TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
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# B.TECH – ELECTRICAL & ELECTRONICS ENGINEERING
## Course Structure R-20

## SEMESTER III

| S.No. | Class | Course Code | Name of the Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | BS | CBSM12 | Probability, Numerical Methods and Complex Analysis | 3 | 1 | 0 | 4 |
| 2 | PC | C23PC1 | Electrical Circuit Analysis | 3 | 1 | 0 | 4 |
| 3 | PC | C23PC2 | Analog Electronics | 3 | 0 | 0 | 3 |
| 4 | PC | C23PC3 | Electrical Machines-I | 3 | 1 | 0 | 4 |
| 5 | PC | C23PC4 | Electro Magnetic Fields | 3 | 0 | 0 | 3 |
| 6 | PC | C23PC5 | Analog Electronics Lab | 0 | 0 | 2 | 1 |
| 7 | PC | C23PC6 | Electrical Machines Lab-I | 0 | 0 | 2 | 1 |
| 8 | PC | C23PC7 | Electrical Circuit Analysis Lab | 0 | 0 | 2 | 1 |
| 9 | MC | MC003 | Cultural Activity | 0 | 0 | 0 | Satisfactory |
| **Total Credits** | | | | **15** | **3** | **6** | **21** |

**Mandatory Course: Cultural Activity**
The student should participate in culture activity (Music/Dance/Singing/etc.) conducted by the College, student should produce the participation certificate for clearing this course.

## SEMESTER IV

| S.No. | Class | Course Code | Name of the Subject | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | ES | CESEM1 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 2 | PC | C24PC1 | Digital Electronics | 3 | 0 | 0 | 3 |
| 3 | PC | C24PC2 | Electrical Machines-II | 3 | 1 | 0 | 4 |
| 4 | PC | C24PC3 | Control Systems | 3 | 1 | 0 | 4 |
| 5 | PC | C24PC4 | Power System-I | 3 | 0 | 0 | 3 |
| 6 | PC | C24PC5 | Digital Electronics Lab | 0 | 0 | 2 | 1 |
| 7 | PC | C24PC6 | Electrical Machines Lab –II | 0 | 0 | 2 | 1 |
| 8 | PC | C24PC7 | Control Systems Lab | 0 | 0 | 2 | 1 |
| 9 | MC | MC004 | Videos with Social Messages | 0 | 0 | 0 | Satisfactory |
| **Total Credits** | | | | **15** | **3** | **6** | **21** |

**Mandatory Course: Video with Social Messages**
Student should make video with social messages. This has to be uploaded in the youtube.com, by maintaining the terms and conditions of youtube.com. Student should produce youtube.com link with screen shot for clearing this mandatory course.

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# ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**3 /1/ 0/ 4**

## PROBABILITY, NUMERICAL METHODS AND COMPLEX ANALYSIS (CBSM12)

**Course Objectives:**

**To learn:**

1. Random variables that describe randomness or an uncertainty in certain realistic situation.
2. The study of discrete and continuous distribution predominantly describes important probability distribution.
3. Sampling distribution of mean, variance, point estimation and interval estimation
4. The testing of Hypothesis of Large samples.
5. The topics those deals with methods to find roots of an equation.
6. The topic of integration that deals using numerical techniques.
7. Differentiation and integration of complex valued functions.

**Course Outcomes:**

After learning the contents of this paper the student must be able to learn concept of
**CO1:** Random variables and various discrete and continuous probability distribution and their properties.
**CO2:** Calculate mean, of sampling distributions and to make important decisions for few samples which are taken from a large data .
**CO3:** Find the root of a given equation using numerical methods.
**CO4:** Solve the problems by iteration method using convergence criteria.
**CO5:** Choose the methods based on equal and unequal intervals to solve problems of interpolation.
**CO6:** Analyse the complex functions with reference to their analyticity, integration using Cauchy's integral theorem & formula.

**UNIT I**
**Random Variables & Distributions**

Random variables – discrete and continuous, mass function density function of probability distributions inomial, Poisson and Normal distributions related properties.

**UNIT II**
**Sampling Distributions & Hypothesis Theory**

Sampling distributions of means ($\sigma$known and unknown). Tests of hypothesis- point stimations-Interval estimations. Null hypothesis, alternative hypothesis, Type-1, Type-2 errors, critical region, confidence interval for mean, testing of single mean and two means.

