ENGINEERING MATHEMATICS-III

EEE 211	**Credits : 3**
Instruction : 3 Periods Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Course Outcomes:

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

CO1: Explain the characteristics of scalar and vector valued functions and provide a physical interpretation of the gradient, divergence, curl and related concepts.
CO2: Transform line integral to surface integral, surface to volume integral and vice versa using Green's theorem, Stoke's theorem and Gauss's divergence theorem.
CO3: Explain analytical methods for solving pdes like applying Separation of Variables to solve elementary problems in linear second order Partial Differential Equations (heat and wave equations)..
CO4: Understand the need for a function or its approximation as an infinite Fourier series to represent discontinuous function which occurs in signal processing and electrical circuits
CO5: Find different Fourier transforms of non-periodic functions and also use them to evaluate boundary value problems

Program Matrix

COs	**Program Outcomes (POs)**												**PSOs**	
	Domain Specific POs					**Domain Independent POs**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	0	0	0	3	0	0	0	0	1	2	2
CO2	3	0	0	0	0	0	3	0	0	0	0	1	2	2
CO3	3	0	0	0	0	0	3	0	0	0	0	1	3	2
CO4	3	0	0	0	0	0	3	0	0	0	0	1	3	2
CO5	3	0	0	0	0	0	3	0	0	0	0	1	3	2

UNIT-I: VECTOR DIFFERENTIATION **[12 Lectures]**

Scalar and vector point functions – Del applied to scalar point functions: Gradient, directional derivative - Del applied to vector point functions - Physical interpretation of divergence and curl - Del applied twice to point functions - Del applied to products of point functions.

Sections: 8.4, 8.5, 8.6, 8.7, 8.8 and 8.9.

UNIT-II: VECTOR INTEGRATION **[12 Lectures]**

Integration of vectors – Line integral ,Circulation, work done– Surfaces integral ,flux – Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorems (all theorems without proofs) – Irrotational and Solenoidal fields.

Sections: 8.10, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16 and 8.18.

UNIT-III:

PARTIAL DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS [12 Lectures]

Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of the first order (Lagrange's linear equations) ;

Applications: Method of separation of variables – Vibrations of a stretched string: Wave equation - One dimensional heat flow equation ($\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

Sections: 17.1, 17.2, 17.4, 17.5, 17.8, 17.9, 17.10, 17.11, 18.2, 18.4 and 18.5.

UNIT – IV: FOURIER SERIES [12 Lectures]

Introduction – Euler's formulae – Conditions for a Fourier expansion – Functions having points of discontinuity – Change of interval – Even and odd functions – Half range series - Parseval's formula.

Sections:10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7 and 10.9 .

UNIT – V: FOURIER TRANSFORMS [12 Lectures]

Introduction – Definition – Fourier integral theorem(without proof) - Fourier sine and cosine integrals – Fourier transforms – Properties of Fourier transforms – Convolution theorem - Parseval's identity for fourier transforms - Relation between Fourier and Laplace transforms - Fourier transforms of the derivatives of a function - Applications of transforms to boundary value problems.

Sections: 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9 and 22.11.

Textbook:

1.B. S. Grewal, "*Higher Engineering Mathematics*", 43rd edition, Khanna publishers, 2017.

Reference Books:

1. N P. Bali and Manish Goyal, "A text book of Engineering mathematics" ,Laxmi publications, latest edition.
2. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons, 2011.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3rd edition , Alpha Science International Ltd., 2002.
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13th edition , Pearson Publishers.

ENGINEERING MECHANICS & STRENGTH OF MATERIALS	
EEE 212	**Credits : 3**
Instruction : 2 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Course Outcomes: Students will be able to:

CO1: Evaluate the forces in concurrent and coplanar force systems, using various principles and also under different conditions of equilibrium. Analyze the forces in various applications and apply the concepts of friction to some basic applications of Electrical engineering.
CO2: Understand and apply principles of parallel force systems to find centroid and moment of inertia of different objects.
CO3: Apply the concepts of kinematics and kinetics to analyze force on particles under rectilinear.
CO4: Distinguish between various mechanical properties like yield strength, ultimate strength etc., of a given material and also to determine various types of direct stresses. Analyze the effect of shear force & bending moment on various beams.
CO5: Determine the bending stresses in different beams of various cross sections and to find torsional stresses in shafts

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Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	3	0	0	0	3	0	2	0	0	1	3	1
CO2	0	2	0	0	0	0	1	0	3	0	0	1	3	1
CO3	0	2	0	3	0	0	1	0	2	0	0	1	2	1
CO4	0	2	0	3	1	0	2	0	1	0	0	1	2	0
CO5	0	1	0	3	0	0	2	0	0	0	0	1	2	1

SYLLABUS

<u>Part –A :</u> Engineering Mechanics

Unit – I **(12 Periods)**

<u>**Statics:**</u>

Fundamentals of Mechanics: Basic Concepts, Force Systems and Equilibrium, Moment and Couple, law of Transmissibility, Varignon's theorem, Resultant of force system – problems on Coplanar Concurrent force system , Condition of static equilibrium for coplanar force system, concept of free body diagram, problems on spheres or rollers.

Friction Concept of dry friction, limiting friction, angle of friction, Friction problems related to connecting bodies and ladder.

Unit – II **(10 Periods)**

Properties of bodies:

Center of Gravity: Center of Gravity of Plane figures, Composite Sections and shaded areas. **Area Moment of Inertia:** Parallel and Perpendicular axis theorem, problems on area Moment of Inertia of T, I, L sections.

Unit – III **(08 Periods)**

Dynamics:

Kinematics – Introduction to kinematics, problems on Equations of motion for uniform and varying acceleration. Projectile derivation and simple problems.

Kinetics – simple problems on D'Alemberts principle, Work energy method, Impulse momentum methods.

Part – B : Strength of Materials

Unit – IV **(15 Periods)**

Simple Stresses and Strains: Stresses and Strains, stress-strain curve, Bars of uniform and varying cross-section, Poisons ratio, volumetric strain and relation between moduli of elasticity

Shear Force and Bending Moment: Cantilever and Simply Supported beams subjected to point loads and uniformly distributed loads.

Unit – V **(15 Periods)**

Bending stresses in beams: Theory of pure bending, Flexure formula, Section modulus for cantilever and simply supported beams having symmetrical sections like T and I

Torsion of Shafts: Torsion equation for circular shaft, polar modulus and related problems.

Text Books:

1. Engineering mechanics by Bhavikatti. New age international.
2. Engineering mechanics by A.K. Tayal.
3. S. Ramamrutham & R, Narayanan, Strength of Materials, Dhanpat Rai publications.
4. R.K. Bansal "A Text Book of Strength of Materials, Lakshmi Publications Pvt. Ltd,New Delhi

References:

1. Engineering Mechanics by S.Timoshenko and D.H. Young McGraw-Hill.
2. Mechanics of Materials by E P Popov
3. Dr Sadhu Singh, Strength of Materilas.

NETWORK THEORY	
EEE 213	**Credits : 3**
Instruction : 2 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Course Outcomes: At the end of the course the student will be able to:

CO	BL	CO Statement
CO1	BL-4	**Analyze** the behavior of magnetically coupled circuits, Two port network and **Calculate** various parameters of two port network
CO2	BL-4	**Analyze** natural and forced response of electric circuits. **Determine** transient and steady state response of RL ,RC and RLC circuits
CO3	BL-4	**Explain** circuits under resonant condition and **Determine** parameters of series and parallel RLC circuits.
CO4	BL-3	**Apply** Laplace transforms for electrical circuits to **Determine** its time response.
CO5	BL-4	**Synthesize** one port and two port networks and **Determine** passive elements of the network

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	1	-	-	-	-	-	-	1	2	-
CO2	2	3	1	-	1	-	-	-	-	-	-	1	1	-
CO3	2	3	1	-	1	-	-	-	-	-	-	1	1	-
CO4	2	3	1	-	1	-	-	-	-	-	-	1	1	-
CO5	2	3	1	-	-	-	-	-	-	-	-	1	-	1

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COS	**POS**	**LEVEL**	**DESCRIPTION**
CO1	PO1	2	Analyze two port networks and magnetically coupled circuits with the knowledge of basic electrical engineering, mathematics.
CO1	PO2	3	Analysis of transmission line parameters , magnetically coupled circuits
CO1	PO3	1	Design of T Parameters for transmission lines in power systems
CO1	PO5	1	Simulation of various networks using Mat lab
CO1	PO12	1	Recognize the need of analysis of two port parameters in power systems.
CO1	PSO1	2	Design Power system components using T-parameters.
CO2	PO1	2	Evaluate the natural and forced response of circuits with the knowledge of basic electrical engineering, mathematics.
CO2	PO2	3	Analyze the behavior of inductor, and capacitor in autonomous stage.

