

Faculty of Engineering & Technology
KAKATIYA UNIVERSITY, WARANGAL-506 009
Department of Electrical & Electronics Engineering

B. Tech. (EEE) V SEMESTER

S. No.	CourseCode	Course Title	Scheme of Instruction			Lecturer hrs/week	Scheme of Examination		Credits
			L	T	P		CI E	SEE	
1	PC3101EE	Linear Control Systems	3	1	0	4	30	70	4
2	PC3102EE	Electrical Machines-III	3	1	0	4	30	70	4
3	PC3103EE	Linear IC Applications	3	0	0	3	30	70	3
4	PE-I	Professional Elective-I	3	0	0	3	30	70	3
5	PC3107EE	Measurements and Instrumentation	3	1	0	4	30	70	4
6	HSMC3108	Managerial Economics and Accountancy	3	0	0	3	30	70	3
8	PC3109EE	Electrical Machines-II Laboratory	0	0	2	2	25	50	1
10	PC3110EE	Measurements and Instrumentation Laboratory	0	0	2	2	25	50	1
		Total	18	3	4	25	230	520	23

(PE-I) Professional Elective – I

1. PE3104EE Utilization of Electrical Energy
2. PE3105EE High Voltage Engineering
3. PE3106EE Electric Machine Design

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PC3101EE
LINEAR CONTROL SYSTEMS

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	1	0	4	External Marks :70

UNIT-I

Introduction to Control Systems: Classification of control systems. Feed-Back Characteristics, Effects of feedback - Mathematical modeling of Electrical and Mechanical systems -Transfer function- Transfer function of Potentiometer, synchro, AC servo motor, DC servo motor - Block diagram reduction technique - Signal flow graph, Masson's gain formula

UNIT-II

Time Domain Analysis: Standard test signals - Time response of first order systems - Transient response of second order system for unit step input, Time domain specifications - Steady state response - Steady state errors and error constants - Effects of P, PD, PI and PID controllers.

UNIT-III

Stability Analysis in S-Domain:The concept of stability - Routh's stability Criterion, Absolute stability and relative stability- limitations of Routh's stability.

Root Locus Technique: The root locus concept - construction of root loci- Effects of adding poles and zeros on the root loci.

UNIT-IV

Frequency Response Analysis: Introduction to frequency response - Frequency domain specifications - Bode plot - Stability analysis from Bode plots - Determination of transfer function from the Bode Diagram - Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin.

Control System Design: Introduction - Lag, Lead and Lag-Lead Compensator design infrequency Domain.

UNIT-V

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models - State transition matrix - Solution of state equation - Concepts of Controllability and Observability.

Text Book:

1. I.J.Nagrath & M.Gopal, Control System Engineering, 4th ed., New Delhi: New Age International Pvt. Ltd.,2012

Reference Books:

1. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
2. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
3. N.C.Jagan - Control Systems, B.S Publications, 2nd edition, 2008.
4. S.Palani, Control Systems Engineering, 2nd ed., New Delhi: Tata McGraw Hill Education (India) Pvt.Ltd.
5. A.Anand Kumar, control systems, 2nd ed., New Delhi: Prentice Hall of India, 2014
6. A.Nagoorkani, Control Systems, 2nd ed., New Delhi: RBA Publications'.

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PC3102EE

Electrical Machines - III

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks: 70

UNIT - I

Synchronous machines: Constructional features of round rotor and salient pole machines-Armature winding-integral slot and fractional slot winding-Distribution, pitch and winding factors-EMF equation-Harmonics in generated EMF, suppression of harmonics-Armature reaction-leakage reactance-Synchronous Impedance.

UNIT - II

Synchronous Generator: Voltage Regulation – Phasor diagram of round rotor synchronous generator-Load characteristics-Regulation by synchronous Impedance method, MMF method, ZPF method and ASA method.

Salient pole synchronous generators-two reaction theory-experimental determination of X_d and X_q (Slip Test)-phasor diagrams

UNIT-III

Parallel operation of Synchronous machines- Synchronization of alternators with infinite bus bars-Synchronizing power and torque-parallel operation and load sharing-effect of change of excitation and mechanical power input.

Short-circuit analysis on alternators-determination of sub-transient, transient and steady state reactance.

UNIT- IV

Synchronous Motors: Theory of operation-phasor diagram-variation of current and power factor with excitation-hunting and its suppression-starting methods-synchronous condenser-circle diagrams-applications.

UNIT-V

Special Machines: Brushless D.C. Motors: Construction & Principle of Operation, Torque equation, Torque -angle Characteristics. Switched Reluctance Motor: Constructional features, Principle of operation, Torque production, Torque - angle characteristics, various operating modes of SRM.

Permanent Magnet Synchronous Motor: Construction, principle operation of PMSM and their operating characteristics.

