JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure for B. Tech (Electrical and Electronics Engineering)

II B. Tech (EEE) – II Sem

S.No	Course Code	Subject	Th	Tu	Lab	C
1	15A54402	Mathematics – IV	3	1	-	3
2	15A52301	Managerial Economics and Financial Analysis	3	1	-	3
3	15A02401	Electrical Machines – II	3	1	-	3
4	15A02402	Electrical Power Generating Systems	3	1	-	3
5	15A02403	Electromagnetic Fields	3	1	-	3
6	15A04409	Analog Electronic Circuits	3	1	-	3
7	15A02404	Electrical Machines Laboratory – I	-	-	4	2
8	15A02405	Control Systems & Simulation Laboratory	-	-	4	2
9	15A02406	Comprehensive Online Examination – I	-	-	-	1
		Total	**18**	**6**	**8**	**23**

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T	Tu	C
3	1	3

(15A54402) MATHEMATICS –IV
(Common to ECE, EEE)

Objectives: To enable the students to understand the mathematical concepts of special functions & complex variables and their applications in science and engineering.

UNIT – I: Special Functions: Gamma and Beta Functions – their properties – Evaluation of improper integrals. Series Solutions of ordinary differential equations (Power series and Frobenius Method).

UNIT – II: Bessel functions – Properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

UNIT – III

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method.

Conformal mapping: Transformation of e^z, Inz, z^2, Sin z, cos z, Bilinear transformation - Translation, rotation, magnification and inversion – Fixed point – Cross ratio – Determination of bilinear transformation.

UNIT – IV

Complex integration: Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point – Isolated singular point – Pole of order m – Essential singularity.

UNIT – V

Residue – Evaluation of residue by formula and by Laurent's series – Residue theorem.

Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)d\theta$ (c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher

REFERENCES:

1. Mathematics III by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Advanced Engineering Mathematics, Peter V.O'Neil, CENGAGE publisher.
3. Advanced Engineering Mathematics by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel, Oxford.

Outcomes: The student achieves the knowledge to analyse the problems using the methods of special functions and complex variables

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	3	**1**	**3**

(15A52301) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Relationship of Managerial Economics with Financial Accounting and Management. **Demand Analysis**: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behavior- Break-Even Analysis (BEA) - Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account –

Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT V: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcome: After completion of this course, the student will able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

TEXT BOOKS:

1. Managerial Economics 3/e, Ahuja H.L, S.Chand, 2013.
2. Financial Management, I.M.Pandey, Vikas Publications, 2013.

REFERENCES

1. Managerial Economics and Financial Analysis, 1/e, Aryasri, TMH, 2013.
2. Managerial Economics and Financial Analysis, S.A. Siddiqui and A.S. Siddiqui, New Age International, 2013.
3. Accounting and Financial Mangement, T.S.Reddy & Y. Hariprasad Reddy, Margham Publishers.

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(15A02401) ELECTRICAL MACHINES – II

OBJECTIVES:

To make the student learn about:

- Constructional details of transformer and its operation (i) on no load (ii) on load
- Predetermination of regulation and efficiency of transformer from OC and SC test results
- Parallel operation of transformers
- Constructional details, principle of operation and the importance of slip in Induction motor operation
- The slip-torque characteristics and torque calculations of Induction motor
- Methods of starting and speed control of Induction motor

UNIT-I SINGLE PHASE TRANSFORMERS

Single Phase Transformers- Constructional Details- Hystersis 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-II TESTING OF TRANSFORMERS, THREE 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.

Three Phase Transformers - Connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and Open Δ, Third Harmonics in Phase Voltages-Three Winding Transformers-Tertiary Windings- Scott Connection.

UNIT-III THREE-PHASE INDUCTION MOTORS

Polyphase Induction Motors-Constructional Details of Cage and Wound Rotor Machines-Production of Rotating Magnetic Field - Principle of Operation – Slip - Rotor Emf and Rotor Frequency - Rotor Reactance, Rotor Current and Power factor at Standstill and under running conditions - Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed and Their Inter Relationship.

UNIT-IV 3-PHASE INDUCTION MOTOR CHARACTERISTICS

Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristic – Load characteristics - Equivalent Circuit - Phasor Diagram - Crawling and Cogging -Circle Diagram-No Load and Blocked Rotor Tests-Predetermination of Performance.

UNIT-V STARTING AND SPEED CONTROL OF INDUCTION MOTORS

Starting Methods and Starting Current and Torque Calculations, Speed Control-Change of Frequency; Pole Changing and Methods of Consequent Poles; Cascade Connection. Injection of an Emf.

