| 19BS2111 | II Year I Sem | Mathematics-III | 3L:0T:0P | 3 Credits |
|---|---|---|---|---|

**Course Objectives:**

- Concept, properties of Laplace transforms
- Solving ordinary differential equations using Laplace transforms techniques.
- Various methods to the find roots of an equation.
- Concept of finite differences and to estimate the value for the given data using interpolation.
- Evaluation of integrals using numerical techniques
- Solving ordinary differential equations using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

**Course Outcomes:** After learning the contents of this paper the student must be able to

- Use the Laplace transforms techniques for solving ODE's
- Find the root of a given equation.
- Estimate the value for the given data using interpolation
- Find the numerical solutions for a given ODE's
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems
- Taylor's and Laurent's series expansions of complex function

**UNIT-I Fourier series**

Fourier series and Transforms: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

**UNIT-II Fourier Transforms**

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

**UNIT-III Laplace Transforms:**

Laplace Transforms; Laplace Transform of standard functions; first shifting theorem; Laplace transforms of functions when they are multiplied and divided by't'. Laplace transforms of derivatives and integrals of function; Evaluation of integrals by Laplace transforms; Laplace transforms of Special functions; Laplace transform of periodic functions.

Inverse Laplace

**UNIT- IV Complex Variables (Differentiation):** Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne- Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**UNIT – V Complex Variables (Integration):** Line integrals, Cauchy's theorem, Cauchy's Integral formula, Liouville's theorem, Maximum-Modulus theorem (All theorems without proof); zeros of analytic functions, singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem (without proof).

**Text Books:**


1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

**Reference Books:**


1. M. K. Jain, SRK Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations , New Age International publishers.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

| 19EE2112 | II Year I Sem | Electrical Circuits | 3L:0T:0P | 4 Credits |
|---|---|---|---|---|

**Prerequisite:** Mathematics - II (Ordinary Differential Equations and Multivariable Calculus)
Basic Electrical Engineering

**Course Objectives:**

- To understand the network theorems for AC&DC Excitations.
- To understand Network Topology and Three phase circuits
- To analyze transients in Electrical systems.
- To evaluate Network parameters of given Electrical network
- To analyse Magnetic Circuits, and to design basic filter configurations,

**Course Outcomes:**

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyzecircuitsinthesinusoidalsteady-state(single-phaseandthree-phase).
- Analyze two port circuit behavior.

**UNIT – I**

**Network Theorems (With A.C. & D.C):** Thevinin's, Norton's, Maximum Power Transfer, Tellegen's, Superposition, Reciprocity, Milliman's and Compensation theorems for (AC & D.C) excitations.

**UNIT – II**

**Network topology:** Definitions, Graph, Tree, Basic cutset and Basic Tie set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Dependent & Independent Voltage and Current Sources, Duality & Dual Networks

**Three phase circuits:** Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of active and reactive power.

**UNIT – III**

**Transient Analysis:** Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations – Initial conditions – Classical method and Laplace transforms methods of solutions.

**Locus diagrams:** Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters.

**UNIT – IV**

**Network Parameters:** Network functions driving point and transfer impedance function networks-poles and zeros –necessary conditions for driving point function and for transfer function.

**Two port network parameters** – Z, Y, ABCD and hybrid parameters and their relations– two port network parameters using transformed variables.

**UNIT – V**

**Filters:** Introduction to filters –low pass – high pass and band pass – RC, RL, filters- constant K filters.

**Magnetic Circuits:** Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit - Analysis of series and parallel magnetic circuits.

**TEXT BOOKS**


1. "William Hayt and Jack E. Kemmerly", "Engineering circuit analysis", Mc Graw Hill Company, 6th edition, 2016.
2. "C.K Alexander &M.N.O Sadiku", Electric circuits, Mc Graw Hill Company.
3. "D. Roy Chowdary", "Networks and systems", New age international publishers, 2009.
4. "N. C. Jagan & C. Lakshminarayana", "Network Theory", B.S Publications, 2014.
5. "A. Chakrabarthy", Circuit Theory, Dhanpat Rai, 2005.