# PROBABILITY, NUMERICAL METHODS AND COMPLEX ANALYSIS (CBSM12)

## UNIT III
## Algebraic and Transcendental Equations

Solution of algebraic and transcendental equations – Bisection method, Regula-falsi method, Iteration method, Newton-Raphson method.

## UNIT IV
## Interpolation and Integration

Finite differences- interpolation using Newton's forward and back ward difference Formulae- Interpolation with unequal intervals- Newton's divided difference and Lagrange's formulae- Numerical integration- Trapezoidal rule and Simpson's 1/3 and 3/8 rules.

## UNIT V
## Functions of a Complex Variable & Complex integration

Introduction and definitions, Continuity, differentiability, analyticity, properties, Cauchy - Riemann equations in Cartesian and polar co-ordinates(without proof), harmonic and conjugate harmonic functions, Milne-Thompson method. Cauchy integral theorem, Cauchy integral formula, generalized Cauchy integral Formula related problems (without proofs).

**Text Books:**

1. Probability & Statistics for Engineers by D.K. Murugesan & P. Guru Swamy, Anuradha Publications.
2. S.S. Sastry- introductory methods of numerical analysis- PHI-4$^{th}$edition-2005.
3. B.S. Grewal- Higher Engineering Mathematics- Khanna Publishers- 36$^{th}$Edition-2010.
4. Complex variables and applications by James ward Brown and Ruel V. Churchill-Eighth Edition –Mc-Graw Hill Higher Education.

**Reference Books:**

1. Probability & Statistics for Engineers, Millers and John E. Freund, Prentice Hall of India.
2. B.S. Grewal- Higher Engineering Mathematics- Khanna Publishers- 36$^{th}$Edition-2010.
3. Fundamentals of complex analysis by Saff, E.B.and A.D.S nider, Pearson.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**3 /1/ 0/ 4**

# ELECTRICAL CIRCUIT ANALYSIS (C23PC1)

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

**Course Objectives:**

1. To understand network theorems and Network Topology.
2. To analyze transients in Electrical systems.
3. To evaluate Network parameters of given Electrical network.
4. To understand the Two Port Network and Network Functions.

**Course Outcomes:**

After completion of this course, the students will be able to

1. Apply network theorems for the analysis of electrical circuits.
2. Illustrate about network topology.
3. Obtain the transient and steady-state response of electrical circuits.
4. Analyze circuit analysis using laplace transform.
5. Analyze two port circuit behavior.

**UNIT I**
**Network Theorems**

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Millman theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis, Concept of duality and dual networks. Definitions–Graph – Tree, Basic cut set and Basic Tie set matrices for planar networks.

**UNIT II**
**Solution of First and Second Order Networks**

Solution of first and second order differential equations for Series and parallel R-L, R-C, R- L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response for DC and AC Excitations.

**UNIT III**
**Sinusoidal Steady State Analysis**

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. . Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer Three-phase circuits. Series and parallel resonances.

# ELECTRICAL CIRCUIT ANALYSIS (C23PC1)

## UNIT IV
## Electrical Circuit Analysis Using Laplace Transforms

Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots).

## UNIT V
## Two Port Network and Network Functions

Network functions driving point and transfer impedance function networks, necessary conditions for driving point functions and for transfer function, Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

**Text Books:**

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall,2006.
2. D.Roy Choudhury,“NetworksandSystems”,NewAgeInternationalPublications,1998.

**Reference Books:**

1. W.H.HaytandJ.E.Kemmerly,“EngineeringCircuitAnalysis”,McGrawHillEducation,2013.
2. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw HillEducation,2004.
3. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers,1999.
4. Electric Circuits by Schaum’soutlines.
5. Problems&SolutionsinElectricalEngineeringbyV.C.Natesan,Parkersmith’s

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**3 /0/ 0/ 3**

## ANALOG ELECTRONICS (C23PC2)

**Prerequisite:** Basic Electrical and Electronics Engineering.

**Course Objectives:**

1. To explain the operation, Design and Analysis of Single stage amplifiers using BJT and MOSFET.
2. To analyze Feedback amplifiers, Large Signal amplifiers and Oscillators.
3. To explain the operation of Linear and non Linear wave shaping circuits
4. To understand the switching characteristics of Diode and Transistor

**Course Outcomes:**

After completion of this course the student is able to

1. Apply the knowledge of BJT to design practical amplifier circuits.
2. Design electronic sub systems such as Feedback amplifiers, Oscillators.
3. Design Power amplifiers.
4. Design Linear and nonlinear wave shaping circuits with different inputs.
5. Analyze Multi vibrators using transistors.