CO2	PO3	1	Design circuits with charged passive elements
CO2	PO5	1	Simulate the transient behavior of networks using Mat lab
CO2	PO12	1	Recognize the need of transients in power systems.
CO2	PSO1	1	Analyzing Power system transients under fault condition
CO3	PO1	2	Frequency response of RLC circuits can be obtained with the knowledge of basic electrical engineering, mathematics.
CO3	PO2	3	Analysis of three phase circuits under balanced and unbalanced loads
CO3	PO3	1	Designing of circuits, elements having a particular specified F_r , bandwidth.
CO3	PO5	1	Simulate three phase circuits using MATLAB
CO3	PO12	1	Recognize the need of three phase circuits and frequency response of elements to design power systems.
CO3	PSO1	1	Analyzing resonant behavior of Power system
CO4	PO1	2	Tie-set and cut-set matrices are obtained with the knowledge of basic electrical engineering, mathematics.
CO4	PO2	3	Analysis of electrical circuits using Laplace transforms
CO4	PO3	1	Solution of complex networks using Topology
CO4	PO5	1	Design dual networks and mathematical modeling using Mat lab
CO4	PO12	1	Recognize the need of Laplace transforms to design power systems
CO4	PSO1	1	Application of Laplace transforms to power systems.
CO5	PO1	2	Synthesize the functions with the knowledge of basic electrical engineering, mathematics.
CO5	PO2	3	Analysis of elements by synthesizing the given transfer function
CO5	PO3	1	Design elements by applying different synthesizing methods
CO5	PO12	1	Recognize the need of synthesis in power systems
CO5	PSO2	1	Application of synthesis to compensators in control systems

SYLLABUS

UNIT-I: **(12 periods)**
Coupled Circuits: Magnetically coupled circuits, dot convention.
Two-port Network s: Z, Y, H, T Parameters of two port networks, reciprocity theorem.

UNIT-II: **(12 periods)**

DC Transients: Source free RL & RC circuits, Driven RL & RC circuits, Natural and forced response of RL & RC circuits. Source free and driven RLC circuits, Natural and forced response of RLC circuits.

UNIT-III: **(12 periods)**
Resonance: Series and parallel resonant circuits, bandwidth and Q-factor.
Three phase circuits: Balanced and unbalanced circuits.

UNIT-IV: **(12 periods)**
Concept of Duality, initial and final value theorems in s-domain, Application of Laplace transforms to electrical circuits.

Network Topology: Definitions – Graphs, Tree, Basic cut set and basic tie set matrices for planar or non-planar networks**.**

UNIT-V:

Network Synthesis: Elementary Synthesis Operation, LC Network Synthesis, Properties of RC Network Functions, Foster and Cauer Forms of RC and RL Networks. Synthesis of RLC networks.

Text books:

1. W. H. Haytjr& J. E. Kemmerly, Engineering circuit analysis, 7th edition, Mc.graw hill publications 2006.
2. M. E. Vanvalkunberg, Network analysis, 3rd edition, prentice Hall of India 1974.
3. M. E. Van valkunberg, Modern Network analysis.

REFERENCES:

1. C K *Alexander* & M. N. O. *Sadiku, Fundamentals of Electric Circuits,5th Edition,* Published by McGraw-Hill.
2. Engineering *Network Analysis* & Filter Design by *GOPAL.G. BHISE*, Umesh Publications,publishers of science and technical books.

ELECTRICAL MEASUREMENTS	
EEE 214	**Credits:3**
Instruction: 3 Periods /week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes: At the end of the course the student will be able to:

CO1	BL-3	**Apply** basic electrical engineering concepts to **Determine** the shunts and multipliers required to extend the range of instruments.
CO2	BL-3	**Apply** compensation techniques to**compensate** the errors while measuring power and energy by using measuring instruments.
CO3	BL-4	**Analyze** the behavior of the bridges to **Measure** R,L,C and frequency when any changes are occurred in the arms of the bridges.
CO4	BL-3	**Apply** concepts of DVM, Q-meter, CRO and electrical transducers to **Measure** Voltage, Quality factor of a test coil, Phase and Frequency of unknown sinusoidal signal.
CO5	BL-3	**Illustrate** concepts of Potentiometers, CT's and PT's to **Determine** the error.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent POs**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2										1		
CO2	3	2		1								1		
CO3	3	2	1	1								1		
CO4	3	2										1		
CO5	2	2	1	1								1		

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	3	Operation of electromechanical and electrostatic meters is illustrated with the knowledge of basic electrical engineering, mathematics and sciences.
CO1	PO2	2	Based on the extension range of meters, the shunts and multipliers are determined.
CO1	PO12	1	Recognize the need of meters for doing experimental setup in power systems, power electronics and drives.
CO2	PO1	3	Operation of watt meters, energy meters, power factor meters, frequency meters and synchroscope with the knowledge of basic electrical engineering, mathematics and sciences
CO2	PO2	2	The errors in energy meters and watt meters are identified and analyzed, by using compensation techniques these errors are reduced.
CO2	PO12	1	Recognize the need of Compensation techniques to reduce errors in energy and power measurement
CO3	PO1	3	R, L, C and frequency are calculated by using bridges with the knowledge of basic electrical engineering, mathematics.

CO3	PO2	2	The errors in bridge due to environmental changes are identified and the behavior of the bridge with respect to temperature variations is analyzed.
CO3	PO3	1	The two independent variables of the bridge are designed to measure unknown R, L, C and Frequency.
CO3	PO12	1	Recognize the need of bridge analysis to determine unknown elements like R, L, C and frequency.
CO4	PO1	3	The operations of CRO, Q-meter, DVM and transducers are illustrated with the knowledge of basic electrical engineering, mathematics and sciences.
CO4	PO2	2	Change in Phase and frequency of an unknown sinusoidal signal is identified and the Changes are analyzed by observing lissajous figures. Variation in the Quality factor of a test coil is identified and formulated by deriving an expression for errors due to shunt resistance and distributed capacitance of a test coil. Improvement in sensitivity and resolution are identified and analyzed by using different digit DVMs.
CO4	PO12	1	Recognize the need of CRO, Q-meter. DVM and Electrical transducers in Industrial applications.
CO5	PO1	2	The operation of Potentiometers, CTs and PTs are illustrated with the knowledge of basic electrical engineering concepts.
CO5	PO2	2	The errors in CTs and PTs and errors in meters using Potentiometers are identified and those errors are analyzed with the help of basic electrical engineering.
CO5	PO3	1	Ratings of CTs and PTs are designed based on operating current and voltage of protection equipment.
CO5	PO12	1	Recognize the need of Potentiometers to calibrate the meters and to measure unknown resistance, inductance and power. Recognize the need of CTs and PTs to measure high voltages and currents in substations.

SYLLABUS

UNIT-I **(10periods)**

Instruments: Objectives of Measurements, Analog Versus Digital Measurements, Sources of Measurement Error, Static characteristics of Measuring Instruments, Instruments: Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, and Electrostatic Instruments, Extension of range of Instruments.

UNIT-II **(10periods)**

Measurement of Power and Energy: Dynamometer type Wattmeter's and Torque Expression. Measurement of reactive Power. Single Phase Induction type Energy Meters. Driving Torque and Braking Torque Equations, Errors and Compensation, Power Factor Meters, Frequency Meters, Electrical Resonance and Weston type of SynchroScope.