**REFERENCE BOOKS:**


1. "Van Valkenburg", "Network Analysis", PHI, 3rd Edition, 2014
2. "Franklin F Kuo," "Network Analysis & Synthesis", Wiley India PVT. Ltd., second Edition, 2006
3. "K.C. A. Smith & R. E. Alley", "Electrical Circuits", Cambridge University Press, 1992
4. "K. Rajeswaran", "Electric Circuit theory", Pearson Education, 2004.
5. "A. Bruce Carlson", "Circuits", Thomson Publishers, 1999

| 19EE2113 | II Year I Sem | Electro Magnetic Fields | 3L:1T:0P | 4 Credits |
|---|---|---|---|---|

**Prerequisite:** Mathematics-II (Ordinary Differential Equations and Multivariable Calculus) & Applied Physics

**Course Objectives:**

- To introduce the concepts of electric field and magnetic field.
- Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.

**Course Outcomes:** At the end of the course, students will demonstrate the ability

- To understand the basic laws of electromagnetism.
- To obtain the electric and magnetic fields for simple configurations under static conditions.
- To analyze time varying electric and magnetic fields.
- To understand Maxwell's equation in different forms and different media.
- To understand the propagation of EM waves.

**UNIT – I Static Electric Field:**

Review of conversion of a vector from one coordinate system to another coordinate system, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

**UNIT – II Conductors, Dielectrics and Capacitance:**

Dielectric constant and strength –Linear, Isotropic and Homogenous Dielectrics - Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation.

**UNIT – III Static Magnetic Fields and Magnetic Forces:**

Magnetization in materials – Classification of materials in terms of their magnetic property-Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions.

**UNIT – IV Time Varying Fields and Maxwell's Equations:**

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

**UNIT – V Electromagnetic Waves:**

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane wave in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Poynting theorem.

**Text Books:**

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

**Reference Books:**

1. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

2. G. W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.
3. W. J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
4. W. J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968.
5. E. G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press, 1966.
6. B. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers, International Edition, 1971.
7. A. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009

| 19EE2114 | II Year I Sem | Electrical Machines-I | 3L:1T:0P | 4 Credits |
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**Prerequisite:** Basic electrical & Electronics Engineering

**Course Objectives:**

- To study and understand different types of DC generators, Motors and Transformers, their construction, operation and applications.
- To analyze performance aspects of various testing methods.

**Course Outcomes:** After this course, the student will be able to

- Identify different parts of a DC machine & understand its operation.
- Carry out different testing methods to predetermine the efficiency of DC machines.
- Understand different excitation and starting methods of DC machines.
- Control the voltage and speed of a DC machines.

**UNIT – I D.C. Generators:**

Principle of operation – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – E. M.F Equation. Armature reaction – compensating winding – commutation – reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures. Characteristics of generators and its applications.

**UNIT – II D.C Motors:**

Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation. Speed control of D.C. Motors - Armature voltage and field flux control methods. Motor starters (3 point and 4 point starters) – Applications of DC motors – Electronic starters.

**UNIT – III Testing of D.C. machines:**

Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency. Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test - separation of stray losses in a d.c. motor test.

**UNIT – IV Single phase transformers:**

Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses – Types of Cooling.

**UNIT – V Testing of transformers and poly phase transformers:**

OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers equivalent circuit - comparison with two winding transformers. Polyphase transformers - Polyphase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ - Third harmonic voltages and tertiary winding in three phase transformers.

**Text Books:**

1. "I.J. Nagrath & D.P. Kothari", "Electric Machines", Tata Mc Graw Hill Publishers, 3rd edition, 2004.
2. "P.S. Bimbra", "Electrical Machines", Khanna Publishers, 7th Edition, 2014.

**Reference Books:**

1. E. Clayton & N. M. Hancock "The Performance and Design Of Direct Current Machines" 3rd Edition Pitman, London 1959.
2. "A. E. Fritzgerald, C. Kingsley and S. Umans", "Electric Machinary", McGraw Hill Companies, 6th edition, 2003.
3. "Abhijith Chakrabarthi & SubithaDebnath", "Electrical Machines", Mc Graw Hill, 2015.

| 19EC2116 | II Year I Sem | Analog Electronics | 3L:0T:0P | 3 Credits |
|---|---|---|---|---|

**Course Objectives:**

- To introduce components such as diodes, BJTs and FETs their switching characteristics, applications Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
- To introduce the basic building blocks of linear integrated circuits.
- To introduce the concepts of waveform generation and introduce some special function ICs

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Know the characteristics, utilization of various components.
- Understand the biasing techniques
- Design and analyze various rectifiers, small signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- A thorough understanding, functioning of OP-AMP, design OP-AMP based circuits with linear integrated circuits.