**UNIT I**
**Single Stage Amplifiers**

H-parameter analysis, Classification of Amplifiers Analysis of CE,CB,&CC Amplifiers, Distortion in Amplifiers, Comparison of CE, CB, CC Amplifiers, Low frequency response of BJT Amplifiers , FET Biasing, Low frequency response of FET Amplifiers, Miller Effect Capacitance, High Frequency response of BJT amplifiers, Square Wave Testing.

**UNIT II**
**Feedback Amplifiers**

Concept 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, Illustrative problems.
**Oscillators:** Conditions for oscillations, Frequency and Amplitude Stability of Oscillators, Generalized analysis of LC Oscillators, Quartz, Hartley, and Colpitt's Oscillators, RC – phase shift and Wein Bridge oscillators.

# ANALOG ELECTRONICS (C23PC2)

**UNIT III**
**Large Signal Amplifiers**

Class A Power Amplifier, Maximum Efficiency of Class –A Amplifier, Transformer Coupled Amplifier, Push Pull Amplifier complimentary symmetry Class-B Power Amplifier, Phase Inverters, Transistor Power Dissipation, Thermal Runway, and Heat sinks.

**UNIT IV**
**Wave Shaping**

High Pass, Low Pass RC Circuit their response for Sinusoidal, Step, and Pulse and Ramp Inputs.
**Clippers and Clampers:** Diode Clippers, Transistor Clippers, Clipping at Two Independent Levels, Transfer Characteristics of Clippers, Comparators, Clamping Operation, Clamping Circuits using Diode with different inputs, Clamping Circuit Theorem, Practical Clamping Circuits.

**UNIT V**
**Switching Characteristics of Devices**

Diode as a Switch, Piecewise Linear Diode Characteristics, Transistor as a Switch, Breakdown Voltage Consideration of Transistor, Design of Transistor Switch, Transistor Switching Times.
**Multi vibrators:** Analysis and Design of Bistable, Monostable, Astable, Multivibrators and Schmitt Trigger usingTransistors.

**Text Books:**

1. "RobertLBoylesteadandLouisNashelsky","ElectronicDevicesandcircuittheory",Pearson, Tenth edition2009
2. "S.Salivahanan,N.SureshKumarandA.VallavaRaj","ElectronicDevicesand circuits", TMH, 2nd Edition2008.
3. "Jacob Millman, Harbert Taub and Mothiki S Prakash Rao", "Pulse Digital& SwitchingWaveforms",TMH,2nd Edition2008.

**Reference Books:**

1. "RobertT.Paynter","IntroductoryElectronicDevicesandCircuits",PEI, 7Edition,2009.
2. "Anil. K. Maini, VarshaAgarwal", "Electronic Devices and Circuits", Wiley,1st Edition 2009.
3. "Jacob Millman, Harbert Taub and Mothiki S Prakash Rao", "Pulse Digital& Switching Waveforms", TMH, 2nd Edition2008.
4. "DavidA.Bell", "Solidstate Pulse Circuits",PHI,4thEdition2007.

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# ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**3 /1/ 0/ 4**

## ELECTRICAL MACHINES - I (C23PC3)

**Prerequisite:** Mathematics, Electrical Circuits.

**Course Objectives:**

1. To study and understand different types of DC generators, Motors and Transformers.
2. To analyze performance aspects of various testing methods.

**Course Outcomes:**

After completion of this course, the students will be able to
1. Identify different parts of a DC machine & understand its operation
2. Carry out different testing methods to predetermine the efficiency of DC machines
3. Understand different excitation and starting methods of DC machines
4. Control the voltage and speed of a DC machines
5. Analyze single phase and three phase transformers circuits.

**UNIT I**
**D.C. Generators**

Principle of operation – Action of commutator – constructional features– Armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature–E. M.F Equation. Armature reaction – Cross magnetizing and de- magnetizing AT/pole – 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. Load characteristics of shunt, series and compound generators.

**UNIT II**
**DC 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) Testing of D.C. machines - Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

# ELECTRICAL MACHINES - I (C23PC3)

**UNIT III**
**Testing of DC Machines**

Methods of Testing – direct, indirect, and regenerative testing – Brake test –Swinburne's test Hopkinson's test – Field's 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.

**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. Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ.

**Text Books:**

1. A.E.FitzgeraldandC.Kingsley,"ElectricMachinery",NewYork,McGrawHillEducation, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers,2004.

