Techno India NJR Institute of Technology

Academic Administration of Techno NJR Institute

Syllabus Deployment

Name of Faculty: Dr. Nitin Kothari   Subject Code:3EE4-06

Subject: Analog Electronics

Department: Department of Electrical Engineering (EE& EEE)   SEM: III

Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Ability to design and analyze various oscillator.

CO2: Know about different power amplifier circuits, their design and use in electronics and communication circuits

CO3: Demonstrate the ability to design practical circuits using operational amplifier that perform the desired operations.

Lecture No.	Unit	Topic
1	**1**	**DIODE CIRCUITS:** Overview
2	1	P-N junction diode
3	1	I-V characteristics of a diode
4	1	Review of half wave rectifiers and full wave rectifiers
5	1	Zener diodes
6	1	Clamping and clipping circuits, Numerical
7	**2**	**BJT CIRCUITS STRUCTURE AND I-V CHARACTERISTICS OF A BJT:** Overview
8	2	(Contd.) I-V characteristics of a BJT
9	2	BJT as a switch, BJT as an amplifier
10	2	Small-signal model, biasing circuits
11	2	Current mirror
12	2	Common-emitter, common-base and common collector

		amplifier
13	2	Small signal equivalent circuits, high-frequency equivalent circuits.
14	2	Numerical
15	**3**	**MOSFET CIRCUITS:** Overview
16	3	MOSFET structure, MOSFET I-V characteristics
17	3	MOSFET as a switch, MOSFET as an amplifier
18	3	Small-signal model and biasing circuits
19	3	Common-source, common-gate and common-drain amplifiers
20	3	Small signal equivalent circuits - gain
21	3	Input and output impedances, transconductance
22	3	High frequency equivalent circuit, Numerical
23	**4**	**DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS** Overview
24	4	Differential amplifier, multi-stage amplifier
25	4	Operational amplifiers Differential amplifier
26	4	Power amplifier
27	4	Direct coupled multi-stage amplifier
28	4	Internal structure of an operational amplifier, ideal opamp
29	4	Non-idealities in an op-amp (Output offset voltage, input bias current), Numerical
30	**5**	**LINEAR APPLICATIONS OF OP-AMP:** Overview
31	5	Idealized analysis of op-amp circuits
32	5	Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier
33	5	Integrator, active filter, P, PI and PID controllers
34	5	Lead/lag compensator using an op-amp, voltage regulator
35	5	Oscillators (Wein bridge and phase shift).
36	5	Analog to Digital Conversion, Numerical
37	**6**	**NONLINEAR APPLICATIONS OF OP-AMP** Overview
38	6	Hysteretic Comparator, Zero Crossing Detector
39	6	Square-wave and triangular-wave generators
40	6	Precision rectifier, peak detector, Mono shot & Numerical

TEXT/REFERENCE BOOKS

1. Microelectronic Circuits – Theory and Applications, Adel S Sedra, Kenneth C Smith and Arun N Chandorkar, Oxford University Press
2. Op-amps and linear integrated circuit technology, Ramakant A. Gayakwad,PHI
3. Electronic Devices and Circuits, J.B. Gupta, S.K. Kataria& Sons.

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Syllabus Deployment

Name of Faculty: Payal Jain Subject Code:3EE2-01

Subject : Advanced Engineering Mathematics

Department: Department of Electrical Engineering (EE& EEE) SEM: III

Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE (3 OUTCOMES)

At the end of this course students will be able to:

CO1: Solve higher order linear differential equation using appropriate techniques for modelizing and analysing electrical circuits

CO 2: Solve problems related to Laplace transform, application to signal processing and control systems

CO3: Understand Fourier transform, Z-Transform and application to signal processing and control systems

Lecture No.	Unit	Topic
1	**1**	**NUMERICAL METHODS:** Finite differences
2	1	Relation between operators
3	1	Interpolation using
4	1	Newton's forward and backward difference formulae.
5	1	Gauss's forward and backward interpolation formulae.
6	1	Stirling's Formulae
7	1	Interpolation with unequal intervals
8	1	Newton's divided difference and
9	1	Lagrange's formulae.
10	1	Numerical Differentiation
11	1	Numerical integration: Trapezoidal rule
12	1	Simpson's 1/3rd and 3/8 rules
13	1	Solution of polynomial and transcendental equations-Bisection

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14	1	Method, Newton-Raphson method and Regula-Falsi method
15	**2**	**LAPLACE TRANSFORM:** Definition
16	2	Definition and existence of Laplace transform
17	2	Properties of Laplace Transform and formulae
18	2	Unit Step function
19	2	Dirac Delta function
20	2	Heaviside function
21	2	Laplace transform of periodic functions
22	2	Finding inverse Laplace transform by different methods
23	2	Convolution theorem
24	2	Fourier Transform
25	2	Fourier Complex
26	2	Sine and Cosine transform
27	2	properties and formulae
28	2	Inverse Fourier transforms
29	2	Convolution theorem
30	2	Z-Transform: Definition, properties and formulae
31	2	Convolution theorem
32	2	Inverse Z-transform
33	2	Application of Z-transform to difference equation.
34	2	Application of Z-transform to difference equation.
35	**3**	**COMPLEX VARIABLE:** Differentiation, Cauchy-Riemann equations
36	3	Analytic functions, harmonic functions, finding harmonic conjugate
37	3	Elementary analytic functions (exponential, trigonometric, logarithm) and their properties
38	3	Elementary analytic functions (exponential, trigonometric, logarithm) and their properties
39	3	Conformal mappings, Mobius transformations and their properties
40	3	Conformal mappings, Mobius transformations and their properties

TEXT/REFERENCE BOOKS

1 M. Ray, J. C. Chaturvedi & H.C. Sharma, Differential Equations, Students friends & company

2 Chandrika Prasad, Mathematics for Engineers, Prasad Mudralaya
3 Bird, Higher Engineering Mathematics, ELSEVIER. 2004
4 Jeffrey, Advanced Engineering Mathematics, ELSEVIER.

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Syllabus Deployment

Name of Faculty: Abrar Ahmed   Subject Code:3EE4-05

Subject : Electrical Circuit Analyses

Department: Department of Electrical Engineering (EE& EEE)   SEM: III

Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO1 : Apply different techniques for analysis of electrical circuit.

CO2 :Explain transient response of different circuits using Laplace transform.

CO3 :Analyses magnetically coupled circuits.

CO4 :Apply graph theory to formula network equations.

CO5 :Compute Fourier series for complex waveforms.

Lecture No.	Unit	Topic
1	**1**	**NETWORK THEOREMS** Overview
2	1	Superposition theorem
3	1	Thevenin theorem
4	1	Norton theorem,
5	1	Maximum power transfer theorem
6	1	Reciprocity theorem
7	**1**	Compensation theorem
8	1	Analysis with dependent current
9	1	Voltage sources
10	1	Node and Mesh Analysis. Concept of duality and dual networks.
11	**2**	**SOLUTION OF FIRST AND SECOND ORDER NETWORKS** Overview

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12	2	Solution of first and second order differential equations for
13	2	Series and parallel R-L
14	2	R-C, RL- C circuits
15	**2**	Initial and final
16	2	Conditions in network elements,
17	2	Forced and free response, time constants
18	2	Steady state and transient state response
19	**3**	**SINUSOIDAL STEADY STATE ANALYSIS** Overview
20	3	Representation of sine function as rotating phasor
21	3	Phasor diagrams
22	3	Impedances and admittances
23	3	AC circuit analysis
24	3	Effective or RMS values, average power and complex power.
25	**3**	Three-phase circuits. Mutual coupled circuits
26	3	Dot Convention in coupled circuits, Ideal Transformer.
27	**4**	**ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORM** Overview
28	4	Review of Laplace Transform
29	4	Analysis of electrical circuits using Laplace Transform for standard inputs
30	4	Convolution integral
31	4	Inverse Laplace transform
32	4	Transformed network with initial
33	4	Conditions. Transfer function representation
34	4	Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances
35	**5**	**TWO PORT NETWORK AND NETWORK FUNCTIONS** Overview
36	5	Two Port Networks, terminal pairs, relationship of two port
37	5	Variables, impedance parameters
38	5	Admittance parameters
39	5	Transmission parameters and hybrid parameters
40	5	Interconnections of two port networks.

TEXT/REFERENCE BOOKS

1 Van Valkenburg, Network Analysis, PHI

2 Hayt & Kemmerly, Engineeirng Circuit Analysis, 6/e (TMH)

3 J. Edminster & M. Nahvi, Electric Circuits (SIE), 5/e, Scaum's Out Line.

4 Nagsarkar & Sukhija, Circuits & Networks, Oxford

5 John Bird, Electric Circuit Theory & Technology, ELSEVIER

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Syllabus Deployment

Name of Faculty: LalitaVaishnav Subject Code:3EE4-07

Subject : Electrical Machine

Department: Department of Electrical Engineering (EE& EEE) SEM: III

Total No. of Lectures Planned: 50

COURSE OUTCOMES HERE

At the end of this course students will be able to

CO1: Explain the construction, working principle, performance and applications of Poly-phase induction machine, Single phase motors, synchronous generator (Alternator) and synchronous motor.

CO2: Identify, formulate and solve the numerical problems related to above machines.

CO3: Analyze the performance characteristics for different electrical machines and obtain simple equivalent circuit for the machine.

CO4: Explain different testing and starting methods for electrical machines so as to identify their applicability in different practical situations.

CO5: Evaluate the purpose for parallel operation of synchronous generators and learn the conditions to be satisfied for this.

Lecture No.	Unit	Topic
1	**1**	**MAGNETIC FIELDS AND MAGNETIC CIRCUITS**: Review of magnetic circuits - MMF, flux, reluctance, inductance
2	1	Review of Ampere Law and BiotSavart Law

3	1	Visualization of magnetic fields produced by a bar magnet
4	1	Visualization of magnetic fields produced by a current carrying coil through air
5	1	Visualization of magnetic fields produced by a current carrying coil through a combination of iron and air
6	1	Influence of highly permeable materials on the magnetic flux lines
7	**2**	**ELECTROMAGNETIC FORCE AND TORQUE:** B-H curve of magnetic materials and flux-linkage v/s current characteristic of magnetic circuits
8	2	Linear and nonlinear magnetic circuits
9	2	Numerical on linear and nonlinear magnetic circuits
10	2	energy stored in the magnetic circuit
11	2	Force as a partial derivative of stored energy with respect to position of a moving element
12	2	Torque as a partial derivative of stored energy with respect to angular position of a rotating element
13	2	Galvanometer coil, relay contact, lifting magnet
14	2	Rotating element with eccentricity or saliency
15	**3**	**DC MACHINES**: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core
16	3	Visualization of magnetic field produced by the field winding excitation with armature winding open
17	3	Air gap flux density distribution
18	3	Flux per pole, induced EMF in an armature coil
19	3	Armature winding: Armature coil, lap and wave winding
20	3	Commutation: construction of commutator , linear commutation
21	3	Armature MMF wave, armature reaction
22	3	Air gap flux density distribution with armature reaction
23	3	Derivation of back EMF equation and torque equation
24	3	Numerical on induced EMF in an armature coil, back EMF and torque
25	**4**	**DC MACHINE - MOTORING AND GENERATION:** Armature circuit equation for motoring and generation,
26	4	Types of field excitations – separately excited, shunt and series
27	4	Open circuit characteristic of separately excited DC generator

28	4	Back EMF with armature reaction
29	4	Voltage build-up in a shunt generator, critical field resistance and critical speed
30	4	V-I characteristics and torque speed characteristics of separately excited, shunt and series motors
31	4	Speed control through armature voltage
32	4	Losses, load testing and back-to-back testing of DC machines
33	4	Numerical on Armature circuit equation for motoring and generation, Losses, load testing
34	**5**	**TRANSFORMERS**: Principle, construction and operation of single-phase transformers
35	5	Equivalent circuit, phasor diagram of single phase transformer
36	5	Voltage regulation, losses and efficiency
37	5	Testing : open circuit and short circuit tests
38	5	Polarity test, back-to-back test
39	5	Separation of hysteresis and eddy current losses
40	5	Parallel operation of single-phase
41	5	Three-phase transformer: construction, types of connection and their comparative features
42	5	Parallel operation of three-phase transformers
43	5	Autotransformers : construction, principle, applications and comparison with two winding transformer
44	5	Magnetizing current, effect of nonlinear B-H curve of magnetic core material
45	5	Harmonics in magnetization current, Phase conversion: Scott connection
46	5	Three-phase to six-phase conversion
47	5	Tap-changing transformers: No-load and on-load tap-changing of transformers
48	5	Three-winding transformers. Cooling of transformers
49	5	Numerical on voltage regulation, losses and efficiency
50	5	Numerical on open circuit and short circuit tests, Autotransformers and Three-phase Transformer

TEXT/REFERENCE BOOKS

1 A. E. Fitzgerald, C. Kingsley Jr and Umans, Electric Machinery, 6th Edition

McGraw Hill, International Student Edition.
2 Kothari & Nagrath, Electric Machines, 3/e, TMH
3 M. G. Say, The Performance and Design of AC machines, Pit man & Sons.
4 Guru, Electric Machinery, 3e, Oxford 2000
5 R. K. Srivastava, Electrical Machines, Cengage Learning.

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Techno India NJR Institute of Technology

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Syllabus Deployment

Name of Faculty: Miss. Payal Paliwal — Subject Code: 3EE4-08

Subject Name: Electromagnetic Fields — SEM: III

Department: Department of Electrical Engineering (EE& EEE)

Total no. of lectures planned: 28

COURSE OUTCOMES

At the end of this course students will be able to:

CO1:Define and recognize different co□ordinate systems to describe the spatial variations of the physical quantities.

CO2:Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields.

CO3: Get familiar with Maxwell's equations and able to apply electromagnetic theory to solve problems primarily in physics and electrical engineering

Lecture No.	Unit	Topic
1	**1**	**REVIEW OF VECTOR CALCULUS** Overview
2	1	Vector algebra- addition, subtraction, components of vectors, scalar and vector multiplications, triple products
3	1	Three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus, differentiation, partial differentiation, integration
4	1	Vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another
5	**2**	**STATIC ELECTRIC FIELD:** Coulomb's law, Electric field intensity
6	2	Electrical field due to point charges. Line, Surface and Volume charge distributions, Gauss law and its applications

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7	2	Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations
8	2	Electric dipole, Electrostatic Energy and Energy density
9	**3**	**CONDUCTORS, DIELECTRICS AND CAPACITANCE:** Current and current density, Ohms Law in Point form
10	3	Continuity of current, Boundary conditions of perfect dielectric materials
11	3	Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line
12	3	Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations
13	**4**	**STATIC MAGNETIC FIELDS:** Biot-Savart Law, Ampere Law
14	4	Magnetic flux and magnetic flux density
15	4	Scalar and Vector Magnetic potentials
16	4	Steady magnetic fields produced by current carrying conductors
17	**5**	**MAGNETIC FORCES, MATERIALS AND INDUCTANCE:** Force on a moving charge, Force on a differential current element, Force between differential current elements
18	5	Nature of magnetic materials, Magnetization and permeability
19	5	Magnetic boundary conditions
20	5	Magnetic circuits, inductances and mutual inductances
21	**6**	**TIME VARYING FIELDS AND MAXWELL'S EQUATIONS**
22	6	Faraday's law for Electromagnetic induction, Displacement current
23	6	Point form of Maxwell's equation, Integral form of Maxwell's equations
24	6	Motional Electromotive forces. Boundary Conditions.
25	**7**	**ELECTROMAGNETIC WAVES:** Derivation of Wave Equation, Uniform Plane Waves
26	7	Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material.
27	7	Wave equation for a conducting medium, Plane waves in lossy dielectrics
28	7	Propagation in good conductors, Skin effect, Poynting theorem

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TEXT/REFERENCE BOOKS

1. Electromagnetic Field Theory, Sadiku, Oxford.
2. Principles of Electromagnetics,Mahapatra, TMH.
3. Electromagnetic Field Theory and Transmission Lines, Rao, Wiley

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Syllabus Deployment

Name of Faculty: Chandra Prakash Jain Subject Code: 3EE3-04

Subject Name: Power generation Process SEM: III

Department: Department of Electrical Engineering (EE& EEE)

Total no. of lectures planned: 29

COURSE OUTCOMES HERE

At the end of this course students will be able to

CO 1: Explain the operations of thermal power plant with all main parts and cycles.

CO 2: Be aware of the principle of operation, components, layout, location, environmental and social issues of nuclear, diesel and gas power plant.

CO 3: Identify and demonstrate the components of hydro power plant. Explain operation of hydro power plant.

CO 4: Understand the operation of electrical energy generation using biomass, tidal, geothermal, hydel plants.

Lecture No.	Unit	Topic
1	**1**	**CONVENTIONAL ENERGY GENERATION METHODS** Thermal Power plants: Basic schemes and working principle.
2	1	(ii) Gas Power Plants: open cycle and closed cycle gas turbine plants
3	1	Combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants
4	1	(iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials.
5	1	Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor.
6	1	Efficiencies of various power plants.

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7	**2**	**NEW ENERGY SOURCES** Impact of thermal, gas
8	2	Hydro and nuclear power stations on environment. Green House Effect (Global Warming).
9	2	Renewable and non renewable energy sources.
10	2	Conservation of natural resources and sustainable energy systems. Indian energy scene.
11	2	Introduction to electric energy generation by wind
12	2	Solar and tidal.
13	**3**	**LOADS AND LOAD CURVES** Types of load, chronological load curve, load duration curve, energy load curve and mass curve.
14	3	Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization.
15	**4**	**POWER FACTOR IMPROVEMENT** Causes and effects of low power factor
16	4	Advantages of power factor improvement
17	4	Power factor improvement using shunt capacitors and synchronous condensers
18	**5**	**POWER PLANT ECONOMICS** Capital cost of plants, annual fixed and operating costs of plants,
19	5	Generation cost and depreciation. Effect of load factor on unit energy cost.
20	5	Role of load diversity in power system economics. Calculation of most economic power factor when
21	5	a) KW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction
22	5	Off peak energy utilization, co-generation, and energy conservation
23	**6**	**TARIFF** Objectives of tariffs. General tariff form
24	6	Flat demand rate, straight meter rate, block meter rate
25	6	Two part tariff, power factor dependent tariffs, three part tariff. Spot (time differentiated) pricing.
26	**7**	**SELECTION OF POWER PLANTS** Comparative study of thermal, hydro
27	7	Nuclear and gas power plants. Base load and peak load plants.
28	7	Size and types of generating units, types of reserve and size of plant.

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29	7	Selection and location of power plants.

TEXT/REFERENCE BOOKS

1.B. R. Gupta. Generation of Electrical Energy (4/e), S. Chand Publication. 2013
2 S. L. Uppal. Electrical Power (13/e), Khanna Publishers
3 V. K. Mehta, Principles of Power system (3/e), S. Chand Publication 2005
4 Soni, Gupta and Bhatnagar, Generation of Electrical Power, Dhanpat Rai & Sons

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Syllabus Deployment

Name of Faculty: Mr. Hitkaran Singh   Subject Code: 3EE1-02

Subject Name: Technical Communication   SEM: III

Department: Department of Electrical Engineering (EE& EEE)

Total no. of lectures planned: 28

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO 1 : Students learn the correct method for formal correspondence in writing letters, reports and resumes.

CO 2: To clear the concept of grammar usage , vocabulary and to develop self confidence through oral communication and reading.