**UNIT-I: DIODE CIRCUITS**

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, clamping and clipping circuits. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits,

**UNIT-II: MOSFET CIRCUITS**

MOSFET structure and I-V characteristics. MOSFET as a switch. small signal equivalent circuits - gain, input and output impedances, small-signal model and common-source, common-gate and common-drain amplifiers, trans conductance, high frequency equivalent circuit.

**UNIT-III: MULTI-STAGE AND POWER AMPLIFIERS**

Direct coupled and RC Coupled multi-stage amplifiers; Differential Amplifiers, Power amplifiers - Class A, Class B, Class C

**UNIT-IV: FEEDBACK AMPLIFIERS:** Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

OSCILLATORS: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators.

**UNIT-V: OPERATIONAL AMPLIFIERS**

Ideal op-amp, Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Inverting and non-inverting amplifier, Differentiator, integrator, Square-wave and triangular-wave generators.

**Text Books**:


1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2nd edition 2010
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.

**References:**


1. Electronic Devices Conventional and current version -Thomas L. Floyd 2015, pearson. 2. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

| 19EE2151 | II Year I Sem | Electrical Circuits Lab | 0L:0T:3P | 1 Credit |
|---|---|---|---|---|

**Prerequisite:** Basic Electrical Engineering, Electrical Circuit Analysis

**Course Objectives:**

- To design electrical systems
- To analyze a given network by applying various Network Theorems
- To measure three phase Active and Reactive power.
- To understand the locus diagrams

**Course Outcomes:** After Completion of this lab the student is able to

- Analyze complex DC and AC linear circuits
- Apply concepts of electrical circuits across engineering
- Evaluate response in a given network by using theorems

The following experiments are required to be conducted as compulsory experiments

1. Verification of compensation & Milliman's theorems
2. Verification of Reciprocity and Maximum Power Transfer theorems
3. Series and Parallel Resonance
4. Time response of first order RL/RC network for periodic non–sinusoidal inputs–Time constant and Steady state error determination.
5. Locus Diagrams of RL and RC Series Circuits
6. Two port network parameters–Z–Y parameters, Analytical verification.
7. Two port network parameters–A, B, C, D & Hybrid parameters, Analytical verification
8. Separation of Self and Mutual inductance in a Coupled Circuit .Determination of Co-efficient of Coupling.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

9. Study of Harmonics for various lighting loads.
10. Determination of form factor for non-sinusoidal wave form.
11. Measurement of Active Power for Star connected balanced loads.
12. Measurement of Reactive Power for Star connected balanced loads

**TextBooks:**

1.M.E.VanValkenburg,"NetworkAnalysis",PrenticeHall,2006.
2.D.RoyChoudhury,"NetworksandSystems",NewAgeInternationalPublications,1998.

**References:**

1.W.H.HaytandJ.E.Kemmerly,"EngineeringCircuitAnalysis",McGrawHillEducation,2013.
2.C.K.AlexanderandM.N.O.Sadiku,"ElectricCircuits",McGrawHillEducation,2004.
3.K.V.V.MurthyandM.S.Kamath,"BasicCircuitAnalysis",JaicoPublishers,1999.

| 19EE2152 | II Year I Sem | Electrical Machines-I Lab | 0L:0T:3P | 1 Credit |
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**Course Objective:**

- To expose the students to the operation of DC Generator
- To expose the students to the operation of DC Motor.
- To perform OC and SC tests on single phase Transformer
- To examine the self excitation in DC generators.

**Course Outcomes:**

- Differentiate between Different types of DC Machines.
- Analyze the characteristics of DC Generator.
- Analyze the characteristics of DC Motor.
- control the speed of DC motors.

The following experiments are required to be conducted as compulsory experiments

Part - A

1. Magnetization characteristics of DC shunt generator
2. Swinburne's Test on D.C.Shunt Machine
3. Brake test on D.C.Shunt motor
4. Speed control of D.C.Shunt Motor
5. Separation of losses of a D.C. Shunt Machine
6. Load Test on D.C.Shunt Generator
7. Load Test on D.C.Series Generator
8. Hopkinson's Test on a Pair of Identical D.C. Shunt Machines

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

Part - B

9. Field's Test on a pair of Identical D.C. Series Machines
10. Seperation of Core losses in DC Shunt motor.
11. Load Characteristics' of D.C.Compound Generator
12. Brake Test on D.C.Compound Motor

| 19EC2154 | II Year I Sem | Analog Electronics Lab | 0L:0T:3P | 1 Credit |
|---|---|---|---|---|

**Prerequisite**: Analog Electronics

**Course Objectives:**

- To introduce components such as diodes, BJTs and FETs their switching characteristics, applications
- Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
- To introduce the basic building blocks of linear integrated circuits.
- To introduce the concepts of waveform generation and introduce some special function ICs.

