumentation standards.
- Analyze performance characteristics of system using Frequency response methods.

ETEC 305A	MEASUREMENT & INSTRUMENTATION	L	T	P	C
		3	1	-	4

UNIT I

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, electrodynamometer type, induction type instruments and extension of range of ammeter, voltmeter (shunt and multiplier).

UNIT II

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

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 $10\frac{1}{2}$ bit (very high price concept).

UNIT – IV

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 & Sons

ETEC 355 A	MEASUREMENT & INSTRUMENTATION LAB	L	T	P	C
		-	-	2	1

Hands-on experiment Hands-on experiments related to the course contents ETEC 307A by performing experiments as given below:

Objective: To attain practical knowledge about oscilloscope, different types of transducers, strain gauge etc.

1. Study blocks wise construction of an Analog Oscilloscope & Function generator.
2. Study blocks wise construction of a Multimeter & frequency counter.
3. Study Measurement of different components & parameters like Q of a coil etc using LCRQ meter.
4. Study of distortion factor meter and determination of the % distortion of the given oscillator
5. Determine output characteristics of a LVDT and Measure displacement using LVDT
6. Study characteristics of temperature transducer like Thermocouple, Thermistor & RTD with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
7. Measurement of Strain using Strain Guage.
8. To study differential pressure transducer & signal conditioning of output signal.
9. Measurement of level using capacitive transducer.
10. Study of Distance measurement using ultrasonic transducer.

Note: Any Eight Experiments should perform from above list and two experiments can be suitably chosen on the contemporary topics

ETEC 357A	PRACTICAL TRAINING-I	L	T	P	C
		-	-	-	1

COURSE OBJECTIVE:

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 OUTCOME:

This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared under practical training-I.
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions.

SEMESTER VI

ETEC 401 A	EMBEDDED SYSTEMS	C
		4

COURSE OVERVIEW

This course is designed to provide indispensable knowledge for building efficient, high-value, smart embedded systems that radically transform the way in which people interact with and control their physical world. It is such a technology which imbibes the fusion of hardware and software programming. Embedded systems consist of wide range of devices and sensors that allow information to be collected, shared, and processed in unprecedented ways. Aircraft, cars, household appliances, cellular telephones, consumer wearables and electronics and health monitoring devices all contain microprocessor that are being linked with other information processing devices and hence becomes ubiquitous component of our everyday lives. The landscape of embedded development uses single-chip micro-controllers like 8051, PIC and ARM micro controllers which is the brain of an embedded system.

The overall educational objective of this course is to allow students to discover how the computer interacts with its environment. It will provide hands-on experiences of how an embedded system could be used to solve problems. The focus of this introductory course is to understand, analysis and design.

COURSE OBJECTIVES

In this course student will be introduced to the basics of micro controller, their different types and features**:** The Embedded System Design Process, different types of micro-controllers and application of micro controller and their Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors, protocols: RS-232, I^2C Bus, UART, USB, CAN. In this, the student begins by mastering simple concepts. Once the student truly understands simple concepts, he or she can then embark on the creative process of design, which involves putting the pieces together to create a more complex system. True creativity is needed to solve complex problems using effective combinations of simple components. Embedded systems afford an effective platform to teach new engineers how engineering processes can be applied in the real world.

Although the students are engaged with a fun and rewarding lab experience, the educational pedagogy is centered on fundamental learning objectives. After the successful conclusion of this class, students should be able to understand the basic components of a micro controller, write C language programs that perform I/O functions and implement in Embedded System debugging techniques.

COURSE OUTCOMES

Our goal is for students to learn these concepts:

- Understanding how the computer stores and manipulates data.

- The understanding of embedded systems using modular design and abstraction.
- C programming: considering both function and style.
- The strategic use of memory.
- Debugging and verification using a simulator and on the real microcontroller.
- Use and describe the implementation of a real-time operating system on an embedded computer system.

ETEC 401 A	EMBEDDED SYSTEMS	L	T	P	C
		3	1	-	4

UNIT-I

INTRODUCTION OF MICROCONTROLLER: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton, CISC V/S RISC; micro-controllers memory types; micro-controllers features: clocking, I/O pins, interrupts, timers, and peripherals.

UNIT-II

THE 8051 ARCHITECTURE: Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing,

BASIC ASSEMBLY LANGUAGE PROGRAMMING CONCEPTS: Instruction Set : Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Assembly Language Programming, Programming Tools and Techniques, Programming the 8051.

APPLICATIONS OF MICROCONTROLLER- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors. Protocols: RS-232, I^2C Bus, UART, USB, CAN.

UNIT – III

EMBEDDED SYSTEMS-Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Bus protocols: I^2C bus and CAN bus; Internet-Enabled Systems

EMBEDDED SOFTWARE DEVELOPMENT TOOLS: An approach for SOC Design, System Architecture and Complexity, Host and Target machines, Linker, Locators for Embedded Software, Getting Embedded Software into the Target System; Uses of Target system or its emulator and In-Circuit Emulator , Issues in Embedded System Design: Debugging Techniques, Case Study of an Embedded System for a Smart Card, ACVM

UNIT- IV

INTRODUCTION TO REAL-TIME OPERATING SYSTEMS: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

INTRODUCTION TO MICROCONTROLLERS:

PIC Microcontroller: Introduction to 16F87X, Features, Memory Organizations: Program Memory, Data Memory

ARM Processors: Introduction to ARM processor- processor and memory organization

TEXT BOOKS

- The 8051 Microcontroller and Embedded Systems, M.A. Mazidi and J. G. Mazidi, PHI.
- Embedded Systems, Raj Kamal, TMH.