CO3: To overcome the barriers in the GDPI and develop analytical perspective through
mock drills

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION TO TECHNICAL COMMUNICATION-DEFINITION OF TECHNICAL** Overview
2	1	Communication, Aspects of technical communication, forms of
3	1	Technical communication, importance of technical communication,
4	1	Technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.
5	**2**	**COMPREHENSION OF TECHNICAL MATERIALS/TEXTS AND INFORMATION** Overview
6	2	Design & development- Reading of technical texts, Reading and
7	2	Comprehending instructions and technical manuals, Interpreting

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8	2	Summarizing technical texts, Note-making. Introduction of different
9	**2**	Kinds of technical documents, Information collection, factors affecting
10	2	Information and document design, Strategies for organization, Information design and writing for print and online media.
11	3	**TECHNICAL WRITING, GRAMMAR AND EDITING- TECHNICAL WRITING PROCESS** Overview
12	3	Forms of technical discourse, Writing, drafts and revising,
13	**3**	Basics of grammar, common error in writing and speaking, Study of advanced
14	3	Grammar, Editing strategies to achieve appropriate technical style
15	3	Introduction to advanced technical communication. Planning, drafting
16	3	Writing Official Notes, Letters
17	3	E-mail, Resume, Job Application
18	3	Minutes of Meetings
19	**4**	**ADVANCED TECHNICAL WRITING**- Technical Reports, types of technical
20	4	Reports, Characteristics and formats and structure of technical reports
21	4	Technical Project Proposals, types of technical proposals
22	4	Characteristics and formats and structure of technical proposals
23	4	Technical Articles
24	4	Types of technical articles
25	4	Writing strategies
26	4	Structure and formats of technical articles

TEXT/REFERENCE BOOKS

1. A Textbook Of English For Engineers And Technologists (Combined Edition, Vol. 1 & 2) ; Orient Blackswan 2010
2. Robert M.Sherfield, Developing Soft Skills, Montgomery And Moody Fourth Edn. 2009 Pearson Publishers.
3. K.Alex, Soft Skills: Know Yourself & Know The World, S. Chand ;

2009

4. Robert Bramson , Coping With Difficult People, Dell 2009

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Syllabus Deployment

Name of Faculty: Mr. RajkumarSoni | Subject Code: 3EE4-23

Subject Name: Electrical Circuit Design Lab | SEM: III

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 16

Lab OUTCOMES

At the end of this course students will be able to:

CO1 Practically verify theorems for AC and DC circuit.
CO2 PSpice programs for DC and AC analysis and transient analysis of RC and RL circuit.
CO3 Hendon Conversion Y-connected resister to Delta connected circuit.
CO4 Obtained voltageand current vs frequency graph for resonant circuit.
CO5 To learn to program calculate the resistance of conductor.

Lab No.	Topic
1	Introduction to Datasheet Reading.
2	Introduction to Soldering De-soldering process and tools.
3	Simulate characteristic of BJT and UJT. Validate on Bread Board c PCB.
4	Simulate Bridge Rectifier Circuit and validate on Bread Board or PCE a) Half Bridge.

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5	Simulate Bridge Rectifier Circuit and validate on Bread Board or PCB. b) Full Bridge.
6	Simulate Regulated Power Supply and validate on Bread Board or PCB. a) Positive Regulation (03 Volt to 15 Volt).
7	Simulate Regulated Power Supply and validate on Bread Board or PCB. b) Negative Regulation (03 Volt to 15 Volt).
8	Simulate Regulated Power Supply and validate on Bread Board or PCB. c) 25 Volt, 1–10 A Power Supply.
9	Simulate Multi-vibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB. a) Astable Mode.
10	Simulate Multi-vibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB. b) Bi-stable Mode.
11	Simulate Multi-vibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB. c) Mono-stable Mode.
12	Introduction to Sensors to measure real time quantities and their implementation in different processes. Proximity, Accelerometer, Pressure, Photo-detector, Ultrasonic Transducer
13	Introduction to Sensors to measure real time quantities and their implementation in different processes. Smoke, Temperature, IR, Color, Humidity, etc.Transducer
14	Hardware implementation of temperature control circuit using Thermistor.
15	Simulate Buck, Boost, and Buck-Boost circuit and validate on Bread Board or PCB.
16	Simulate Battery Voltage Level Indicator Circuit and validate on Bread Board or PCB.

TEXT/REFERENCE BOOKS

1 Circuits And Networks: Analysis And Synthesis, Sudhakar, TMH 2006

2 Sivanagaraju – Electrical circuit analysis, Cengage learning 2009

3 Robbins – Circuit analysis : Theory and Practice, Cengage Learning 2012

4 Electrical Networks, Singh, TMH 2009

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Syllabus Deployment

Name of Faculty: LalitaVaishnav Subject Code:3EE4-22

Lab Name: Electrical Machine Lab-I

Department: Department of Electrical Engineering (EE & EEE) SEM: III

Total No. of Lab: 11

Lab OUTCOMES

At the end of this course students will be able to:

CO1 Have knowledge of various parts of a electrical machine.

CO2 Ability to conduct speed control of different types of DC Motors.

CO3 Ability to conduct characteristics of DC Servo Motor

Lab No.	Topic
1	To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
2	To perform sumpner's test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
3	To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
4	To perform the heat run test on a delta/delta connected 3-phase transformer

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	and determine the parameters for its equivalent circuit.
5	To perform the parallel operation of the transformer to obtain data to study the load sharing.
6	Separation of no load losses in single phase transformer.
7	To study conversion of three-phase supply to two-phase supply using Scott-Connection.
8	Speed control of D.C. shunt motor by field current control method & plot the curve for speed verses field current.
9	Speed control of D.C. shunt motor by armature voltage control method & plot the curve for speed verses armature voltage.
10	To determine the efficiency at full load of a D.C shunt machine considering it as a motor by performing Swinburne's test.
11	To perform Hopkinson's test on two similar DC shunt machines and hence obtain their efficiencies at various loads.

TEXT/REFERENCE BOOKS

1 A. E. Fitzgerald, C. Kingsley Jr and Umans, Electric Machinery, 6th Edition McGrawHill, International Student Edition.

2 Kothari &Nagrath, Electric Machines, 3/e, TMH

3 M. G. Say, The Performance and Design of AC machines, Pit man & Sons.

4 Guru, Electric Machinery, 3e, Oxford 2000

5 R. K. Srivastava, Electrical Machines, Cengage Learning.

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Syllabus Deployment

Name of Faculty: Nitin Kothari Subject Code: 3EE4-21

Lab Name: Analog Electronics Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: III

Total No. of Lab: 08

Lab OUTCOMES

At the end of this course students will be able to:

CO1 Understand the characteristics of different Electronic Devices.

CO2 Verify the rectifier circuits using diodes and implement them using hardware.

CO3 Design various amplifiers like CE, CC, common source amplifiers and implement them using hardware and also observe their frequency responses

CO4 Understand the construction, operation and characteristics of JFET and MOSFET, which can be used in the design of amplifiers.

CO5 Understand the need and requirements to obtain frequency response from a transistor so that Design of RF amplifiers and other high frequency amplifiers is feasible

Lab No.	Topic
1	Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1 kHz with and without negative feedback.

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2	Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor
3	Plot and study the characteristics of small signal amplifier using FET.
4	Study of push pull amplifier. Measure variation of output power & distortion with load.
5	Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency
6	Study transistor phase shift oscillator and observe the effect of variation in R& C on oscillator frequency and compare with theoretical value.
7	Study the following oscillators and observe the effect of variation of C on Oscillatorfrequency :(a) Hartley (b) Colpitts.
8	To plot the characteristics of UJT and UJT as relaxation.

TEXT/REFERENCE BOOKS

1 Electronic devices & circuits theory, R.L. Boylestad, Louis Nashelsky , Pearson education

2 Electronic devices & circuits, David Bell, Oxford Publications

3 M Rashid – Microelectronic circuits : Analysis & Design, Cengage learning

4 Millman, Electronics Devices and Circuits, TMH

5 Electronic Devices,7e, Floyd, Pearson

6 A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing

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Syllabus Deployment

Name of Faculty: Dr. Yasmin Subject Code: 4EE2-01
Subject Name: Biology

Department: Department of Electrical Engineering (EE& EEE) SEM: IV

Total No. of Lectures Planned: 31

Course out come :
CO1:To understand that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.
CO2: To understand that classification per se is not what biology is all about. The criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy.
CO3: To understand that "Genetics is to biology what Newton's laws are to Physical Sciences" and also that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
CO4: To understand that without catalysis life would not have existed on earth and.the molecular basis of coding and decoding genetic information is universal.
CO5: To analyse biological processes at the reductionist level and understand that the fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Objective, scope and outcome of the course.
2	**2**	**ENERGY SCENARIO: Commercial** And Non-Commercia Energy Introduction**:** Purpose: To convey that Biology is a important a scientific discipline as Mathematics, Physics an Chemistry. Bring out the fundamental differences between scienc

		and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why We need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.
3	**3**	**CLASSIFICATION:** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes
4	3	(d) Ammonia excretion- aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial
5	3	organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus,
6	3	(e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model
7	**4**	**GENETICS:** Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws, Concept of segregation and independent assortment.
8	4	Concept of allele. Gene mapping, Gene interaction,
9	4	Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring.
10	4	Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes.
11	4	Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

12	5	**BIOMOLECULEs:** Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose Nucleotides and DNA/RNA. Two carbon units and lipids.,
13	5	Amino acids and proteins.
14	5	Nucleotides and DNA/RNA. Two carbon units and lipids.,
15	**6**	**Enzymes:** Purpose: To convey that without catalysis life would not have existed on earth. Enzymology: How to monitor enzyme catalysed reactions.
16	6	How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action.
17	6	Discuss at least two examples. Enzyme kinetics and kinetic,
18	**7**	**INFORMATION TRANSFER:** Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure-from single stranded to double helix to nucleosomes. Define gene in terms of complementation and recombination.
19	7	Concept of genetic code. Universality and degeneracy of genetic code.
20	7	Define gene in terms of complementation and recombination.
21	**8**	**MACROMOLECULAR ANALYSIS:** Purpose: To analyse biological processes at the nreductionistic level. Proteins- structure and function.
22	8	Hierarch in protein structure. Primary secondary,
23	8	Tertiary and quaternary structure.
24	8	Proteins as enzymes, transporters, receptors and structural elements.
25	**9**	**METABOLISM:** Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency

26	9	This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle).
27	9	Synthesis of glucose from CO_2 and H_2O (Photosynthesis).
28	9	Energy yielding and energy consuming reactions. Concept of Energy charge
29	**10**	**MICROBIOLOGY:** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms.
30	10	Microscopy. Ecological aspects of single celled organisms.
31	10	Sterilization and media compositions. Growth kinetics.

Reference books:

1. Genetics and molecular biology by David r. Hyde, McGraw Hill.
2. Taxonomy: The Classification of Biological Organisms by Kristi Lew
3. ENZYMES: Catalysis, Kinetics and Mechanisms by N.S. Punekar, Springer
4. Textbook of Microbiology by C. K. Jayaram Paniker and R. Ananthanarayan
5. Textbook of Microbiology by C.P. Baveja , Arya Publications
6. PLANT ANATOMY (PAPER-VII) & PLANT METABOLISM

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Syllabus Deployment

Name of Faculty: Mr. Yogendra Singh Solanki — Subject Code: 4EE4-08
Subject Name: Digital Electronics
Department: Department of Electrical Engineering (EE& EEE) — SEM: IV
Total No. of Lectures Planned: 35

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Verify the functionality of TTL ICs & understand the respective datasheet.
CO2: Design combinational logic circuits using TTL ICs.
CO3: Design sequential logic circuits using TTL ICs.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Objective, Scope And Outcome Of The Course.
2	**2**	**FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES :** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations.
3	2	Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number systems.
4	2	Binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.
5	2	Characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.
6	2	Practice Problems.

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7	**3**	**COMBINATIONAL DIGITAL CIRCUITS:** Standard representation for logic functions, K-map representation.
8	3	Simplification of logic functions using K-map, minimization of logical functions. Don't care conditions.
9	3	Q-M method of function realization.
10	3	Multiplexer, De-Multiplexer/Decoders, Adders, Sub tractors.
11	3	BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design.
12	3	Digital comparator, parity checker/generator, code converters.
13	3	Priority encoders, decoders/drivers for display devices.
14	**4**	**SEQUENTIAL CIRCUITS AND SYSTEMS :** A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop.
15	4	J- K, T and D-types flip flops, Flip Flop Inter conversions
16	4	applications of flip flops, ripple (Asynchronous) counters
17	4	synchronous counters, counters design using flip flops,
18	4	Asynchronous sequential counters, applications of counters.
19	4	Shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter.
20	4	Ring counter, Twisted ring Counter, sequence generator
21	**5**	**A/D AND D/A CONVERTERS :** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter.
22	5	Specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit.
23	5	Analog to digital converters: quantization and encoding, parallel comparator A/D converter.
24	5	successive approximation A/D converter, counting A/D converter, dual slope A/D converter,
25	5	A/D converter using voltage to frequency and voltage to time conversion,
26	5	Specifications of A/D converters, example of A/D converter ICs.
27	**6**	**SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES** Memory organization and operation,
28	6	Expanding memory size, classification and characteristics of memories, sequential memory

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29	6	Read only memory (ROM), read and write memory(RAM)
30	6	content addressable memory (CAM), charge de coupled device memory (CCD)
31	6	Commonly used memory chips, ROM as a PLD.
32	6	Programmable logic array, Programmable array logic
33	6	Complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).
34		Revision to course work.
35		Revision to course work.

TEXT/REFERENCE BOOKS

1. Modern Digital Electronics, R.P Jain, Tata McGraw-Hill Education
2. Digital Circuit & Logic Design, Morris Mano, Prentice Hall of India
3. Digital Principles & Applications, A.P.Malvino & D.P Leach, Tata McGraw-Hill Education

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Syllabus Deployment

Name of Faculty: LalitaVaishnav	Subject Code:4EE4-05
Subject : Electrical Machine - II	
Department: Department of Electrical Engineering (EE& EEE)	SEM: IV
Total No. of Lectures Planned: 48	

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Explain the construction, working principle, performance and applications of Poly-phase induction machine, Single phase motors, synchronous generator (Alternator) and synchronous motor.

CO2: Identify, formulate and solve the numerical problems related to above machines.

CO3: Analyze the performance characteristics for different electrical machines and obtain simple equivalent circuit for the machine.

CO4: Explain different testing and starting methods for electrical machines so as to identify their applicability in different practical situations.

CO5: Evaluate the purpose for parallel operation of synchronous generators and learn the conditions to be satisfied for this.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Objective, scope and outcome of the course.
2	**2**	**FUNDAMENTALS OF AC MACHINE WINDINGS:** Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang
3	2	Full-pitch coils, concentrated winding, distributed winding,

		winding axis
4	2	3D visualization of the above winding types
5	2	Air-gap MMF distribution with fixed current through concentrated winding
6	2	Air-gap MMF distribution with fixed current through distributed winding
7	2	Sinusoidally distributed winding, winding distribution factor.
8	2	Numerical on distributed windings and winding distribution factor
9	2	Numerical on full-pitch coils, concentrated winding, distributed winding
10	**3**	**PULSATING AND REVOLVING MAGNETIC FIELDS:** Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement
11	3	Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings
12	3	Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields
13	3	Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents)
14	3	Revolving magnetic field
15	**4**	**INDUCTION MACHINES:** Construction, Types (squirrel cage and slip-ring)
16	4	Torque Slip Characteristics
17	4	Starting and Maximum Torque. Equivalent circuit
18	4	Phasor Diagram, Losses and Efficiency
19	4	(Cont.) Phasor Diagram, Losses and Efficiency
20	4	Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency)
21	4	(Cont.) Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency)
22	4	Methods of starting
23	4	(Cont.) Methods of starting
24	4	Braking and speed control for induction motors
25	4	(Cont.) Braking and speed control for induction motors

26	4	Generator operation and Self excitation
27	4	Doubly-Fed Induction Machines.
28	4	Numerical on starting torque and maximum torque
29	4	Numerical on Equivalent circuit Losses and Efficiency
30	4	Numerical on starting and braking
31	**5**	**SINGLE-PHASE INDUCTION MOTORS:** Constructional features
32	5	Double revolving field theory
33	5	Equivalent circuit, determination of parameters
34	5	Split-phase starting methods
35	5	Applications of Single-phase induction motors
36	5	Numerical on single phase induction motor
37	**6**	**SYNCHRONOUS MACHINES:** Constructional features, cylindrical rotor synchronous machine
38	6	Generated EMF, equivalent circuit and phasor diagram
39	6	Armature reaction
40	6	Synchronous impedance, voltage regulation
41	6	Operating characteristics of synchronous machines
42	6	V-curves
43	6	Salient pole machine- two reaction theory
44	6	Analysis of phasor diagram, power angle characteristics
45	6	Parallel operation of alternators - synchronization and load division
46	6	Numerical on generated EMF and equivalent circuit
47		Revision to course work
48		Revision to course work

Text Book/Reference Book:

1 A. E. Fitzgerald, C. KingsleyJr and Umans, Electric Machinery, 6th Edition McGraw Hill, International Student Edition.

2 Kothari & Nagrath, Electric Machines 3/e,TMH

3 M. G. Say, The Performance and Design of AC machines, Pit man & Sons.

4 Guru, Electric Machinery 3e, Oxford

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Syllabus Deployment

Name of Faculty: Ashika Sharma Subject Code:4EE3-04

Subject : Electronic Measurement & Instrumentation

Department: Department of Electrical Engineering (EE& EEE) SEM: IV

Total No. of Lectures Planned: 36

COURSE OUTCOMES HERE

At the end of this course students will be able to

CO1: Analyze the mechanism of torque production and operation of permanent magnet and electro-magnetic measuring instruments.

CO2: Understand the working of potentiometer and different DC and AC bridges for accurate measurement of electrical quantities.

CO3: Determine the magnitude of electrical quantities like resistance, inductance, capacitance, power, energy etc. over wide range of magnitude.

CO4: Explain the working principle of Current transformer and Potential transformer and also can define the ratio error and phase angle error.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Objective, scope and outcome of the course
2	**2**	**MEASURING INSTRUMENTS:** Moving coil, moving iron meter construction, operation, torque equation and errors
3	2	Electrodynamic meter-construction, operation, torque equation and errors
4	2	Induction meter construction, operation, torque equation and errors
5	2	Applications of instruments for measurement of current, voltage, single-phase power and single-phase energy
6	2	Errors in wattmeter and energy meter and their compensation and adjustment
7	2	Testing and calibration of single-phase energy meter by phantom

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		loading
8	2	Numerical on Moving coil, moving iron, electrodynamic, Induction meter
9	**3**	**POLYPHASE METERING:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems
10	3	One-wattmeter, two- wattmeter and three-wattmeter methods. 3-phase induction type energy meter
11	3	Instrument Transformers: Construction and operation of current and potential transformers.
12	3	Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors
13	3	Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy
14	3	Numerical on One-wattmeter, two- wattmeter and three-wattmeter methods.
15	**4**	**POTENTIOMETERS:** Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers
16	4	Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations, Volt ratio boxes
17	4	Construction, operation and standardization of AC potentiometer in-phase and quadrature potentiometers
18	4	Applications of AC potentiometers
19	4	Numerical on potentiometer
20	**5**	**MEASUREMENT OF RESISTANCES:** Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method
21	5	Substitution method, Wheatstone bridge method
22	5	Measurement of low resistances - Potentiometer method and Kelvin's double bridge method
23	5	Measurement of high resistance: Price's Guardwire method
24	5	Measurement of earth resistance
25	5	Numerical on - ammeter and voltmeter method
26	5	Numerical on Wheatstone bridge method, Wheatstone bridge

		method
27	**6**	**AC BRIDGES:** Generalized treatment of four-arm AC bridges. Sources and detectors
28	6	Maxwell's bridge, Hay's bridge for selfinductance measurement
29	6	Anderson bridge for self-inductance measurement
30	6	Heaviside's bridge for mutual inductance measurement
31	6	De Sauty Bridge for capacitance measurement
32	6	Wien's bridge for capacitance and frequency measurements
33	6	Sources of error in bridge measurements and precautions
34	6	Screening of bridge components. Wagner earth device
35	6	Numerical on AC Bridges
36		Revision to course work

TEXT/REFERENCE BOOKS

1 H. S. Kalsi, Electronic Inst. & Measurement, TMH 2004
2 Morris, Electrical Measurements & Instrumentation, ELSEVIER
3 Bell, Electronic Instrumentation And Measurement, Oxford 1994
4 W. D. Cooper, Electronic Inst. & Measurement Techniques, Prentice Hall, India.

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Name of Faculty: Mr. Shambhu P. Choubisa	Subject Code: 4EE1-03 (MEFA)
Department: Department of Electrical Engineering (EE& EEE)	SEM: IV
Total No. of Lectures Planned: 32	

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Understand the roles of managers in firms

CO2: Understand the internal and external decisions to be made by managers

CO3: Analyze the demand and supply conditions and assess the position of a company

CO4: Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.

CO5: Analyze real-world business problems with a systematic theoretical framework.

