Anil Neerukonda Institute of Technology & Sciences (Autonomous)
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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

II/IV B.TECH-EEE SYLLABUS

REGULATION-R20

2021-22

Second Year Semester-1

Code	Subject	Category R20	Periods						Sessional Marks	Semester End Examination Marks	Total Marks	Credits
			L	T	P	E	O	Total				
EEE 211	Engineering Mathematics-III	BS	3	0	0	1	5	9	40	60	100	3
EEE 212	Engineering Mechanics & Strength of Materials	ES	2	1	0	1	5	9	40	60	100	3
EEE 213	Network Theory	PC	2	1	0	1	5	9	40	60	100	3
EEE 214	Electrical Measurements	PC	3	0	0	1	5	9	40	60	100	3
EEE 215	Electronics Circuit and analysis	PC	3	0	0	1	4	8	40	60	100	3
EEE 216	Microprocessors and Microcontrollers	PC	3	0	0	1	4	8	40	60	100	3
EEE 217	Networks & Measurements Laboratory	PC	0	0	3	0	1	4	50	50	100	1.5
EEE 218	Electronics Laboratory-I	PC	0	0	3	0	1	4	50	50	100	1.5
	Constitution of India & Intellectual Property Rights											0
	Total		**16**	**2**	**6**	**6**	**30**	**60**	**340**	**460**	**800**	**21**

Second Year Semester-2

Code	Subject	Category R20	Periods						Sessional Marks	Semester End Examination Marks	Total Marks	Credits
			L	T	P	E	O	Total				
EEE 221	Engineering Mathematics-IV	BS	3	0	0	1	6	10	40	60	100	3
EEE 222	Thermodynamics and Mechanics of Fluids	ES	2	1	0	1	5	9	40	60	100	3
EEE 223	Signals and Systems	PC	3	0	0	1	4	8	40	60	100	3
EEE 224	Electromagnetics	PC	3	0	0	1	4	8	40	60	100	3
EEE 225	Performance of DC Machines and Transformers	PC	2	1	0	1	5	9	40	60	100	3
EEE 226	Electrical Power Generation and Utilization	PC	2	1	0	1	5	9	40	60	100	3
EEE 227	Electrical Machine Laboratory-1	PC	0	0	3	0	1	4	50	50	100	1.5
EEE 228	Digital Electronics, Microprocessors and Controllers Laboratory	PC	0	0	3	0	1	4	50	50	100	1.5
	Total		**16**	**2**	**6**	**6**	**30**	**60**	**340**	**460**	**800**	**21**

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 student should 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	Develop mathematical modeling of mechanical and electrical systems. 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 PDE's 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

SYLLABUS

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

Scalar and vector point functions – Del applied to scalar point functions–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– Surface integral ,flux– Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorem (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, 18.2, 18.4, 18.5, 18. 6 and 18. 7.

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.

TEXT BOOK:

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*, 3rdedition, Alpha Science International Ltd., 2002.
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, *Calculus*, 13thedition, 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**

Prerequisite: Requires the knowledge of Engineering Mathematics.

Course Outcomes: At the end of the course the student will be able to:	
CO-1	Compute the resultant forces of concurrent and coplanar force system and Compute the reaction force by applying principles of friction.
CO-2	Compute the centroid, second moment of area, center of gravity, product moment of inertia and mass moment of inertia.
CO-3	Compute the motion parameters like displacement, velocity, acceleration using kinematics and kinetics.
CO-4	Understand the concepts of stress-strain relationships, Analyze the effects of shear force & bending moment on various beams.
CO-5	Compute the bending stresses in Beams and Torsional stresses in shafts.

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

Part A: Engineering Mechanics

UNIT - I **Periods: 3L+1T=4**

Statics:

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 **Periods: 6L+2T=8**

Properties of Rigid 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 **Periods: 6L+2T=8**

Dynamics:

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

Kinetics: Simple problems using D'Alemberts principle, Work energy method and Impulse momentum methods.

Part B: Strength of Materials

UNIT - IV **Periods: 6L+2T=8**

Simple Stresses & Strains:

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 **Periods: 6L+2T=8**

Stresses in Beams & Shafts:

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

REFERENCE BOOKS:

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
4. Strength of materials by ss rattan 3rd edition

WEB RESOURCES:

1. Engineering Mechanics: https://nptel.ac.in/courses/112/106/112106286/
2. Strength of Materials: https://nptel.ac.in/co105105108/urses/105/105/

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 : 2 Periods & 1 Tut/Week	**Sessionals 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	**Apply** basic electrical engineering concepts to **Determine** the shunts and multipliers required to extend the range of instruments.
CO2	**Apply** compensation techniques to**compensate** the errors while measuring power and energy by using measuring instruments.
CO3	**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	**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	**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 & ANALYSIS