REFERENCE BOOKS

- Computers and Components, Wayne Wolf, Elseveir.
- Embedding system building blocks, Labrosse, CMP publishers.
- Micro Controllers, Ajay V Deshmukh, TMH.
- Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
- An Embedded Software Primer, David E. Simon, Pearson Education.

ETEC 451 A	EMBEDDED SYSTEMS LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 401A by performing experiments as given below:

Objective: To perform lab experiment on Micro controller, PIC Controller based on PWM scheme.

Micro Controller

1. Write an Assembly language Programme (ALP) to generate 10 kHz square wave.
2. Write an ALP to generate 10 kHz frequency using interrupts.
3. Write an ALP to interface one Microcontroller with other wring serial/parallel communication.
4. Write an ALP for temperature & pressure measurement & to display on intelligent LCD display

PIC Microcontroller

5. Write an ALP for PWM based speed control of stepper motor.
6. Write an ALP for PWM based regulator of voltage.
7. Write an ALP to send/receive the data from an computer to MC through serial communication

General

8. Study of Development tools/environment for Microcontroller Programme.
9. Develop an embedded system for traffic light controller using Micro controller
10. Develop an embedded system for the automatic motion of a car (Model of car) & Subsequent display on LCD using Microcontroller.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed and setup by the course coordinator as per the scope of the syllabus.

ETEC 302A	MICROWAVE ENGINEERING	C
		4

COURSE OVERVIEW

In this the student will be introduced with the basics of microwave devices, microwave measurements and modeling of RF circuits used in communication systems.

COURSE OBJECTIVE

In this course the student will

- Analyse of Waveguides and gain complete knowledge about Microwave Components.
- Design of Impedance Matching and Tuning using lumped and distributed elements for network.
- Analyse and study characteristics of microwave tube Generators and Amplifiers.
- Analyse and study characteristics of microwave Semiconductor of detector, switch, generator and amplifier.

COURSE OUTCOMES

The student will

- Understand various parameters of waveguide and use of component as per applications.
- Able to design impedance matching network for any transmission line or system.
- Able to analyze and find applications and limitations of microwave tube Generators and Amplifiers
- Able to analyze and find applications and limitations of microwave Semiconductor devices.
- Able to find various applications of microwave engineering in specific.
- Appreciate that during analysis/ synthesis of microwave systems, the different mathematical

ETEC 302A	MICROWAVE ENGINEERING	L	T	P	C
		3	1	-	4

UNIT I

Microwave Amplifiers and Oscillators: Introduction to microwave transmission, applications and limitations,Two cavity and Multicavity Klystron amplifiers, Reflex Klystron Oscillators, Magnetron oscillators, TWT amplifiers.

UNIT – II

Microwave Components: Scattering Matrices and its properties, Directional coupler, E&H plane Tee, Magic Tee, Circulators, Isolators, Attenuators and Phase Shifters, Impedance matching techniques

UNIT – III

Microwave devices and measurements: Principles of Microwave transistor and FET, Gunn Oscillators, IMPATT, TRAPATT and BARITT devices, PIN diode and TUNNEL diode, HMT

Microwave Measurements: Power, Frequency, Impedance, VSWR.

UNIT – IV

Design of RF filters: Introduction to RF concepts, Basic filter configurations: LPF, HPF, BPF, BSF, Filter design

RF amplifier design & basic oscillator, mixer model: Characteristics of Amplifier, Types, amplifier power relations, Power gain definitions, Basic oscillator & Mixer model.

TEXT BOOKS:

1. S.Y. Liao, “Microwave Devices” PHI
2. Pozar, “Microwave Engineering” John Wiley.
3. Rizzi, “Microwave Engg. Passive Circuits” PHI.

REFERENCE BOOKS:

1. R. E. Collin, “Foundation of Microwave Engineering” Mc. Graw Hill.
2. Kennedy, “Electronic Communication System” TMH.

ETEC 352 A	MICROWAVE ENGINEERING LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 302A by performing experiments as given below:

List of experiments:

1. Study of wave guide components.
2. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
3. To measure VSWR of unknown load and determine its impedance using a smith chart.
4. Study of characteristics of Gunn oscillator & Gunn diode as modulated source (PIN modulation) and determination of modulation depth.
5. Study of insulation & coupling coefficient of a Magic Tee& coupling coefficient and directivity of a directional coupler
6. Measurement of attenuation of an attenuator and isolation, insertion loss, cross coupling of an circulator.
7. Study of waveguide horn and its radiation pattern and determination of the beam width.
8. To study working of MIC Components like Power Divider, Ring resonator, Filters & Microwave Amplifier
9. Measurement of Guide wavelength (λ_g), free Space wavelength (λ). & Concept of reduction of wavelength due to substrate material
10. Measurement of SWR in a Microwave transmission line.
11. Study of audio & data communication over Microwave bench.
12. Measurement of microwave power using power meter.

ETEC 406A	WIRELESS COMMUNICATION	C
		4

COURSE OVERVIEW

This course provides a comprehensive overview and advanced knowledge of wireless communication systems. Building on the prior knowledge on digital communications, students develop further understanding on the challenges and opportunities brought by the wireless medium in designing current and future wireless communication systems and networks.