CO6: Make optimal business decisions by integrating the concepts of economics, mathematics and statistics.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION** to scope, objective and outcome of subject
2	**2**	**MEANING, NATURE AND SCOPE OF ECONOMICS**, deductive v/s inductive methods,
3	2	Static and dynamics, Economic problems: scarcity and choice,
4	2	Circular flow of economic activity,
5	2	national income-concepts and measurement.
6	2	Numerical

7	3	Demand-types of demand, determinants of demand,
8	3	Demand function, elasticity of demand
9	3	Demand forecasting –purpose, determinants and methods
10	**3**	**SUPPLY-DETERMINANTS OF SUPPLY**, Supply Function, Elasticity Of Supply.
11	3	Numerical
12	3	Numerical
13	**4**	**THEORY OF PRODUCTION**- production function
14	4	Law of variable proportions, laws of returns to scale, production optimization,
15	4	Least cost combination of inputs, iso quant's.
16	4	Cost concepts-explicit and implicit cost, fixed and variable cost,
17	4	Opportunity cost, sunk costs, cost function,
18	4	Cost curves, cost and output decisions, cost estimation.
19	4	Numerical
20	**5**	**MARKET STRUCTURE AND PRICING THEORY** ,Perfect competition, Monopoly,
21	5	Monopolistic competition, Oligopoly
22	5	Equilibrium price, equilibrium quantity
23	5	Numerical
24	**6**	**BALANCE SHEET AND RELATED CONCEPTS**, Concepts,
25	6	Profit and loss statement and related concepts,
26	6	Financial ratio analysis, cash-flow analysis, funds flow analysis,
27	6	Comparative financial statement, ,
28	6	Analysis and interpretation of financial statements
29	6	Capital budgeting techniques
30	6	Numerical
31	6	Numerical
32	6	Numerical

TEXT/REFERENCE BOOKS

1. Managerial Economics – Analysis, Problems & Cases By P. L. Mehta, Sultan Chand & Sons.
2. Managerial Economics By Craig Peterson, Pearson Education

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Syllabus Deployment

Name of Faculty: Abrar Ahmed	Subject Code:4EE4-06
Subject: Power Electronics	
Department: Department of Electrical Engineering (EE& EEE)	SEM: IV
Total No. of Lectures Planned: 48	

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO1 :Get familiar with the characteristics of modern power electronic devices and the basic principle of operation of various power-electronic circuits

CO2 :Understand the fundamental principles involved in the operation of power electronic switches and the different methods to control them

CO3 :Design different types of phase-controlled single phase and three phase converters along with necessary protective circuits for application in different domains of engineering

CO4 :Use research-based knowledge for design of DC-DC converter and inverter

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION** Objective, scope and outcome of the course.
2	**2**	POWER SWITCHING DEVICES DIODE, THYRISTOR,
3	2	MOSFET, IGBT:
4	2	I-V Characteristics; Firing circuit for thyristor;
5	2	Voltage and current commutation of a thyristor
6	2	Gate drive circuits for MOSFET and IGBT
7	2	Gate drive circuits for MOSFET and IGBT
8	3	**THYRISTOR RECTIFIERS** Single-phase half-wave and full-wave rectifiers

9	3	Thyristor rectifiers Single-phase half-wave and full-wave rectifiers
10	**3**	Phase full bridge thyristor rectifier with R-load
11	3	Highly inductive load;
12	3	Three-phase full-bridge thyristor rectifier with R-load
13	3	Highly inductive load;
14	3	Input current wave shape and power factor
15	**4**	**DC-DC BUCK CONVERTER** Elementary chopper with an active switch and diode
16	4	Concepts of duty ratio
17	4	Average voltage,
18	4	Power circuit of a buck converter
19	4	Power circuit of a buck converter
20	4	Analysis and waveforms at steady state
21	4	Analysis and waveforms at steady state
22	4	Duty ratio control of output voltage.
23	4	Duty ratio control of output voltage
24	**5**	**DC-DC BOOST CONVERTER** Power circuit of a boost converter,
25	5	DC-DC boost converter Power circuit of a boost converter,
26	5	Analysis and waveforms at steady state
27	5	Analysis and waveforms at steady state
28	5	Relation between duty ratio and average output voltage.
29	5	Relation between duty ratio and average output voltage.
30	**6**	**SINGLE-PHASE VOLTAGE** Source Inverter
31	6	Power circuit of single-phase voltage source inverter
32	6	Switch states and instantaneous output voltage
33	6	Square wave operation of the inverter
34	6	Concept of average voltage over a switching cycle
35	6	Concept of average voltage over a switching cycle
36	6	Bipolar sinusoidal modulation
37	6	Unipolar sinusoidal modulation
38	6	Unipolar sinusoidal modulation
39	6	Modulation index
40	6	Modulation index and output voltage.
41	**7**	**THREE-PHASE VOLTAGE** Source Inverter
42	7	Power circuit of a three-phase voltage source inverter

43	7	Power circuit of a three-phase voltage source inverter
44	7	Switch states
45	7	Instantaneous output voltages
46	7	Average output voltages over a sub-cycle, three-phase sinusoidal modulation.
47	7	Average output voltages over sub-cycle, three-phase sinusoidal modulation.
48		Revision to course work.

TEXT/REFERENCE BOOKS

1 M. D. Singh and K. B. Khanchandani: Power Electronics 2/e, MGH. 2008

2 M. H. Rashid: Power Electronics, Circuits Devices and Applications, Pearson. 2011

3 V. R. Moorthi: Power Electronics-Devices, Circuits and Industrial Applications, Oxford. 2005

4 Theodore Wildi: Electrical Machines, Drives and Power Systems, Pearson. 2007

5 Ned Mohan: Power Electronics, John Wiley. 2013

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Syllabus Deployment

Name of Faculty: Dr. Vivek Jain	Subject Code: 4EE4-07
Subject: Signal System	
Department: Department of Electrical Engineering (EE& EEE)	SEM: IV
Total No. of Lectures Planned: 41	

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Analyze different types of signals and system properties

CO2: Represent continuous and discrete systems in time and frequency domain using different transforms

CO3: Investigate whether the system is stable.

CO4:Acquire an understanding of MIMO systems

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION**: Objective, scope and outcome of the course.
2	**2**	**INTRODUCTION TO SIGNALS AND SYSTEMS:** Signals and systems as seen in everyday life and in various branches of engineering and science
3	2	Periodicity, absolute integrability, determinism and stochastic character.
4	2	Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals
5	2	Continuous and discrete time signals, continuous and discrete amplitude signals
6	2	System properties: linearity: additively and homogeneity, shift-

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		invariance
7	2	Causality, stability, reliability. Examples.
8	**3**	**BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS:** Impulse response and step response
9	3	Convolution, input-output behavior with a periodic convergent inputs
10	3	Cascade interconnections
11	3	Characterization of causality of LTI systems
12	3	Characterization of stability of LTI systems
13	3	Numerical on causality and stability
14	3	System representation through differential equations
15	3	System representation through difference equations.
16	3	Numerical on differentia and difference equations
17	3	State-space Representation of systems. State-Space Analysis, Multi input, multi-output representation
18	3	State Transition Matrix and its Role
19	3	Periodic inputs to an LTI system
20	3	The notion of a frequency response and its relation to the impulse response
21	3	Numerical on system response
22	**4**	**FOURIER, LAPLACE AND Z- TRANSFORMS**: Series representation of periodic signals
23	4	Waveform Symmetries, Calculation of Fourier Coefficients
24	4	Fourier Transform, convolution/multiplication and their effect in the frequency domain
25	4	Magnitude and phase response, Fourier domain duality
26	4	The Discrete- Time Fourier Transform (DTFT)
27	4	Properties of Fourier transform, Parseval's Theorem
28	4	Discrete Fourier Transform and its properties
29	4	Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals
30	4	Laplace domain analysis, solution to differential equations and system behavior
31	4	Properties of Laplace transform
32	4	The z-Transform for discrete time signals and systems System

		functions, poles and zeros of systems and sequences
33	4	Properties of Z transform
34	**5**	**SAMPLING AND RECONSTRUCTION** : Sampling Theorem
35	5	The Sampling Theorem and its implications
36	5	Spectra of sampled signals
37	5	Reconstruction: ideal interpolator, zero-order hold, first-order hold
38	5	Aliasing and its effects
39	5	Relation between continuous and discrete time systems
40	5	Introduction to the applications of signal and system theory
41	5	Modulation for communication, filtering, feedback control systems

TEXT/REFERENCE BOOKS

1. Signals and Systems, A.V. Oppenheim, A.S. Willsky and I.T. Young, Prentice Hall, 1983.
2. Signals and Systems - Continuous and Discrete, R.F. Ziemer, W.H. Tranter and D.R. Fannin, 4th edition, Prentice Hall, 1998.
3. Circuits and Systems: A Modern Approach, Papoulis, HRW, 1980.
4. Signal Processing and Linear Systems, B.P. Lathi, Oxford University Press, c1998.

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Syllabus Deployment

Name of Faculty: Pradeep C. Subject Code:4EE4-22

Subject: Digital Electronics Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: IV

Total No. of Lab Planned: 10

CO1 To minimize the complexity of digital logic circuits.

CO2 To design and analyse combinational logic circuits.

CO3 To design and analyse sequential logic circuits.

CO4 Able to implement applications of combinational & sequential logic circuits.

Lab No.	Topic
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs).
2	To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates.
3	To realize an SOP and POS expression.
4	To realize Half adder/ Subtractor& Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.
5	To realize a 4-bit ripple adder/ Subtractor using basic half adder/

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	Subtractor& basic Full Adder/ Subtractor.
6	To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8- to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.
7	Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven segment display.
8	Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.
9	Construct a divide by 2,4& 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

TEXT/REFERENCE BOOKS

1. Modern Digital Electronics, R.P Jain, Tata McGraw-Hill Education
2. Digital Circuit & Logic Design, Morris Mano, Prentice Hall of India
3. Digital Principles & Applications, A.P.Malvino& D.P Leach, Tata McGraw-Hill Education

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Syllabus Deployment

Name of Faculty: Ashika Sharma   Subject Code:4EE4-24

Lab: Measurement Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: IV

Total No. of Lab: 10

CO1 Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter.

CO2 Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method.

CO3 Calibrate a voltmeter using Crompton potentiometer.

CO4 Calibrate a single-phase energy meter by phantom loading at different power factors.

Lab No.	Topic
1	Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes.
2	Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter.
3	Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method.
4	Calibrate an ammeter using DC slide wire potentiometer.

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5	Calibrate a voltmeter using Crompton potentiometer.
6	Measure low resistance by Crompton potentiometer.
7	Measure Low resistance by Kelvin's double bridge.
8	Measure earth resistance using fall of potential method.
9	Calibrate a single-phase energy meter by phantom loading at different power factors.
10	Measure self-inductance using Anderson's bridge.

TEXT/REFERENCE BOOKS

1. Electrical Measurements Book by A.V.BakshiU.A.BakshiA.P.Godse
2. Measurements And Instrumentation Book by A.V.BakshiU.A.BakshiA.P.Godse

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Syllabus Deployment

Name of Faculty: LalitaVaishnav Subject Code: 4EE4-21

Lab: Electrical Machine – II Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: IV

Total No. of Lab: 12

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO1: To study various types of starters used for 3 phase induction motor.

CO2: To perform load test on 3-phase induction motor and calculate torque, output power, input power, efficiency, input power factor and slip for various load settings.

CO3: Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p. f. (v) Efficiency.

CO4: To study effect of variation of field current upon the stator current and power factor of synchronous motor andPlot V-Curve and inverted V-Curve of synchronous motor for different values of loads

Lab No.	Topic
1	To study various types of starters used for 3 phase induction motor.

2	To connect two 3-phase induction motor in cascade and study their speed control.
3	To perform load test on 3-phase induction motor and calculate torque, output power, input power, efficiency, input power factor and slip for various load settings.
4	To perform no load and blocked rotor test on a 3-phase induction motor and determine the parameters of its equivalent circuits.
5	Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p. f. (v) Efficiency.
6	Speed control of 3- Φ Induction Motor.
7	To plot the O.C.C. & S.C.C. of an alternator.
8	To determine Zs, Xd and Xq by slip test, Zero power factor (ZPF)/ Potier reactance method.
9	To determine the voltage regulation of a 3-phase alternator by direct loading.
10	To determine the voltage regulation of a 3-phase alternator by synchronous impedance method.
11	To study effect of variation of field current upon the stator current and power factor of synchronous motor andPlot V-Curve and inverted V-Curve of synchronous motor for different values of loads.
12	To synchronize an alternator across the infinite bus and control load sharing.

TEXT/REFERENCE BOOKS

1. Electrical Machines Book by A.V.Bakshi U.A.Bakshi A.P.Godse
2. Theory & Performance of Electrical Machines Book by J. B. Gupta.

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Syllabus Deployment

Name of Faculty: Rajkumar Soni Subject Code:4EE4-22

Subject: Power Electronics Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: IV

Total No. of Lectures Planned: 12

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO1: Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT.

CO2: Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.

CO3: Find UJT static emitter characteristics and study the variation in peakpoint and valley point.

CO4: Study and obtain waveforms of single-phase half wave controlled rectifierwith and without filters. Study the variation of output voltage with respect to firing angle.

CO5: Control the speed of a dc motor using single-phase half controlled bridgerectifier and full controlled bridge rectifier. Plot armature voltage versusspeed characteristics.

Lab No.	Experiment/Objective
1	1) Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT.
2	2) Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
3	3) Find V-I characteristics of TRIAC and DIAC.
4	4) Find output characteristics of MOSFET and IGBT..
5	5) Find transfer characteristics of MOSFET and IGBT.
6	6) Find UJT static emitter characteristics and study the variation in peakpoint and valley point.
7	7) Study and test firing circuits for SCR-R, RC and UJT firing circuits.
8	8) Study and test 3-phase diode bridge rectifier with R and RL loads. Studythe effect of filters.
9	9) Study and obtain waveforms of single-phase half wave controlled rectifierwith and without filters. Study the variation of output voltage with respect to firing angle.
10	10) Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.
11	11) Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode.
12	12) Control the speed of a dc motor using single-phase half controlled bridgerectifier and full controlled bridge rectifier. Plot armature voltage versusspeed characteristics

TEXT/REFERENCE BOOKS

1. Power Electronics P. S. Bimbhra
2. Fundamentals of Power Electronics Book by Robert Warren Erickson.
3. First Course on Power Electronics and Drives Book by Ned Mohan

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Syllabus Deployment

Name of Faculty: Payal Jain Subject Code:5EE6.1A
Subject Name: Optimisation Technique

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:
CO 1 : Be able to use to implement optimization algorithms.
CO 2 : Be able to model engineering minima/maxima problems as optimization problems.

Lecture No.	Unit	Topic
1	**1**	**Introduction:**
2	1	Engineering application of Optimization,
3	1	Engineering application of Optimization,
4	1	Formulation of design
5	1	Formulation of design
6	1	problems as mathematical programming problems
7	1	classification of optimization problems.
8	1	Engineering application of Optimization,
9	**2**	**Formulation of design**
10	2	Optimization Techniques:
11	2	Classical optimization,
12	2	multivariable with no constraints,
13	2	unconstrained minimization techniques,

14	2	Penalty function techniques,
15	2	Penalty function techniques,
16	2	Lagrange multipliers and feasibility techniques.
17	**3**	**Lagrange multipliers and feasibility techniques**.
18	3	Linear Programming:
19	3	Graphical method,
20	3	Simplex method, Duality in linear
21	3	Simplex method, Duality in linear
22	3	programming (LP),
23	3	programming (LP),
24	3	Sensitivity analysis Applications in civil engineering.
25	**4**	**Sensitivity analysis** Applications in civil engineering.
26	4	Non Linear Programming Techniques/Method:
27	4	Unconstrained optimization,
28	4	One dimensional minimization,
29	4	Golden section, elimination,
30	4	Quadratic and cubic,
31	4	Fibonacci, interpolation
32	4	Direct search, Descent,
33	**5**	**Constrained optimization**, Direct and indirect, Optimization
34	5	With calculus, KhunTucker conditions.
35	5	Constrained Optimization Techniques:
36	5	Direct,
37	5	Complex,
38	5	Cutting plane,
39	5	Exterior
40	5	Penalty function methods for structural engineering problems.

TEXT/REFERENCE BOOKS

1 Rao S. S.: Engineering Optimization- Theory and Practice, New Age International. 2009

2 Hadley. G.: Linear programming, Narosa Publishing House, New Delhi. 2003

3 Deb. K.: Optimization for Engineering Design Algorithms and Examples, PHI.

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Syllabus Deployment

Name of Faculty: Vivek Jain Subject Code:5EE6.2A
Subject Name: Principle of Communication Systems

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES
At the end of this course students will be able to:
CO1:Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
CO2: Analyze the behaviour of a communication system in presence of noise.
CO3: Investigate pulsed modulation system and analyze their system performance.

Lecture No.	Unit	Topic
1	**1**	**Noise Effects in Communication Systems**:
2	1	Resistor noise, Networks with reactive
3	1	Elements, Noise temperature,
4	1	Noise bandwidth,
5	1	Effective input noise
6	1	Temperature,
7	1	Noise figure. Noise figure &
8	1	Equivalent noise temperature in cascaded circuits. 6
9	**2**	**Amplitude Modulation**:
10	2	Frequency translation, Recovery of base band signal,
11	2	Spectrum & power relations in AM systems.
12	2	Methods of generation &

13	2	Demodulation of AM-DSB,
14	2	AMDSB/SC and AM-SSB
15	2	Signals. Modulation & detector circuits for AM systems. AM transmitters &
16	2	Receivers.
17	**3**	**Frequency Modulation**: Phase & freq.
18	3	Modulation & their relationship,
19	3	Spectrum &bandwidth of a sinusoidally modulated FM signal,
20	3	Phasor diagram, Narrow
21	3	Band & wide band FM. Generation &
22	3	Demodulation of FM signals.
23	3	FM transmitters & receivers, Comparison of AM,
24	3	FM & PM. Pre emphasis & deemphasis.
25	**4**	**Threshold in FM**, PLL demodulator.
26	4	Noise in AM and FM:
27	4	Calculation of signal-to-noise ratio in SSB-SC,
28	4	DSBSC,
29	4	DSB with carrier,
30	4	Noise calculation of square law demodulator &
31	4	envelope detector.
32	4	Calculation of S/N ratio in FM demodulators,
33	**5**	**Super-heterodyne receivers**.
34	5	Pulse Modulation Systems
35	5	Pulse Modulation Systems
36	5	Sampling theorem,
37	5	Generation and
38	5	demodulation
39	5	methods of PAM,
40	5	PWM,

TEXT/REFERENCE BOOKS

1. Principles of Communication Systems, Herbert Taub, Donald Schilling, Goutam Saha, TMH
2. An Introduction To Analog & Digital Communications, Haykins, Wiley

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3. Communication Systems Engineering, Proakis J. G. and Salehi M., Pearson Education

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Syllabus Deployment

Name of Faculty: Neha Tak Subject Code:5EE5A
Subject Name: Transmission & Distribution of Electrical Power
Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:

CO 1. Learn the basics of various fundamentals of electrical power generation, transmission & distribution.

CO 2. Learn transmission line parameters, their calculations also the effects on transmission lines.

CO 3. Learn electrical characteristics of transmission line such as types of transmission lines, various effects on transmission & per unit representation of power system.

CO 4. Learn Mechanical design along with the types of insulators.

CO 5. Learn information regarding conductors and insulation, different types of underground cable parameters and power system earthing.