UNIT-III **(18periods)**

Bridge Methods: Measurement of Resistance by Using Wheatston's bridge, Kelvin's Double Bridge, Loss of Charge Method and Megger. Measurement of Inductance by Using Maxwel,s Inductance, Maxwels Inductance-Capacitance, Anderso's, Owe's and Hays bridge, Measurement of Frequency by Using Wien's bridge. Measurement of Capacitance by Using Desauty's and Schering's Bridges. Wagner's Earthing Device.

UNIT-IV **(12periods)**

Electronic Measurements: Basic CRO Circuits, Measurement of Phase and Frequency (Lissajious patterns), Q Meter, Resolution of Digital Meters, Digital voltmeters (Ramp type DVM & Integrating type DVM).

Transducers : Current transducer and Voltage transducer

UNIT-V **(10periods)**

Potentiometers: Basic slide wire potentiometer, Crompton's D.C. Potentiometer, Polar and co- ordinate Type Potentiometers, Applications of DC and AC potentiometers.

Instrument Transformers: CTs, PTs - Ratio and Phase angle errors and their reduction.

Text Book:

1. A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai& Sons, Delhi.

Reference Books:

1. E.W. Golding &Widdis, Electrical Measurements, 5th Edition, Wheeler Publishing.
2. J.B Gupta, Electrical Measurements and MeasuringInstruments.
3. Electronic Measurements by Hellfric&Cooper.

ELECTRONICS CIRCUITS AND ANALYSIS	
EEE 215	**Credits:3**
Instruction: 3 Periods /week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

COURSE OBJECTIVES:

- To provide an overview of transistor biasing, amplifiers, feedback amplifiers and oscillators.
- To understand the operation and design steps of multivibrators.

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: Analyze different biasing circuits and determine h-parameters of transistor configurations.
CO2: Determine various parameters of an amplifier like gain, input impedance and output impedance and bandwidth by analyzing small signal and low frequency hybrid model circuits.
CO3: Apply the concept of negative feedback and analyze the current series, current shunt, voltage series and voltage shunt amplifiers.
CO4: Design RC and LC sinusoidal oscillators for given specifications.
CO5: Determine the stable state voltages, currents and design the multivibrators

.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											-	-
CO2	3	2											-	-
CO3	3	2											-	-
CO4	3	2	2										-	-
CO5	3	2	2										-	-

SYLLABUS

UNIT-I **12hrs**

Transistor biasing and hybrid model

The operating point, criteria for fixing the operating point, Bias Stability, The stability factor S, Stabilization techniques: Fixed bias circuit, Collector-to-Base bias, Voltage divider bias. Thermal runaway, Thermal stability, Transistor hybrid model, h-parameters (CE, CB, CC)

UNIT-II **12hrs**

Single stage & Multistage Amplifiers

Single stage transistor Amplifier, Analysis of transistor amplifier circuits (CE, CB, CC) using exact and approximate models

Multistage RC coupled amplifier-Low frequency, mid frequency and high frequency response, Band width of multistage amplifiers, Concept of gain bandwidth product, Cascode amplifiers, Darlington pair, Distortion in amplifiers

UNIT-III **10hrs**

Feedback Amplifiers

Basic block diagram of feedback amplifier, general characteristics of negative feedback amplifier, Analysis of input impedance, output impedance and gain for different topologies and practical negative feedback amplifiers.

Unit-IV **10hrs**

Oscillators

Condition of Oscillations, General form of LC oscillator circuit, Analysis of Hartley oscillator, Colpitts oscillator, Clapp oscillator, RC phase shift oscillator, Wien bridge oscillator and crystal oscillator.

UNIT-V **10hrs**

Multivibrators

Transistor Switching times, fixed bias transistor binary, self biased transistor binary, Schmitt trigger circuit, collector coupled monostable multivibrator, collector coupled astable multivibrator.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Jacob Millman& Herbert Taub, “Pulse Digital & Switching Waveforms” McGraw-Hill Book Company Inc.

References:

1. K.Venkata Rao, Rama sudha. K, G.Manmadha Rao, Pulse and Digital Circuits, Pearson.
2. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMH publications.

MICROPROCESSORS AND MICRO CONTROLLERS	
EEE 216	**Credits:3**
Instruction: 3 Periods /week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

COURSE OBJECTIVES

- To understand the basic concepts of Microprocessors.
- Knowledge on instruction-set & implementing them for many applications.
- Knowledge on different Interfacing techniques of processor.
- Differentiation between Processors &Controller.
- Architecture, Instruction set & Interfacing of microcontroller.

Course Outcomes: At the end of the course the student will be able to:

CO	BL	CO Statement
CO1	BL-2	**Describe** the architecture and various addressing modes of a typical 8085 microprocessor.
CO2	BL-4	**Classify** different Memory devices to **Discuss** the interfacing between memory and 8085 microprocessor
CO3	BL-3	**Describe** the architecture of a typical 8086 microprocessor to **illustrate** general bus operations.
CO4	BL-3	**Describe** the various peripheral devices and **show** how the peripherals (8259, 8251 & 8253) are interfaced with Microprocessor.
CO5	BL-4	**Use** the architecture of 8051 microcontroller and **illustrate** how 8051 is interfaced with advanced applications.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	2	-	-	-	-	-	-	1	-	1
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	1	-	-	-	-	-	-	-	-	1	-	1
CO5	2	1	1	-	-	-	-	-	-	-	-	1	-	1

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	2	Microprocessor 8085 architectureand operations (arithmetic binary operations) are illustrated with the knowledge of basic engineering sciences like digital electronics and mathematics.
CO1	PO2	2	Based on the mnemonics and register knowledge of 8085,opcodesare formulated and analyze the instructions of different bytes.

CO1	PO12	1	Recognize the need of 8085 architecture and instruction sets, in order to be compatible enough for microprocessor programming, utilized in research and industrial applications.
CO1	PSO2	1	With the knowledge of programming basics in 8085, as per the requirement and availability, their application to control drives are analyzed.
CO2	PO1	2	Thefundamental knowledge of basic engineering mathematics, engineering physics and electronics engineering is utilizedfor illustrating individual memorystructures.
CO2	PO2	2	Based on the knowledge of memory IC configuration, allocation of address lines are formulated and their connection with processor is analyzed.
CO2	PO3	1	The classification and configuration knowledge of memory ICs are utilized for designinginterfacing circuits with processors.
CO2	PO5	2	Using MATLAB/SIMULINK software memory devices in the form of circuits are designed and analyzed.
CO2	PO12	1	Recognize the need of memory classification and interfacing, as memory device play a major role in every processor based research and industrial application.
CO2	PSO2	1	With the knowledge of memory interfacing, as per the requirement and availability, their application with processor in control and drives are analyzed.
CO3	PO1	2	Microprocessor 8086 architecture, organization and operations are demonstrated with the knowledge of basic engineering sciences like digital electronics and mathematics.
CO3	PO2	2	Based on the mnemonics and register knowledge of 8086, opcodesare formulated and instructions of different bytes are analyzed.
CO3	PO3	1	The formulation of address bus allocation in 8086 is utilized for designing interfacing systems of 8086 with odd and even memory banks.
CO3	PO12	1	Recognize the need of 8086 architecture and instruction sets, in order to be compatible enough for programming, utilized in research and industrial applications.
CO3	PSO2	1	With the knowledge of programming basics in 8086, as per the requirement and availability, their application to control drives are analyzed.
CO4	PO1	2	The fundamental knowledge of basic engineering mathematics, engineering physics and electrical engineering is utilized for illustrating interfacing devices and ICs like stepper motor, keyboard/display ICs, etc.
CO4	PO2	1	Based on the knowledge of interfacing IC devices, allocation of address lines are formulated and their connection with processor is analyzed.
CO4	PO3	1	The configuration knowledge of interfacing devices and ICs such as stepper motorare utilized for designing their interfacing with processors, as per the application and requirement.
CO4	PO12	1	Recognize the need of interfacing auxiliary devices and ICs with processors, as it is commonly employed in research and industrial application.
CO4	PSO2	1	With the knowledge of specific application based IC interfacing, as per the requirement and availability, their control design with processor and drives are analyzed.