COURSE OBJECTIVE

Students will try to learn:

- To deal with the fundamental cellular radio concepts such as frequency reuse and handoff.
- Different types of radio propagation models and predict the large – scale effects of radio propagation in many operating environment.
- To provides idea about analog and digital modulation techniques used in wireless communication.
- To deal with the different types of equalization techniques and diversity concepts.
- Advanced transceiver schemes and second generation and third generation wireless networks
- To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.

COURSE OUTCOME

After successful completion of the course student will be able to

- Apply cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis to design cellular network with given quality of service constraints.
- Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.
- Analyse and design receiver and transmitter diversity techniques.
- Design wireless communication systems with 3G (e.g., CDMA) and 4G (OFDM) technologies.
- Describe and differentiate four generations of wireless standard for cellular networks.

		3	**1**	**-**	**4**

UNIT I

Introduction to Cellular Mobile Systems: Basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.

UNIT II

Elements of Cellular Radio Systems Design and Interference: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems, Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects.

UNIT III

Cell Coverage for Signal & Antenna Structures: General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model – characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation, Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment: Hand off & Dropped Calls: hand off, types of handoff and their characteristics, dropped call rates & their evaluation. Fixed channel
Assignment, non-fixed channel assignment, traffic & channel assignment

UNIT IV

Multiple Access Techniques: FDMA, TDMA, CDMA: Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, CDMA compared with TDMA.

Wireless Systems: GSM, IS-95, mobile management, voice signal processing and coding.

TEXT BOOKS:

1. William, C. Y. Lee, “Mobile Cellular Telecommunications”, McGraw Hill.
2. Theodore S Rappaport, “Wireless Communication Principles and Practice”, Pearson Education.

REFERENCE BOOKS:

1. “Mobile Communication Hand Books”, IEEE Press.
2. Mischa Schwartz, “Mobile Wireless Communications”, Cambridge University Press.

3. Lawrence Harte, “3G Wireless Demystified”, McGraw Hill Publications.
4. Kaveh Pahlavan and Prashant Krishnamurthy”, Principles of Wireless Networks”, PHI.

ETEC320A	IoT ARCHITECTURE AND PROTOCOLS	C
		3

COURSE OVERVIEW

The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations

COURSE OBJECTIVES

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and RealWorld Design Constraints
- To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)

COURSE OUTCOMES:

Student will be able to

- Implement Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art - IoT Architecture.
- Classify Real World IoT Design Constraints, Industrial Automation in IoT.

ETEC320A	IoT ARCHITECTURE AND PROTOCOLS	L	T	P	C
		3	-	-	3

UNIT I

Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs , IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT II

Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT III

Developing IoTs

Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor based application through embedded system platform, Implementing IoT concepts with python

UNIT IV

Challenges in IoT

Design challenges, Development challenges, Security challenges, other challenges

Domain specific applications of IoT

Home automation, Industry applications, Surveillance applications, Other IoT applications

Text Books:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

REFERENCE BOOKS:

1. Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1- 4493- 9357-

ETEC 314 A	DIGITAL SIGNAL PROCESSING	C
		4

COURSE OVERVIEW:

The main objective of this subject is to help the students to mathematically analyze different types of signals and their associated systems.

COURSE OBJECTIVES:

- Linear filtering using DFT and frequency analysis of signals using DFT.
- Introduction to discrete time systems implementation.
- To understand designing of FIR and IIR filters using window method.
- Introduction to design IIR filter in frequency domain.

COURSE OUTCOMES:

- Students will be able to study data compression technique, real time computing and various other newly emerging techniques related to this field.
- Students can implement DSP algorithms on purpose-built hardware such as application specific integrated circuits.
- Learn how to run programs on MATLAB software.
- Applications of DSP include audio signal processing, audio compression, digital image processing, video compression and so on. With good knowledge of this subject, students can work on various real time projects.

ETEC 314 A	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	-	4

UNIT I

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, schur-cohn 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:

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:

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:

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:

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

REFERENCE BOOKS:

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

ETEC 360 A	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		-	-	2	1

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

below:

Perform the experiments using MATLAB:

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

ETMC123A	BUSINESS APPLICATIONS OF ECONOMICS	C
		3

Overview:

"The Quest of knowledge is like searching for pearls in the depth of the ocean"

Anonymous.

The fundamental and unique course of "Business Applications of Economics" would encourage the action learning and value addition to the potential business learners who are enthusiastic and passionate with the thought of working in International behemoths and soon-to-be-Indian behemoths of today. Also, then they need to apprehend about Business Economics jargons which are basically related to various disciplines like Management Accounting, Economics, Basic Finance, and the like. Study of the course on Economics gives practical insight to solve business dilemmas by using its tools for other disciplines.

Business Economics is one of the most important parts of economics. It has both theoretical as well as practical importance in today's business scenario. Different theories of microeconomics help in the study of various business problems which create a major impact on the performance of a firm in complex business world like today. The analysis of its applications has great importance in the fields, such as production, pricing, optimum allocation of resources, social welfare and etc. It provides a critical insight in business decision making and forward planning in addition to make these decisions appropriate enough to maximize the sale and growth of a firm.

To make this course student-friendly, the learning would be anecdotal, personal examples from the eyes of the instructor and including amazing CFOs and it will highlight their new roles in ever-growing and changing business ecosystem in this digital world & sensitizing them of principles of business economics at firm level.