EEE 215	**Credits : 3**
Instruction : 2 Periods & 1 Tut/Week	**Sessionals 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: 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 **[10 Periods]**

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 **[10 Periods]**

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 **[10 Periods]**

Feedback Amplifiers

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

Unit-IV **[10 Periods]**

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 **[10 Periods]**

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 : 2 Periods & 1 Tut/Week	**Sessionals 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-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 **[10 Periods]**

8085 Microprocessor

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

UNIT-II **[10 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 **[10 Periods]**

8086 Microprocessor

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

UNIT-IV **[10 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 **[10 Periods]**

8051 Microcontroller and Its Application

Pin Diagram and Architecture of 8051, applications of microcontroller, memory organization, Difference between microprocessor and microcontroller, Interfacing 8051 with LEDs, Seven segment display and Push button, ADC and DAC interfacing.

TEXT BOOKS:

1. Microprocessors and Interfacing, Douglas V Hall, McGraw 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 AND MEASUREMENTS LABORATORY

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 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 and band width.
CO3	BL-3	**Test** the Reciprocity theorem and **Determine** the parameters of two port network

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

S.No	Name of the Experiment	CO's
1	Verification of ohm's law and filament lamp characteristics.	CO1
2	Verification of Kirchhoff's Laws.	CO1
3	Verification of superposition theorem.	CO1
4	Verification of Thevenin's Theorems.	CO1
5	Verification of Maximum power transfer theorem.	CO1
6	Verification of Norton's theorem.	CO1
7	Verification of Milliman's Theorem.	CO1
8	Verification of reciprocity theorem.	CO3
9	Resonance of series and parallel R-L-C circuits.	CO2
10	Two Port network parameters.	CO3
11	Calculation of self & mutual inductances, Co-efficient of coupling.	CO2

ELECTRONICS LABORATORY-1

EEE 218	**Credits : 1.5**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Course Outcomes:

By the end of the course student should be able to:	
CO1	Measure the important parameters of a PN diode and to implement for various Applications.
CO2	Design and construct different rectifier and voltage regulation circuits used in regulated Power supplies.
CO3	Design amplifier circuits for specific applications, based on their input and output Characteristics of BJT
CO4	Design and identify the applications of feedback amplifiers and sinusoidal oscillators in different electronic circuits.
CO5	Design and analyze different multivibrator circuits.

LIST OF EXPERIMENTS

1. Plot the V-I characteristics of a PN diode in forward and reverse bias and find the static, dynamic resistances and the reverse saturation current.
2. Plot the V-I characteristics and regulation characteristics of a Zener diode in reverse bias.
3. Plot the output waveforms of a rectifier in different configurations and find the ripple factor
4. Plot the input and output characteristics of CE configured transistor and to find the h- parameter values from the characteristics.
5. Plot the input and output characteristics of CB configured transistor and to find the h- parameter values from the characteristics.
6. Plot the frequency response of a single stage CE amplifier.
7. Plot the frequency response of RC coupled multistage stage CE amplifier.
8. Obtain the input and output impedance of a trans-conductance amplifier
9. Obtain the frequency response of a voltage shunt negative feedback amplifier.
10. Generate a sinusoidal signal using Colpitts oscillator at a desired frequency.
11. Generate a sinusoidal signal using Wein bridge circuit.
12. Generate a sinusoidal signal using RC phase shift oscillator and observe the lissajous patterns at different phase shifts.
13. Study the operation of a Bistable multivibrator and observe the switching action.

ENGINEERING MATHEMATICS-IV	
EEE 221	**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 should 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–Analyticfunction–Entirefunction–Singularpoint–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'sseries(withoutproofs)–Zerosofananalyticfunction–Singularities ofacomplexfunction–Isolatedsingularity,Removablesingularity,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 semicircle.

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]

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.

TEXT BOOK:

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*, 3rdedition, Alpha Science International Ltd., 2002.

4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, *Calculus*, 13thedition, Pearson Publishers.

THERMO DYANAMICS & MECHANICS

EEE 222	**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:	
CO-1	Understand the basic concepts of thermodynamics and laws and apply these laws to analyze various non flow thermodynamic process in a system.
CO-2	Evaluate air standard efficiency of various air standard cycles and understand the working of various IC engines and able to distinguish various engines.
CO-3	Understand the basic concepts of fluid mechanics and apply to determine pressure at a point in a pipe.
CO-4	Apply Bernoulli's equation and impulse momentum equation to practical applications and determine various losses through pipes.
CO-5	Understand the concepts of impact of jets and analyze performance of various hydraulic turbines.

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

Part A: Thermodynamics

UNIT – I **Periods: 6L+2T=8**

Basic Concepts Of Thermodynamics:

Laws of Thermodynamics (statements only), Gas laws, Relation between gas constant and specific heat at constant pressure and constant volume, Reversible Non-Flow Thermodynamic processes of perfect gases, problems on thermodynamic process.