Lecture No.	Unit	Topic
1	**1**	**Supply systems**: Basic network of power system.
2	1	Transmission and distribution
3	1	Voltage, effect of system voltage on size of conductor and losses.
4	1	Comparison of DC 2- wire,

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5	1	DC 3-wire, 1-phase AC and 3-phase AC (3-wire and 4-wire) systems.
6	1	Distribution Systems: Primary and secondary distribution systems, feeder, distributor
7	1	Service mains. Radial and ring- main distribution systems.
8	1	Kelvin's law for conductor size.
9	**2**	**Mechanical Features of Overhead Lines**:
10	2	Conductor material and types of conductor.
11	2	Conductor arrangements and spacing.
12	2	Calculation of sag and tension,
13	2	Supports at different levels,
14	2	Effect of wind and
15	2	Ice loading, stringing chart and sag template.
16	2	Conductor vibrations and vibration dampers.
17	**3**	**Parameters of Transmission Lines**: Resistance inductance and capacitance of
18	3	overheadlines, effect of earth,
19	3	line transposition. Geometric mean radius and distance.
20	3	Inductance and capacitance of line with symmetrical and unsymmetrical spacing
21	3	Inductance and capacitance of double circuit lines.
22	3	Skin and proximity
23	3	Effects. Equivalent circuits and performance of short and
24	3	medium transmission lines.
25	**4**	**Generalized ABCD Line Constants**: equivalent circuit and performance of long
26	4	transmission line. Ferranti effect.
27	4	Interference with communication circuits. Power
28	4	flow through atransmission line
29	4	Corona:Electric stress between parallel conductors.
30	4	Disruptive critical voltage and
31	4	Visual critical voltage, Factors affecting corona.
32	4	Corona power loss. Effects of corona.
33	**5**	**Insulators:** Pin, shackle, suspension,
34	5	Post and strain insulators. Voltage distribution

35	5	Across an insulator string,
36	5	Grading and methods of improving string efficiency.
37	5	Underground Cables: Conductor, insulator, sheathing and armoring materials.
38	5	Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses
39	5	Reduction of maximum stresses. Causes of breakdown. Thermal rating of cable.
40	5	Introduction to oil filled and gas filled cables

TEXT/REFERENCE BOOKS

1 S. Sivanagaraju and S. Satyanarayana: Electric Power Transmission and Distribution, Pearson Publisher.

2 A. S. Pabla: Electric Power Distribution, MGH.

3 B. R. Gupta: Power System Analysis & Design, S. Chand Publishers.

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Syllabus Deployment

Name of Faculty: Yogendra Solanki   Subject Code:5EE6.3A
Subject Name: Introduction to VLSI

Department: Department of Electrical Engineering (EE& EEE)   SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:

- CO 1. Interpret the submicron issues in VLSI Design.
- CO 2. Design different CMOS circuits using various logic families along with their circuit layout.
- CO 3. Analyze parasitic effects, switching delays, power dissipation issues in VLSI designs.
- CO 4. Implement VLSI IC design using EDA tools.

Lecture No.	Unit	Topic
1	**1**	**Introduction to MOS Technology**:
2	1	Basic MOS transistors,
3	1	Enhancement Mode
4	1	Enhancement Mode
5	1	Transistor action,
6	1	Depletion Mode transistor action,
7	1	NMOS and
8	1	CMOS fabrication.
9	**2**	**Basic Electrical Properties of MOS Circuits**:
10	2	Versus relationship,

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11	2	Aspects of threshold voltage,
12	2	Transistor Trans conductance gm.
13	2	The NMOS inverter,
14	2	Pull up to Pull-down ratio for a NMOS Inverter and CMOS
15	2	Inverter,
16	2	MOS transistor circuit Model, Noise Margin.
17	**3**	**CMOS Logic Circuits:The inverter**,
18	3	Combinational Logic, NAND Gate NOR gate,
19	3	Compound Gates, 2
20	3	Input CMOS Multiplexer,
21	3	Memory latches and registers
22	3	Transmission Gate, Gate delays,
23	3	CMOS-Gate Transistor sizing,
24	3	Power dissipation
25	**4**	**Basic Physical Design of Simple Gates** and
26	4	Layout Issues:
27	4	Layout issues for inverter,
28	4	Layout for NAND and
29	4	NOR Gates,
30	4	Complex Logic gates Layout,
31	4	Layout optimization for performance.
32	4	Layout optimization for performance
33	**5**	**Introduction to VHDL**
34	5	Verilog
35	5	other design tools.
36	5	VHDL Code for simple Logic
37	5	Gates, flip-flops,
38	5	shift-registers, Counters,
39	5	Multiplexers,
40	5	Adders and subtractors.

TEXT/REFERENCE BOOKS

1 S. M. Sze: VLSI Technology, MGH. 2003
2 Debaprasad Das: VLSI Design, Oxford
3 Angsuman Sarkaret. al.: VLSI Design and EDA Tools, Scitech Pub

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Syllabus Deployment

Name of Faculty: Yogendra Solanki Subject Code:5EE2A
Subject Name: Microprocessors & Computer Architecture
Department: Department of Electrical Engineering (EE& EEE) SEM:V
Total No of Lectures Planned: 40

COURSE OUTCOMES
At the end of this course students will be able to:
CO1:Develop assembly language programming skills.
CO2: Able to build interfacing of peripherals like, I/O, A/D, D/A, timer etc.
CO3:Develop systems using different microcontrollers.
CO4:Understand 8051 processors microcontroller based systems

Lecture No.	Unit	Topic
1	**1**	**Introduction to 8085** Microprocessor Architecture:
2	1	CPU, address bus, data bus
3	1	and control bus. Input/Output devices,
4	1	buffers, encoders, latches and memories.
5	1	Internal Data Operations and Registers,
6	1	Pins and Signals,
7	1	Peripheral Devices and
8	1	Memory Organization, Interrupts.
9	**2**	**8085 Microprocessor Instructions**:
10	2	Classification,
11	2	Format and
12	2	Timing.

13	2	Instruction Set: 8 Bit and
14	2	16 Bit Instructions,
15	2	Programming and Debugging,
16	2	Subroutines.
17	**3**	**8085 Microprocessor Interfacing**:
18	3	8259, 8257,
19	3	8255,
20	3	8253,
21	3	8155 chips and their
22	3	applications.
23	3	A/D conversion, memory,
24	3	keyboard and display interface (8279).
25	**4**	**8086 Microprocessor: Architecture**: Architecture of INTEL 8086 (Bus Interface
26	4	Unit, Execution unit), register organization, memory addressing, memory
27	4	segmentation, Operating Modes
28	4	Instruction Set of 8086: Addressing Modes:
29	4	Instruction format: Discussion on
30	4	instruction Set: Groups: data transfer, arithmetic, logic string, branch control
31	4	transfer, processor control. Interrupts: Hardware and software interrupts,
32	4	responses and types.
33	**5**	**Basic Computer Architecture**: Central Processing Unit, memory and input/output
34	5	interfacing. Memory Classification Volatile and non-volatile memory, Primary
35	5	and secondary memory, Static and Dynamic memory, Logical, Virtual and
36	5	Physical memory.
37	5	Types Of Memory: Magnetic core memory, binary cell, Rom architecture and
38	5	different types of ROM, RAM architecture, PROM, PAL, PLA, Flash and Cache

39	5	memory, SDRAM, RDRAM and DDRAM. Memory latency, memory bandwidth,
40	5	memory seek time.

TEXT/REFERENCE BOOKS

1. Microprocessors Architecture, Programming &Application, Ramesh S. Gaonkar, (2000).
2. A Textbook of Microprocessors and Microcontrollers, R.S. Kaler I.K International Publishing House Pvt. Ltd.
3. Introduction to Microprocessors, A.P. Mathur, Mc Graw Hill.

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Syllabus Deployment

Name of Faculty: Abrar Ahmad Subject Code:5EE1A
Subject Name: Power Electronics

Department: Department of Electrical Engineering (EE& EEE) SEM:V
Total No of Lectures Planned: 40

COURSE OUTCOMES
At the end of this course students will be able to:

CO1. Acquire knowledge of switching characteristics of various Power Semiconductor devices and able to design and simulate their base/gate drive circuits
CO2. Analyze different controlled rectifier circuits and computing their performances.
CO3. Analyze different dc-dc converter circuits (isolated and non-isolated type) and computing their performances.
CO4. Analyze single phase and three phase Voltage Source Inverter circuit topology with Sin PWM control, Space Vector PWM control and computing their performances..

Lecture No.	Unit	Topic
1	**1**	**Power Semiconductor Devices**: Construction,
2	1	Principle of operation,
3	1	Characteristics

4	1	and applications of Power Transistor& Thyristor.
5	1	Characteristics of GTO, DIAC, MCT,
6	1	TRIAC, Power MOSFET and IGBT; Two-
7	1	Transistor Model of Thyristor,
8	1	Thyristor Commutation methods.
9	**2**	**SCR**: Construction and characteristics,
10	2	specification and ratings, pulse transformer,
11	2	optical isolators, methods of turn on, triggering circuits for SCR: R, RC, UJT
12	2	relaxation oscillator.
13	2	Rating extension by series and parallel connections,
14	2	string efficiency. Protection of
15	2	SCR-Protection against over voltage, over current,
16	2	dv/dt, di/dt, Gate protection.
17	**3**	**Converters-I**: Single Phase half &
18	3	full wave converters with RL & RLE load, Single
19	3	phase dual converters
20	3	phase dual converters
21	3	Three phase half wave converters
22	3	Three phase half wave converters
23	3	Three phase full converters with RL load
24	3	Three phase dual converters
25	**4**	**Converters-II:** Single and three-phase semi converters
26	4	with RL & RLE load.
27	4	Power factor improvement-Extinction angle control,
28	4	symmetrical angle control,
29	4	pulse width modulation control
30	4	pulse width modulation control
31	4	sinusoidal pulse width modulation control
32	4	sinusoidal pulse width modulation control.
33	**5**	**Inversion operation.**
34	5	Effect of load and source impedances.
35	5	DC-DC Converters:
36	5	Step Up/Down Copper,
37	5	Control strategies, Chopper

38	5	Configurations,
39	5	Analysis of type A Chopper
40	5	Voltage, current and load commutated chopper.

TEXT BOOK/REFERENCE BOOK

1. M. H. Rashid," Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland," Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic," Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand," Power Electronics: Essentials and Applications", Wiley India, 2009

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Syllabus Deployment

Name of Faculty: CPJain Subject Code:5EE3A
Subject Name: Control System

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO1: Understand the general concept of a system and classify systems into different types and represent a system using different techniques like block diagram, signal flow graph.

CO2: develop transfer function model of mechanical, electrical, thermal, fluid system and different control system components like servomotors, synchros, potentiometer, tacho-generators etc.

CO3: analyze system response and evaluate error dynamics in time domain.

CO4: Determine system stability using routh-hurtwitz (RH) criteria, root locus techniques in time domain and bode plot and nyquist technique in frequency domain.

Lecture No.	Unit	Topic
1	**1**	**Introduction**: Elements of control systems,
2	1	Concept of open loop and closed loop
3	1	Systems, Examples and application of open loop and closed loop systems, brief idea
4	1	Multivariable control systems.
5	1	Mathematical Modeling of Physical Systems: Representation of

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		physical
6	1	System (Electro Mechanical) by differential equations, Determination of transfer
7	1	Function by block diagram reduction techniques and signal flow method, Laplace
8	1	Transformation function, inverse Laplace transformation.
9	**2**	**Time Response Analysis of First Order** and
10	2	Second Order System:Characteristic
11	2	Equations, response to step,
12	2	Ramp and parabolic inputs.
13	2	Transient response analysis,
14	2	Steady state errors and error constants,
15	2	Transient & steady state analysis of LTI systems
16	2	Transient & steady state analysis of LTI systems
17	**3**	**Control System Components**:
18	3	Constructional and working concept of ac
19	3	Servomotor, synchronous and stepper motor
20	3	Stability and Algebraic Criteria:
21	3	Concept of stability and necessary conditions,
22	3	Routh-Hurwitz criteria and limitations.
23	3	Root Locus Technique: The root locus
24	3	Concepts, construction of root loci.
25	**4**	**Frequency Response Analysis**:
26	4	Frequency response,
27	4	Correlation between time and
28	4	frequency responses,
29	4	Polar and inverse polar plots,
30	4	Bode plots
31	4	Stability in Frequency Domain: Nyquist stability criterion, assessment of relative
32	4	Stability: gain margin and phase margin, M and N Loci, Nichols chart.
33	**5**	**The design problem and preliminary considerations lead**
34	5	The design problem and preliminary considerations lead
35	5	The design problem and preliminary considerations lead

36	5	Lag and
37	5	Lead-lag networks,
38	5	Design of closed loop systems using compensation techniques in time domain and frequency domain.
39	5	Brief idea of proportional,
40	5	Derivative and integral controllers.

TEXT/REFERENCE BOOKS

1. Smarjit Ghosh, Control Systems: Theory and Applications, 2/e, Pearson Publisher. 2004

2 Dhannesh N. Manik: Control System, Cengage Learning. 2012

3 I. J. Nagrath and M. Gopal: Control Systems Engineering, 3rd Ed, New Age Publication.

4 K. R. Varmah: Control Systems, MGH 2010

5 Anandnatrajan et. al.: Control Systems Engineering, 4th ed., Scitech Pub.

Techno India NJR Institute of Technology

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Syllabus Deployment

Name of Faculty: Kirti Subject Code:5EE4A
Subject Name: Data Base Management System

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:
CO 1 Define basic functions of DBMS & RDBMS.
CO 2 : Anal yze database models & entity relationship models Design and implement a database schema for a given problem-domain
CO 3 : Populate and query a database using SQL DML/DDL commands.

Lecture No.	Unit	Topic
1	**1**	**Introduction**
2	1	Need
3	1	Purpose and goals of DBMS
4	1	DBMS Architecture,
5	1	Keys, Generalization and specialization,
6	1	Introduction to relational data model
7	1	ER modeling,
8	1	Concept of ER diagram
9	**2**	**Database Design**:
10	2	Conceptual Data Base design.
11	2	Theory of normalization, Primitive
12	2	Composite data types,

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13	2	Concept of physical and logical databases,
14	2	Data abstraction and data independence,
15	2	Relational algebra and
16	2	Relational calculus.
17	**3**	**SQL, DDL and DML**.
18	3	Constraints assertions,
19	3	Views database security. Application
20	3	Development using SQL:
21	3	Host Language interface embedded SQL programming.
22	3	GL's, Forms management and report writers.
23	3	Stored procedures and triggers.
24	3	Dynamic SQL, JDBC.
25	**4**	**Internal of RDBMS**:
26	4	Physical data organization in sequential,
27	4	Indexed,
28	4	random and
29	4	hashed files.
30	4	Inverted and
31	4	Multi-list structures
32	4	Multi-list structures
33	**5**	**Transaction Management**:
34	5	Transaction concept,
35	5	Transaction state, serializability,
36	5	Conflict serializability, views serializability.
37	5	Concurrency Control:
38	5	Lock based protocol.
39	5	Deadlock Handling: Prevention detection,
40	5	Recovery. (iv) Recovery System:

TEXT/REFERENCE BOOKS

1 Silverschatz Korth and Sudarshan: Database System Concepts, 6th ed., MGH. 2011

2 Raghu Rama Krishnan: Database Management Systems, 2nd ed., MGH.

3 S. K Singh: Database System Concepts, Designs and Applications.

Pearson Education

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Syllabus Deployment

Name of Faculty: Pankaj Ameta Subject Code:5EE10A
Subject Name: DBMS Lab

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lab Planned: 8

Lab OUTCOMES
Atthe end of this course students will be able to:

1. Designing database and constraints using DDL statements.
2. Database connectivity using JDBC/ODBC.
3. Designing front end in HLL and accessing data from backend database.
4. Project for generating Electricity Bills

Lab No.	Practical No.	Topic
1	1	Designing database and constraints using DDL statements.
2	2	Experiments for practicing SQL query execution on designed database.
3	3	Database connectivity using JDBC/ODBC.
4	4	Features of embedded SQL.
5	5	Designing front end in HLL and accessing data from backend database.
6	6	Designing simple projects using front end-back end programming

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7	7	Project for generating Electricity Bills
8	8	Project for managing student's attendance/marks details.

TEXT/REFERENCE BOOKS

1. S. K Singh: Database System Concepts, Designs and Applications, Pearson Education
2. Elmasari: Fundamentals of Data Base Systems, Pearson Education.

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Lab Deployment

Name of Faculty: Dr. Vivek Jain	Subject Code:5EE8A
Subject Name: Microprocessor Lab	SEM: V
Department: Department of Electrical Engineering	
Total No. of Labs Planned: 10	

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: To perform the microprograms like addition, subtraction etc.
CO2: To perform the Transfer a block of data from memory location XX00 to Another memory location XX00 in forward & reverse order.
CO3: To perform the operation on peripheral devices.

Labs No.	Name of Experiment
1	Study the hardware, functions, memory structure and operation of 8085-Microprocessor kit.
2	Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit.
3	• Transfer of a block of data in memory to another place in memory. • Transfer of black to another location in reverse order.
4	• Finding party of a 32-bit number.

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	• Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal.
5	• Program to multiply two 8–bit numbers • Program to generate and sum 15 Fibonacci numbers.
6	• Program for rolling display of message "India", "HELLO". • To insert a number at correct place in a sorted array.
7	• Reversing bits of an 8-bit number. • Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255.
8	Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware.
9	Parallel data transfer between two DYNA-85 kit using 8253 ports.
10	Generation of different waveform on 8253/8254 programmable timer.

TEXT/REFERENCE BOOKS

1. Microprocessors Architecture, Programming &Application, Ramesh S. Gaonkar, (2000).
2. A Textbook of Microprocessors and Microcontrollers, R.S. Kaler I.K International Publishing House Pvt. Ltd.
3. Introduction to Microprocessors, A.P. Mathur, Mc Graw Hill.

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Syllabus Deployment

Name of Faculty: Rajkumar Soni Subject Code:5EE7A
Subject Name: Power Electronics Lab

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lab Planned: 12

Lab OUTCOMES
Atthe end of this course students will be able to:
CO1. Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
CO2. Find V-I characteristics of TRIAC, DIAC, MOSFET and IGBT
CO3. Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters.
CO4. Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.

Lab No.	Practical No.	Topic
1	1	Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT.
2	2	Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
3	3	Find V-I characteristics of TRIAC and DIAC.
4	4	Find output characteristics of MOSFET and IGBT.
5	5	Find transfer characteristics of MOSFET and IGBT.

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6	6	Find UJT static emitter characteristics and study the variation in peak point and valley point.
7	7	Study and test firing circuits for SCR-R, RC and UJT firing circuits.
8	8	Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters.
9	9	Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle.
10	10	Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.
11	11	Study and obtain waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode.
12	12	Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature voltage versus speed characteristics.

TEXT/REFERENCE BOOKS

1. O. P. Arora: Power Electronics Laboratory-Experiments and Organization, Narosa Pub
2. P. B. Zbar: Industrial Electronics- A Text-Lab Manual, MGH.

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Syllabus Deployment

Name of Faculty: CP Jain Subject Code: 5EE11A
Subject Name: PROFESSIONAL ETHICS AND DISASTERS MANAGEMEN

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lab Planned: 9

Lab OUTCOMES

At the end of this course students will be able to:

CO1. To appreciate the importance and values and ethics in implementing the technology and ensure sustainable development, happiness and prosperity.

CO2. To understand the co-existence with nature and to be aware of potential natural and manmade disasters.

Lab No.	Practical No.	Topic
1	1	Human Values: Effect of Technological Growth and Sustainable Development.
2	1	Profession and Human Values: Values crisis in contemporary society. Nature of values. Psychological Values, Societal Values and Aesthetic Values. Moral and Ethical values.
3	2	Professional Ethics: • Professional and Professionalism- Professional Accountability, Role of a professional, Ethic and image of profession.
4	2	Engineering Profession and Ethics-Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world.
5	2	Professional Responsibilities-Collegiality, Loyalty,

		Confidentially, Conflict of Interest, Whistle Blowing
6	3	Disaster Management: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability.
7	3	Types of Disasters, their occurrence/ causes, impact and preventive measures: Natural Disasters- Hydro-meteorological Based Disasters like Flood, Flash Flood
8	3	Types of Disasters, their occurrence/ causes, impact and preventive measures: Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions.
9	4	Manmade Disasters: Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Case studies. Disaster Management Cycle and its components.

TEXT/REFERENCE BOOKS

1. R Subramanian: Professional Ethics, oxford publishers.
2. Engineering Ethics: Concepts and cases by Charles E. Harris, Jr., Michael S. Pritchard, MichaelJ. Rabins. Cengage Learning, Delhi
3. Stephen H. Unger: Controlling Technology- Ethics and Responsible Engineers, John Willey and Sons.