Objective and Expected Outcome:

While going through this course, students would be exposed to business dilemmas as per the course boundaries which will be rationalized with new thinking and tools while delivering the course. Also, this course focuses on recent examples of current market's simulation, merger, disruptive new models of business forms and its impact on new business ecosystem.

Students will appreciate dynamic micro economic principles in action based on the problem of scarcity and choice. Moreover, given uncertain and dynamic environment around us, they need to have a global mind set with Indian ethos and values.

On completion of these unique and over-encompassing principles of business economics, an appropriate acumen will take future managers locally and globally acceptable. Most specifically, this course will make learners-

- To overview various economic tools, theories and principles, the exciting concepts of Marginal Decisions and Incremental Decisions.
- To understand the factors influencing Customer's choice and how their decisions affect the goods market by affecting the demand, the supply and the price.
- To understand the various types of elasticities i.e., demand, price and income as consumer shifts from one market to another, these elasticities show the extent of change in the market conditions which further enhance an insight about the fluctuations in commodity market.
- In a free economy everyone has freedom regarding the consumption and production of goods and services, allocation and mobilization of resources, modes of production and quantity of production. For businessmen, this type of free economy knowledge microeconomics has a great importance.
- Profit maximization and cost minimization are the fundamental goals of a firm which, one can be understood through the dynamics of Cost Analysis & Price Output Decisions, and thereby leading to optimal cost, price decisions with the help of various interesting curves.
- It helps to comprehend with the concepts of market and its various forms which are influenced by the cost, revenue, demand and supply forces.

ETMC123A	BUSINESS APPLICATIONS OF ECONOMICS	L	T	P	C
		3	-	-	3

UNIT I

Promotion of Entrepreneurship: Meaning, definition and functions of an entrepreneur, qualities of a good entrepreneur; Role of Entrepreneur in economic development; Government measures for the promotion of small scale industries with special reference to Haryana; Cultural factors in developing entrepreneurship.

UNIT II

Ownership and Location of Industrial Units: Different forms of Industrial Organisation; Theories of Industrial location; Process of preparing project reports.

Size of Firm and Pricing: Concept of optimum firm, factors determining Optimum size. Technical, Managerial, Marketing Uncertainties and risk.Pricing Methods, Policies and procedures.

UNIT III

Financing of Small Industries: Importance and need : Commercial Banks and term lending in India; Banks and under-writing of capital issues; Brief description about the role of other financial agencies viz; Industrial Finance Corporation of India. State Financial Corporation, Industrial Development Bank of India; Unit Trust of India.

UNIT IV

Problems Faced by Small Enterprises: Problems connected with Marketing, Management of New Products; Power; Finance; Raw Material; Under-utilization of capacity; Causes of under – utilization; Rehabilitation of Sick Mills.

Government and Business

(a) Highlights of Industrial Policy and Licensing Policy.

(b) International Marketing with special reference to export documentation.

TEXT BOOKS:

1. Entrepreneurship of Small Scale Industries – Deshpande Manohar D. (Asian Publishers, New Delhi)
2. Environment and Entrepreneur – Tandon B.C. (Asian Publishers, New Delhi).

REFERENCE BOOKS:

1. The Industrial Economy of India – Kuchhal S.C. (Chaitanya, Allahabad).

ETEC 356A	**ELECTRONIC DESIGN PROJECT LAB**	**C**
		1

COURSE OBJECTIVE

Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems, Embedded systems, Electronic system design employing microcontrollers, PCB design and layout; System assembly considerations. Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.

COURSE OUTCOME

At the end of the course, students will demonstrate the ability to

- Understand the practical issues related to practical implementation of applications using electronic circuits.
- Choose appropriate components, software and hardware platforms.
- Design a Printed Circuit Board, get it made and populate/solder it with components.
- Work as a team with other students to implement an application.
- The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
- It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
- After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
- The student is expected to exert on design, development and testing of the proposed work as per the schedule.
- Art work and Layout should be made using PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
- The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

To create interest in hardware technology and the processes related to the circuit designing.

ETEC356A	ELECTRONICS PROJECT DESIGN LAB	L	T	P	C
		-	-	2	1

1. Introduction & hands on experience to use circuit creation & simulation software like TINAPRO,EAGLE and other software and design circuits For e.g.:
   i. Clipper
   ii. Clamper
   iii. Half Wave Rectifier
   iv. Full Wave Centre tapped Rectifier
   v. RLC resonance circuit
2. Design a circuit for a fixed/regulated power supply.
3. Convert the power supply circuit into PCB & simulates its 2D & 3D view.
4. PCB printing using screen printing or any other technique.
5. Etching of the above PCB.
6. UV exposure & Drilling of PCB.
7. Coating of etched PCB to protect it from oxidation.
8. Fabrication & placing of components as per above power supply circuit.
9. Testing of above circuit.

.

SEMESTER VII

ETCS401A	ARTIFICIAL INTELLIEGENCE	C 4

COURSE OVERVIEW:

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally.

Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines. Our ability to think and act accordingly to situations in the real world appears to be an amazing combination of different skills working in conjunction without us even realizing it. For instance, teaching a child to walk requires effort, but beyond a little help, children learn how to find their balance, walk without falling and avoid any obstacles along the way. However, it seems to take incredible amount of careful planning and execution to create a machine which can do the same on two legs, or for that matter, even four!