**Reference Books:**

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
2. I.J.NagrathandD.P.Kothari,"ElectricMachines",McGrawHillEducation,2010.
3. Problems & Solutions in Electrical Engineering by V.C. Natesan, Parker smith's.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**3 /0/ 0/ 3**

# ELECTRO MAGNETIC FIELDS (C23PC4)

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

**Course Objectives:**

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

**Course Outcomes:**

After completion of this course, the students will be able to

1. Understand the review of vector calculus.
2. Understand the static electric field.
3. Understand the operation of conductors, dielectrics and capacitance.
4. Analyze about Magnetic Forces, Materials and Inductance.
5. Understand the Time Varying Fields and Maxwell's Equations.

**UNIT I**
**Vector Calculus**

Vector algebra addition, subtraction, components of vectors, scalar and vector multiplications triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator Del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

**UNIT II**
**Static Electric Field**

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 III**
**Conductors, Dielectrics and Capacitance**

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations. Static Magnetic Fields Bio-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

# ELECTRO MAGNETIC FIELDS (C23PC4)

## UNIT IV
## Magnetic Forces, Materials and Inductance

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

## UNIT V
## 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. Boundary Conditions.
**Electromagnetic Waves:** Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

**Text Books:**

1. M.N. O. Sadiku, "Elements of Electromagnetics",OxfordUniversityPublication,2014.
2. W. Hayt, "Engineering Electromagnetics", McGraw-Hill Education, 2012.
3. K.A Gangadhar, P.M Ramanathan " Electromanetic Field Theory" Khanna Publishers, 1997.

**Reference Books:**

1. A.Pramanik,"Electromagnetism-Problemswithsolution",PrenticeHallIndia,2012.
2. G.W.Carter,"Theelectromagneticfieldinitsengineeringaspects",Longmans,1954.
3. W.J.Duffin,"ElectricityandMagnetism",McGrawHillPublication,1980.
4. W.J.Duffin,"AdvancedElectricityandMagnetism",McGrawHill,1968.
5. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
6. B. D. Popovic, "Introductor Engineering Electromagnetics", Addison Wesley Educational Publishers, International Edition,1971.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**0 /0/ 2/ 1**

## ANALOG ELECTRONICS LAB (C23PC5)

**Course Objectives:**

1. To train the students to analyze, the operational principle design and application of the Bipolar Junction Transistor (BJT). And Diode
2. To train the students to analyze the operational principle, design and application of the Field Effect Transistor (FET).
3. To develop the students' ability on conducting engineering experiments, analyze experimental observations scientifically.

**Course Outcomes:**

Upon completion of the subject, students will be able to
**CO1:** Analyze Single stage amplifiers.
**CO2:** Analyze Feedback and Power amplifiers.
**CO3:** Analyze Diode applications.
**CO4:** Analyze the different types of FET Amplifiers.
**CO5:** Analyze Transistor applications

**Note: Minimum 05 Experiments are to be done from Part A**

1. PN Diode and Zener Diode Characteristics
2. Half wave Rectifier With and Without Filter
3. Full wave Rectifier with and without Filter
4. Transistor CE Characteristics.
5. Transistor CB Characteristics.
6. Diode Clippers and Clampers
7. FET Characteristics.

**Minimum 5 Experiments are to be done from Part B**

1. Common Emitter Amplifier.
2. Common Source amplifier.
3. Current Shunt & Voltage Series Feedback Amplifier.
4. Class A Power Amplifier (Transformer less)
5. Hartley & Colpitt's Oscillator
6. Astable and Monostable Multivibrators

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**0 /0/ 2/ 1**

## ELECTRICAL MACHINES LAB - I (C23PC6)

**Prerequisite:** Electrical Machines-I
**Course Objectives:**

1. To expose the students to the operation of DC Generator
2. To expose the students to the operation of DC Motor.
3. To examine the self-excitation in DC generators.

**Course Outcomes**:

After completion of this lab, the students will be able to
1. Start and control the Different DC Machines.
2. Assess the performance of different machines using different testing methods
3. Identify different conditions required to be satisfied for self-excitation of DC
4. Generators.
5. Separate iron losses of DC machines into different components.

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

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC series generator (Determination of characteristics)
3. Speed control of DC shunt motor
4. Swinburne's test DC Machine
5. Brake test on DC compound motor (Determination of performance curves)
6. Fields test on DC series machines (Determination of efficiency)
7. Brake test on DC Shunt motor
8. OC &SC Test on Single Phase Transformer
9. Scott connection of transformers
10. Sumpner's Test on a Pair of single-phase transformers

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

1. Retardation test on DC shunt motor (Determination of losses at rated speed)
2. Load test on DC compound generator
3. Hopkinson's test on DC shunt machines (Predetermination of efficiency)
4. Parallel operation of a two single phase transformers.
5. Load test on single phase transformers.