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Syllabus Deployment

Name of Faculty: CP Jain Subject Code: 5EE9A
Subject Name: SP Lab

Department: Department of Electrical Engineering (EE& EEE) SEM: V
Total No of Lab Planned: 6

Lab OUTCOMES
Atthe end of this course students will be able to:
CO1. Idea about simulink, problems based on simulink.
CO2. Write a program to generate Machine Op- code table using two pass Assembler.
CO3. Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation

Lab No.	Practical No.	Topic
1	1	Basics of MATLAB matrices and vectors, matrix and array operations
2	2	Saving and loading data, plotting simple graphs, scripts and functions
3	3	Script files, Function files, Global Variables, Loops, Branches
4	4	Control flow, Advanced data objects,
5	5	Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation.
6	6	Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets)

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TEXT/REFERENCE BOOKS

1. AlmosGilat: MATLAB: An Introduction with Applications, Wiley India Ltd., 2004.
2. Ram N. Patel et. al.: Programming in MATLAB, Pearson.

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Syllabus Deployment

Name of Faculty: Dr. Vivek Jain | Subject Code: 6EE6.1A

Subject: Advance Micro Processor

Department: Department of Electrical Engineering (EE& EEE) | SEM: VI

Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1:Develop assembly language programming skills.

CO2: Able to build interfacing of peripherals like, I/O, A/D, D/A, timer etc.

CO3:Develop systems using different microcontrollers.

CO4:Understand 8086, 8255 processors microcontroller based systems.

Lecture No.	Unit	Topic
1	**1**	**8086 MICROPROCESSOR** Introduction
2	1	Hardware specifications
3	1	8086 architecture
4	1	Address spaces, clock generator
5	1	Bus controller and arbiter
6	1	Minimum and maximum mode of 8086
7	1	System Bus Timing diagram of Minimum mode
8	1	System Bus Timing diagram of Maximum mode

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9	**2**	**SOFTWARE & INSTRUCTION SET** : overview
10	2	Assembly language programming
11	2	Addressing mode of 8086
12	2	Instructions of 8086
13	2	Linking and execution of programs
14	2	MACRO programming
15	2	Assembler directives
16	2	Assembler operators.
17	**3**	**I/O INTERFACES** : Overview
18	3	Programmable peripheral interfacing
19	3	Interfacing between 8086 and 8255
20	3	Interfacing between 8086 and 8155
21	3	Interfacing between 8086 and 8253
22	3	Interfacing between 8086 and 8254
23	3	Interfacing between 8086 and 8259
24	3	Serial Communication Interfaces
25	**4**	**DATA & MEMORY INTERFACING :** Introduction
26	4	Basic Introduction of ADC & DAC
27	4	A/D Convertor Interfacing with 8086
28	4	D/A Convertor Interfacing with 8086
29	4	RAM interfacing & Decoding
30	4	ROM interfacing& Decoding
31	4	DMA 8257 Architecture
32	4	DMA controller Interfacing with 8086
33	**5**	**MULTIPROCESSOR CONFIGURATIONS** : 8086
34	5	8086 based Multiprocessor systems
35	5	8086 based Multiprocessor systems
36	5	8087 Numeric data processor
37	5	Introduction to 8-bit microcontroller 8051 Architecture
38	5	Introduction to 8-bit microcontroller 8051 instruction set
39	5	Introduction to 16-bit microcontroller MSP 430 Architecture
40	5	Introduction to 16-bit microcontroller MSP 430 instruction set

TEXT/REFERENCE BOOKS

1. Microprocessor Architecture: Programming and Applications ith the 8085/8080A, R. S. Gaonkar ,Penram International Publishing, 1996
2. Computer Organization and Design The hardware and software interface D A Patterson and J H Hennessy ,Morgan Kaufman Publishers.
3. Microprocessors Interfacing, Douglas Hall, Tata McGraw Hill, 1991.
4. The 8051 Microcontroller, Kenneth J. Ayala, Penram International Publishing, 1996.

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Syllabus Deployment

Name of Faculty: Abrar Ahmed Subject Code:6EE4A
Subject Name: Advance Power Electronics
Department: Department of Electrical Engineering (EE& EEE) SEM: VI
Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Deduce the characteristics of Power Electronic switches with various parameters.

CO2: Study and analyze power electronic converters.

CO3: Simulate and analyze various power electronic circuits.

.

Lecture No.	Unit	Topic
1	**1**	**AC VOLTAGE CONTROLLERS**: Principle of On-Off Control
2	1	Principle of Phase control
3	1	Single Phase Bi-directional Controllers with Resistive Loads, Single Phase
4	1	Controllers with Inductive Loads, Three Phase full wave AC controllers, AC Voltage
5	1	Controller with PWM Control.
6	**2**	**CYCLO-CONVERTERS**: Basic principle of operation
7	2	Cyclo-converters: Basic principle of operation

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8	2	Cyclo-converters: Basic principle of operation
9	2	Single phase to single phase
10	2	Three-phase to three-phase
11	2	Three-phase to single phase cyclo-converters.
12	2	Output equation,
13	2	Control circuit.
14	**3**	**INVERTERS**: Principle of Operation
15	3	Single-phase bridge inverters.
16	3	Three phase bridge
17	3	Inverters: 180
18	3	120 degree of conduction.
19	3	VSI and CSI.
20	3	Voltage control of Single Phase
21	3	Three Phase Inverters
22	3	Harmonic analysis
23	3	Harmonic reduction techniques
24	3	Pulse width modulation techniques.
25	**4**	**RESONANT PULSE INVERTER:** Series resonant inverter
26	4	Series resonant inverter with unidirectional switches
27	4	Parallel resonant inverter
28	4	Class E resonant inverter
29	4	L-type
30	4	M-type ZCS resonant
31	4	Converter
32	4	ZVS resonant converter.
33	**5**	**POWER SUPPLIES**: Switched Mode DC Power Supplies
34	5	Fly-back converter, forward
35	5	Converter, half and full bridge converter
36	5	Resonant DC power supplies, bi-directional
37	5	Power supplies.
38	5	Resonant AC power supplies,
39	5	Bidirectional AC power supplies. Multistage
40	5	Conversions, Control Circuits

TEXT BOOK/REFERENCE BOOK

1. M. H. Rashid," Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland," Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic," Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand," Power Electronics: Essentials and Applications", Wiley India, 2009

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Syllabus Deployment

Name of Faculty: Vivek Jain Subject Code: 6EE6.3A
Subject: Digital Communication And Information Theory
Department: Department of Electrical Engineering (EE& EEE) SEM: VI
Total No. of Lectures Planned: 40

COURSE OUTCOMES
At the end of this course students will be able to:
CO1:Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
CO2:Perform the time and frequency domain analysis of the signals in a digital communication system.
CO3: Select the blocks in a design of digital communication system.
CO4: Analyze Performance of spread spectrum communication system

Lecture No.	Unit	Topic
1	**1**	**PCM & DELTA MODULATION SYSTEMS:** overview
2	1	PCM
3	1	Delta modulation
4	1	Quantization noise
5	1	PCM and delta modulation
6	1	Signal-to-noise ratio in PCM and delta modulation
7	1	T1 Carrier System, Comparison of PCM and DM. Adaptive delta Modulation. Bit
8	1	Word and frame synchronization, Matched filter detection.
9	**2**	**DIGITAL MODULATION TECHNIQUES:** overview
10	2	Various techniques of phase shift

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11	2	Various techniques of phase shift
12	2	Amplitude shift
13	2	Frequency shift keying.
14	2	Minimum shift keying.
15	2	Modulation
16	2	Demodulation.
17	**3**	**ERROR PROBABILITY IN DIGITAL MODULATION:** overview
18	3	Error Probability in Digital Modulation
19	3	Calculation of error probabilities for
20	3	Calculation of error probabilities for
21	3	PSK
22	3	ASK
23	3	FSK
24	3	MSK techniques.
25	**4**	**INFORMATION THEORY:** Amount Of Information
26	4	Average Information, Entropy
27	4	Information rate, Increase in Average information per bit by coding
28	4	Shannon's Theorem
29	4	Shannon's bound
30	4	Capacity of a Gaussian Channel
31	4	BW-S/N trade off
32	4	Orthogonal signal transmission.
33	**5**	**CODING: CODING OF INFORMATION** overview
34	5	Coding: Coding of Information
35	5	Hamming code
36	5	Single Parity-Bit Code
37	5	Linear
38	5	Block code
39	5	Cyclic code
40	5	Convolution code

TEXT/REFERENCE BOOKS

1 R. N. Mutagi: Digital Communication, 2nd ed., Oxford. 2013

2 P. Ramakrishna Rao: Communication Systems, MGH.
3 H. Taub & D.L. Schilling: Principles of Communication Systems, MGH

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Syllabus Deployment

Name of Faculty: Lalita Vaishnav Subject Code:6EE2A
Subject Name: High Voltage Engineering
Department: Department of Electrical Engineering (EE& EEE) SEM: VI
Total No. of Lectures Planned: 40

COURSE OUTCOMES
At the end of this course students will be able to:
CO1: Analyze different breakdown mechanism in solid, liquid and gaseous medium.
CO2:Understand Lightening and switching over-voltages and Evaluate protection measures by lightening arrestors, ground wires and surge absorbers.
CO3:Interpret the behaviour of travelling waves and understand insulation co-ordination.
CO4: Discuss different techniques for high voltage and current generation.
CO5: Analyse different methods of measurement for high voltage and current in laboratories.
.

Lecture No.	Unit	Topic
1	**1**	**BREAKDOWN IN GASES**: Introduction to mechanism of breakdown in gases
2	1	Townsend's breakdown mechanism. Breakdown in electromagnetic gases
3	1	Application of gases in power system.
4	1	Breakdown in Liquids: Introduction to mechanism of breakdown in liquids

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5	1	Suspended solid particle mechanism and cavity breakdown. Application of oil in
6	1	Power apparatus.
7	1	Breakdown in solids: Introduction to mechanism of breakdown in solids
8	1	Electromechanical breakdown, treeing & tracking breakdown and thermal breakdown
9	**2**	**HIGH DC VOLTAGE GENERATION** Overview
10	2	High DC Voltage Generation: Generation of high dc voltage, basic voltage
11	2	Multiplier circuit.
12	2	High AC Voltage Generation: Cascaded Transformers.
13	2	Impulse Voltage generation: Impulse voltage
14	2	Basic impulse circuit, Mark's
15	2	Multistage impulse generator.
16	2	Measurement of High Voltage: Potential dividers - resistive, capacitive
17	**3**	**MIXED POTENTIAL DIVIDERS**. Sphere gap- Construction and operation. Klydonorgraph.
18	3	Nondestructive Insulation Tests: (i) Measurement of resistively, dielectric constant
19	3	Loss factor.
20	3	High Voltage Schering Bridge- measurement of capacitance and
21	3	Dielectric loss.
22	3	Partial Discharges: Introduction to partial discharge
23	3	Partial discharge
24	3	Equivalent circuit. Basic wide-band and narrow band
25	**4**	**PD DETECTION CIRCUITS**. Overview
26	4	Over voltages: Causes of over voltages
27	4	Introduction to lightning phenomena
28	4	Over voltages due to lighting.
29	4	Travelling Waves: Travelling waves on transmission lines-open end line
30	4	Short circuited line, line terminated through a resistance,
31	4	Line connected to a cable

32	4	Reflection and refraction at a T-junction and line terminated through a capacitance.
33	**5**	**ATTENUATION OF TRAVELING WAVES.** Over Voltage Protection
34	5	Over Voltage Protection: Basic construction and operation of ground wires protection
35	5	Angle and protective zone, ground rods
36	5	Counterpoise, surge absorber, rod
37	5	Gap and arcing horn, lighting arresters - expulsion type
38	5	Non -linear gap type
39	5	Metal oxide gapless type.
40	5	Insulation Coordination: Volt-time curves, basic impulse insulation levels

TEXT/REFERENCE BOOKS

1. Naidu: High Voltage Engineering 4/e, MGH. 2013
2 John Kuffel, E. Kuffel and W. S. Zaengl: High Voltage engineering, Elsevier.
3 C. L.Wadhwa: High Voltage Engineering, Wiley Eastern Ltd.

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Syllabus Deployment

Name of Faculty: Chandra Prakash Jain Subject Code:6EE1A
Subject Name: Modern Control Theory

Department: Department of Electrical Engineering (EE& EEE) SEM: VI

Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1:Various terms of basic and modern control system for the real time analysis and design of control systems.

CO2:To perform state variables analysis for any real time system.

CO3:Apply the concept of optimal control to any system.

CO4:Able to examine a system for its stability, controllability, and observability.

CO5: Implement basic principles and techniques in designing linear control systems.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION**: Concept of Linear vector space Linea Independence
2	1	Bases & Representation
3	1	Domain and range. Concept of Linearity, relaxedness
4	1	Time invariance, causality.
5	1	State Space Approach of Control System Analysis: Modern V conventional
6	1	Control theory, concept of state, state variable state vector, stat space, state
7	1	Space equations, Writing state space equations of mechanica Electrical systems
8	1	Analogous systems.
9	**2**	**STATE SPACE REPRESENTATION** using physical and phas

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		variables, comparison
10	2	Form of system representation.
11	2	Block diagram representation of state model.
12	2	Signal flow graph representation.
13	2	State space representation using canonical variables.
14	2	Diagonal matrix.
15	2	Jordan canonical form,
16	2	Derivation of transfer functions from state-model.
17	**3**	**SOLUTION OF STATE EQUATIONS**: Overview
18	3	Eigen values and Eigen vectors.
19	3	Matrix. Exponential,
20	3	State transition matrix, Properties of state transition matrix.
21	3	Computation of State transition
22	3	Matrix concepts of controllability
23	3	Observability
24	3	Pole placement by state feedback
25	**4**	**DIGITAL CONTROL SYSTEMS**: Introduction,
26	4	Sampled data control systems, signal
27	4	Reconstruction
28	4	Difference equations.
29	4	The z-transform
30	4	Z-Transfer
31	4	Block diagram analysis of sampled data
32	4	Systems, z and s domain relationship.
33	**5**	**MODELING OF SAMPLE-HOLD CIRCUIT,** Sample-Hold Circuit,
34	5	Steady state accuracy
35	5	Stability in z-plane and Jury
36	5	Stability criterion, bilinear transformation
37	5	Routh-Hurwitz criterion on s-planes
38	5	Digital PID controllers
39	5	Introduction to adaptive control
40	5	Introduction to adaptive control

TEXT/REFERENCE BOOKS

1 I. J. Nagrath and M. Gopal: Control Systems Engineering, 3rd Ed, New Age Publication.
2 S. K. Bhattacharya: Control Systems Engineering, 3e, Pearson Publishers
3 Dhannesh N. Manik: Control System, Cengage Learning.

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Syllabus Deployment

Name of Faculty: Chandra Prakash Jain   Subject Code: 6EE6.2A

Subject: Power System Instrumentation

Department: Department of Electrical Engineering (EE& EEE)   SEM: VI

Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Sensors and process control techniques &Computer application in process control

CO2: Analyze different methods of interfacing sensors with amplifiers and digital circuits

CO3: Design signal conditioning and analog controllers for process control

.

Lecture No.	Unit	Topic
1	**1**	**THEORY OF ERRORS:** overview
2	1	Accuracy
3	1	Precision, systematic
4	1	Random errors, limits of error
5	1	Probable error
6	1	Standard deviation.
7	1	Gaussian error curves
8	1	Combination of errors
9	**2**	**TRANSDUCERS CONSTRUCTION:** Operating Characteristics
10	2	Operating Characteristics of active and digital
11	2	Transducers, Measurement of temperature

12	2	Pressure, displacement
13	2	Acceleration, noise level.
14	2	Instrumentation for strain
15	2	Displacement
16	2	Velocity, acceleration, force, torque and temperature.
17	**3**	**SIGNAL CONDITIONING** : Introduction
18	3	Signal Conditioning: Instrumentation amplifiers,
19	3	Isolation amplifiers, analog
20	3	Multipliers, analog dividers
21	3	Function generators, timers
22	3	Sample and hold
23	3	Optical and magnetic isolators.
24	3	Frequency to voltage converters
25	**4**	**TEMPERATURE TO CURRENT CONVERTERS.** Shielding
26	4	Grounding.
27	4	Power System Instrumentation-I
28	4	Measurement of voltage
29	4	Current, phase angle
30	4	Frequency
31	4	Active power
32	4	Reactive power in power plants.
33	**5**	**ENERGY METERS** : Introduction
34	5	Multipart tariff meters. Basic idea of LT & HT panel's.
35	5	Power System Instrumentation-II:
36	5	Capacitive voltage transformers
37	5	Their transient behavior
38	5	Current Transformers for measurement and
39	5	Protection
40	5	Composite

TEXT/REFERENCE BOOKS

1 R. H. Cerni and L. E. Foster: Instrumentation for Engineering Measurements, John Wiley and Sons. 1962

2 Curtis and D. Hohnson: Process Control Instrumentation Technology, John Wiley and sons

3 R. Morrison: Instrumentation Fundamentals and Applications, John Wiley and Sons.

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38	5	Basics of Web Service
39	5	CLOUD Computing to make Smart
40	5	Grids smarter, Cyber Security for Smart Grid

TEXT/REFERENCE BOOKS

1 Vehbi C. Güngör, Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke: Smart Grid Technologies- Communication Technologies and Standards IEEE Transactions on Industrial Informatics, Vol. 7, No.

2 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang: Smart Grid – The New and Improved Power Grid- A Survey, IEEE Transaction on Smart Grids

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Syllabus Deployment

Name of Faculty: Ashiaka Sharma Subject Code:6EE5A
Subject Name: Smart Grid Technology

Department: Department of Electrical Engineering (EE& EEE) SEM: VI

Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1 Understand the features of Smart Grid.

CO2 Assess the role of automation in Transmission and Distribution

CO3 Apply Evolutionary Algorithms for the Smart Grid and Distribution Generation.

CO4 Understand operation and importance of PMUs, PDCs, WAMS, Voltage and Frequency control in Micro Grids.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION :**To Smart Grid
2	1	Evolution of Electric Grid, Concept, Definitions and
3	1	Need for Smart Grid, Smart grid drivers
4	1	Functions, opportunities,
5	1	Challenges and benefits
6	1	Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing
7	1	Grid, Present development & International policies in Smart Grid, Diverse
8	1	Perspectives from experts and global Smart Grid initiatives.
9	**2**	**SMART GRID TECHNOLOGIES:** Technology Drivers

10	2	Technology Drivers, Smart energy resources, Smart
11	2	Substations, Substation Automation
12	2	Feeder Automation ,Transmission systems
13	2	EMS, FACTS and HVDC, Wide area monitoring
14	2	Protection and Control, Distribution Systems: DMS, Volt/Var control, Fault
15	2	Detection, Isolation and service restoration, Outage management, High-Efficiency
16	2	Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric
17	**3**	**VEHICLES (PHEV**). Smart Meters
18	3	Smart Meters and Advanced Metering Infrastructure: Introduction to Smart
19	3	Meters, Advanced Metering infrastructure (AMI)
20	3	Drivers and benefits, AMI protocols
21	3	Standards and initiatives
22	3	AMI needs in the smart grid
23	3	Phasor Measurement, Unit (PMU), Intelligent
24	3	Electronic Devices (IED)
25	**4**	**THEIR APPLICATION FOR MONITORING & PROTECTION.** Power Quality
26	4	Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid
27	4	Power Quality issues of Grid connected
28	4	Renewable Energy Sources
29	4	Power Quality Conditioners for Smart Grid
30	4	Web based Power Quality monitoring
31	4	Power Quality Audit.
32	5	**HIGH PERFORMANCE COMPUTING** For Smart Grid Applications:
33	**5**	Local Area Network
34	5	(LAN), House Area Network (HAN)
35	5	Wide Area Network (WAN)
36	5	Broadband over
37	5	Power line (BPL), IP based Protocols

33	**5**	**CIRCUIT BREAKERS-II**: Air blast
34	5	SF6 and vacuum circuit breakers.
35	5	Selection of circuit breakers
36	5	Rating of circuit breakers.
37	5	Digital Protection: Introduction to digital protection. Brief description of block
38	5	Diagram of digital relay. Introduction to digital over current,
39	5	Transformer differential and
40	5	Transmission line distance protection.

TEXT/REFERENCE BOOKS

1 Bhavesh Bhalja, R. P. Maheshari and Nilesh G. Chothani: Protection and Switchgear, Oxford.

2 Bhuvanesh A. Oza and Nair: Power System Protection and Switchgear, MGH. 2010

3 B. Ravindranath and M. Chander: Power system Protection and Switchgear, Wiley.

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Syllabus Deployment

Name of Faculty: Rajkumar Soni Subject Code:6EE3A
Subject Name: SWITCHGEAR & PROTECTION
Department: Department of Electrical Engineering (EE& EEE) SEM: VI
Total No. of Lectures Planned: 40

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Acquire the knowledge of various abnormal conditions that could occur in power system.