CO5	PO1	2	Microcontroller 8051 architecture, organization and operations are demonstrated with the knowledge of basic engineering sciences like digital electronics and mathematics.
CO5	PO2	1	Based on the register knowledge of 8051, opcodesare formulated and instructions of different bytes are analyzed.
CO5	PO3	1	The formulation of port allocation in 8051 is utilized for designing interfacing systems of 8051 with memory and interfacing devices.
CO5	PO12	1	Recognize the need of 8051 architecture and port identification, in order to be compatible enough for programming, utilized in research and industrial applications.
CO5	PSO2	1	With the knowledge of programming basics in 8051, as per the requirement and availability, their application to control drives are analyzed.

SYLLABUS

UNIT-I: **(12 periods)**

8085 MICROPROCESSOR: Introduction and evolution of microprocessors, Internal architecture and functional pin description of 8085, Addressing modes, Types of instruction and instruction set,Timing diagrams, Types of interrupt.

UNIT-II : **(12 periods)**

MEMORY DEVICES& INTERFACING: Introduction to memory device, Types of memory devices, Difference between SRAM and DRAM, Chip select signal generation, Memory interfacing with processor, I/O and peripheral device interfacing: Memory mapped and standard I/O mapped.

UNIT-III: **(12 periods)**

8086 MICROPROCESSOR:Introduction of microprocessor 8086, Internal architecture and pin diagram,Register organization, Memory segmentation, Types of interrupt, External memory addressing.

UNIT-IV: **(12 periods)**

MICROPROCESSOR INTERFACING WITH ADVANCED DEVICES: Stepper motor interfacing, Key board/display device: 8279 block diagram and its operation, 8251 (USART): block diagram and functions of each block, 8253 timer: block diagram and modes of operation.

UNIT-V: **(12 periods)**

MICROCONTROLLER AND ITS APPLICATION: Introduction and applications of microcontroller, Difference between microprocessor and microcontroller,Pin Diagram and Architecture of 8051, Interfacing 8051 with LEDs, Seven segment display and Push button, ADC and DAC interfacing.

TEXT BOOKS:

1. Microprocessors and Interfacing, Douglas V Hall, Mc-Graw Hill, 2nd Edition.

2. Kenneth J Ayala, “The 8051 Micro Controller Architecture, Programming and Applications”, Thomson Publishers, 2nd Edition.

3. R.S. GAONKAR: Processor Architecture, Programming and Applications With The 8085/8080A, Wiley Eastern Ltd.

REFERENCE BOOKS:

1. A. NagoorKani, “8085 MICROPROCESSOR AND ITS APPLICATIONS”, Tata McGraw-Hill Education.

2. R.S. Kaler, “ A Text book of Microprocessors and Micro Controllers”, I.K. International Publishing House Pvt. Ltd.

3. Ajay V. Deshmukh, “Microcontrollers – Theory and Applications”, Tata McGraw-Hill Companies – 2005.

NETWORKS & MEASUREMNETS LAB	
EEE 217	**Credits: 1.5**
Instruction: 3 Periods /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course Outcomes: At the end of the course the student will be able to:

COs	BLs	CO Statement
CO1	BL-3	**Demonstrate** KCL, KVL, Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem, Superposition theorem and Millman's theorem, Reciprocity theorem to **Examine** the response in network elements.
CO2	BL-4	**Analyze** the coupled circuits, series and parallel resonance RLC circuits to **Determine** the self-inductance, mutual inductance and coefficient of coupling, resonant frequency, quality factor, band width and the parameters of two port network.
CO3	BL-3	**Calibrate** the Wattmeter and energy meter to **Evaluate** the error of the given load
CO4	BL-4	**Analyze** the measurement of power with the help of Voltmeter, Ammeter and Wattmeter to **Determine** active and reactive power for the given AC circuit.
CO5	BL-4	**Design** different AC and DC bridges to **Determine** an unknown resistance, Inductance, Capacitance, frequency in ac circuits and unknown voltage

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent POs**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	3		1			1	1		1	1	1
CO2	2	3	1	3		1			1	1		1	1	1
CO3	2	3	1	3		1			1	1		1	1	1
CO4	2	3	3	3		1			1	1		1	1	1
CO5	2	3	3	3	1	1			1	1		1	1	1

S.No	Name of the Experiment	CO’s
1	Verification of Ohm’s Law, KCL and KVL.	CO1
2	Verification of Superposition theorem.	CO1
3	Verification of Thevenin’s & Norton’s theorem	CO1
4	Verification of Maximum Power Transfer theorem.	CO1
5	Determination of L, M and k of coupled coil.	CO2
6	Series and Parallel Resonance.	CO2
7	Verification of Two port parameters.	CO2
8	Calibration of Wattmeter by Phantom Loading.	CO3
9	Calibration of Energy meter.	CO3
10	Two wattmeter method of 3-phase power measurement	CO4
11	Direct Loading.	CO4
12	3-phase reactive power measurement.	CO4
13	Anderson’s Bridge & Maxwell’s Bridge	CO5
14	Schering Bridge & De-Sauty’s Bridge	CO5
15	Kelvin Double Bridge.	CO5

ELECTRONIC DEVICES & CIRCUITS LAB	
EEE 218	**Credits: 1.5**
Instruction: 3 Periods /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course Outcomes: At the end of the course the student will be able to

CO1: Understand the use of RPS and CRT.	
CO2: Verify the working of diodes, transistors and their applications.	
CO3: Set up a bias point in a transistor	
CO4: Design simple hardware circuits using diodes and transistors.	
CO5: Design simple DC power supply circuits.	

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	0	0	0	0	0	0	1	0	0	1	3	-
CO2	0	3	1	2	0	0	2	0	1	0	0	1	2	-
CO3	1	0	0	0	0	0	0	0	2	0	0	1	2	-
CO4	0	3	3	0	0	0	2	0	2	0	0	1	2	-
CO5	1	3	3	1	0	0	0	0	1	0	0	1	-	-

LIST OF EXPERIMENTS

1. Study of CRO and Applications
2. V-I Characteristics of PN Junction Diode
3. V-I Characteristics of Zener Diode and Zener regulator characteristics.
4. V-I Characteristics of LED
5. Half-wave rectifier without and with filter
6. Full-wave rectifier without and with filter
7. Characteristics of BJT in CB configuration, h-parameters
8. Characteristics of BJT in CE configuration, h-parameters
9. Drain and transfer characteristics of JFET
10. Transistor as a switch
11. Implementation of logic gates using diodes and transistors.
12. SCR Characteristics

ENGINEERING MATHEMATICS – IV	
EEE 221	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Pre -requisites: Complex Numbers, Differentiation, Integration, Binomial expansions and partial fractions**.**

COURSE OUTCOMES:

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

CO1: Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
CO2: Understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals and represent functions as Taylor and Laurent series and determine their intervals of convergence and use residue theorem to evaluate certain real definite integrals.
CO3: Be familiar with numerical solution of ordinary differential equations.
CO4: Understand the characteristics and properties of Z-transforms and its applications.
CO5: Analyze the Statistical data by using statistical tests and to draw valid inferences about the population parameters.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	0	0	0	3	0	0	0	0	1	3	3
CO2	3	0	0	0	0	0	3	0	0	0	0	1	3	3
CO3	3	0	0	0	0	0	3	0	0	0	0	1	3	3
CO4	3	0	0	0	0	0	3	0	0	0	0	1	3	3
CO5	3	0	0	0	0	0	3	0	0	0	0	1	3	3

SYLLABUS

UNIT-I: FUNCTIONS OF A COMPLEX VARIABLE: [12 Lectures]

Complex function, Real and Imaginary parts of Complex function, Limit, Continuity and Derivative of a Complex function, Cauchy-Riemann equations, Analytic function, entire function, singular point, conjugate function, Cauchy-Riemann equations in polar form, Harmonic functions, Milne-Thomson method, Simple applications to flow problems- Applications to flow problems – some standard transformations(Translation, Inversion and reflection , Bilinear transformations and its fixed points).