# ELECTRICAL MACHINES LAB - I (C23PC6)

**Text Books:**

1. A.E.FitzgeraldandC.Kingsley,"ElectricMachinery",NewYork,McGrawHillEducation, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers,2004.

**Reference Books:**

1. M.G.Say,"PerformanceanddesignofACmachines",CBSPublishers,2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
3. I.J.Nagrathand D.P.Kothari, "Electric Machines", McGraw Hill Education, 2010. Electrical Machines lab manual by Dr.D.K.Chaturvedi.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III Semester** **L/T/P/C**
**0/0/2/1**

## ELECTRICAL CIRCUIT ANALYSIS LAB (C23PC7)

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

**Course Objectives**:

1. To design electrical systems.
2. To analyze a given network by applying various Network Theorems.

**Course Outcomes:**

After completion of this lab, the students will be able to

1. Apply suitable theorems to find voltage, current &power in electrical circuits.
2. Understand time response of RC/RL network.
3. Determine Circuit parameters for two port network.

**Experiments:**

**Conduct any 10 experiments:**

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition and Reciprocity Theorems
3. Verification of Maximum Power Transfer theorems
4. Verification of Millman theorem.
5. Time response of first order RC / RL network for periodic non – sinusoidal inputs.
6. Verification of series and parallel resonance.
7. Two port parameters –Z & Y Parameters, Analytical verification.
8. Two port parameters –A, B, C, D& Hybrid Parameters, Analytical verification.
9. Separation of Self and Mutual inductance in a Coupled Circuit. Determination of Co-efficient of Coupling.
10. Determination of form factor for non sinusoidal wave form
11. Simulation/ PSPICE of KCL and KVL
12. Simulation/PSPICE of Mesh & Nodal Analysis
13. Simulation/PSPICE of compensation and Milliman's theorem
14. Simulation/PSPICE of Two port parameters- Z & Y Parameters

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# ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**3/1/ 0/ 4**

## ENGINEERING MECHANICS (CESEM1)

**Course Objectives:**

The objectives of this course are to

1. To explain the importance of mechanics in the context of engineering and conservation equations.
2. To introduce the techniques for analyzing the forces in the bodies.
3. To explain the significance of centroid, centre of gravity and moment of inertia.
4. To apply the different principles to study the motion of a body, and concept of relative velocity and acceleration and describe the trajectory of a particle under projectile motion.
5. To identify the basic elements of a mechanical system and write their constitutive equations.

**Course Outcomes:**

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

1. Draw free body diagrams and determine the resultant of forces and/or moments.
2. Apply laws of mechanics to determine efficiency of simple machines with consideration of friction.
3. Determine the centroid and second moment of area of sections.
4. Analyze statically determinate planar frames. Analyze the motion and calculate trajectory characteristics.
5. Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.

**UNIT I**
**Introduction to Engineering Mechanics**

Basic concepts, System of Forces Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System.
**Equilibrium of System of Forces** - Free body diagrams, Equations of Equilibrium of Coplanar Systems

**UNIT II**
**Friction**

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack, ladder friction.
**Centroid** – Introduction-Centroid of Lines-Areas- centroid of I, T, L, Z-sections.
**Centre of Gravity -** Centre of Gravity of bodies- standard sections – Theorem of Pappus.

# ENGINEERING MECHANICS (CESEM1)

**UNIT III**
**Area Moment of Inertia**

Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections.
**Mass Moment of Inertia**: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of standard sections

**UNIT IV**
**Kinetics of Rigid Bodies**

Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies

**UNIT V**
**Mechanical Vibration**

Definitions Concepts- Simple Harmonic motion- free vibrations-simple compound pendulum.
**Virtual Work**: Theory of Virtual Work- Application

**Text Books:**

1. Engineering Mechanics: R.K.Bansal, Laxmi publications.
2. Engineering Mechanics: S.S.Bavakatti, New age International.
3. Engineering Mechanics Statics & Dynamics: N.H. DUBEY McGraw Hill International Edition.