We attempt to unravel these special abilities that are crucial in making us appear 'intelligent'. Our innate ability to perceive the environment and create internal representations for it, to be able to process colossal amounts of information systematically, to learn from the environment, and to plan a course of action for getting desired results is what inspires us to build machines capable of performing or surpassing human expertise.

COURSE OBJECTIVES AND EXPECTED OUTCOMES:

The course is oriented toward imparting a clear understanding of the problem-solving processes that we take for-granted. The course begins with an overview of the concept of intelligent agents and the various approaches for building them. The general ideas behind creating a machine that can learn are introduced here.

Next the core idea behind solving problems using search techniques is introduced. We learn how everyday problems can be represented as graph search or local search problems and how they can be tackled. Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed. We notice how exploiting knowledge of the problem & its domain allows us to avoid hunting naively through large search-spaces, thereby increasing efficiency. We develop the idea of deriving heuristic estimates from knowledge about problems and our experience in solving those.

Knowledge representation is another key aspect of dealing with information in the real-world. We study various ways in which facts and rules about the world can be encoded systematically and be used to derive meaningful inferences or answer queries. Logic is introduced as one such mechanism for expressing information. Propositional logic and predicate logic are both covered in detail with emphasis to problem-solving in AI. Reasoning systems based on logic are also discussed here. Logic-based proof techniques can be used to verify claims based on existing knowledge and also derive new inferences by combining incoming facts & rules with existing knowledge. Techniques discussed here are forward-chaining, backward-chaining & resolution. Rule-based Expert systems are a direct application and are covered in detail here.

Real world always entails uncertainty and the concept of uncertainty is introduced. The cause of uncertainty and the ways of incorporating it into our problem-solving techniques is studied in detail. Some of the topics covered

here include, Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks.

As always, we are fascinated by the idea of machines which can teach themselves or can be taught using examples from the environment. We study various learning paradigms here. The idea of supervised, unsupervised and reinforcement learning is covered. The course concludes with a discussion about the applications of AI across various domains. Specific examples of AI can be studied from domains like Robotics, Natural Language Processing, medicine, transport, security etc.

The course is expected to introduce the students to the challenges involved in designing intelligent systems and allow them to gain a thorough insight into the underlying components of such systems. The student will learn about the potential of this exciting field and explore various present-day applications of AI as it expands rapidly from specialized applications with limited scope to ubiquitous applications running our phones, homes, vehicles and so much more

ETEC405A	ARTIFICIAL INTELLIEGENCE	L	T	P	C
		3	1	-	4

UNIT I

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction.

Problem Solving (Blind): State space search; production systems, search space control; depth-first, breadth-first search.

Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction.

UNIT II

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems.

Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency.

UNIT III

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors.

Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

UNIT IV

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

TEXT BOOKS:

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

REFERENCES BOOKS:

1. Artificial Intelligence, P. H. Winston,Pearson Education.

2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.

3. Principles of AI, N. J. Nilsson, Narosa Publishing House.

ETEC 455A	ARTIFICIAL INTELLIEGENCE LAB	L	T	P	C
		-	-	2	1

COURSE OVERVIEW:

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

COURSE OBJECTIVES AND EXPECTED OUTCOMES:

Upon a successful completion of this course students should be able to:

- Demonstrate working knowledge in Prolog in order to write simple Prolog programs
- Understand different types of AI agents Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)
- Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving
- Know how to build simple knowledge-based systems
- Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

LIST OF EXPERIMENTS

Write the following programs using PROLOG.

- Write a program to solve 8-queens problem.
- Solve any problem using depth first search.
- Solve any problem using best first search.
- Solve 8-puzzle problem using best first search
- Solve Robot (traversal) problem using means End Analysis.
- Solve traveling salesman problem.

ETEC 404A	OPTICAL COMMUNICATION	C
		4

COURSE OVERVIEW:

This course is to introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system.

COURSE OBJECTIVE

The student will recall basic laws of optical physics and studies various modes of operation of optical fibers and identifies the various causes for signal degradation. Understanding the difference between single mode and multimode fiber and where the two are appropriate in a real-world system. Calculation of various types of losses occurring in transmission of signals and predicting a pulse (or a bit) propagates in optical fiber and is influenced by dispersion. The student will understand and categorize the types of sources of light on basis of physical construction and principle of operation. He also gets to know about the conversion of light energy to electrical energy and classify the optical detectors on basis of ability to efficiently detect and hence convert electrical energy into light energy and the various phenomenon involved in the conversion of electrical energy into light energy. The student will be explained the operation of optical receiver and identifies the various effects of losses in the system and evaluation of the performance of digital receiver. Generations of various types of optical fibers from first generation to next generation fibers and their development is also studied.

COURSE OUTCOMES:

- Distinguish Step Index, Graded index fibers and compute mode number of a fiber.
- Explain the Transmission Characteristics of fiber.
- Losses and attenuation in fiber.
- Classify the construction and characteristics of optical sources and detectors.
- Future optical fibers

ETEC 404A	OPTICAL COMMUNICATION	L	T	P	C
		3	1	-	4

UNIT I

Introduction: Electromagnetic spectrum used for optical communication, Optical Communication System, Advantage of Optical Communication System, Basics of transmission of light rays.