OUTCOMES:

After completing the course, the student should be able to do the following:

- Draw the equivalent circuit of transformer
- Conduct O.C, S.C tests and predetermine the regulation and efficiency of transformer
- Compute the load shared by each transformer when several transformers operate in parallel
- Draw the circle diagram of a three phase Induction motor and predetermine the performance characteristics
- Determine the starting torque, maximum torque, slip at maximum torque using given data

TEXT BOOKS:

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electric Machines 4th edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2010, 16th Reprint 2015.

REFERENCE BOOKS:

1. The Performance and Design of Alternating Current Machines, M. G. Say, CBS Publishers, 3rd Edition, 2002.
2. Theory of Alternating Current Machinery, Alexander S. Langsdorf, Tata McGraw-Hill, 2nd edition, 1999, 35th Reprint.
3. A Textbook of Electrical Machines, K R Siddhapura and D B Raval, Vikas Publishing House Pvt. Ltd., 2014.

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B. Tech II - II sem (E.E.E)	**T**	**Tu**	**C**
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(15A02402) ELECTRICAL POWER GENERATING SYSTEMS

OBJECTIVES:

To make the student learn about:

- Structure, essential components and their layout in thermal power station
- Selection of site for thermal power station
- Selection of site for hydro power generation
- Various aspects and issues involved in Nuclear power generation
- Electric power generation from renewable energy sources as sun, wind and ocean
- Cost of generation and tariff methods

UNIT-I: THERMAL POWER GENERATING SYSTEMS

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers.

UNIT-II: HYDRO & NUCLEAR POWER GENERATING SYSTEMS

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.

Nuclear Power: Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT –III: SOLAR & WIND POWER GENERATING SYSTEMS

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell-V-I Characteristics.

Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics-Pitch & Yaw Controls – Power Electronics Application – Economic Aspects.

UNIT-IV: BIOGAS & GEOTHERMAL POWER GENERATING SYSTEMS

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

Geothermal and Ocean Power Generation: Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

UNIT-V: ECONOMIC ASPECTS OF POWER GENERATION

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs Of Generation and their Division Into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method.-Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

OUTCOMES: After completing the course, the student should be able to do the following:

- Estimate the coal requirement, cost per kWh generation and number of units generated for thermal power station
- Estimate the required flow of river water, cost of generation and number of units generated in hydel power generation
- Compute various factors like load factor, plant factor
- Evaluate the tariffs to be charged for the consumers
- Plot the load curve, load duration curve and hence determine the load capacity of the plant

TEXT BOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

REFERENCE BOOKS:

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013.

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(15A02403) ELECTROMAGNETIC FIELDS

OBJECTIVES:

To make the student learn about:

- The laws concerning static electric fields: Coulomb's law, Gauss law; the laws concerning static magnetic fields: Biot-savart law, Ampere circuital law
- The equations concerned with static electric fields
- The equations concerned with static magnetic fields
- The difference between the behaviors of conductors and dielectrics in electric fields
- The energy stored and energy density in (i) static electric field (ii) magnetic field
- Electric dipole and dipole moment, magnetic dipole and dipole moment

UNIT-I ELECTROSTATICS

Electrostatic Fields - Coulomb's Law - Electric Field Intensity(EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss's Law-Application of Gauss's Law-Maxwell's First Law – Numerical Problems.
Laplace's Equation and Poisson's Equations - Solution of Laplace's Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

UNIT- II CONDUCTORS AND DIELECTRICS

Behavior of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

UNIT-III MAGNETO STATICS

Static Magnetic Fields – Biot-Savart Law – Oerstead's experiment – Magnetic Field Intensity(MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems.
Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

UNIT – IV MAGNETIC POTENTIAL

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

UNIT-V TIME VARYING FIELDS

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.

Wave Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance**.**

OUTCOMES: After going through this course the student acquires:

- Knowledge on basic principles, concepts and fundamental laws of electromagnetic fields.
- The knowledge to understand 3-dimensional co-ordinate systems, electrostatics, magneto statics, time-varying fields and interaction between electricity and magnetism.
- The knowledge to calculate the quantities associated with uniform plane wave motion in different media of transmission.