Text Books:

1. Bhimbra P.S., Electrical Machinery., 7th Ed. New Delhi: Khanna Publishers-2014

Reference Books:

1. Kothari D.P. & Nagrath I.J. - Electrical Machines - Tata McGraw Hill, 2004.
2. Bhimbra P.S. - Generalized Theory of Electrical Machines, Khanna Publications, 2000.
3. Say MG. - The Performance and Design of AC. Machines - Pitman Publication, 2002.
4. Irving L. Kosow - Electric Machinery and Transformers, PPH, Pearson Education, 2nd Edition. 2009.

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B. Tech. (EEE) VI SEMESTER

PC3103EE
LINEAR IC APPLICATIONS

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	0	0	3	External Marks :70

UNIT – I

Operational amplifiers: Characteristics, Open loop voltage gain, Output impedance, Input impedance, Common Mode Rejection Ratio - Offset balancing techniques - Slew rate, Frequency response - Basic applications - Inverter summer, Analog integrator, Differentiator, Current to voltage converter, Voltage to current converter, Voltage follower, a.c. amplifier.

UNIT – II

Circuits using Op-amps: Voltage limiter, Clipper and Clamper, Precision rectifier-full wave and half wave, Peak detector, Comparator, Zero crossing detector, Schmitt trigger, Monostable, astable and bistable multivibrators, Multiplier, Divider, Difference amplifier, Instrumentation amplifier.

UNIT – III

Waveform generation using Op-amps: Sine, Square, Triangular and Quadrature oscillators, 555 timer - Functional diagram, Operation as monostable and astable, Voltage to frequency converter using 555, 565.

UNIT – IV

Voltage regulators using Op-amp: Series voltage regulators - Shunt regulators using Op-amp - Switching regulators using Op-amp, Buck, Boost, Buck-boost regulators, Regulators using IC 723 - Dual voltage regulator - Fixed voltage regulators - Current sensing and current fold back protection.

UNIT – V

RC active filters: Butterworth - First order - Second order for low pass - High pass - Band pass - Band reject - Notch - State variable filter - Switched capacitor filter - Universal filter - Power amplifiers - Power boosters, Monolithic power amplifier features.

Suggested Reading:

1. Gayakwad W.A. Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2002.
2. Malvino Albert Paul, Electronic Principles, 6th Edition, Tata McGraw Hill, 1999.
3. Roy Choudhury, Shail Jam - Linear integrated Circuits, New Age International, 2nd Edition, 2003.
4. William D. Stanley, OP Amps with Linear Integrated Circuits, Pearson, 2000.

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B. Tech. (EEE) V SEMESTER

PE3104EE

UTILIZATION OF ELECTRICAL ENERGY

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	0	0	3	External Marks :70

UNIT I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens - Design of elements. Core type, Coreless type furnaces, High frequency eddy current heating, Dielectric heating. Arc furnace.

Electric welding: Resistance welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

UNIT II

Schematic Utilization and Connection Diagrams for Motor Control: Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

UNIT III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations - Determination of M.S.C.P, Rouseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps - Fluorescent lamp, LED lamp, starting and power factor corrections, stroboscopic effects - Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT IV

Electric Traction: System of Electric Traction - Transmission of drive - Systems of track electrification - Traction mechanics - Speed time curves - Tractive effort - Specific energy consumption - Mechanics of train movement -Coefficient of adhesion.

Traction Motors: Desirable characteristics, d.c series motors, a.c series motors 3-phase induction motors, d.c motor series and parallel control, Energy saving.

UNIT V

Train Lighting: Systems of train lighting - Special requirements of train lighting - Methods of obtaining unidirectional polarity - Methods of obtaining constant output - Single battery system - Double battery parallel block system - Principal equipment of double battery system - Coach wiring - Dynamo.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

Suggested Readings:

1. Partab H, *Art and Science of Utilization of Electric Power*, Dhanpat Rai & Sons, 1997.
2. K.B. Raina and S.K. Bhattacharya, *Electrical Design, Estimating and Costing*, Wiley Eastern Ltd., 1991.
3. Partab H, *Modern Electric Traction*, Dhanpat Rai & Sons, 2000.

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B. Tech. (EEE) V SEMESTER

PE3105EE

HIGH VOLTAGE ENGINEERING

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	0	0	3	External Marks :70

UNIT – I

Breakdown in Gases

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge

Breakdown in Liquid and Solid Insulating Materials

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT – II

Generation of High Voltages

Generation of high voltages, generation of high D.C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT- III

Measurements of High Voltages and Currents

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscilloscopes for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT – IV

LIGHTNING AND SWITCHING OVER-VOLTAGES

Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

UNIT – V

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment,

High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

TEXT BOOKS:

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education,2013.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers,2007.