CO2: Ability to design various protective devices in power system for protecting equipment and personnel.

CO3: Knowledge of various types of existing circuit breakers, their design and constructional details.

CO4: Knowledge of various conventional relays,their design and latest developments.

CO5: Knowledge of standards and specifications related to switchgear and protection.

Lecture No.	Unit	Topic
1	**1**	**STATIC RELAYS**: Introduction to static relays, merits an demerits.
2	1	Comparators: amplitude and phase comparators, duality betwee amplitude and
3	1	Phase comparators. Introduction to (a) amplitude comparator: circulating current
4	1	Type, phase splitting type and sampling type

5	1	(b) Phase comparators-vector
6	1	Product type and coincidence type.
7	1	Static Over Current Relays: Introduction to instantaneous, definite time, inverse
8	1	Time and directional over current relays.
9	**2**	**STATIC DIFFERENTIAL RELAYS**: Overview
10	2	Brief description of static differential relay schemes single
11	2	Phase and three phase schemes.
12	2	Introduction to static differential protection of generator and
13	2	Transformer.
14	2	Static Distance Relays
15	2	Introduction to static reactance and
16	2	Mho relays
17	**3**	**CARRIER CURRENT PROTECTION**: Basic apparatus and
18	3	Scheme of power line carrier
19	3	System. Principle of operation of directional comparison and phase comparison
20	3	Carrier protection and carrier assisted distance protection.
21	3	Distance Protection: Effect of power swings on the performance of distance
22	3	Protection. Out of step tripping and blocking relays
23	3	Mho relay with blinders.
24	3	Introduction to quadrilateral and elliptical relays.
25	**4**	**CIRCUIT BREAKERS**-I:Electric arc and its characteristics, arc interruption-high
26	4	Resistance interruption and current zero interruption. Arc interruption theories
27	4	Recovery rate theory and energy balance theory.
28	4	Restriking voltage and recovery voltage
29	4	Develop expressions for restriking voltage
30	4	RRRV. Resistance switching, current chopping and interruption of capacitive Current.
31	4	Oil circuit breakers-bulk oil and minimum oil circuit breakers. Air circuit
32	5	Breakers. Miniature Circuit breaker (MCB).

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Syllabus Deployment

Name of Faculty: Mr. CPJain Subject Code: 6EE11A

Subject Name: Entrepreneurshipdevelopment SEM: VI

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 6

Lab OUTCOMES

Atthe end of this course students will be able to:

CO1. Definition of entrepreneur, qualities of a successful entrepreneur, Charms of being an entrepreneur, achievement- motivation, leadership and entrepreneurial competencies.

CO2. Identification and selection of business opportunities and market survey, business plan. Implementation and customer satisfaction.

CO3. Business crises, problem-solving attitude, communication skill. Government policies for entrepreneurs.

CO4. Marketing & Sales Promotion, Techno-Economic Feasibility Assessment by Preparation of Preliminary & Detailed project report.

Lab No.	Experiment /Objective
1	Definition of entrepreneur, qualities of a successful entrepreneur, Charms of being an entrepreneur, achievement-motivation, leadership and entrepreneurial competencies.

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2	Decision-making, procedures and formalities for starting own business, financial support system.
3	Identification and selection of business opportunities and market survey, business plan. Implementation and customer satisfaction.
4	Business crises, problem-solving attitude, communication skill. Government policies for entrepreneurs.
5	Knowledge based enterprises, Scope of entrepreneur in present context, area of future entrepreneurship.
6	Marketing & Sales Promotion, Techno-Economic Feasibility Assessment by Preparation of Preliminary & Detailed project report

TEXT/REFERENCE BOOKS

1. Entrepreneurial Development Book by Khanka S.S.
2. Entrepreneurship Development and Small Business Enterprises Book by Poornima M. Charantimath

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni	Subject Code:6EE8A
Subject Name: Power System Lab	SEM: VI
Department: Department of Electrical Engineering (EE & EEE)	
Total no. of Labs planned: 9	

Lab OUTCOMES

Atthe end of this course students will be able to:

CO1. Study the burden effect on the performance of CT and measure ratio error.

CO2. Find out the sequence components of currents in three 1-Phase transformers and 3-Phasetransformer and compare their results.

CO3. Study gas actuated Buchholz relay.

CO4. Study earthing of power station, substation and building

Lab No.	Experiment/Objective
1	Study the burden effect on the performance of CT and measure ratio error.
2	Find out the sequence components of currents in three 1-Phase transformers and 3-Phasetransformer and compare their results.
3	(i) Study over current relay.(ii) Draw the current-time characteristic of an over current relay for TMS=1 & 0.5

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	andPSM=1.25 & 1.0.
4	(i) Study percentage bias differential relay.(ii) Plot the characteristics of a percentage bias differential relay for 20%, 30% and 40% biasing.
5	Study gas actuated Buchholz relay.
6	Study under frequency relay and check it's setting experimentally.
7	Design a HV transmission line.
8	Study a typical grid substation.
9	Study earthing of power station, substation and building

TEXT/REFERENCE BOOKS

1. Modern Power System Analysis Book by D.P. Kothari and I.J. Nagrath
2. Power System Engineering Book by D.P. Kothari and I.J. Nagrath

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Syllabus Deployment

Name of Faculty: Ms. Aashika Sharma	Subject Code:6EE10A
Subject Name: Smart Grid LAB	SEM: VI
Department: Department of Electrical Engineering (EE & EEE)	
Total no. of Labs planned: 5	

Lab OUTCOMES

Atthe end of this course students will be able to:

CO1. Study different components of smart grid

CO2. To design and simulate hybrid wind-solar power generation system using simulating software

CO3. Study Different terminology used in power quality assessment

CO4. Study and measure certain parameters of power quality in laboratory with and without power quality improvement devices.

Lab No.	Experiment/Objective
1	Study different components of smart grid
2	To visit thermal/nuclear power plant
3	To design and simulate hybrid wind-solar power generation

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	system using simulating software
4	Study Different terminology used in power quality assessment
5	Study and measure certain parameters of power quality in laboratory with and without power quality improvement devices.

TEXT/REFERENCE BOOKS

1. Smart Grid: Fundamentals of Design and Analysis Book by James A. Momoh
2. Smart Grid: Technology and Applications by Akihiko Yokoyama, KithsiriLiyanage,

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Syllabus Deployment

Name of Faculty: Mr. Abrar Ahmed Subject Code : 6EE9A
Subject Name: Advance Power Electronics Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: VI

Total No. of Lectures Planned: 12

Lab OUTCOMES

Atthe end of this course students will be able to:

CO1. Study and test AC voltage regulators using triac, antiparallel thyristors and triac&diac.

CO2. Study and test buck, boost and buck- boost regulators.

CO3. Study and test Zero voltage switching.

CO4. Study and test SCR DC circuit breaker.

CO5. Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic.

CO6. Study speed control of dc motor using one, two and four quadrant choppers.

CO7. Study single-phase cyclo-converter.

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Lab No.	Experiment /Objective
1	Study and test AC voltage regulators using triac, antiparallel thyristors and triac&diac.
2	Study and test single phase PWM inverter.
3	Study and test buck, boost and buck- boost regulators.
4	Study and test MOSFET chopper.
5	Study and test Zero voltage switching.
6	Study and test SCR DC circuit breaker.
7	Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic.
8	Control speed of a single-phase induction motor using single phase AC voltage regulator.
9	(i) Study single-phase dual converter.(ii) Study speed control of dc motor using single-phase dual converter.
10	Study one, two and four quadrant choppers (DC-DC converters).
11	Study speed control of dc motor using one, two and four quadrant choppers.
12	Study single-phase cyclo-converter.

TEXT/REFERENCE BOOKS

1. Recent Developments in Power Electronics Book by Muhammad H. Rashid
2. Fundamentals of Power Electronics Book by Robert Warren Erickson

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Syllabus Deployment

Name of Faculty: Mr. CPJain Subject Code:6EE7A
Subject Name:Control System Lab

Department: Department of Electrical Engineering (EE & EEE) SEM: VI

Total No. of Lectures Planned: 11

Lab OUTCOMES

Atthe end of this course students will be able to:

CO1. Defining Systems in TF, ZPK form.

CO2. For a given 2ndorder system plot step response and obtain time response specification.

CO3. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse

CO4. Check for the stability of a given closed loop system.

Lab No.	Experiment /Objective
1	Introduction to MATLAB Computing Control Software.
2	Defining Systems in TF, ZPK form.

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3	(a) Plot step response of a given TF and system in state-space. Take different values of damping ratioand wn natural undamped frequency. (b) Plot ramp response.
4	For a given 2ndorder system plot step response and obtain time response specification.
5	To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse
6	To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system.
7	To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies.(a) Log Network(b) Lead (c) Log-lead Network.
8	To draw characteristics of ac servomotor
9	To perform experiment on Potentiometer error detector.
10	Check for the stability of a given closed loop system.
11	Plot bode plot for a 2ndorder system and find GM and PM.

TEXT/REFERENCE BOOKS

1. Control Systems Engineering Book by I.J. Nagrath and M. Gopal
2. Automatic Control Systems Book by Benjamin Kuo

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Syllabus Deployment

Name of Faculty: Kirti Dashora Subject Code:7EE3A
Subject Name: Artificial Intelligence Techniques

Department: Department of Electrical Engineering (EE& EEE) SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO4: Demonstrate profciency developing applications in an 'AI language', expert system shell, or data mining tool.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION :** Artificial Intelligence
2	1	Knowledge based Expert systems
3	1	Importance and Definition of AI
4	1	Introduction to ES
5	1	Es basics
6	1	ES building tools and shells
7	**2**	**KNOWLEDGE REPRESENTATION:** Overview
8	2	Concept of knowledge

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9	2	Representation of knowledge using logics rules
10	2	Representation of knowledge using , frames
11	2	Procedural versus. Declarative knowledge, forward versus backward chaining
12	2	Control Strategies: Concept of heuristic search
13	2	Search techniques depth first search, Breath first search
14	2	Generate & test hill climbing
15	2	Best first search.
16	**3**	**ARTIFICIAL NEURAL NETWORK:** Overview
17	3	Biological Neurons and synapses
18	3	Characteristics Artificial Neural Networks
19	3	Types of activation functions
20	3	Perceptions: Perception representation
21	3	Limitations of perceptrons.
22	3	Single layer and multiplayer perceptrons
23	3	Perceptron learning algorithms
24	**4**	**BASIC CONCEPTS IN LEARNING ANN:** Overview
25	4	Supervised learning
26	4	Back propagation algorithm
27	4	Back propagation algorithm derivation
28	4	Unsupervised learning
29	4	Kohonen's top field network
30	4	Kohonen's top field network algorithm
31	**5**	**FUZZY LOGIC:** Overview
32	5	Fuzzy logic concepts
33	5	Fuzzy relation and membership functions
34	5	Defuzzification
35	5	Fuzzy controllers
36	5	Genetic Algorithm: concepts
37	5	Coding, reproduction
38	5	Crossover, mutation
39	5	Scaling and fitness
40	5	Examples

TEXT/REFERENCE BOOKS

1 Saroj Kaushik: Artificial Intelligence, Cengage Learning. 2007
2 Elaine Rich and Kevin Knight: Artificial Intelligence 3/e, MGH
3 Padhy: Artificial Intelligence & Intelligent Systems, Oxford 2005
4 James Anderson: An introduction to Neural Networks. 1995
5 Dan. W Patterson: Artificial Intelligence and Expert Systems.

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Syllabus Deployment

Name of Faculty: Chandra Prakash Jain Subject Code:7EE6.2A
Subject Name: Computer Aided Design Of Electrical Machines

Department: Department of Electrical Engineering (EE& EEE) SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:
CO 1: Understand general concepts of CAD
CO 2: Understand and implement CAD for Electrical Equipment
CO 3: Understand and implement CAD of DC Machine
CO 4: Understand and implement CAD of Transformer
CO 5: Understand and implement CAD of Three phase Induction Motor

Lecture No.	Unit	Topic
1	**1**	**BASIC PRINCIPLES OF** Electrical Machine Design
2	1	Specifications, Factors affecting
3	1	The design, Limitations, main dimension, loadings, output equation, factor
4	1	Affecting the size and rating
5	1	Electrical Engineering Materials: conducting
6	1	Magnetic and insulating materials
7	1	Magnetic Circuit Calculation: Ohm's law for magnetic circuit, mmf required for air

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8	1	Gap and iron parts, tapered teeth, real and apparent flux density, magnetizing current.
9	**2**	**HEATING AND COOLING:** Electrical Machines
10	2	Heat dissipation and heat flow
11	2	Equations, Newton's law of cooling
12	2	Equations for temperature rise,
13	2	Rating of Machines: Continuous,
14	2	Short and intermittent ratings, mean
15	2	Temperature rise, hydrogen cooling of turbo alternators,
16	2	Quantity of cooling medium.
17	**3**	**COMPUTER AIDED DESIGN OF TRANSFORMERS:** overview
18	3	Power and Distribution
19	3	Transformers
20	3	Core and yoke cross sections
21	3	Square and stepped core, output
22	3	Equations, main dimensions
23	3	Types & design of windings
24	3	Optimization concepts
25	**4**	**COMPUTER AIDED DESIGN OF** Synchronous Machines:
26	4	Turbo and Hydro alternators
27	4	Choice of specific magnetic & electric loading
28	4	Short circuit ratio and its effects
29	4	Air gap length, output equation
30	4	Main dimensions, flow charts for design of
31	4	Synchronous machine
32	4	Design of stator core & winding.
33	**5**	**COMPUTER AIDED DESIGN OF** Induction Machines:
34	5	Output equation, main
35	5	Dimensions
36	5	Design criteria

37	5	Flow charts for design of induction motor
38	5	Air gap
39	5	Length, design of stator core and winding
40	5	Rotor design

TEXT BOOK /REFERENCE BOOK

1 A. K. Sawhney: A Course in Electrical Machine Design, Dhanpat Rai & Sons
2 B. Edikins: Generalized Theory of Electrical Machines
3 Fitzegerald: Electrical Machinery, Kingsley.
4 M. G. Say: The Performance and Design of AC Machines, Pitman & Sons
5 R. K. Agrawal: Electrical Machine Design

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Syllabus Deployment

Name of Faculty: Rajkumar Soni Subject Code:7EE6.1A
Subject Name: Electromagnetic Field Theory

Department: Department of Electrical Engineering (EE& EEE) SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:

CO1: Understand the basic mathematical concepts related to electromagnetic vector fields. .

CO2: Apply the principles of electrostatics to the solutions of problems relating to electric field

CO3: and electric potential, boundary conditions and electric energy density.

CO4: Apply the principles of magneto statics to the solutions of problems relating to magnetic

CO5: field and magnetic potential, boundary conditions and magnetic energy density.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION**: Vector Relation in rectangular
2	1	Cylindrical
3	1	Spherical and general
4	1	Curvilinear coordinate system.
5	1	Concept and physical interpretation of gradient
6	1	Divergence and curl
7	1	Green's
8	1	Stoke's and Helmholz theorems

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9	**2**	**ELECTROSTATICS:** Electric field vectors-electric field intensity
10	2	Flux density & polarization
11	2	Electric field due to various charge configurations. The potential
12	2	Functions and displacement vector
13	2	Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness
14	2	Theorem. Continuity equation.
15	2	Capacitance and electrostatics energy. Field
16	2	Determination by method of images. Boundary conditions. Field mappings
17	**3**	**CONCEPT OF FIELD CELLS.**
18	3	Magneto statics: Magnetic field vector
19	3	Magnetic field intensity, flux density
20	3	Magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector
21	3	Potential, self & mutual inductance.
22	3	Energy stored in magnetic field,
23	3	Boundary conditions, Analogy between electric and
24	3	Magnetic field
25	**4**	**FIELD MAPPING AND CONCEPT OF FIELD CELLS.**
26	4	Time Varying Fields
27	4	Faraday's law
28	4	Displacement currents
29	4	Equation of continuity.
30	4	Maxwell's equations, Uniform plane wave in free space
31	4	Dielectrics and conductors
32	4	Skin effect sinusoidal time variations, reflections, refraction & polarization of UPW
33	**5**	**STANDING WAVE RATIO**. Pointing vector and power considerations
34	5	Transmission Lines: The high-frequency circuit.
35	5	LCR ladder model.
36	5	The transmission Lin equation.
37	5	Solution for loss-less lines.

38	5	Wave velocity
39	5	Wave impedance.
40	5	Reflection and Transmission coefficients

TEXT/REFERENCE BOOKS

1 Hayt: Engineering Electromagnetics, 7/e, (With CD), MGH
2 Matthew N. O. Sadiku: Principles of Electromagnetics, 4th ed., Oxford
3 G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson.
4 S. Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pu
5 V.V. Sarwate: Electromagnetic Field and Waves, Willey Eastern Ltd.

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni Subject Code: 7EE6.3A

Subject Name: Economic Operation of Power Systems SEM: VII

Department: Department of Electrical Engineering (EE& EEE)

Total no. of lectures planned: 45

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO 1:Able to explain Expression for cost of electrical energy, Depreciation, power plant cost analysis, Factors effecting economics of generations and distributions.

CO 2: Able to perform calculation for Input, output and heat rate characteristics, Economic scheduling considering transmission losses, Coordination equations.

CO 3: Able to performHydro Thermal coordination,Scheduling methods and applications.

CO 4: Able to understand the concept of Parallel operation of Generators, Load sharing, sharing of load currents, Active and reactive power control.

CO 5: Will be able to explain Concepts of physical efficiencies of electrical goods and services,Break even and minimum cost analysis.

Lecture No.	Unit	Topic
1	**1**	**ECONOMICS OF POWER GENERATION :** Introduction,
2	1	Cost of electrical energy
3	1	Expression for cost of electrical energy

4	1	Depreciation, power plant cost analysis
5	1	Economics in plant selection
6	1	Selection of types of generation and types of equipment's
7	1	Factors effecting economic generations and distributions
8	1	Generating cost, economics of different types of generating plants
9	**2**	**ECONOMICAL OPERATIONS :**Thermal Power Plants
10	2	Methods of loading turbo generators
11	2	Input, output and heat rate characteristics
12	2	Incremental cost, two generations units
13	2	Large no of units, sequence of adding units
14	2	Effects of transmission losses
15	2	Economic scheduling considering transmission losses
16	2	Coordination equations
17	2	Penalty factors
18	**3**	**HYDRO THERMAL COORDINATION**overview
19	3	Advantages of combined operation
20	3	Base load peak load operation requirement,
21	3	Combined working of run-off river and steam plant
22	3	Reservoirs hydro plants and thermal plants (long term operational aspects)
23	3	Short term hydro thermal coordination
24	3	Coordination equations
25	3	Scheduling methods and applications
26	**4**	**PARALLEL OPERATIONS OF GENERATORS**Conditions
27	4	Synchronizingcurrent and power
28	4	Two alternators in parallel
29	4	Effect of change in excitation
30	4	Load sharing, sharing of load currents
31	4	Infinite bus bars
32	4	Active and reactive power control
33	4	Synchronizing power, torque
34	4	Operating limits of alternators

35	4	Operating characteristics of cylindrical alternator rotor
36	**5**	**ECONOMICS FOR ELECTRICAL ENGINEERS**Overview
37	5	Concepts of physical efficiencies of electrical goods and services
38	5	Supply and demand
39	5	Break even and minimum cost analysis
40	5	Linear and nonlinear break even
41	5	Minimum cost analysis
42		Revision of course work
43		Revision of course work
44		Revision of course work

TEXT/REFERENCE BOOKS

1.J. Wood & B. F. Wollenburg: Power Generation, Operation and Control, John Wiley.
2.D. P. Kothari & I. J. Nagrath: Modern Power System Analysis, MGH.
3.O. I. Elgerd: Electric Energy System Theory, MGH.
4.P. Kundur: Power System Stability and Control, MGH.
5.Arthur R. Bergen and Vijay Vittal: Power System Analysis, Second Edition. PHI.