Propagation in Dielectric Waveguides: Introduction, Optical fibers structures and their types, Step-index Fibers, Graded Index Fibers, Modes & Rays, Wave Guides.

UNIT II

Wave Propagation: Wave Propagation in Step-Index & Graded Index Fiber, Overall Fiber Dispersion-Single Mode Fibers, Multimode Fibers, Dispersion-Shifted Fiber, Dispersion, Flattened Fiber, Polarization.

Attenuation in Optical Fibers: Introduction, Absorption, Scattering, Very Low Loss Materials, All Plastic & Polymer-Clad-Silica Fibers.

UNIT III

Optical Sources:

LED: Light emitting diode: recombination processes, spectrum of recombination radiation, LED characteristics, internal quantum efficiency, external quantum efficiency, LED structure, lens coupling to fiber, behavior at high frequencies.

LASER: Basic principles of laser action in semi -conductors, optical gain, lasing threshold, laser structures and characteristics, laser to fiber coupling, comparison with LED source.

UNIT – IV

Avalanche and PIN photo detectors: Principles of optical detection, quantum efficiency, responsivity, general principles of PIN photo detector, intrinsic absorption, materials and designs for PIN photodiodes, impulse and frequency response of PIN photodiodes, noise in PIN Photodiodes, multiplication process, APD Design, APD bandwidth, APD noise.

Optical Fiber Communication System: Telecommunication, Local Distribution Series, Digital Optical Fiber Communication System-First Generation, Future System.

Applications-Military Applications, Civil, Consumer & Industrial Applications.

TEXT BOOKS:

1. John Senior “Optical Fiber Communication”, PHI

REFERENCE BOOK:

1. Keiser, “Optical Fiber Communication” Mc. Graw Hill
2. J. Gowar, “Optical Communication System” PHI.
3. Optical fiber Communication: Selvarajan, Kar, Srinivas; TMH.

ETEC 452A	OPTICAL COMMUNICATION LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 404A by performing experiments as given below:

List of Experiments:

1. To determine the numerical aperture and attenuation loss for a given optical fiber cable.
2. To measure
    a) Mode field diameter of a single mode fiber.
    b) NA of a multimode fiber.
    c) Dispersion of optical fiber.
3. To study the mode characteristics of single mode fiber.
4. To measure attenuation characteristics of an optical fiber.
    a) Propagation Loss.
    b) Bending Loss.
5. To study Light Coupling to Multimode Graded Index Fibers.
6. To study the characteristics of LED and photodiode.
7. To study the connectors, couplers and splices.
8. To set up of voice link on Optical communication Link.
9. To set up Analog/ Digital Optical communication Link.

ETEC 413A	RADAR & SONAR ENGINEERING	C
		3

COURSE OVERVIEW

This course is to make the students understand the basic concept in the field of Radar and Sonar. Students are taught about different types of Radar Systems.

COURSE OBJECTIVE

- The student learns the fundamentals of physical acoustics and sonar, basic radar principles, and modern navigation systems and general propagation phenomena.
- Students will understand electromagnetic and acoustic wave propagation theory as applied to radar and sonar systems.
- Students will have the ability to develop mathematical and signal processing tools needed to analyze radar and sonar data.

COURSE OUTCOMES

- Use of physical acoustics, electromagnetics, wireless communications, and mathematics to understand fundamentals of radar, sonar, and navigation systems.
- Develop the ability to understand and design basic sonar, radar, and navigation systems
- Understand operating principles of basic radar and sonar systems.
- Apply detection and estimation theory to radar and sonar problems.
- Apply target and noise models.
- Perform Doppler processing.
- Understand the differences and be able to apply passive and active processing.
- Understand array beamforming.
- Ability to write succinct, accurate and complete technical reports.

ETEC 413A	RADAR & SONAR ENGINEERING	L	T	P	C
		3	-	-	3

UNIT –I

Introduction to Radar: Radar Block Diagram & operation, Radar Frequencies, Radar development, Application of Radar.

Radar Equation: Simple form of Radar Equation, Prediction of Range performance, Minimum detectable signal, Receiver noise, Signal to Noise ratio, Transmitter Power, Pulse repetition frequency & range ambiguities, System losses, Propagation effects**.**

UNIT - II

CW & Frequency Modulated Radar: The Doppler Effect, CW Radar, Frequency-modulated CW Radar, Multiple Frequency CW Radar.

MTI & Pulse Doppler Radar: Introduction, Delay Line Cancellors, Multiple or staggered, Pulse repetition frequencies, range-Gated Doppler Filters, Digital Signal Processing, Other MTI delay line, Limitation of MTI performance, Non coherent MTI, Pulse Doppler Radar, MTI from a moving platform.

UNIT - III

Tracking Radar: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range, Acquisition.

UNIT – IV

Receivers, Displays & Duplexers: Radar Receivers, Noise Figure, Mixer, Low-noise Front ends, Displays, Duplexer, Receiver protectors.