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Know the characteristics, utilization of various components.
- Understand the biasing techniques
- Design and analyze various rectifiers, small signal amplifier circuits. Design sinusoidal and non-sinusoidal oscillators.
- A thorough understanding, functioning of OP-AMP, design OP-AMP based circuits with linear integrated circuits.

The following experiments are required to be conducted as compulsory experiments

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Full Wave Rectifier with & without filters
3. Common Emitter Amplifier Characteristics
4. Common Source amplifier Characteristics
5. Measurement of h-parameters of transistor in CB, CE, CC configurations
6. Adder and Subtractor using Op Amp.
7. Integrator Circuit using IC 741.
8. Current Shunt Feedback amplifier
9. RC Phase shift Oscillator
10. Class A power amplifier

In addition to the above ten experiments, at least any two of the experiments from the following list are required to be conducted

11. Common Base Amplifier Characteristics
12. Inverting and Non-inverting Amplifiers using Op Amps.
13. Differentiator circuit using IC 741.
14. Hartley and Colpitt's Oscillators

| 19EE2211 | II Year II Sem | Electrical Measurements and Instrumentation | 3L:0T:0P | 3 Credits |
|---|---|---|---|---|

**Pre-requisite:** Basic Electrical and Electronics Engineering, Network theory & Electromagnetic fields.

**Course objectives:**

1. To introduce the basic principles of all measuring instruments
2. To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.

**Course Outcomes:** After completion of this course, the student

- Understand different types of measuring instruments, their construction, operation and characteristics
- Identify the instruments suitable for typical measurements
- Apply the knowledge about transducers and instrument transformers to use them effectively.

**UNIT – I INTRODUCTION TO MEASURING INSTRUMENTS**

Introduction: : Objectives of measurements, Performance characteristics, Static and dynamic characteristics, Accuracy, Precision, Type of errors, ammeter and voltmeter: PMMC, MI instruments, expression for deflection and control torque, errors and compensation, extension of range using shunts and series multipliers ; Electro static voltmeter, extension of range of ES voltmeters, rectifier type voltmeters.

**UNIT – II POTENTIOMETERS AND INSTRUMENT TRANSFORMERS**

DC Potentiometers: Principle and operation of Crompton potentiometer, standardization, measurement of unknown resistance, current, voltage; AC potentiometers: polar and coordinate type, standardization, applications;

Instrument transformers: CT and PT, ratio and phase angle error.

**UNIT – III MEASUREMENT OF POWER, POWER FACTOR AND ENERGY**

Measurement of Power: Single phase dynamometer type wattmeter, LPF and UPF, double elements and three elements dynamometer wattmeter; Expression for deflection and control torque, measurement of Active and reactive power for balanced and unbalanced Systems, Electrodynamometer power factor meter.

Measurement of Energy: Single phase induction type energy meter, driving and braking torques, errors and compensations, testing by phantom loading using RSS meter, three phase energy meter, maximum demand meters, introduction to net energy metering

**UNIT – IV DC AND AC BRIDGES**

Measurement of Resistance: Methods of measuring low, medium, high resistance, Wheatstone bridge, carry foster, Kelvin's double bridge, loss of charge method; Measurement of Inductance:

Maxwell's bridge, hay's bridge , Anderson's bridge, Owen's bridge; Measurement of Capacitance: Desauty's bridge, Wein's bridge, Schering bridge.

**UNIT – V TRANSDUCERS AND OSCILLOSCOPES**

Transducers: Definition of transducers, classification of transducers, advantages of electrical transducers, characteristics and choice of transducers, principle of operation of LVDT and capacitor transducers, LVDT applications, strain gauge and its principle of operation, gauge factor

Cathode ray oscilloscope: Cathode ray tube, time base generator, horizontal and vertical amplifiers, CRO probes, applications of CRO, measurement of phase and frequency, Lissajous patterns, sampling oscilloscope, analog oscilloscope.