**Reference Books:**

1. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGraw Hill International Edition, 1983.
2. Beer F.P & Johnston E.R Jr. Vector, "Mechanics for Engineers", TMH, 2004.
3. Hibbeler R.C & Ashok Gupta, "Engineering Mechanics", Pearson Education, 2010.
4. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.
5. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
6. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**3/0/0/3**

## DIGITAL ELECTRONICS (C24PC1)

**Course Objectives:**

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

**Course Outcomes:**

Upon completion of the Course, the students will be able to

1. Convert numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
2. Realize simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
3. Design and analyze of combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
4. Design of sequential logic circuits and synthesizing of threshold functions.
5. Design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

**UNIT I**
**Number System and Switching Functions**

Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Error Detecting and Correcting Codes.

**UNIT II**
**Boolean Algebra**

Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

**Minimization of Boolean Functions:** Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map conditions, Tabular Method.

# DIGITAL ELECTRONICS (C24PC1)

**UNIT III**
**Combinational Circuits**

Introduction, Adders, Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, code converters, Comparators and Hazards.

**UNIT IV**
**Sequential Circuits I**

Introduction, Basic Differences between Combinational and Sequential circuits, the Binary Cell, Latch, Flip-Flop-Types, and Race around condition, Excitation tables and characteristic equations. Conversion from one type of Flip-Flop to another, preset and Clear inputs, Timing and Triggering Consideration, Clock Skew.

**Sequential Circuits II:** Introduction, Register-Types, Counter –Types, Design of Ripple (mod-N) Counter, Ring Counter.

**UNIT V**
**Sequential Machines**

State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Finite state machine- capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table.

**Text Books:**

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.

**References Books:**

1. Anand Kumar, “Switching Theory and Logic Design” PHI, 2008.
2. Charles H. Roth, “Fundamentals of Logic Design” Thomson Publications, 5th Edition, 2004.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**3/1/0/4**

## ELECTRICAL MACHNIES – II (C24PC2)

**Prerequisite:** Basic Electrical Engineering, Electrical Machines-I

**Course Objectives:**

1. To deal with the detailed analysis of poly phase induction motors &Synchronous generators and motors.
2. To understand operation, construction and types of single phase motors and their applications in house hold appliances.
3. To introduce the concept of parallel operation of synchronous generators.
4. To introduce the concept single special motors.

**Course Outcomes:**

After completion of this course, the students will be able to

1. IdentifyandunderstanddifferentpartsofInductionmotorandspecifytheiroperations.
2. Analyze the characteristics and speed control of Induction motor.
3. Understand and analyze the construction, operation and characteristics of synchronous generator.
4. Understand the parallel operation of synchronous machines and working principle of synchronous motor.
5. Analyze the construction and working of single phase and special motors.

**UNIT I**
**Poly- Phase Induction Machines**

Constructional details of cage and wound rotor machines- production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

**UNIT II**
**Characteristics of Induction Machines**

Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging -.No-load Test and Blocked rotor test – Predetermination of performance-Methods of starting and starting current and Torque calculations.
**Speed Control Methods:** Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator- principle of operation.

# ELECTRICAL MACHNIES – II (C24PC2)

**UNIT III**
**Synchronous Machines**

Constructional Features of round rotor and salient pole machines – Armature windings – Integralslot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m. f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of $X_d$ and $X_q$ (Slip test) Phasor Diagrams – Regulation of salient pole alternators.

**UNIT IV**
**Parallel Operation of Synchronous Machines**

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub- transient, transient and steady statereactances.
**Synchronous Motors –** Theory of operation – phasor diagram– Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. - hunting and its suppression – Methods of starting – synchronous induction motor.

**UNIT V**
**Single Phase Motors & Special Machines**

Single phase induction motor – Constructional features- Double revolving field theory – split-phase motors – shaded pole motor, Capacitor start, Capacitor start – run single phase induction motor, Universal motor.

**Text Books:**

1. "I. J. Nagrath& D. P. Kothari", "Electric Machines", Tata McGraw Hill, 7th Edition,2009.
2. "P.S Bhimbra", "Electrical machines", Khanna Publishers,2014.

**Reference Books:**

1. "M. G. Say", "Performance and Design of AC Machines", CBS Publishers, 3rd Edition,2002.
2. "A.E. Fitzgerald, C. Kingsley and S. Umans", "Electric machinery", McGraw Hill Companies, 7thedition,2013.
3. "Langsdorf", "Theory of Alternating Current Machinery", Tata McGraw-Hill Companies, 2nd edition,1984.
4. "M.V Deshpande", "Electrical Machines", Wheeler Publishing,2011.
5. Problems & Solutions in Electrical Engineering by V.C. Natesan, Parker smith's.