TEXT BOOKS:

1. Engineering Electromagnetics, William.H.Hayt, Mc.Graw Hill, 2010.

2. Principles of Electromagnetics, 6th Edition, Sadiku, Kulkarni, OXFORD University Press, 2015.

REFERENCE BOOKS:

1. Field Theory, K.A.Gangadhar, Khanna Publications, 2003.

2. Electromagnetics 5th edition, J.D.Kraus,Mc.Graw – Hill Inc, 1999.

3. Electromagnetics, Joseph Edminister, Tata Mc Graw Hill, 2006.

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(15A04409) ANALOG ELECTRONIC CIRCUITS

Course Objective

The aim of this course is to familiarize the student with the analysis and design of basic transistor amplifier circuits, Oscillators, Multi-vibrators and wave shaping.

Course Outcomes

On completion of this course the student will be able to understand the

- Methods of biasing transistors & Design of simple amplifier circuits.
- Mid – band analysis of amplifier circuits using small - signal equivalent circuits to determine gain, input impedance and output impedance.
- Method of calculating cutoff frequencies and to determine bandwidth.
- Design and analyse different Oscillator circuits.
- Design of circuits for linear wave shaping and Multi-vibrators.

UNIT I

Multistage Amplifiers

BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

UNIT II

Feedback Amplifiers

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

UNIT III

Sinusoidal Oscillators

Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Weinbridge Oscillators.

UNIT IV

Large Signal Amplifiers

Class A power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer coupled amplifier – Push-Pull Amplifier – Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier) – Phase Inverters, Transistor Power Dissipation, Thermal Runaway, Heat Sinks.

UNIT V

Linear wave shaping: High pass, Low pass RC circuits-response for sinusoidal, Step, Pulse, Square and Ramp inputs, Clippers and Clampers

Multi-Vibrators: Analysis of Diode and transistor switching times, Analysis and Design of Bistable, Monosatable and Astable Multi-vibrators, Schmitt trigger Using Transistors.

Text Books :

1. Integrated Electronics – Millman and Halkias
2. Pulse, Digital & Switching Waveforms by Jacob Milliman, Harbert Taub and Mothiki S Prakash Rao, 2nd edition 2008, Tata McGraw Hill Companies

References:

1. K.Lal Kishore, "Electronic Circuit Analysis", Second Edition, BSP
2. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006
3. Electronic Devices and Circuits – Mottershead
4. A. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.
5. David A. Bell, "Solid State Pulse Circuits", 4th edition, 2002 PHI.

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4 2

(15A02404) ELECTRICAL MACHINES LABORATORY - I

OBJECTIVES: The student has to learn about:

- No load and load characteristics of DC generators
- Various tests on DC motors
- The speed control techniques of DC motors

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

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Load test on DC compound generator. Determination of characteristics.
5. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
6. Fields test on DC series machines. Determination of efficiency.
7. Swinburne's test and speed control of DC shunt motor. Predetermination of efficiencies.
8. Brake test on DC compound motor. Determination of performance curves.

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

9. Load test on DC series generator. Determination of characteristics.
10. Retardation test on DC shunt motor. Determination of losses at rated speed.
11. Separation of losses in DC shunt motor.

OUTCOMES: The student should be able to do the following:

- Conduct experiments to obtain the no-load and load characteristics of D.C. Generators
- Conduct tests on D.C. motors for predetermination of efficiency
- Conduct tests on D.C. motors for determination of efficiency
- Control the speed of D.C. motor in a given range using appropriate method
- Identify the reason as to why D.C. Generator is not building up voltage

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(15A02405) CONTROL SYSTEMS AND SIMULATION LABORATORY

The objectives of this lab course are to make the student practically learn about

- The effects of feedback on system performance
- Determination of transfer function of DC Machine.
- The design of controllers/compensators to achieve desired specifications.
- The characteristics of servo mechanisms used in automatic control applications.

Any Eight of the following experiments are to be conducted:

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. Transfer Function of DC Machine
6. Effect of P, PD, PI, PID Controller on a Second Order System.
7. Lag and Lead Compensation – Magnitude and Phase Plot
8. Temperature Controller Using PID
9. Characteristics of Magnetic Amplifiers
10. Characteristics of AC Servo Motor

Any two simulation experiments are to be conducted:

1. PSPICE Simulation of Op-Amp Based Integrator and Differentiator Circuits.
2. Linear System Analysis (Time Domain Analysis, Error Analysis) Using MATLAB.
3. Stability Analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant System Using MATLAB
4. State Space Model for Classical Transfer Function Using MATLAB – Verification.

OUTCOMES: At the end of the course the student should be able to

- Design the controllers/compensators to achieve desired specifications.
- Understand the effect of location of poles and zeros on transient and steady state behavior of systems.
- Assess the performance, in terms of time domain specifications, of first and second order systems.
- Use MATLAB/SIMULINK software for control system analysis and design.