Sections:20.1, 20.2, 20.3, 20.4, 20.5, 20.6 and 20.8.

UNIT – II: COMPLEX INTEGRATION & SERIES OF COMPLEX TERMS [12 Lectures]

Complex integration - Cauchy's theorem - Cauchy's integral formula – Series of complex terms: Taylor's series, Maclaurin's series expansion, Laurent's series (without proofs). Zeros of an analytic function, Singularities of a complex function, Isolated singularity, Removable singularity, Poles, pole of order m, simple pole, Essential singularity, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m, Evaluation of real definite integrals: Integration around the unit circle, Integration around a semi circle

Sections: 20.12, 20.13, 20.14 , 20.16 ,20.17,20.18,20.19 and 20.20.

UNIT – III : NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS[12 Lectures]

Numerical solution of Ordinary Differential equations: Picard's Method, Taylor's series method, Euler's Method, Runge-Kutta Method, Predictor-Corrector Methods, Milne's Method.

Sections: 32.1,32.2,32.3,32.4,32.7,32.8 and 32.9

UNIT-IV: Z-transforms [12 Lectures]

Introduction – Definition - Some standard Z-transforms – Linearity property – Damping rule – Some standard results - Shifting $U_n$to the right/left, Multiplication by n - Two basic theorems (Initial value theorem and Final value theorem) – Convolution theorem.Evaluation of inverse Z- transforms - Applications to difference equations.

Sections:23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 23.12, 23.15 and 23.16.

UNIT-V: SAMPLING THEORY [12 Lectures]

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of Significance of Large samples (Test of significance of single mean, difference of means .) – Confidence limits for unknown mean – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – chi square test – Goodness of fit.

Sections:27.1, 27.2, 27.3, 27.4, 27.5, 27.7, 27.11, 27.12,27.13, 27.14, 27.15, 26.16, 27.17 and 27.18.

Textbook:

1.B. S. Grewal, "*Higher Engineering Mathematics*", 43rd edition, Khanna publishers, 2017.

Reference Books:

1. N P. Bali and Manish Goyal, "A text book of Engineering Mathematics" ,Laxmi publications, latest edition.
2. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons, 2011.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3rd edition , Alpha Science International Ltd., 2002.
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13th edition , Pearson Publishers.

THERMO DYNAMICS & MECHANICS OF FLUIDS	
EEE 222	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Engineering Physics
2. Engineering Mathematics-II
3. Engineering Mechanics

Course Objectives:

- The course aims at instilling the basics of thermodynamics and fluid mechanics.
- It is further designed to give an overall view of internal combustion engines, Hydraulic Turbines and their performance.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1.	Understand the physical significance of laws of thermodynamics.
CO2.	Apply thermodynamic principles to analyze the performance of IC engines.
CO3.	Comprehend the fundamentals of fluid mechanics and properties of fluids.
CO4.	Apply Bernoulli's equation and impulse momentum equation to practical applications.
CO5.	Distinguish different classes of hydraulic turbines and analyze their performance.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

SYLLABUS

UNIT I: [12 Periods]

Laws of Thermodynamics (statements only), Gas laws, Relation between gas constant and specific heat at constant pressure and constant volume. Reversible Thermodynamic processes of perfect gases.

UNIT II: [12 Periods]

I C ENGINES:Classification, Otto cycle, Diesel cycle and Dual combustion cycle-Air Standard efficiency, working of 2-stroke and 4-stroke engines. Petrol engines and Diesel engines. Power and efficiency of IC engines.

UNIT III: [12 Periods]

Introduction to Fluid mechanics, Fluid properties, mass density, specific weight, specific gravity, viscosity, simple problems on viscosity, surface tension, capillarity, compressibility & bulk modulus of elasticity, vapour pressure.

Fluid statics: Fluid pressure and its measurement, state Pascal's law and Hydrostatic law, problems on Simple & Differential U-tube manometers.

UNIT IV: [14 Periods]

Fluid Kinematics-Types of fluid flows, Stream line, Path line, Streak line, derivation of Continuity equation in 3D, simple problems on Stream function and Velocity potential function.

Fluid Dynamics: Euler's equation, Bernoulli's equation and its applications -Venturimeter, Orificemeter, Darcy weishbach equation, Major and Minor losses in pipes. Simple problems on losses in pipes.

UNIT V: [14 Periods]

Hydraulic machines: Impact of jets on series of stationary and moving vanes, Velocity triangles, workdone. Turbines: Classification, Component parts and working principles of Pelton and Francis turbines hydraulic, mechanical and overall efficiency, unit quantities & specific speed, problems of pelton wheel.

Text Books:

1. R.S. Khurmi and J.K. Gupta, *Thermal Engineering*, S.Chand& Co publishers
2. Dr. R.K. Bansal, *Fluid Mechanics and Hydraulic machinery edition 9* Laxmi publications.

Reference Books:

1. P.N. Modi& S.M. Seth, *Hydraulics and fluid mechanics: including hydraulic machines, 2009, Standard Book House*
2. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd.

SIGNALS AND SYSTEMS	
EEE 223	**Credits:3**
Instruction: 3 Periods & 1 E/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student will be able to:	
CO1	Identify the type of signals and systems and apply transformations on the independent variable.
CO2	Characterize the LTI system and find its response for a given input signal.
CO3	Analyze the continuous time signals and systems in the frequency domain using CTFS, CTFT and Laplace transforms.
CO4	Analyze the discrete time signals and systems in the frequency domain using DTFT and Z transforms.
CO5	Sample and reconstruct the low pass and band pass signal using sampling techniques. .

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO4	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO5	2	2	-	-	-	-	-	-	-	-	-	1	2	2

Justification of Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

CO's	Justification ofCO'scorrelationwith PO's and PSO's
CO1	Students will apply the mathematical knowledge to identify the given signal or system and to perform different operations on signal and system, so moderate correlation with**PO1.**
	Students will be able to identify the right mathematical approach and use the properties of different signals & systems to solve complex decision making problems ,soweak correlation with**PO2.**
	Students can apply this knowledge in processing of signals and image, so weak correlation with**PO12.**
CO2	Students will apply the mathematical knowledge to determine the response of LTI systems for a given input and tocharacterize the LTI system, so weak correlation with**PO1.**

	Students will be able to identify the right method ofconvolution and use the properties of LTI systems to determine the response of complex LTI systemsfor a given input ,so weak correlation with**PO2.**
	Students can apply this knowledge in processing of signals and image, so weak correlation with**PO12.**
CO3	Students will apply the mathematical knowledge to apply the different transforming techniques like CTFT,CTFS& LT and to analyze the given continuous time signals and systems , so moderate correlation with**PO1.**
	Students will be able to identify the righttransforming technique and use it's properties to analyze the complex continuous time signals and systems in frequency domain ,so moderate correlation with**PO2.**
	Students can apply this knowledge in Processing of signals and image, so weak correlation with**PO12.**
CO4	Students will apply the mathematical knowledge to apply the different transforming techniques like DTFT &ZT and to analyze the given discretetime signals and systems ,so moderate correlation with**PO1.**
	Students will be able to identify the righttransforming technique and use it's properties to analyze the complex discrete time signals and systems in frequency domain, so moderate correlation with**PO2.**
	Students can apply this knowledge in processing of signals and image, so weak correlation with**PO12.**
CO5	Students will apply the mathematical knowledge to convert the continuous time signals into discretetimei.e sampling and for reconstruction of the low pass and band pass signal from it's sampled version, so moderate correlation with**PO1.**
	Students will be able to identify the rightsampling technique and use it's principle to sample the complex signal of either low pass or band pass, so moderate correlation with**PO2.**
	Students can apply this knowledge in the processing of signals and image, so weak correlation with**PO12.**
CO1-CO5	Students will be able to apply all the course outcomes to few key areas in signal and image processing, so moderate correlation with **PSO1**.
CO1	Students will be able to apply the**course outcomes 3,4 &5** to analyze the modulated signal in frequency domainin communication systems, so moderate correlation with **PSO2** and students will be able to apply the **course outcomes 1& 2** to few areas in communication systems ,so weak correlation with**PSO2.**

SYLLABUS

Unit- I Introduction to Signals and Systems 10 Periods

Continuous-Time (CT) signals and Discrete-Time (DT) signals and their representation; commonly used CT and DT signals- impulse, step, pulse, ramp, signum and exponentials; classification of CT and DT signals- periodic and aperiodic, even and odd, energy and power signals; operations on CT and DT signals- addition, subtraction, multiplication, differentiation and integration of CT signals, Time-shifting,Time-reversal and time-scaling of CT and DT signals, classification of CT and DT systems: static and dynamic, linear and non-linear,time- invariant and time-varying,causality,stability and invertability of systems.