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain Subject Code:7EE4A
Subject Name:Non Conventional Energy Source

Department: Department of Electrical Engineering (EE& EEE) SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:
CO 1 :The concept of solar energy and their applications in different fields.
CO 2: The ways to harness energy from nonconventional energy sources like geothermal, wind and ocean.
CO 3:The ways of nuclear energy production and management of environmental problems due nuclear waste.
CO :4The harmful effect of air, water and noise pollution on living things.

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** World Energy Situation
2	**1**	Conventional and non-conventional energy
3	1	Sources, Indian energy scene.
4	1	Tidal Energy: Introduction to tidal power.
5	1	Components of tidal power plants, double
6		Basin arrangement. Power generation.
7	1	Advantages and limitations of tidal power
8	1	Generation. Prospects of tidal energy in India.
9	**2**	**SOLAR ENERGY: SOLAR RADIATION,** Solar Radiation Geometry
10	2	Solar radiation on tilted
11	2	Surface. Solar energy collector. Flat- plate collector

12	2	Concentrating collector parabolidal and heliostat.
13	2	Solar pond. Basic solar power plant.
14	2	Solar cell
15	2	solar cell array
16	2	basic photo-voltaic power generating system
17	**3**	**WIND ENERGY**: Basic principle of wind energy conversion, efficiency of conversion,
18	3	Site selection. electric power generation-basic components, horizontal axis and
19	3	Vertical axis wind turbines, towers, generators, control and monitoring components.
20	3	Basic electric generation schemes- constant speed constant frequency, variable speed
21	3	Constant frequency and variable speed variable frequency schemes. Applications of wind energy. Geothermal Energy: Geothermal fields, estimates of geothermal power. Basic
22	3	Geothermal steam power plant, binary fluid geothermal power plant and geothermal
23	3	Preheat hybrid power plant. Advantages and disadvantages of geothermal energy.
24	3	Applications of geothermal energy. Geothermal energy in India.
25	**4**	**NUCLEAR FUSION ENERGY**: Introduction
26	4	Nuclear fission and nuclear fusion.
27	4	Requirements for nuclear fusion. Plasma confinement
28	4	Magnetic confinement and inertial confinement.
29	4	Basic Tokamak reactor
30	4	Laser fusion reactor.
31	4	Advantages of nuclear fusion.
32	4	Fusion hybridand cold fusion.
33	**5**	**BIOMASS ENERGY**: Introduction, biomass categories,
34	5	Bio-fuels. Introduction
35	5	Biomass conversion technologies.
36	5	Biogas generation, basic biogas plants-fixed dome type, floating gasholder type
37	5	Deen Bandhu biogas plant, Pragati design biogas plant.

38	5	Utilization of bio gas.
39	5	Energy plantation. Pyrolysis scheme.
40	5	Alternative liquid fuels ethanol and methanol. Ethanol production.

TEXT/REFERENCE BOOKS

1 G. D. Rao: Renewable Energy

2 B. H. Khan: Non-Conventional Energy Resources, MGH

3 A. N. Mathur: Non-Conventional Resources of Energy

4 Boyle: Renewable Energy, 3rded Oxford

5 Bent Sorensen, 4th ed.: Renewable Energy, Elsevier

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain — Subject Code:7EE2A
Subject Name: Power System Analysis
Department: Department of Electrical Engineering (EE& EEE) — SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to:
CO 1:Develop an appropriate mathematical model of power system
CO 2:Carry out power flow analysis of practical power system for balanced system.
CO 3:Conduct studies during balanced faults to decide the fault levels and circuit breaker ratings.
CO 4:Conduct studies during unbalanced faults to decide the fault levels and circuit breaker ratings.
CO 5:Analyze the stability of single machine-infinite bus system and can decide the critical clearing time

Lecture No.	Unit	Topic
1	1	**PERCENT AND PER UNIT QUANTITIES:** Overview
2	1	Percent and per unit quantities.
3	1	Single line diagram for a balanced 3-phase system .
4	1	Single line diagram for a balanced 3-phase system
5	1	**Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y bus..
6		**Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y bus
7	1	**Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y bus

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8	1	Modification of an existing Y bus.
9	**2**	**IMPENDENCE MODEL:** Bus admittance and impedance matrices
10	2	Thevenin's theorem and Z bus. Direct determination of Z bus.
11	2	Modification of an existing bus.
12	2	**Symmetrical fault Analysis:** Transient on a Transmission line
13	2	Short circuit of a synchronous machine on no load,
14	2	Short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under sub transient
15	2	Transient and steady state conditions. Selection of circuit breakers,
16	2	Algorithm for short circuit studies. Analysis of three-phase faults
17	**3**	**SYMMETRICAL COMPONENTS:** Fortescue theorem
18	3	Symmetrical component transformation
19	3	Phase shift in star-delta transformers. Sequence Impedances of transmission lines
20	3	Synchronous Machine and Transformers
21	3	Zero sequence network of transformers and transmission lines. Construction of sequence networks of power system
22	3	**FAULT ANALYSIS:** Analysis of single line to ground faults using symmetrical components
23	3	**Fault Analysis:** Analysis of single line to ground faults using symmetrical components
24	3	Connection of sequence networks under the fault condition
25	**4**	**UNSYMMETRICAL FAULT ANALYSIS:** Analysis of line-to-line and
26	4	i) Double line to ground faults using symmetrical components
27	4	connection of sequence networks under fault conditions.
28	4	Analysis of unsymmetrical shunt faults using bus impedance matrix method.
29	4	Analysis of unsymmetrical shunt faults using bus impedance matrix method.
30	4	Analysis of unsymmetrical shunt faults using bus impedance matrix method.
31	4	Analysis of unsymmetrical shunt faults using bus impedance

		matrix method.
32	4	Analysis of unsymmetrical shunt faults using bus impedance matrix method.
33	**5**	**LOAD FLOW ANALYSIS:** Load flow problem
34	5	Load Flow Analysis**:** Load flow problem
35	5	Development of load flow equations
36	5	Bus classification
37	5	Gauss Seidel
38	5	Newton Raphosn,
39	5	Decoupled and fast decoupled methods for load flow analysis.
40	5	Comparison of load flow methods

TEXT/REFERENCE BOOKS

1.Chakraborti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., A Text Book on Power System Engineering, Dhanpat Rai and Co. (P) Ltd. (2008).

2. J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH.

3. B. R. Gupta: Power System Analysis and Design, Third Edition, S. Chand & Co.

4. Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw□Hill (2007)

5. W. D. Stevenson: Element of Power System Analysis, MGH.

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SyllabusDeployment

Name of Faculty: Mr. RajkumarSoni | Subject Code: 7EE5A

Subject Name: Power System Engineering | SEM: VII

Department: Department of Electrical Engineering (EE& EEE)

Total no. of lectures planned: 46

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

CO 1:Able to explain System constraints, optimal operation of power systems.Economic distribution of load between power stations, unit commitment

CO 2:Able to perform calculation of Power angle equations, Power angle curves under steady state, transient conditions, Swing equation, steady state and dynamic stabilities.

CO 3:Able to perform Equal area criterion calculation to calculate transient stability studies under basic disturbances with Critical clearing angle and Critical clearing time.

CO 4:Able to understand the concept of Excitation system (AC and DC) and Interconnected powers systems (Reserve capacity of power stations, spinning and maintenance resaves)

CO 5:Will be able to demonstrate and calculate related to Series compensation of transmission lines, Tap Changing Transformer, voltage stability and Power System Security.

Lecture No.	Unit	Topic
1	**1**	**ECONOMIC OPERATION OF POWER SYSTEMS:** Overview
2	1	Introduction, system constraints, optimal operation of power systems.
3	1	Input output, heat rate

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4	1	Incremental rate curves of thermal generating units.
5	1	Economic distribution of load between generating units within a plant
6	1	Economic distribution of load between power stations
7	1	Transmission loss equation
8	1	Introduction to unit commitment
9	1	Dynamic programming
10	**2**	**POWER SYSTEM STABILITY-I:** Overview
11	2	Power angle equations
12	2	Power angle curves under steady state
13	2	Power angle curves under transient conditions.
14	2	Rotor dynamics
15	2	Swing equation (solution of swing equation not included).
16	2	Synchronizing power coefficient.
17	2	Introduction to steady state and dynamic stabilities
18	2	Steady state stability limit.
19	**3**	**POWER SYSTEM STABILITY-II:** Overview
20	3	Introduction to transient stability.
21	3	Equal area criterion
22	3	Application of Equal area criterion to transient stability studies under basic disturbances.
23	3	Critical clearing angle
24	3	Critical clearing time.
25	3	Factors affecting stability
26	3	Methods to improve stability.
27	**4**	**EXCITATION SYSTEMS:** Overview
28	4	Introduction of excitation systems of synchronous machines, types of excitation systems
29	4	Elements of various excitation systems and their control (functional block diagrams and their brief description)
30	4	DC excitation systems, AC excitation systems, brushless

		excitation system.
31	4	**Interconnected Power Systems** Introduction to isolated
32	4	Interconnected powers systems.
33	4	Reserve capacity of power stations, spinning and maintenance resaves.
34	4	Advantages and problems of interconnected power systems
35	4	Power systems inter connection in India
36	**5**	**TAP CHANGING TRANSFORMER**
37	5	Phase angle control
38	5	Phase shifting transformer
39	5	Series compensation of transmission lines
40	5	Location and protection of series capacitors
41	5	Series capacitors advantages and problems
42	5	Introduction to power system security
43	5	Introduction to voltage stability
44		Revision of course work
45		Revision of course work
46		Revision of course work

TEXT/REFERENCE BOOKS

1. J. Nagrath and D.P. Kothari: Power System Engineering 2/e, MGH.
2. J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH.
3. B. R. Gupta: Power System Analysis and Design, Third Edition, S. Chand & Co.
4. C. L. Wadhwa: Electrical Power Systems, New age international Ltd. Third Edition
5. W. D. Stevenson: Element of Power System Analysis, MGH.

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain　　Subject Code:7EE1A
Subject Name:Power System Planning

Department: Department of Electrical Engineering (EE& EEE)　　SEM: VII
Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE

At the end of this course students will be able to:

CO 1:Discuss primary components of power system planning, planning methodology for optimum power system expansion, various types of generation, transmission and distribution.

CO 2:Show knowledge of forecasting of future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.

CO 3:Discuss methods to mobilize resources to meet the investment requirement for the power sector

CO 4:Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION :** Power Planning
2	1	National and Regional Planning
3	1	National and Regional Planning
4	1	Structure of planning tools
5	1	Electricity Regulation
6	1	Electrical Forecasting
7	1	Forecasting techniques modelling
8	1	Forecasting techniques modelling

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9	**2**	**GENERATION PLANNING:** Overview
10	2	Integrated power generation cogeneration/captive power,.
11	2	Power pooling and power trading.
12		Transmission and distribution planning.
13	2	Power system Economics.
14	2	Power sector finance, financial planning,
15	2	Private participation
16	2	Rural Electrification investment, concept of Rational tariffs
17	**3**	**POWER SUPPLY RELIABILITY:** Overview
18	3	Reliability planning.
19	3	System operation planning,
20	3	Load management, load prediction,
21	3	Reactive power balance
22	3	Online power flow studies
23	3	State estimation,
24	3	Computerized management, power system simulator.
25	**4**	**COMPUTER AIDED PLANNING** Overview
26	4	Wheeling.
27	4	Environmental effects
28	4	Greenhouse effect
29	4	Greenhouse effect
30	4	Technological impacts.
31	4	Insulation coordination.
32	4	Reactive compensation
33	**5**	**OPTIMAL POWER SYSTEM EXPANSION PLANNING :** Overview
34	5	Formulation of least cost
35	5	Optimization problem incorporating the capital
36	5	Operating and maintenance cost of candidate plants of different types (thermal, hydro, Nuclear, Non-conventional etc.)
37	5	Operating and maintenance cost of candidate plants of different types (Thermal, Hydro, Nuclear, Non-conventional etc.)
38	5	Operating and maintenance cost of candidate plants of different types (Thermal, Hydro, Nuclear, Non-conventional etc.)
39	5	Operating and maintenance cost of candidate plants of different

		types (Thermal, Hydro, Nuclear, Non-conventional etc.)
40	5	Minimum assured reliability constraint – optimization techniques for solution by programming

TEXT/REFERENCE BOOKS

1 X. Wang, J. R. Mc Donald: Modern Power System Planning, MGH.

2 Electric Power Planning, A. S. Pabla, McGraw Hill, 2nd Edition, 2016

3 A. S. Pabla: Electrical Power System Planning, Machmillan India Ltd

4 M. Tllic, F. Faliana and L. Fink: Power System Restructuring Engineering and Economics, Kulwar Academic Publisher.

5 L. L. Lie: Power System Restructuring and Deregulation, John Willey & Sons UK.

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain Subject Code: 7EE9A

Subject Name: Industrial Economics and Management Lab SEM: VII

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 10

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

1. Ability to express money Banking and Trade: Functions of money, supply & demand for money.

2. Ability toexplain sources of public revenue, principles of taxation, direct and indirect taxes, Theory of international trade.

3.Management Principles: Management functions, responsibilities of management to society, development of management though.

4.Production Management: Production planning and control, inventory control, quality control and Total quality management.

5. Ability to CPM, PERT, project information systems. Marketing functions, management of sales and advertising marketing research.

6. Ability to explain Finance and Account Management: Engineering Economics: Investment decision.

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Lab No.	Topic
1	Money Banking and Trade: Functions of money, supply & demand for money, money price level & inflation, black money, meaning, magnitude & consequences. Functions of Commercial banks, banking system in India, shortcomings and improvements. Function of RBI, monetary policy-making, objectives and features.
2	Sources of public revenue, principles of taxation, direct and indirect taxes, Theory of international trade, balance of trade and payment, Foreign exchange control, devaluation New economic policy: Liberalization, extending privatization, globalization.
3	Management Principles: Management functions, responsibilities of management to society, development of management thought.
4	Nature of planning, decision making, management by objectives, Line and staff authority relationships, decentralization and delegation of authority, span of management.
5	Production Management: Production planning and control, inventory control, quality control and Total quality management. ISO standards Related to quality/Environment/safety etc. Tools of Project Management
6	CPM, PERT, project information systems. Marketing functions, management of sales and advertising marketing research.
7	Human Resource Management: Function, application of industrial psychology for selection, training and recruitment.
8	Communication process, media channels and barriers to effective communication, theories of motivation, leadership.
9	Finance and Account Management: Engineering Economics: Investment decision, present worth,annual worth and rate of return methods. Payback time.
10	Need for good cost accounting system, cost control techniques of

	financial control, financial statements, financial ratios, breakeven analysis, budgeting and budgetary control

TEXT/REFERENCE BOOKS

1. Industrial Economics & Management, 2/Ed. Book by S. P. Singh
2. Industrial Economics and Management Principles Book by Dr. Rajan Mishra

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni Subject Code: 7EE8A

Subject Name: Power System Modeling and Simulation LAB SEM: VII

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 12

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

1 Ability to Simulate Swing Equation in Simulink.

2 Ability toModeling of Synchronous Machine.

3 Modeling of Induction Machine.

4 Simulation of Synchronous Machine with FACTS device.

5 Ability to design an EHV transmission line.

6 Ability to FACTS Controller designs with FACT devices for SMIB system.

Lab No.	Topic
1	Simulate Swing Equation in Simulink (MATLAB)
2	Modeling of Synchronous Machine.
3	Modeling of Induction Machine.
4	Simulate simple circuits using Circuit Maker.
5	(a) Modeling of Synchronous Machine with PSS
6	(b) Simulation of Synchronous Machine with FACTS device.

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7	(a) Modeling of Synchronous Machine with FACTS device
8	(b) Simulation of Synchronous Machine with FACTS devices.
9	FACTS Controller designs with FACT devices for SMIB system.
10	Revision of course work
11	Revision of course work
12	Revision of course work

TEXT/REFERENCE BOOKS

1. MATLAB and SIMULINK for Engineers (English, Paperback, TyagiAgam Kumar)
2. Understanding FACTS Book by Narain G. Hingorani
3. HVDC and FACTS Controllers: Applications of Static Converters in Power Systems Book by Vijay K. Sood

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain Subject Code: 7EE7A

Subject Name: Power system planning LAB SEM: VII

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 8

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

1 Ability to Write components of Structure of power system.

2 Ability toExplain in detail various planning tools.

3 Modeling of Electrical Forecasting techniques.

4 Simulation of Synchronous Machine with FACTS device.

5 Ability to Transmission and distribution planning.

6 Ability to explain concept of Rational tariffs.

Lab No.	Topic
1	Status of National and Regional Planning, for power system
2	Write components of Structure of power system
3	Explain in detail various planning tools.
4	Write short note on Electricity Regulation
5	Modeling of Electrical Forecasting techniques

6	Transmission and distribution planning
7	Concept of Rational tariffs
8	Rural Electrification

TEXT/REFERENCE BOOKS

1. Electric Power System Planning: Issues, Algorithms and Solutions Book by Hossein Seifi and Mohammad SadeghSepasian
2. Power System Planning Book by R. L. Sullivan

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Syllabus Deployment

Name of Faculty: Chandra Prakash Jain   Subject Code: 8EE4.3A
Subject Name: Power System Transients

Department: Department of Electrical Engineering (EE& EEE)   SEM: VIII

Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to
CO 1 :To understand the causes and effects of switching and lightning surges
CO 2 :To identify the protection schemes of power system equipment from overvoltage's like ground wires, surge absorbers and arrestors.
CO 3 :To design of insulation of power system components
CO 4 :To carry out the insulation testing procedures

Lecture No.	Unit	Topic
1	**1**	**WAVE TERMINOLOGY,** Development Of Wave Quotations,
2	1	Terminal problems,
3	1	Lattice diagrams,
4	1	Origin and Nature of power system transients and
5	1	Surges, Surge parameters of
6	1	Plants,
7	1	Equivalent Circuit representations.
8	1	Lumped and distributed circuit transients.
9	**2**	**LINE ENERGISATION** and De-Energisation Transients-
10	2	Earth and earth wire effects.
11	2	Current chopping
12	2	Short line fault condition and
13	2	Its relation to circuit breaker duty.
14	2	Trapped charge effects.

15	2	Effect of source and
16	2	Source representation in short line fault studies.
17	**3**	**CONTROL OF TRANSIENTS,** Control Of Transients,
18	3	Lightening phenomenon,
19	3	Influence of tower footing resistance
20	3	Earth resistance,
21	3	Traveling waves in distributed parameters
22	3	Multi conductor lines,
23	3	Parameters as a
24	3	Function of frequency.
25	**4**	**MECHANISM OF LIGHTNING DISCHARGE** Types Of Lightning Strokes,
26	4	Mechanism of Lightning Discharge Types of Lightning strokes,
27	4	Harmful effects of lighting,
28	4	Harmful effects of lighting
29	4	Protections against lightning,
30	4	Protections against lightning,
31	4	Overhead Ground wires.
32	4	Overhead Ground wires.
33	**5**	**LIGHTENING ARRESTERS,** Types of lightening arresters,
34	5	Types of lightening arresters,
35	5	Surge Absorber simulation
36	5	Surge diverters in
37	5	Transient analysis.
38	5	Fourier integral and
39	5	Z transform methods in
40	5	Power system transient

TEXT/REFERENCE BOOKS

1 C. S. Indulkar and D. P. Kothari: Power System Transients, NEW AGE.
2 Lou Van der Sluis: Transients in Power Systems, John Wiley
3 N. R. Watson, J. Arrillaga: Power Systems Electromagnetic Transients, John Wiley.

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain Subject Code: 8EE4.1A
Subject Name: Utilization of Electrical Power

Department: Department of Electrical Engineering (EE& EEE) SEM: VIII

Total No. of Lectures Planned: 40

COURSE OUTCOMES HERE
At the end of this course students will be able to
CO 1 :Illustrate Working Principle Electric Power Utilization And Their Application In Real Life.
CO 2 :Choose Proper Traction Systems Depending Upon Application Considering Economic And
CO 3 :Technology Up-Gradation.
CO 4 :Traction System; Analyze The Performance Parameter Of The Traction System.