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# ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**3/1/0/4**

## CONTROL SYSTEMS (C24PC3)

**Prerequisite:** Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms , Numerical Methods and Complex variables

**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:**

After completion of this course, the student will be able to

1. Acquiring knowledge about control problems and transfer function representation.
2. Analyze the time response.
3. Analyze the concept of stability of a system in time domain.
4. Analyze the concept of stability of a system in frequency domain.
5. Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

**UNIT I**
**Introduction to Control System**

Concepts of Control Systems- Different examples of control systems - Classification of control systems,Open Loop and closed loop control systems and their differences- Feedback Characteristics, Effects of feedback. Mathematical modelling of Translational and Rotational mechanical systems.
Block diagram representation. Block diagram algebra – Representation by Signal flow graph – Reduction of SFG using mason's gain formula.

**UNIT II**
**Time Response Analysis**

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Time response of second order systems synthesis & calculations - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral controllers.

# CONTROL SYSTEMS (C24PC3)

**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 loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

**UNIT IV**
**Frequency Response Analysis**

Introduction, Frequency domain specifications-Relationship between time and frequency response, Bode Plots, Polar Plots, Nyquist Stability Criterion. Compensation techniques – Introduction to Lag, Lead, and Lead- Lag Controllers.

**UNIT V**
**State Variable Analysis**

Concepts of state variables, State space model, Diagonalization of State Matrix, Properties of state transition matrix, solution of state equations, Eigen values and Stability Analysis, Concept of controllability and Observeability.

**Text Books:**

1. B. C. Kuo, “Automatic Control System”, Prentice Hall,1995.
2. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International,2009.

**Reference Books:**

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education,1997
2. K. Ogata, “ Modern Control Engineering” , Prentice Hall, 1991.
3. N. K. Sinha, “Control Systems”, New Age International (P) Limited Publishers, 3rd Edition, 1998.
4. N. Nise, “Control Systems Engineering”, John wiley, 6th Edition, 2011.
5. SonveerSingh,"ATextbookofControlSystemsEngineering",KhannaBookPublishingCO.(P)Ltd, 2012.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**3/0/0/3**

## POWER SYSTEM - I (C24PC4)

**Prerequisite:** Basic Electrical Engineering, Electrical Machines-I, Electrical Machines-II.
**Course Objectives:**

1. To understand the different types of power generating stations.
2. To examine A.C. and D.C. distribution systems.
3. To understand and compare overhead line insulators and Insulated cables.
4. To illustrate the economic aspects of power generation and tariff methods.
5. To evaluate the transmission line parameters calculations
6. To understand the concept of corona.

**Course Outcomes:**

1. Understand the concepts of power systems.
2. Understand the operation of conventional generating stations and renewable sources of electrical power.
3. Evaluate the power tariff methods.
4. Determine the electrical circuit parameters of transmission lines
5. Understand the layout of substation and underground cables and corona.

**UNIT I**
**Generation of Electric Power**

Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Non Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

**UNIT II**
**Economics of Generation**

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

**UNIT III**
**Overhead Line Insulators & Insulated Cables**

Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators. Introduction, insulation, insulating materials, Extra high voltage cables, Types of cables: grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables.

# POWER SYSTEM - I (C24PC4)

**UNIT IV**
**Inductance & Capacitance Calculations of Transmission Lines**

Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors- transposition, bundled conductors, and effect of earth on capacitance. Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

**UNIT V**
**AC Distribution**

Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation . 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.
**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.

**Text Books:**

1. P.V. Gupta, M.L. Soni, U.S. Bhatnagar, A. Chakrabarti "Power System Engineering" Dhanpat Rai & Co, 2013.
2. C.L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, Second Edition, New Age International, 2009.

**Reference Books:**

1. C.L. Wadhwa –Electrical Power Systems, Fifth Edition, New Age International, 2009
2. M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, Wheeler Pub. 1998
3. H.Cotton& H. Barber-The Transmission and Distribution of Electrical Energy, Third "V.K Mehta and Rohit Mehta", "Principles of Power Systems", S. Chand& Company Ltd, New Delhi, 2004

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**0/0/ 2/ 1**

## DIGITAL ELECTRONICS LAB (C24PC5)

**Course Objectives:**

1. To study the sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations.
2. Knowledge of the methods for analysis and synthesis of combinational and sequential circuits.
3. To study the theory and applications of 74XX combinational and sequential series IC's.