Unit-II Linear Time-Invariant Systems 8 Periods

CT and DT types of Linear time invariant (LTI) system, Impulse response, Step response, Response of a LTI system to arbitrary inputs, Transfer function of LTI system,DT type LTI system- convolution sum,CT type LTI system- convolutionintegral, Graphical representation of convolution, Properties of LTI systems,causality of LTI systems, interconnected LTI systems (CT and DT), CT type of LTI systems described by Linear constant coefficient differential equations, DT type LTI systems described by constant coefficient linear difference equations, BIBO stability of LTI systems (CT and DT types).

Unit III Analysis of CT Signals and Systems 10 Periods

Fourier series analysis of CT Signals, CT Fourier transform(FT)- magnitude and phase spectrum,Fourier transform for standard signals,Fourier transform of arbitrary signals, Properties of Fourier transform , Inverse Fourier transform.Laplace Transform(LT)- Relation between FT & LT, pole-zero locations, Laplace transform for standard signals& it's ROC, Properties of ROC,Properties of Laplace transform ,Inverse Laplace transform, causality and stability &Analysis of CT systems using Fourier transformandLaplace Transform.

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Unit IV Analysis of DT Signals and Systems 10 periods

Discrete-time Fourier transform(DTFT) & inverse DTFT, convergence of DTFT ,DTFT properties , Z-Transform (ZT) & its ROC, ROCs of right-sided, left sided and finite duration sequences,propertiesof ROC & ZT, inverse ZT, inversion methods-power series, PFE and Residue methods, solution of difference equations using ZT, relationship between ZT and DTFT.Application of ZT and DTFT in DT signal and system analysis, DT system function, transfer function, poles and zeros, stability

Unit V Sampling 7 periods

Sampling theorem & it's Graphical and analytical proof for band limited signals, Nyquist rate, anti-aliasing filter,Types of sampling-Impulse sampling, Natural and flat top sampling;aperture effect due to flat- top sampling, Reconstruction of signal from its samples, Effect of under sampling - Aliasing; Introduction to band pass signals samplingtheorem

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Text Books :

1. A.V. Oppenheim, AS Willsky and S.H. Nawab: Signals and Systems, Pearson.
2. S.Haykin and B.V Veen: Signals and Systems, John Wiley

References:

1. P. Ramakrishna Rao and Shankar Prakriya : Signals and Systems, second addition, McGraw Hill (India) pvt Ltd. 2013
2. NagoorKani: Signals and Systems, McGraw Hill
3. E.W Kamen and B.S.Heck: Fundamentals of Signals and Systems using the Web and Matlab, Pearson.
4. P. Ramesh Babu and R. Anandanatarajan: Signals and Systems 4/e, Scitech.
5. K. Raja Rajeswari and B. Visveswara Rao: Signals and Systems , PHI.

ELECTROMAGNETICS	
Code: EEE 224	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	Sessionals Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Objectives:

At the end of the course student should understand

- Static Electric Fields
- Static Magnetic Fields
- Time Varying fields and coloration of electric and magnetic field.

Course Outcomes:

CO	BL	CO Statement
CO1	BL-2	**Define** various coordinate systems and **Apply** Coulomb's law and Gauss law to **Determine** electric field intensity and electric flux density for various charge distributions
CO2	BL-2	**Explain** energy density in electrostatics, properties of conductors and dielectrics and to **Solve** capacitance of composite parallel capacitors.
CO3	BL-3	**Apply** Poisson's and Laplace's equations to **Solve** boundary value problems and **Apply** Biot-Savart's law and Ampere's circuital law to **Determine** magnetic field intensity and magnetic flux density for various current distributions
CO4	BL-3	**Apply** Lorentz force equation to **Determine** force and torque on a closed path and **Explain** properties of magnetic materials to **Solve** inductance of different configurations
CO5	BL-2	**Explain** Faraday's law of electromagnetic induction and **Discuss** wave equation in different mediums and Pointing theorem

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	2	-

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	3	Coordinate systems, Coulomb's law and Gauss law are explained with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO1	PO2	2	Based on Coulomb's law and Gauss law, determine the force and electric field intensity due to several charge distributions.

CO1	PO12	1	Recognize the need of electric field intensity in the field of electromagnetic waves
CO1	PSO1	2	Electric field intensity calculations are helpful in developing the capacitance of power transmission lines.
CO2	PO1	3	Properties of conductors and dielectrics are described with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO2	PO2	2	Calculate the capacitance for parallel palace capacitor and composite parallel plate capacitors
CO2	PO12	1	Recognize the need of capacitance calculations in modeling the power transmission lines.
CO2	PSO1	2	Capacitance calculations are helpful in modeling of power lines.
CO3	PO1	3	Biot-Savart's law and Ampere's circuital law are explained with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO3	PO2	2	Poisson's and Laplace's equations are useful in solving the boundary value problems.
CO3	PO12	1	Recognize the need of magnetic field intensity in the field of electromagnetic waves
CO3	PSO1	2	Magnetic field intensity calculations are helpful in developing the inductance of power transmission lines.
CO4	PO1	3	Lorentz force equation is developed with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO4	PO2	2	Evaluate the inductance for different configurations such as solenoid, toroid and coaxial cable.
CO4	PO12	1	Recognize the need of inductance calculations in modeling the power transmission lines.
CO4	PSO1	2	Inductance calculations are helpful in modeling of power lines.
CO5	PO1	3	Faraday's laws of electromagnetic induction are explained with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO5	PO2	2	Develop the three dimensional wave equations in free space and for harmonically varying fields.
CO5	PO12	1	Recognize the need Faraday's law in describing the operation of electrical machines.
CO5	PSO1	2	Wave equation is helpful in describing the wave propagation on power transmission lines.

SYLLABUS

UNIT-I: **(12periods)**

Co-ordinate systems: Cartesian, Cylindrical and Spherical coordinate systems, Coordinate transformations, **Static electric fields:** various types of charge distribution, The experimental law of Coulomb, Electric field intensity, Electric field intensity due to infinite line, infinite surface charge distributions. Electric flux density, Gauss law and its applications, point form Gauss law.

UNIT-II: **(12 periods)**

Absolute Electric potential, Potential difference, potential gradient, Calculation of potential differences for point charge, infinite line charge distribution. Electric dipole, Energy density in electrostatic field, Current, current density, continuity equation of current, point form of ohm's law, properties of conductors and boundary conditions, properties of dielectrics and boundary conditions,

UNIT-III: (12 periods)

capacitance, parallel plate capacitor, composite parallel plate capacitor, energy stored in capacitor, Poisson's and Laplace's equations, one-dimensional solutions of Laplace's equations, applications of Poisson's and Laplace's equations, method of images, **Static magnetic fields:** types of current distributions, Biot-Savart law, magnetic field intensity due to straight conductor, circular loop, infinite sheet of current**.**

UNIT-IV: (12 periods)

Ampere's circuital law and applications, point form of Ampere's circuital law, magnetic flux and magnetic flux density, Integral and differential forms of Maxwell's equations for static fields, Lorentz force equation, Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit. The nature of magnetic materials, Magnetic boundary conditions, Energy stored in magnetic field.