**Text Books:**


1. E W Golding and F C Widdis, "Electrical measurements and measuring instruments", Wheeler publishing, 5th Edition, 2006
2. A K Sawhney, "Electrical and Electronic measurement and instruments", Dhanpat Rai and Sons Publications, 2002.


**References:**


1. Buckingham and Price, "Electrical measurements", Prentice Hall.
2. D V S Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2nd Edition, 2009
3. A S Morris, "Principles of measurement of instrumentation", Pearson/Prentice Hall of India, 2nd Edition, 1994
4. H S Kalsi, "Electronic Instrumentation", Tata McGraw-Hill Publications, 1st Edition 1995.

| 19EE2212 | II Year II Sem | Electrical Machines-II | 3L:0T:0P | 4 Credits |
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**Prerequisite:** Basic Electrical Engineering, Electrical Machines-I

**Course Objectives:**

- To deal with the detailed analysis of poly-phase induction motors & Alternators
- To understand operation, construction and types of single phase motors and their applications in house hold appliances and control systems.
- To introduce the concept of parallel operation of alternators
- To introduce the concept of regulation and its calculations.

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines

**UNIT I POLYPHASE INDUCTION MOTORS:**

Polyphase induction motors – types and constructional features – principle of operation – phasor diagram – equivalent circuit – slip torque characteristics – effect of rotor resistance – NL & RB tests, circle diagram – starting – Crawling and cogging – Applications.

**INDUCTION GENERATORS:** Motor to generator transition – Induction Generator Starting and operation with other three phase sources – Isolated generator operation and voltage build-up.

**UNIT II SINGLE PHASE INDUCTION MOTORS:**

Single phase induction motors – split phase type, capacitor start, and capacitor run shaded pole types and constructional features – Principle of operation – equivalent circuit based on double revolving field theory universal motors – Testing of Single phase Induction motor - Applications.

**UNIT III ALTERNATORS:**

Alternators – types and constructional features – EMF equation – Distribution factor – pitch factor – effect of harmonics on EMF equation - rotating magnetic field – armature reaction – load characteristics – Power angle Characteristics

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**UNIT IV PERFORMANCE OF ALTERNATORS:**

Regulation of alternators, Predetermination of regulation by synchronous impedance method, ampere turn method, Zero Power factor method Basic ideas of two reaction theory – direct and quadrature axis reactances and their determination – Phasor diagram and regulation of salient pole alternators – Expression for power developed as a function of torque angle – parallel operation of alternators – Short circuit ratio (SCR) - Single phase Synchronous generators.

**UNIT V SYNCHRONOUS MOTORS:**

Synchronous Motors: synchronous machines on infinite bus bars – Phasor diagram – V and inverted V curves – current and power circle diagrams – Hunting and its suppression – starting

methods – synchronous condenser – reluctance motor - Short circuit transients in synchronous machine, short circuit under loading conditions.

**TEXT BOOKS:**

1. "Generalized Machine Theory", Bhimbra, Khanna publishers, 5th edition.
2. "Electrical Machines", I.J.Nagarath & D.P.Kothari., Tata McGraw Hill, 4th edition.
3. "Performance and Design of AC Machines" , M.G.Say, Pitman, ELBS.

**REFERENCE BOOKS:**

1. 'General Theory of Electrical Machines' , Adkins; Chapman & Hall, 1979.
2. 'Electrical Machinery' , Fitzgerald A.E. & Kingsley; McGraw-Hill, 6th edition.
3. 'Theory of AC Machinery', Langsdorf A.S.; TataMcGraw-Hill, 2001
4. 'Alternating Current Machines', Puchestein, Lloyd & Cenrad, Asia Publishing House, 1968
5. 'Electric Machinery Fundamentals', Chapman S.J.; McGraw-Hill, 1991

| 19EE2213 | II Year II Sem | Control Systems | 3L:1T:0P | 4 Credits |
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**Course objectives:**

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

**UNIT-I:Introduction: Concepts of Control Systems**- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations - Impulse Response and transfer functions - Translational and Rotational mechanical systems. Block diagram algebra and system representations – Signal flow graphs - Mason's gain formula. Transfer function of Servo motors.