**Course Outcomes:**

1. On completion of this lab course the students will be able to:
2. Acquires the knowledge of 74XX IC's.
3. Design various combinational & sequential circuits using various Digital ICs.
4. Acquires the knowledge of differentiating between Linear and Digital IC's.
5. Acquires the knowledge of demonstrating by designing digital circuits

**Note:**

1. To perform any twelve experiments.
2. Verify the functionality of the IC in the given application.

**LIST OF EXPERIMENTS**
**Design and Implementation of:**

1. Study of logic gates.
2. Design a 4-bit Gray to Binary and Binary to Gray Converter.
3. Design a 16 bit Adder/ Subtractor using 4-bit Adder /Subtractor IC's.
4. Design a 3*8 Decoder.
5. Design a16x4 priority encoder using two 8x3 priority encoder.
6. Design a 16*1 multiplexer using 8x1 multiplexer.
7. Design a 16bit comparator using 4 bit comparators.
8. Study of Flip flops.
9. Design an 8 bit parallel load and serial out shift register using two 4 bit shift register.
10. Design an 8 bit serial in and serial out shift register using two 4 bit shift register.
11. Deign a Ring counter and twisted ring counter using a 4-bit shift register.
12. Design a modulo counter using two decade counters.
13. Design a 4 digit hex counter using synchronous one digit hex counters.
14. Design a 4 digit hex counter using Asynchronous one digit hex counters.
15. Design a 4 bit pseudo random sequence generator using 4-bit ring counter.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**0/0/ 2/ 1**

# ELECTRICAL MACHINES LAB – II (C24PC6)

**Prerequisite:** Electrical Machines – I & Electrical Machines – II

**Course Objectives:**

1. To understand the operation of synchronous machines
2. To understand the analysis of power angle curve of a synchronous machine
3. To understand the equivalent circuit of a single phase transformer and single phase Induction motor
4. To understand the circle diagram of an induction motor by conducting a blocked rotor test.

**Course Outcomes:**

After completion of this lab the students will be able to

1. Assess the performance of different machines using different testing methods
2. To convert the Phase from three phase to two phase and vice versa
3. Compensate the changes in terminal voltages of synchronous generator after estimating the change by different methods
4. Control the active and reactive power flows in synchronous machines
5. Start different machines and control the speed and power factor

**The following experiments are required to be conducted compulsorily as a part of curriculum:**

1. No-load & Blocked rotor tests on three phase Induction motor
2. Load test on three phase induction motor
3. Separation of core losses of three phase induction motor
4. Equivalent Circuit of a single phase induction motor
5. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods
6. Determination of Xd and Xq of a salient pole synchronous machine by dynamic slip test
7. V and Inverted V curves of a three phase synchronous motor.
8. Measurement of sequence impedance of a three-phase alternator.

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

1. Regulation of three-phase alternator by Z.P.F. and A.S.A methods
2. Load test on single phase induction motor
3. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers
4. Speed control of single phase induction motor by V/F control.

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## ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech IV Semester** **L/T/P/C**
**0/0/ 2/ 1**

## CONTROL SYSTEMS LAB (C24PC7)

**Prerequisite:** Control Systems

**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:**

After completion of this lab the students will be able to

1. How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application.
2. Apply various time domain and frequency domain techniques to assess the system performance
3. Apply various control strategies to different applications (example: Power systems, electrical drives etc).
4. Test system controllability and Observability using state space representation and applications of state space representation to various systems.

**The following experiments are required to be conducted compulsorily as a part of curriculum:**

1. Time response of Second order system.
2. Characteristics of Synchro pair.
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 servomotor.
5. Transfer function of DC motor.
6. Transfer function of DC generator.
7. Temperature controller using PID.
8. Characteristics of AC servomotor.

# CONTROL SYSTEMS LAB (C24PC7)

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

1. Effect of P, PD, PI, PID Controller on a second order systems.
2. Lag and lead compensation – Magnitude and phase plot.
3. (a) Simulation of P, PI, PID Controller.
4. (b) Linear system analysis (Time domain analysis, Error analysis) using suitable software.
5. Stability analysis (Bode, Root Locus, NY Quist) of Linear Time Invariant system using suitable Software.
6. State space model for classical transfer function using suitable software-Verification.
7. Design of Lead-Lag compensator for the given system and with specification using suitable Software.
8. Evaluation of error constants using time response plots.

**Reference Books and Software:**

1. Manuals of related software.
2. PSPICE
3. MATLAB