UNIT – II **Periods: 6L+2T=8**

I.C. Engines:

Classification of IC engines, Otto cycle, Diesel cycle and Dual combustion cycle-Air Standard efficiency, working of 2-stroke and 4-stroke engines. Petrol engines and Diesel engines. Problems on Air standard cycles.

Part B: Mechanics of Fluids

UNIT – III **Periods: 6L+2T=8**

Fluid Statics:

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 **Periods: 6L+2T=8**

Fluid Dynamics:

Fluid Kinematics: Types of fluid flows, Stream line, Path line, Streak line, derivation of Continuity equation, 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 **Periods: 6L+2T=8**

Hydraulic Machines:

Impact of Jets: Force exerted by a jet of water on a stationary/moving flat vertical, inclined, curved plates and series of vanes.

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 & SYSTEMS

EEE 223	**Credits : 3**
Instruction : 3 Periods /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

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.

.

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

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	
EEE 224	**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-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 **[10Periods]**

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 **[10 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 **[10 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 **[10 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 **[10 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. Poynting theorem and energy conservation.

TEXT BOOKS:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" , Tata McGraw Hill 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 Pub.

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 : 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-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 **[10 Periods]**

DC Generators: Principle of operation, Constructional features, Expression for induced E.M.F., Types of DC Generators, Armature reaction: effects and remedial measures, Commutation, Methods to improving commutation, Characteristics of DC Generators, Parallel operation of DC shunt generators.

UNIT–II **[10 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.

UNIT–III **[10 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–IV **[10 Periods]**

Single-phase Transformers: Principle of operation, Constructional features, E.M.F equation, Equivalent circuit, Vector diagram, Voltage regulation, Efficiency, Open circuit test, Short circuit Test, Sumpner's test, Parallel operation, Auto transformers, All-day efficiency.

UNIT–V **[10 Periods]**

Poly Phase Transformers: Three phase Transformer connections-(Δ/Δ, Y-Y, Δ-Y, Y-Δ), Open delta connection-power supplied by V-V bank- Scott connection – Desirable conditions for satisfying parallel operation of 3-phase transformers.

TEXT BOOKS:

1. J. Nagarath and D. P. Kotari, Electrical Machines, MH Publishers.
2. Dr. P.S. Bimbhra, “Electrical Machinery”, Khannapublishers2004.
3. Clayton and Hancock, “Performance and Design of Direct Current Machines”, CBSpublishers2004.
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 : 2 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

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 **[10 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.

UNIT II **[10 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, classification of reactors, components of nuclear reactor, different power reactors. (video lectures on the related topics may be shown).

UNIT III **[10 Periods]**

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

Diesel power plant: schematic arrangement, Essential elements of diesel power plant, Fuel injection system.

Magneto hydro dynamic (MHD) power generation: basic concepts, principle, classification.

UNIT IV **[10 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 [10 Periods]

Heating and welding: Arc furnace, power frequency and high frequency methods of electric heating, Resistance welding, arc welding, modern welding techniques.
Electric Traction: traction system, supply systems, recent trend in electric traction
Illumination: Definitions, laws of illumination, the electric lamps, cold cathode lamps, light fittings, requirements of good lighting.

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.
4. E.O.Taylor, Utilization of electrical energy, Orient Blackswan, 1971.

ELECTRICAL MACHINES LABORATORY-I

EEE 227	**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-4	**Obtain** the OCC, Load and efficiency characteristics of DC generators and **Analyze** their performance.
CO2	BL-4	**Obtain** the regulation and efficiency characteristics of single phase transformer and **Analyze** their performance.
CO3	BL-4	**Obtain** the speed-torque and efficiency characteristics of DC motor 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	2	3	1	3		1			1	1		1	0	1
CO2	2	3	1	3		1			1	1		1	0	0
CO3	2	3	1	3		1			1	1		1	1	0

S.No	Name of the Experiment	CO's
1	Swinburne's Test.	CO3
2	Load test on DC shunt motor.	CO3
3	Load test on DC series motor.	CO3
4	Speed control of DC shunt motor.	CO3
5	Speed control of DC series motor.	CO3
6	OCC & Load characteristics of DC shunt generator.	CO1
7	OCC & Load characteristics of DC separately excited shunt generator.	CO1
8	Load characteristics of DC compound generator.	CO1
9	Prediction of internal and external characteristics of a DC shunt generator.	CO1
10	Retardation Test.	CO1
11	Separation of losses in a DC machine.	CO3
12	Hopkinson's Test.	CO1
13	OC & SC tests on a 1-phase Transformer.	CO2
14	Sumpner's Test	CO2

DIGITAL ELECTRONICS, MICROPROCESSOR AND CONTROLLERS LABORATORY	
EEE 228	**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-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