Introduction to Sonar : Introduction to naval weapon engineering, Transmission Loss, Range Effect, Concept of cylindrical spreading, Types of losses, SVP, Ray tracing, concept of best depth, convergence zone familiarization, figure of merit. ASW systems, passive sonar systems, VDS, TASS, Sonobuoys, Bi-Static Sonar, Non-Acoustic Detection, Magnetic Anomaly Detection (MAD)

TEXT BOOK:

1. Introduction to Radar Systems: Merrill I. Skolnik, ; MGH

REFERENCE BOOK:

1. Electronic Communication Systems: Kennedy; TMH

ETEC 414 A	INTRODUCTION TO NANOTECHNOLOGY	C
		3

COURSE OVERVIEW

This is an essential course for undergraduates in the engineering program. The purpose of this course is to explain emerging needs in nanotechnology environment, health, safety and incorporate them into basic education that can be immediately employed in industry. Students are introduced to various opportunities in the emerging field of Nano Electronics and Nano Technologies.

COURSE OBJECTIVE

- Introduction to modern electronics and its trends towards Nano electronics.
- Pattern formation methods in Nano electronics.
- Basics of low dimensional systems and their use as NANO SCALE SENSORS and Actuators
- Introduction to various newly emerged Nano structures and applications
- Basics of future integrated circuits like quantum computing using super conductors.

COURSE OUTCOMES

- Understand working of single electron devices which have great advantages and are used in various supersensitive electrometers and computers.
- Student will develop the skills needed to excel and be able to work in one of the fastest growing occupations. By studying a specific program in the field students will be able to apply to jobs all over the world. Studying materials science and nanotechnology can lead to an international career, as it is a key aspect of most companies the world over.

		L	T	P	C
ETEC 414 A	INTRODUCTION TO NANOTECHNOLOGY	3	-	-	3

UNIT I

Introduction to Modern Electronics and its Trends towards Nano electronics: International Technology roadmap characteristics: New Concepts in Electronics, From Microelectronics Towards Nano electronics.

Basic Concepts of Electromagnetic waves and Quantum Mechanics: Electromagnetic Waves and Maxwell's Equations, Duality of Electron, Schrodinger Equation, Eigenvalue Problem and Electron in Quantum Well, Electrons in Multiple Quantum Wells, Super lattices, Artificial Atoms, Quantum Dots, Molecules, Energy Level Splitting, Chemical Bonds, Optical Transitions and Lasers.

UNIT II

Pattern Formation in Nano electronics: High – Resolution Lithography, Dip-Pin Lithography, And NEMS: Nano-Electro-Mechanical Systems, Self-Assembly Structures: Chemically – Directed Self-Assembly, Surface-Layer Proteins in Nanolithography.

UNIT III

Traditional Low-Dimensional Systems: Quantum Wells, Cascade Lasers and Other Quantum-Well Devices, Quantum Wires, Quantum Dots and Quantum Dot Molecules, Quantum – Dot – Based Cellular Automata, Coulomb Effects: Single Electron Devices, Nanoscale Sensors and Actuators.

UNIT IV

Newly Emerged Nanostructures and Applications: Applications of Inorganic-Organic Hetero structures, Quantum Dots Embedded in Organic Matrix: Organic Light Emitting Diodes, Quantum Wire Interconnects: DNA Computing, Carbons Nanotubes for Data Processing, Molecular Electronics Materials and Biomolecules, Future Integrated Circuits: Quantum Computing using super conductors.

TEXT BOOKS:

1. C. P. Poole and F. J. Owens, "Introduction to Nanotechnology", John Wiley & Sons.
2. M. A. Ratner and D. Ratner, "Nanotechnology: A gentle introduction to the next big Idea", PHI.

REFERENCE BOOKS:

1. Rainer Waser, "Nanoelectronics and INformation Technology: Advanced Electronic Materials and Novel Devices", John Wiley & sons.
2. Jurgen Schulte, "Nanotechnology: Global Strategies, Industry Trends and Applications", John Wiley.
3. Luryi, Jimmy Xu, Alex Zaslavsky, "Future trends in Microelectronics: The Nano Millenium", John Wiley.
4. S. E. Lyshevski, "Nano and Micro Electromechanical Systems Fundamentals of Nano and Micro-ENgineering", 2nd Edition, CRC Press.

ETEC 457A	MINOR PROJECT	C

		2

The object of Minor Project Work is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department at the end of semester.

ETEC 463A	PRACTICAL TRAINING-II	L	T	P	C
		-	-	2	1

COURSE OBJECTIVE:

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 OUTCOME:

This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared under practical training-I.
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions.

SEMESTER VIII

ETEC 403A	DIGITAL IMAGE PROCESSING	C
		4

COURSE

OVERVIEW

The objective of this course is to introduce the basic concept and methodologies for digital image processing. Digital image processing, as a computer-based technology, carries out automatic processing, manipulation and interpretation of visual information, and it plays an increasingly important role in many aspects of our daily life, as well as in a wide variety of disciplines and fields in science and technology.

COURSE OBJECTIVES

- Introduction to various digital image fundamentals.
- Methods to enhance image in spatial domain.
- Methods to enhance image in frequency domain.
- Model for image restoration.
- Image compression standards and models.
- Introduction to morphology and basic morphological algorithms.
- Patterns and classes to recognize objects.

COURSE OUTCOMES

- Student will be able to generate and storing of the image data in numerous fields like education, medical, agriculture, military etc. These data need to be identified and sorted in a proper way so as to access, use and interpret them easily for which image processing is require.
- There are various other fields related to this subject like signal processing, biological vision, machine learning, and artificial intelligence and so on. With good knowledge of this subject students can go for various job opportunities.
- Apply knowledge in various fields such as 3 –D Robotics, remote sensing, medical diagnosis and industrial inspection. One such example is computerized photography (e.g., Photoshop).