UNIT-V: (12 periods)

Inductance and mutual inductance, Inductance of solenoid, toroid, coaxial cables. **Time varying fields:** Faraday's law of Electromagnetic induction, statically induced e.m.f, dynamically induced e.m.f, modified ampere's circuital law for time varying fields, significance of displacement current, integral and differential forms of Maxwell's equations for time varying fields.

TEXT BOOKS:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" , Tata Mc GrawHill Publishing Company Ltd, New Delhi, 2008
2. Sadiku MH, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009
3. Narayana Rao N., "Elements of Engineering Electromagnetics" Fourth Edition Prentice Hall of India, New Delhi 1998.

REFERENCES:

1. David K Cheng, "Field and Wave Electromagnetics", Pearson Education Inc, Delhi, 2004
2. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", Mc Graw Hill Book Co, 2005.
3. Karl E Longman and Sava V Savov, "Fundamentals of Electromagnetics", Prentice Hall of India, New Delhi,2006.
4. K.A. Gangadhar "Electromagnetics Field Theory" Khanna Publishers, Delhi, 2013.

PERFORMANCE OF DC MACHINES & TRANSFORMERS	
EEE 225	**Credits:3**
Instruction: 3 Periods & 1 E/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Objectives:

At the end of the Course, Students are able

- To understand the construction and operation of DCMachines.
- To study the various starting and testing methods of DCmachine
- To analyze different speed control techniques of DCMachine.
- To understand the working and equivalent circuit parameters of single phasetransformer.
- To analyze the performance of three phasetransformers.

Course Outcomes: At the end of the course the student will be able to:

CO	BL	CO Statement
CO1	BL-2	**Describe** construction and operation of DC machines and **Examine** armature reaction, commutation to **Determine** the compensating winding and inter poles
CO2	BL-3	**Explain** characteristics and speed control DC motor and **Analyze** starting and starters to **Determine** the starter resistance and number of starter sections
CO3	BL-3	**Analyze** the different testing methods to **Determine** the losses and efficiency of DC machine
CO4	BL-3	**Describe** construction and operation of single phase transformers and **Analyze** the transformers to **Determine** voltage regulation and efficiency
CO5	BL-2	**Explain** three winding transformer, poly phase connections, tap changing and cooling methods and **Discuss** Scott connection and auto transformers

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	3	2	-	2	-	-	-	-	-	-	1	-	2
CO3	2	3	2	-	-	-	-	-	-	-	-	1	-	2
CO4	2	3	2	-	-	-	-	-	-	-	-	1	2	-
CO5	2	3	2	-	1	-	-	-	-	-	-	1	2	-

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	2	Construction and operation of DC machines are explained with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO1	PO2	3	With the knowledge of armature reaction and commutation, analyze demagnetization, cross magnetization and sparking and determine compensating winding and inter poles

CO1	PO12	1	Recognize the need of parallel operation of generators in electric power generation and transmission
CO2	PO1	2	Characteristics of the motors are explained with the knowledge of fundamentals of basic electrical engineering and mathematics
CO2	PO2	3	Analyze the starting of DC motors and starters to determine the starting resistance and number of starter sections
CO2	PO3	2	Analyze the speed control of DC motors to develop different controllers for speed control
CO2	PO5	2	Develop the different controllers in MATLAB environment for speed control of DC motors
CO2	PO12	1	Recognize the need of speed control of motors in the field of electric drives
CO2	PSO2	2	Analyze the speed control methods and starting of motors and design controlling techniques in the field of electric drives
CO3	PO1	2	Losses and efficiency of the DC machine are explained with the knowledge of fundamentals of basic electrical engineering and mathematics
CO3	PO2	3	Analyze the testing methods of DC machine to determine the losses and efficiency of the machine
CO3	PO3	2	Analyze the testing methods to develop performance of the machines
CO3	PO12	1	Recognize the need of testing methods in the field of electrical engineering
CO3	PSO2	2	Analyze the testing methods to find the efficiency of motors as a part of components in the field of electric drives
CO4	PO1	2	construction and operation of single phase transformers are explained with the knowledge of fundamentals of basic electrical engineering and mathematics
CO4	PO2	3	Analyze the transformer to determine its regulation and efficiency
CO4	PO3	2	Analyze the parallel operation of transformers to develop the load sharing
CO4	PO12	1	Recognize the need of parallel operation of transformers in the field of power systems
CO4	PSO1	2	Determine voltage regulation and efficiency of transformers and load sharing during the parallel operation of transformers as a part of power system components
CO5	PO1	2	three winding transformer, poly phase connections, tap changing, cooling methods and auto transformers are explained with the knowledge of fundamentals of basic electrical engineering and mathematics
CO5	PO2	3	Analyze the Scott connection to determine the phase conversion from three phase to two phase
CO5	PO3	2	Analyze the poly phase connections to develop phase shifting on primary and secondary sides of different three phase transformer connections
CO5	PO5	1	Develop the poly phase connections in MATLAB environment to determine the phase shifting
CO5	PO12	1	Recognize the cooling methods and tap changing of transformers in the field of power systems
CO5	PSO1	2	Determine phase shifting in poly phase connections and develop auto transformer connections as a part of power system components

SYLLABUS

UNIT–I **(12 Periods)**

DC Generators-I: Principle of operation, Constructional features, Expression for induced e.m.f., Methods of excitation, Armature reaction: effects and remedial measures, compensating winding, Commutation, Methods to improve commutation, inter poles.

UNIT–II **(12 Periods)**

DC Generators-II: Open circuit characteristics and load characteristics, Voltage build up in shunt generator and causes of its failure, Parallel operation of DC generators.

UNIT–III **(12 Periods)**

D.C. Motors: Significance of back e.m.f.,Torque expression, Torque vs speed equations, Characteristics of motors, speed control of D.C. motors, starting and starters, Introduction to BLDC motors.

UNIT–IV **(12 Periods)**

Testing of D.C. Machine: Losses and efficiency, Condition for maximum efficiency, Efficiency at maximum power output, Brake test, Swinburne's test, Hopkinson's test, Field's test, Separation of losses.

UNIT–V **(12 Periods)**

Single-phase Transformers: Principle of operation, Constructional features, e.m.f equation, Equivalent circuit, Phasor diagram, Voltage regulation, Efficiency, Open circuit test, Short circuit Test, Sumpenere's test, Parallel operation.

Polyphase transformers: Three phase Transformer connections, Scott connection, Auto transformers, Three winding transformers.

TEXT BOOKS:

1. J. Nagarath and D. P. Kotari, Electrical Machines, TMHPublishers.
2. Dr. P.S. Bimbhra, " Electrical Machinery", Khanna publishers2004.
3. Clayton and Hancock, "Performance and Design of Direct Current Machines", CBS publishers2004.
4. M .G Say, "The Performance and Design of Alternating Current Machines", CBS Publishers.

REFERENCE BOOKS:

1. S.K. Bhattacharya, "Electrical Machines", Tmh,1998

ELECTRICAL POWER GENERATION AND UTILIZATION	
EEE 226	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

1. Basic Knowledge of Electrical Engineering Concepts.

Course Objectives:

On completion of this subject / course the student should able to:

- Understand concepts and phenomenon of different sources of power generation.
- Understand the process of electrical energy generation by various types of power plants.
- Familiarize the tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.
- Understand the utilization of electrical energy for various applications like heating, welding and illumination.