Lecture No.	Unit	Topic
1	**1**	**ELECTRIC HEATING**: Different methods of electric heating
2	1	Principle of high frequency induction and dielectric heating
3	1	Construction, operation, performance and applications of arc furnace and induction furnace
4	1	Electric Welding: Welding process, welding transformer
5	1	Classification of Electric Welding: arc welding,
6	1	Resistance welding
7	1	Welding of various metals
8	1	Numerical Electric Heating
9	1	Numerical Electric Welding
10	**2**	**ILLUMINATIONS:** Definitions, laws of illuminations
11	2	Polar curves, luminous efficiency

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12	2	Photometer, incandescent lamps
13	2	Filament materials, Halogen lamp
14	2	Electric discharge lamps, sodium vapour lamp,
15	2	Mercury vapour lamp and fluorescent lamp. Light Calculations:
16	2	Commercial, industrial, street and flood lighting.
17	2	Numerical Light
18	2	Numerical Light Calculations
19	**3**	**ELECTROLYTIC PROCESS:** Principles And Applications Of Electrolysis,
20	3	Electro-deposition, Manufactures of chemicals,
21	3	Anodizing, electro-polishing , electro-cleaning, electroextraction
22	3	Electro-refining
23	3	Electro-stripping (parting) power supplies for electrolytic process
24	**4**	**ELECTRIC TRACTION & MEANS OF SUPPLYING POWER**: Systems of Electric Traction:
25	4	DC & AC Systems, Power Supply for Electric Traction System
26	4	Comparison and application of different systems
27	4	Sub-station equipment and layout, conductor rail & pantograph
28	4	Numerical
29	**5**	**TRACTION METHODS**: Types of services,
30	5	Speed time and speed distance curves,
31	5	Numerical
32	5	Numerical
33	5	Estimation of power and energy requirements, Mechanics of train movement
34	5	Numerical
35	5	Co-efficient of adhesion, Adhesive weight, effective weight. Traction Motor Controls:
36	5	DC and AC traction motors
37	5	Series parallel starting. Methods of electric braking of traction motors.
38		Revision to course work.
39		Revision to course work.
40		Revision to course work.

TEXT/REFERENCE BOOKS

1	C. L. Wadhwa: Utilization of Electric Traction Electric Power.
2	H. Partab: Art and Science of Electrical Energy, Dhanpat Rai & Sons
3	H. Partab:Modern Electric Traction, Dhanpat Rai & Sons

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Syllabus Deployment

Name of Faculty: Mr. Chandra Prakash Jain Subject Name: Electric Drives and Their Control	Subject Code: 8EE2A
Department: Department of Electrical Engineering (EE& EEE)	SEM: VIII
Total No. of Lectures Planned: 42	

COURSE OUTCOMES HERE
At the end of this course students will be able to
CO 1 :Classify Electrical Drives, And Justify Multi-Quadrant Operation Of Drives
CO 2 :Along With Load Equalization
CO 3 :Analyze The Thermal Model And Determine The Motor Rating For Different
CO 4 :Duty Cycles Considering The Effect Of Load Inertia And Environmental
CO 5:Identify Suitable Form Of Electrical Drives System In Industry

Lecture No.	Unit	Topic
1	**1**	**DYNAMICS OF ELECTRIC DRIVES :** overview
2	1	Fundamental torque equations
3	1	Speed-torque conventions
4	1	Multi-quadrant operation,
5	1	Nature and classification of load torques,
6	1	Steady state stability,
7	1	Load equalization
8	1	Close loop configurations of drives.
9	**2**	**DC DRIVES: SPEED TORQUE CURVES** torque and power limitation
10	2	Torque and power limitation in armature voltage and field control,
11	2	Torque and power limitation in armature voltage and field

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		control,
12	2	Starting, Braking
13	2	Regenerative Braking, dynamic braking and plugging
14	2	Speed Control-Controlled Rectifier fed DC drives,
15	2	Speed Control-Controlled Rectifier fed DC drives,
16	2	Chopper Controlled DC drives.
17	**3**	**INDUCTION MOTOR DRIVES-I :** overview
18	3	Starting, Braking-Regenerative braking,
19	3	Starting, Braking-Regenerative braking,
20	3	Plugging and dynamic braking
21	3	Speed Control: Stator voltage control
22	3	Variable frequency control from voltage source,
23	3	Variable frequency control from voltage source,
24	3	Voltage Source Inverter (VSI) Control
25	**4**	**INDUCTION MOTOR DRIVES-II** Variable frequency control from current source
26	4	Variable frequency control from current source,
27	4	Variable frequency control from current source,
28	4	Current Source Inverter (CSI) Control,
29	4	Cycloconverter Control
30	4	Static rotor resistance control
31	4	Slip Power Recovery
32	4	Stator Scherbius drive, Static Kramer drive.
33	**5**	**SYNCHRONOUS MOTOR DRIVE** Control of Synchronous Motor-Separately Controlled
34	5	Control of Synchronous Motor-Separately Controlled
35	5	Control of Synchronous Motor-Separately Controlled
36	5	VSI fed Self-Controlled Synchronous Motor Drives.
37	5	VSI fed Self-Controlled Synchronous Motor Drives.
38	5	Dynamic and Regenerative Braking of Synchronous Motor with VSI
39	5	Dynamic and Regenerative Braking of Synchronous Motor with VSI
40	5	Control of Synchronous Motor Using Current Source Inverter (CSI).
41		Revision to course work.

42		Revision to course work.

TEXT/REFERENCE BOOKS

1 G. K. Dubey: Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi.

2 B. K. Bose: Power Electronics and Motor Drives, Elsevier

3 V. Subrahmanyam: Electric Drives- Concepts and Applications, MGH

4 Theodore Wildi: Electrical Machines, Drives and Power Systems, Pearson

5 S. K. Pillai: A First Course on Electrical Drives, Wiley Eastern limited, India

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni | Subject Code: 8EE1A
Subject Name:EHV AC/DCTRANSMISSION

Department: Department of Electrical Engineering (EE& EEE) | SEM: VIII

Total No. of Lectures Planned: 42

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

CO 1:Qualitative comparison of AC and DC transmission system with all aspects

CO 2:Understand the need of EHV AC transmission and various issues related with it

CO 3 :Reactive power management, Stability of AC and DC systems

CO 4 :In depth converter analysis, faults, protections, harmonic considerations, grounding system

CO 5 :Journey from conventional HVDC control to modern HVDC control schemes

Lecture No.	Unit	Topic
1	**1**	**EHV AC TRANSMISSION:** Need Of Ehv Transmission Lines
2	1	power handling capacity and surge impedance loading
3	1	Problems of EHV transmission,
4	1	Bundled Conductors: geometric mean radius of bundle
5	1	properties of bundleconductors
6	1	Electrostatic fields of EHV lines and their effects
7	1	Corona effects: Corona loss,
8	1	Audio and radio noise.
9	**2**	**LOAD FREQUENCY CONTROL**: Introduction to control of active and reactive power flow
10	2	Turbine speed governing system
11	2	Turbine speed governing system

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12	2	Speed governing characteristic of generating unit and load sharing between parallel operating generators
13	2	Method of Load Frequency Control:
14	2	Flat frequency, flat tie line
15	2	Tie line load bias control
16	2	Automatic generation control (description of block diagram only)
17	**3**	**VOLTAGE CONTROL**: No load receiving end voltage
18	3	Reactive power generation.
19	3	Methods of voltage control
20	3	Synchronous phase modifier
21	3	Shunt capacitors and reactors
22	3	Saturable reactors, Thyristorised static VAR compensators
23	3	TCR, FC-TCR
24	3	TSC- TCR.
25	**4**	**FACTS:**Introduction
26	4	FACTS controllers
27	4	Types of FACTS controllers
28	4	Brief description of STATCOM
29	4	Thyristor controlled series capacitors
30	4	Thyristor controlled series capacitors
31	4	Unified power flow controller
32	4	Unified power flow controller
33	**5**	**HVDC TRANSMISSION**: Types of D.C. links
34	5	HVDC Transmission: Types of D.C. links
35	5	Basic scheme and equipment of converter station.
36	5	Basic scheme and equipment of converter station. Ground return
37	5	Basic principles of DC link control
38	5	Basic converter control characteristics
39	5	Basic converter control characteristics
40	5	Application of HVDC transmission
41		Revision to course work.
42		Revision to course work.

TEXT/REFERENCE BOOKS

1 E. W. Kimbark: Direct Current Transmission, Vol. I, Wiley

Interscience
2 K. R. Padiyar: HVDC Power Transmission System, Wiley Eastern Ltd
3 K. R. Padiyar: HVDC Power Transmission Systems. NEW AGE PUB
4 J. Arrillaga: H.V.D.C Transmission, Peter Peregrines
5 J. Arrillaga HVDC et. al, : Computer Modelling of Electrical Power System. John Wiley.

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Syllabus Deployment

Name of Faculty:RajkumarSoni Subject Name:Facts Devices & Their Applications	Subject Code: 8EE4.2A
Department: Department of Electrical Engineering (EE& EEE)	SEM: VIII
Total No. of Lectures Planned: 40	

COURSE OUTCOMES HERE (3 OUTCOMES)

Atthe end of this course students will be able to

CO 1 Understands basic concepts of Power flow control of an AC transmission line.Stability consideration, Basic types of FACTS controllers, Voltage-Sourced Converters

CO 2 Able to Introduction to understands power factor control, Static Shunt Compensators, Synchronous Compensators (STATCOM). Comparison between STATCOM and SVC.

CO 3 Able to explain Static Series Compensator, Power oscillation and sub synchronous oscillation damping, Thyristors switched series capacitor (TSSC),Thyristors controlled series capacitor (TCSC),

CO 4 Able to understand the concept of Static voltage and Phase angle regulator. Power flow control and Improvement of stability by phase angle regulator. TCVR andTCPAR

CO 5 Will be able to explain Unified Power Flow Controller (UPFC),Compensators and phase angle regulator. Applications of UPFC. IPFC: Interline Power Flow Controller (IPFC) its characteristics and applications

Lecture No.	Unit	Topic
1	**1**	**PROBLEMS OF AC** Transmission Systems**,**
2	1	Power flow inparallel paths and meshed system,
3	1	Factors limiting loading capability,

4	1	Stability consideration. Power flow control of an ac transmission line.
5	1	Basic types of facts controllers.
6	1	Advantages of FACTS technology.
7	1	Voltage-Sourced Converters:
8	1	Basic concept of voltage-sourced converters,
9	**2**	**SINGLE AND THREE PHASE** Bridge Converters**.**
10	2	Introduction to power factor control.
11	2	Transformer connections for 12-pulse,
12	2	24 pulse and 48 pulse operations.
13	2	Static Shunt Compensators:
14	2	Mid-point and end point voltage regulation of
15	2	Transmission line, and stability improvement. Basic operating principle of Static
16	2	Synchronous Compensators (STATCOM). Comparison between STATCOM and SVC.
17	**3**	**STATIC SERIES COMPENSATORS:** Compensators
18	3	Concept of series capacitive compensation,
19	3	Voltageand transient stabilities,
20	3	Power oscillation and sub synchronous oscillation damping.
21	3	Introduction to Thyristors switched series capacitor (TSSC),
22	3	Thyristors controlled series capacitor (TCSC),
23	3	Static synchronous series compensator, -
24	3	Operation, characteristics and applications.
25	**4**	**STATIC VOLTAGE AND PHASE** Angle Regulators**:**
26	4	Voltage and phase angle regulation.
27	4	Power flow control and
28	4	Improvement of stability by phase angle regulator.
29	4	Introduction to thyristors controlled voltage and phase angle regulators
30	4	(TCVR andTCPAR)
31	4	Introduction to thyristor controlled braking resistor and thyristor
32	4	Controlled voltage limiter.
33	**5**	**UPFC**: Unified Power Flow Controller (UPFC),
34	5	Basic operating principles,
35	5	Conventional transmission control capabilities. Comparison of

		UPFC to series
36	5	Compensators and phase angle regulator. Applications of UPFC.
37	5	IPFC: Interline Power Flow Controller (IPFC),
38	5	Basic operating principles and
39	5	Characteristics.
40	5	Applications of IPFC.

TEXT/REFERENCE BOOKS

1 K. R. Padiyar: Flexible AC Transmission Systems

2 N. G. Hingorani, L. Gyugyi: Understanding FACTS: IEEE Press Book.

3 Yong Hua Song, Allan T Johns : Flexible AC Transmission Systems FACTS

4 Xiao Ping Zhang, Christian Rehtanz, Bikash Pal: Flexible AC Transmission Systems.

5 R. Mohan & R. M. Mathur: Thyristor-based FACTS Controllers for Electrical Transmission Systems, John Wiley

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni Subject Code:8EE3A
Subject Name: Protection of Power System

Department: Department of Electrical Engineering (EE& EEE) SEM: VIII

Total No. of Lectures Planned: 52

COURSE OUTCOMES HERE

Atthe end of this course students will be able to

CO 1 :Introduction to protection, Trip circuit of a circuit breaker, CTs &PTs Current transformer, Steady state ratio and phase angle errors in CTs and PTs, CVT

CO 2:HRC fuse and thermal relay, different types of Overcurrent relays, Earth fault relay, Parallel feeders and ring mains.

CO 3 :Generator Protection, Differential and percentage differential protection, Rotor protection-protection against excitation and prime mover failure, Field earth fault and unbalanced stator currents (negative sequence current protection).

CO 4 :Power Transformer protection, Percentage differential protection, Magnetizing inrush current, percentage differential relay with harmonic restrain, Buchholz relay, Bus bar Protection, High impedance relay scheme, frame leakage protection.

CO 5 :Transformer Line Protection: Construction, operating principle and characteristics of an electromagnetic impedance relay, Induction Motor Protection: Introduction to various faults and abnormal operating conditions, Earth fault and negative sequence voltage relays

Lecture No.	Unit	Topic
1	1	**CAUSES AND CONSEQUENCES OF** Dangerous Currents
2	1	Faults, overloads and switching over currents
3	1	Introduction to protection

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4	1	Trip circuit of a circuit breaker
5	1	Functional characteristics of a relay
6	1	Zone of protection
7	1	Primary and backup protection
8	1	**CTs &PTs** Current transformer construction
9	1	Current transformer construction
10	1	Measurement and protective CTs
11	1	Type of potential transformers
12	1	Steady state ratio and phase angle errors in CTs and PTs
13	1	Transient errors in CT and CVT (Capacitive Voltage Transformer).
14	**2**	**OVERCURRENT PROTECTION** HRC fuse
15	2	Thermal relay
16	2	Over current relays – instantaneous, definite time
17	2	Inverse time and inverse definite minimum time over current relays, time and current grading
18	2	Induction disc type relay
19	2	Directional over current relay, 30, 60 and 90 degree connections.
20	2	Earth fault relay
21	2	Brief description of over current protective schemes for a feeder
22	2	Parallel feeders and ring mains
23	**3**	**GENERATOR PROTECTION** Stator protection
24	3	Differential and percentage differential protection
25	3	Protection against stator inter-turn faults
26	3	Stator overheating protection
27	3	Rotor protection-protection against excitation and prime mover failure
28	3	Field earth fault and unbalanced stator currents (negative sequence current protection)
29	**4**	**TRANSFORMER PROTECTION ;** overview
30	4	Percentage differential protection
31	4	Magnetizing inrush current, percentage differential relay with harmonic restrain
32	4	Buchholz relay
33	4	Differential protection of generator transfer unit
34	4	Bus bar Protection
35	4	Differential protection of bus bars

36	4	High impedance relay scheme, frame leakage protection
37	**5**	**TRANSMISSION LINE PROTECTION :** Introduction
38	5	Introduction to distance protection
39	5	Construction, operating principle and characteristics of an electromagnetic impedance relay
40	5	Effect of arc resistance
41	5	Induction cup type reactance and mho relays
42	5	Comparison between impedance, reactance and mho relays
43	5	Three stepped distance protection of transmission line.
44	5	Induction Motor Protection
45	5	Introduction to various faults and abnormal operating conditions
46	5	Unbalance supply voltage and single phasing
47	5	Introduction to protection of induction motors- HRC fuse and over current
48	5	Percentage differential
49	5	Earth fault and negative sequence voltage relays
50		Revision to course work.
51		Revision to course work.
52		Revision to course work.

TEXT/REFERENCE BOOKS

1 Badri Ram: Power System Protection and Switchgear, MGH.
2 RavindraNath M. Chander: Power System Protection and Switch Gear, John Wiley Eastern.
3 Sunil S. Rao.: Power System Protection and Switch Gear, Khanna Publishers.
4 Oza: Power System Protection and Switchgear, MGH.
5 T. S. Madhava Rao: Power System Protections (Static Relays), MGH.

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni Subject Code:8EE5A

Subject Name:Computer Based Power System Lab SEM: VIII

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 9

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO1: Fault analysis (for 3 to 6 bus) and verify the results using MATLAB: (i) LG Fault (ii) LLG Fault

CO2: Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson

CO3: Study of overload security analysis and obtain results for the given problem using MATLAB or any software

Lab No.	Experiment
1	Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault
2	Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: LL Fault and
3	Fault analysis (for 3 to 6 bus) and verify the results using

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	MATLAB or any available software for the cases: 3-Phase Fault
4	Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss-Seidal (ii) Newton Raphson
5	Fast Decoupled Method and verify results using MATLAB or any
6	Study of voltage security analysis
7	Study of overload security analysis and obtain results for the given problem using MATLAB or any software.
8	.Study of economic load dispatch problem with different methods
9	Study of transient stability analysis using MATLAB/ETAP Software

TEXT/REFERENCE BOOKS

1. Power System Engineering Book by D.P. Kothari and I.J. Nagrath
2. Power System Engineering: Planning, Design, and Operation of Power Systems and Equipment Book by Jürgen Schlabbach and Karl-Heinz Rofalski.
3. Power Systems Analysis Illustrated With Matlab And Etap 2019 Edition by SHERTUKDE H M, TAYLOR & FRANCIS LTD

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Syllabus Deployment

Name of Faculty: Mr. Rajkumar Soni Subject Code:8EE6A

Subject Name:Electrical Drives and Control Lab SEM: VIII

Department: Department of Electrical Engineering (EE & EEE)

Total no. of Labs planned: 12

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO1: Study and test the firing circuit of three phase half controlled bridge converter.

CO2: Study and obtain waveforms of 3 phase half controlled bridge converter with R and RL loads.

CO3: Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator.

CO4: Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter

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Lab No.	Experiment
1	Study and test the firing circuit of three phase half controlled bridge converter.
2	Study and obtain waveforms of 3 phase half controlled bridge converter with R and RL loads.
3	Study and test the firing circuit of 3-phase full controlled bridge converter.
4	Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads.
5	Study and test 3-phase AC voltage regulator.
6	Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic.
7	Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator.
8	Control speed of universal motor using AC voltage regulator.
9	Study 3-phase dual converter.
10	Study speed control of dc motor using 3-phase dual converter.
11	Study three-phase cyclo-converter and speed control of synchronous motor using cyclo-converter.
12	Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter

TEXT/REFERENCE BOOKS

1. Fundamentals of Electrical Drives (English, Paperback, Dubey Gopal K.)
2. Fundamentals of Electric Drives and Control B.R.Gupta&V.Singhal.

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Syllabus Deployment

Name of Faculty: Mr. CPJain Subject Code:8EE7A
Subject Name:High Voltage Engineering Lab
Department: Department of Electrical Engineering (EE & EEE) SEM: VIII
Total No. of Lectures Planned: 9

COURSE OUTCOMES HERE

Atthe end of this course students will be able to:

CO1: Determine dielectric strength of transformer oil

CO2: Determine capacitance and dielectric loss of an insulating material using Schering Bridge.

CO3: Study high voltage testing of electrical equipment: line insulator, cable

CO4: Design an EHV transmission line.

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Lab No.	Experiment /Objective
1	Study filtration and Treatment of transformer oil.
2	Determine dielectric strength of transformer oil.
3	Determine capacitance and dielectric loss of an insulating material using Schering bridge.
4	Study solid dielectrics used in power apparatus.
5	Study applications of insulating materials.
6	Study direct testing and indirect testing of circuit breakers.
7	Study high voltage testing of electrical equipment: line insulator, cable
8	Study high voltage testing of electrical equipment: bushing, power capacitor and power transformer.
9	Design an EHV transmission line.

TEXT/REFERENCE BOOKS

1. High Voltage Engineering Fundamentals Book by E. Kuffel and W. S. Zaengl
2. High Voltage Engineering Book by V. Kamaraju.
3. High Voltage Engineering Book by C.L. Wadhwa