**UNIT-II:Time Response Analysis:** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

**UNIT-III:Stability Analysis:** The concept of stability - Routh stability criterion – qualitative stability and conditional stability. Root Locus Technique: The root locus concept - construction of root locus-Root locus analysis.
**Frequency domain Analysis:** Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

**UNIT-IV: Stability Analysis In Frequency Domain:** Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams.**Compensation techniques** – Lag, Lead, and Lead Lag Controllers design in frequency Domain, PID Controllers.

**UNIT-V:State Space Analysis of Continuous Systems:** Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties. Controllability and Observability,

**Text Books:**

1. "I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
2. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

**Reference Books:**

1. "N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. "NISE", "Control Systems Engineering", John wiley, 6 th Edition, 2011.
3. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3 rd edition, 1998.
5. "A.K Jairath" Problems and solutions of control systems with essential theory 5th Edition .

| 19EE2214 | II Year II Sem | Power Systems – I | 3L:1T:0P | 4 Credits |
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**Prerequisite:** BEE, Network Theory

**Course Objectives:**

- To understand the Hydro, Thermal, Nuclear and gas generating stations.
- To examine A.C. and D.C. distribution systems.
- To understand and compare air insulated substations.
- To illustrate the economic aspects of power generation and tariff methods.

**Course Outcomes:** After Completion of this course the student is able to

- Draw the layout of hydro power plant, thermal power station, Nuclear power plant and gas power plant and explain its operation
- Describe A.C. and D.C. distribution systems and its voltage drop calculations
- Illustrate various economic aspects of the power plant erection, operation and different tariff methods

**UNIT- I GENERATION OF ELECTRIC POWER**

Conventional Sources – Layout and major components of Hydro station, Steam Power Plant, Nuclear Power Plant (Types of Reactors) and Gas Turbine Plant.

Non-Conventional Energy Sources: Principles of Solar, Wind, Tidal and Geothermal Power Generations.

**Economic Aspects of Power Generation:** Capital & Operating Cost of different power plants. Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems. Desirable characteristics of Tariff and Tariff Methods

**UNIT – II DC DISTRIBUTION**

Classification of Distribution Systems.- Comparison of DC vs. AC and Under-Ground vs. Over- Head Distribution Systems.- Requirements and Design features of Distribution Systems.-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

**AC DISTRIBUTION**

Introduction, AC distribution, Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

**UNIT-III OVERHEAD LINE INSULATORS:**

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Substations- Indoor and Outdoor substations: Substations Layout showing the location of all the substation equipment, Bus bar arrangements in the substation: Single bus bar, Sectionalized single bus bar, main and transfer bus bar system

**UNIT-IV TRANSMISSION LINE PARAMETERS:**

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of

capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double
Circuit lines, Numerical Problems.

**UNIT-V UNDER GROUND CABLES:** Types of cables, construction, types of insulating materials, calculation of insulation resistance and stress in insulation, numerical problems.
Capacitance of single and three core belted cables, numerical problems. Grading of cables- capacitance grading- numerical problems, description of inter-sheath grading- HV cables

**TEXT BOOKS:**

1. "C. L. Wadhawa", "Generation and utilization of Electrical Energy", New age International (P) Limited, Publishers 1997.
2. "C. L. Wadhawa", "Electrical Power Systems", New age International (P) Limited, Publishers 1997.
3. "M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakraborti", "A Text Book on Power System Engineering", Dhanpat Rai and Co. Pvt. Ltd, 1999.

**REFERENCE BOOKS:**

1. "M.V. Deshpande", "Elements of Power Station design and practice" , Wheeler Publishing, 3rd Edition 1999.
2. "S. N. Singh", "Electrical Power Generation, Transmission and Distribution", PHI, 2003.
3. "V.K Mehta and Rohit Mehta", "Principles of Power Systems", S. Chand& Company Ltd, New Delhi, 2004.

| 19EC2216 | II Year II Sem | Digital Electronics | 3L:0T:0P | 3 Credits |
|---|---|---|---|---|

**Prerequisite**: Analog Electronics.

**Course Objectives:**

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them.
- To analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

**Course Outcomes:** At the end of this course,

- students will demonstrate the ability to Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion. Be able to use PLDs to implement the given logical problem.

## UNIT-I:FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

## UNIT-II: COMBINATIONAL DIGITAL CIRCUITS

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial ladder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

## UNIT-III: SEQUENTIAL CIRCUITS AND SYSTEMS

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J-K-T and D types flip flops ,applications of flip flops shift registers applications of shift registers ,serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters

design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

**UNIT-IV: A/D AND D/A CONVERTERS**

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

**UNIT-V:SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES**

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

**TEXT BOOKS:**


1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.