Course Outcomes:

CO1	BL-2	**Explain** the operation of Thermal power plant based on environmental and material science aspects to **Discus**s their merits and demerits.
CO2	BL-2	**Describe** the operation of Hydro and Nuclear power plant based on environmental and material science aspects to **Differentiate** their similarities and dissimilarities.
CO3	BL-2	**Describe** the operation of non conventional power generation plant based on environmental and material science aspects to **Discuss** their merits and demerits.
CO4	BL-4	**Analyze** power/energy demand curves to **Determine** optimal selection of generating units. **Apply** different types of tariffs to **Calculate** cost/unit of electrical energy consumed.
CO5	BL-2	**Explain** interior and exterior lighting systems to **Recognize** illumination levels for different purposes. **Describe** the heating and welding methods to **Recognize** different process of utilizing electric energy for heating and welding for industrial purposes.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2						2					2	1	
CO2	2						2					2	1	
CO3	2						2					2	1	
CO4	3	2										2	2	
CO5	3	1										2	1	

COs	Pos	Level	Description
CO1	PO1	2	Apply principles of basic sciences to explain different sources of energy and operation of thermal power plant and its components
CO1	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO1	PO12	2	Recognize the need of thermal power plant to meet the future demands within the environmental constraints.
CO1	PSO1	1	Need to identify the environmental aspects of thermal power plant
CO2	PO1	2	Apply principles of basic sciences to explain the operation of hydro and nuclear power plant
CO2	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO2	PO12	2	Recognize the need of hydro and nuclear power plant to meet the future demands within the environmental constraints.
CO2	PSO1	1	Need to identify the environmental aspects of hydro and nuclear power plant
CO3	PO1	2	Apply principles of basic sciences and electrical engineering to explain of operation of gas and MHD power plant.
CO3	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO3	PSO1	1	Need to identify the environmental aspects of non conventional power plant
CO3	PO12	2	Recognize the need of gas and MHD power plant to meet the future demands within the environmental constraints.
CO4	PO1	3	Applying the basic principle of mathematics and electrical engineering to Plot the load/demand curves to determine optimal selection of units.
CO4	PO2	2	Using the fundamentals of basic electrical engineering and mathematics to calculate Cost/ per unit of electrical energy consumed
CO4	PO12	2	Need for determine the optimal selection of units to meet the future demand . Need to recognize application of different types of tariff methods to determine the Cost/ per unit of electrical energy consumed
CO5	PSO1	2	Need to determine the methods to identify economical aspects of generating power plant
CO5	PO1	3	Apply principle of basic sciences to study the different methods of heating, welding and illumination
CO5	PO2	1	Using principles of mathematics and basic sciences to identify, formulate the design of heating element
CO5	PO12	2	Recognize the heating and welding methods for the future application and types of lamps to be installed for illumination process.
CO5	PSO1	1	Need to identify the which process of heating, welding methods and illuminations levels for industrial and different purposes respectively.

SYLLABUS

UNIT I: [12 Periods]

Introduction: Basic structure of electric energy system,Power generation, comparison of different sources of energy.

Thermal power stations: schematic arrangement, choice of site, coal handling, ash handling, draught, condensers, cooling water systems, electro static precipitator, efficiency of steam power station.

UNIT II: [12 Periods]

Hydro electric plants: schematic arrangement,choice of site, hydrology, classification of plants, functions of different components of a hydro plant, speed governing system.

Nuclear power plants: schematic arrangement, choice of site, classification of reactors, components of nuclear reactor, different power reactors. (video lectures on the related topics may be shown).

UNIT III: [12 Periods]

Gas turbine plants: schematic arrangement, components of a gas turbine plant, open cycle and closed cycle plants, combined gas and steam power plants.

Magneto hydro dynamic (MHD) power generation: basic concepts, principle, classification, coal burning MHD steam power plant, gas cooled nuclear MHD power, liquid metal MHD generator.

UNIT IV: [12 Periods]

Operational aspects of generating stations: load curves and associated definitions, selection of units, load duration curves.

Economic considerations: capital and running costs of generating stations, different tariffs, comparison of costs,power factor improvement.

UNIT V: [12 Periods]

Heating and welding: Role of electric heating for industrial applications,arc furnace, power frequency and high frequency methods of electric heating,Resistance welding, arc welding, modern welding techniques.

Illumination: Definitions, laws of illumination, the electric lamps, cold cathode lamps, light fittings, illumination for different purposes, requirements of good lighting, units of illuminations, measurements of illumination

Text Books:

1. Soni, Gupta, Bhatnagar & Chakrabarti, A Text Book On Power System Engineering, Dhanpat Rai & Co,9th Edition 2011.
2. J. B.Gupta, a Course in Power system S K Kataria publications, 11th Edition 2011

Reference Books:

1. C.L.Wadhwa, Generation & Utilization, New Age Publications 6th Edition 2009.
2. J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K.Kataria &Sons, 2014.
3. S.L.Uppal, Electrics Power Systems By, Khanna Publishers 2009.

THERMO DYNAMICS AND MECHANICS OF FLUIDS LABORATORY	
EEE 227	**Credits : 2**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Course objective:

- The Experiments are designed to develop the fundamental knowledge in thermodynamics and mechanics of fluids.
- This is attained by conducting experiments on calibration of devices like pressure gauge and flow meters and analyzing the performance of IC engines and turbo-machinery.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Calibrate pressure gauge and flow measuring devices such as venturimeter and orificemeter.
CO2	Determine the properties of fuels and lubricating oils.
CO3	Determine the friction factor and minor losses in pipes.
CO4	Determine the force exerted by jet on vane and compare with theoretical values.
CO5	Analyze the performance of IC engines and turbo-machinery.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

List of Experiments:

<u>Group-A (ThermoDynamics Experiments)</u>

1. Determination of flash and fire points of oils.
2. Determination of Viscosity using Redwood Viscometer-I&II
3. Calibration of Pressure gauge.
4. Determination of Calorific value of gaseous fuel using Junkers gas calorimeter.
5. Valve timing diagram of 4-stroke engine.

6. Port timing diagram of 2-stroke engine.
7. Load test on 4-stroke diesel engine.

Group-B (Fluid Mechanics Experiments)

1. Verification of Bernoulli's theorem.
2. Determination of coefficient of discharge through Orifice.
3. Calibration of flow meters.
   a. Venturimeter
   b. Orificemeter
4. To determine the head losses for flow through pipes and further obtain friction factor
5. Impact of jet on a
   a. Flat vane (or)
   b. Curved vane
6. To draw the performance characteristic curves for Pelton turbine.
7. To draw the performance characteristic curves for Francis turbine.

DIGITAL ELECTRONICS & MICROPROCESSORS LABORATORY	
EEE 228	**Credits : 2**
Instruction : 3 Periods/Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites:

1. Digital Logic Design (EEE 216)
2. Microprocessor and Microcontroller (EEE 226)

Course Outcomes: At the end of the course the student will be able to:

COs	BLs	CO Statement
CO1	BL-4	**Test** the truth tables by **Design** of combinational and sequential circuits using K maps.
CO2	BL-4	**Develop** programs of 8085 microprocessor and **Obtain** the results.
CO3	BL-4	**Develop** programs of 8085 microprocessor to interface with the peripherals and **Obtain** the results.
CO4	BL-4	**Develop** Programs of 8086 microprocessor and **Obtain** the results.

Program Matrix

	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO2	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO3	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO4	2	3	1	3	2	1	0	0	1	1	0	1	1	0

S.No	Name of the Experiment	CO's
1	a. Verification of Truth Tables of basic gates. b. Function realization	CO1
2	a. Verification of Demorgan's law. b. Realization of logic gates using universal gates.	CO1
3	a. Design of half adder, full adder, half subtractor and full subtractor circuits. b. Design of Flip-Flops.	CO1
4	a. Design of code conversion circuits (BCD – Gray code). b. Design of parity generator and parity checker.	CO1
5	8085 microprocessor a. Addition of two 8-bit numbers with & without carry. b. Addition of two 16-bit numbers with & without carry.	CO2
6	a. Finding largest number in an array. b. Ascending and descending order of given numbers.	CO2
7	a. 8-bit multiplication. b. 8-bit division.	CO2
8	a. Square of the numbers. b. One's compliment.	CO2
9	8086 microprocessor a. Subtraction of two 8-bit numbers with & without carry. b. Subtraction of two 16-bit numbers with & without carry.	CO3
10	Interfacing of stepper motor.	CO4