ETEC 403A	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	1	-	4

UNIT I

Introduction of Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships: Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT II

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering.

Image Restoration: A model of The Image Degradation or Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Dedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

UNIT III Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

UNIT IV

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods

TEXT BOOKS:

1. Rafael C. Gonzalez & Richard E. Woods, “Digital Image Processing”, Pearson Education.
2. A.K. Jain, “Fundamental of Digital Image Processing”, PHI.

REFERENCE BOOKS:

1. Bernd Jahne, “Digital Image Processing”, Springer.
2. William K Pratt, “Digital Image Processing: Piks Inside”, John Wiley & Sons.

ETEC 453A	DIGITAL IMAGE PROCESSING LAB	L	T	P	C
		-	-	2	1

Hands-on experiments related to the course contents ETEC 403A by performing experiments as given below:

Experiments:

1. Point processing in spatial domain
a) Negation of an image
b) Thresholding an image
c) Contrast stretching of an image
2. Bit Plane Slicing
3. Histogram Equalization
4. Histogram Specification
5. Zooming by interpolation and replication
6. Filtering in spatial domain
   a) Low pass filtering
   b) High pass filtering
   c) Median filtering
7. Edge Detection using derivative filter mask
   a) Prewitt
   b) Sobel
   c) Laplacian
8. Data compression using Huffman coding
9. Filtering in frequency domain
   a) Low pass filter
   b) High pass filter
10. Hadamard transform

ETEC 460A	MAJOR PROJECT	C
		6

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

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

- In depth study of the topic assigned in the light of the Report prepared under minor project.
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.

ETEC 306 A	VLSI DESIGN	C
		4

COURSE OVERVIEW

To introduce the technology, design concepts, electrical properties and fabrication of Very Large Scale Integrated circuits.

COURSE OBJECTIVE

- To understand the fabrication process of CMOS technology
- To teach fundamentals of VLSI circuit design and implementation using circuit simulators and layout editors.
- To study various problems due to VLSI technology advancement.
- To study digital circuits using various logic methods and their limitations.
- To highlight the circuit design issues in the context of VLSI technology

COURSE OUTCOMES

- Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
- Design MOSFET based logic circuit
- Draw layout of a given logic circuit
- Realize logic circuits with different design styles
- Demonstrate an understanding of working principle of operation of different types of memories
- Demonstrate an understanding of working principles of clocking, power reduction and distribution.

ETEC 306 A	VLSI DESIGN	L	T	P	C
		3	1	-	4

UNIT - I

MOS Technology: Evolution of VLSI, MOS transistor theory, MOS structure, enhancement & depletion transistor, Threshold voltage, MOS device design equations, fabrication of NMOS, CMOS and Bi-CMOS devices. Equivalent circuit for MOSFET and CMOS.

UNIT - II

MOS Transistor Theory : MOS device design equations, MOS transistor, Evaluation aspects of MOS transistor, threshold voltage, MOS transistor trans-conductance & output conductance, figure of merit, determination of pull-up to pull down ratio for an n-MOS inverter driven by another n-MOS inverter & by one or more pass transistor, alternative forms of pull-up, CMOS and Bi-CMOS-inverters. Latch up in CMOS circuitry and Bi-CMOS, Latch up susceptibility.

UNIT –III

Basic Physical Design of Simple Logic Gates: Design using n-MOS, p-MOS and CMOS, CMOS logic gate design considerations, CMOS logic structures, clocking strategies**.** Types of logics: Clocked CMOS logic, pass transistor logic, domino, zipper CMOS, CMOS complimentary logic, Pseudo NMOS logic.

UNIT – IV

VLSI Fabrication : Crystal Growth, wafer preparation, epitaxial layer,oxidation , lithography, etching, diffusion ,dielectric and poly-silicon film deposition , ion implantation , yield and reliability , metallization.

TEXT BOOKS:

1. S. M. Kang, Y. Lebiebici, “CMOS digital integrated circuits analysis & design” TMH.

2. Weste and Eshrighian, “Principle of CMOS VLSI Design” Pearson Education.

REFERENCE BOOKS:

1. R. J. Baker, H.W. Li, D. E. Boyce, “CMOS Circuit Design, Layout and Simulation” PHI.
2. J. M. Rabaey, “Digital Integrated Circuits” PHI
3. W. Wolf Pearson, “Modern VLSI Design Systems on Silicon” Pearson Education
4. J. P. Vyenmura, “Introduction to VLSI Circuits and Systems” John Wiley
5. Pucknell, “Basic VLSI design: principles and applications” Prentice-Hall

		4

COURSE OVERVIEW

The subject of computer networking is enormously complex, involving many concepts, protocols, and technologies. To cope with the scope and complexity these protocols and technologies are woven together in an intricate manner in what is called the layered protocol stack (or suite).

COURSE OBJECTIVE

In this student will be introduced to

- OSI Model
- Various network layers, TCP/IP, functions of each protocol
- Email – SMTP, POP,IMAP; FTP, HTTP , Firewalls, Proxy Servers
- Multiple access protocols, IEEE standard 802 for LANS and MANS, high-speed LANs
- Wireless transmission, the telephone system, narrowband ISDN, broadband ISDN

COURSE OUTCOMES

At the end of this course students will demonstrate the ability to:

- Understand the concepts of networking thoroughly.
- Design a network for a particular application.
- Analyze the performance of the network.