**REFERENCES:**


1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

| 19EE2251 | II Year II Sem | Electrical Measurements & Instrumentation Lab | 0L:0T:3P | 1 Credit |
|---|---|---|---|---|

**Course Objectives:**

- To calibrate LPF Watt Meter, energy meter, P. F Meter using electro dynamo meter type instrument as the standard instrument
- To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges
- To determine three phase active & reactive powers using single wattmeter method practically
- To determine the ratio and phase angle errors of current transformer and potential transformer.

**Course Outcomes**: After completion of this lab the student is able to

- To choose instruments
- Test any instrument
- Find the accuracy of any instrument by performing experiment
- Calibrate PMMC instrument using D.C potentiometer

**The following experiments are required to be conducted as 10 compulsory experiments**

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 – Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.
9. Calibration of LPF wattmeter – by Phantom testing.
10. Transformer turns ratio measurement using AC bridges.
11. Measurement of 3-phase power with single wattmeter and two C.T 's
12. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method
13. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
14. Measurement of % ratio error and phase angle of given CT by comparison
15. Resistance strain gauge – strain measurements and Calibration.
16. Measurements of parameter of choke coil using 3-ammeter and 3-voltmeter method.

| 19EE2252 | II Year II Sem | Control Systems Lab | 0L:0T:3P | 1 Credit |
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**Course Objectives:**

1. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2. To assess the system performance using time domain analysis and methods for improving it
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To design various controllers and compensators to improve system performance.

**Course Outcomes:**

- The students will be able to understand types of control systems and their behavior can be studies.
- Different applications of control systems will be understood

**The following experiments are required to be conducted compulsory experiments:**

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. To determine the transfer function of DC motor
6. To determine the transfer function of DC generator
7. Temperature controller using PID
8. Characteristics of AC servo motor

**In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:**

9. Effect of P, PD, PI, PID Controller on a second order systems
10. Lag and lead compensation – Magnitude and phase plot
11. (a) Simulation of P, PI, PID Controller.
    b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software
13. State space model for classical transfer function using suitable software -Verification.
14. Design of Lead-Lag compensator for the given system and with specification using suitable software.

| 19EC2254 | II Year II Sem | Digital Electronics Lab | 0L:0T:2P | 1 Credit |
|---|---|---|---|---|

**Prerequisite**: Digital Electronics, Analog Electronics

**Course Objectives:**

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

**Course Outcomes:** At the end of this course, students will demonstrate

- The ability to understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

**List of Experiments:**

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND / NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4 bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8 bit parallel load and serial out shift register using flip-flops.
8. Design and realization a Synchronous and Asynchronous counters using flip-flops
9. Design and realization of Asynchronous counters using flip-flops
10. Design and realization 8x1 using 2x1 mux
11. Design and realization 2 bit comparator
12. Verification of truth tables and excitation tables
13. Realization of logic gates using DTL, TTL, ECL, etc.,
14. State machines

**TEXT BOOKS**:


1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

| 19MC0001 | II Year II sem | Gender Sensitization | 2L:0T:0P | 0 Credits |
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Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

**UNIT – I** UNDERSTANDING GENDER:
Gender: Why Should We Study It? (Towards a World of Equals: Unit -1) Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

**UNIT – II** GENDER AND BIOLOGY Missing Women:
Sex Selection and Its Consequences (Towards a World of Equals: Unit-4) Declining Sex Ratio. Demographic Consequences. Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10) Two or Many? Struggles with Discrimination.

**UNIT - III** GENDER AND LABOUR Housework:
the Invisible Labour (Towards a World of Equals: Unit -3) "My Mother doesn't Work." "Share the Load." Women's Work: Its Politics and Economics (Towards a World of

Equals: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

**UNIT – IV** ISSUES OF VIOLENCE Sexual Harassment:
Say No! (Towards a World of Equals: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (Towards a World of Equals: Unit -11) Blaming the Victim-"I Fought for my Life…." – Additional Reading: The Caste Face of Violence.

**UNIT – V** GENDER : CO – EXISTENCE Just Relationships:
Being Together as Equals (Towards a World of Equals: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

**TEXT BOOK:**

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, "Towards a World of Equals: A Bilingual Textbook on Gender", Telugu Academy, Hyderabad,Telangana,2015.