REFERENCES:

1. D. V. Razevig (Translated by Dr. M. P. Chourasia), “High Voltage Engineering Fundamentals”, Khanna Publishers,1993.
2. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes Publication,2000.
3. R. Arora and W. Mosch “High Voltage and Electrical Insulation Engineering”, John Wiley & Sons,2011.
4. Various IS standards for HV Laboratory Techniques andTesting

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PE3106EE

ELECTRIC MACHINE DESIGN

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	0	0	3	External Marks :70

UNIT-I

INTRODUCTION

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT-II

TRANSFORMERS

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT-III

INDUCTION MOTORS

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT-IV

SYNCHRONOUS MACHINES

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT-V

COMPUTER AIDED DESIGN (CAD)

Limitations (assumptions) of traditional designs need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines- PMSMs, BLDCs, SRM and claw-pole machines.

TEXT BOOKS:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.

REFERENCES:

1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", Satya Prakashan, 1969.
3. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
4. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
5. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

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B. Tech. (EEE) V SEMESTER

PC3107EE

MEASUREMENTS AND INSTRUMENTATION

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	1	0	4	External Marks:70

UNIT- I

Introduction and Error Analysis: Significance of measurement, static characteristics of measuring system-linearity, sensitivity, precision, accuracy, errors in measuring instruments.

Voltage and Current Measuring Instruments: Construction, operation, torque equation, sensitivity, errors, advantages and disadvantages of Permanent Magnet Moving Coil (PMMC) instrument, Moving Iron (MI) instruments and electro-dynamometer type instruments, extension of ranges of voltmeters and ammeter, loading effect on measuring instruments.

UNIT- II

Measuring of Power, Energy and Power factor: Construction, operation, torque equation, errors, advantages and disadvantages of dynamometer type wattmeter, induction type energy meter, measurement of three phase active and reactive power, phantom loading, introduction to static energy meter and smart energy meter.

UNIT- III

DC Bridges: Measurement of unknown resistance using Wheatstone bridge, Kelvin's double bridge, Mega ohm bridge and megger.

AC Bridges: Measurement of unknown inductance using Maxwell's bridge, Anderson's bridge, Hay's bridge, Wien's bridge and Owen's bridge, measurement of unknown capacitance using De Sauty's bridge, Schering bridge.

UNIT- IV

Instrument Transformers: Introduction, uses, ratios and burden, current transformers-construction and errors, effect of secondary open circuit, potential transformers- construction and errors, testing of current transformers with Silsbee's method, Introduction to Hall effect current sensor.

Potentiometers: Construction, standardization and applications of DC potentiometers, construction and operation of phase shifting transformer and phase shifting circuit, construction, standardization and operation of polar and coordinate type AC potentiometers, applications of AC potentiometers

UNIT-V

Electronics Instruments: Construction and operation of Cathode Ray Oscilloscope (CRO), electrostatic deflection system, horizontal and vertical amplifiers, screens and probes used in CRO, deflection sensitivity and deflection factor, measurement of unknown frequency and phase using Lissajous patterns, construction and operation of Digital Voltmeters (DVM), block diagram representation of Digital Storage Oscilloscope (DSO).

Transducers: Introduction and classification of transducers, theory of Strain gauges, thermocouples, Linear Variable Differential Transformer (LVDT).

TEXT BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005
2. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

REFERENCES:

1. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
2. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
3. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
4. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.
5. U.A. Bakshi, A.V. Bakshi, "Electrical Measurements and Instrumentation, Pune: Technical Publications, 2009.

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B. Tech. (EEE) VSEMESTER

HSMC3108

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :30
3	0	0	3	External Marks :70

UNIT-I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT-II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium.

UNIT - III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly.

UNIT-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems.

UNIT-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

Suggested Reading:

1. Mehta P.L., Managerial Economics - Analysis, Problems and Cases, Sulthan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N., Introduction to Accountancy, Vikas Publishing House, 2005
3. Pandey I.M., Financial Management, Vikas Publishing House, 2009

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B. Tech. (EEE) V SEMESTER
PC3109EE
ELECTRICAL MACHINES-II LAB

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :25
0	0	2	1	External Marks :50

LIST OF EXPERIMENTS:

1. No-load test and blocked rotor test on 3-phase induction motor.
2. Speed control of 3-phase induction motor by (a) Cascade connection (b) Pole changing.
3. Speed control of 3-phase induction motor by (a) Rotor resistance control (b) Slip power recovery scheme.
4. Brake test on 3 phase induction motor to find the performance.
5. Power factor improvement of three phase Induction motor using capacitors.
6. Performance characteristics of single-phase induction motor.
7. Voltage regulation of an alternator by (a) Synchronous impedance method (b) Ampere - turn method (c) Z.P.F. method.
8. Voltage regulation of an alternator by Z.P.F. method.
9. Determination of load characteristics of an alternator
10. Determination of X_d and X_q of salient pole synchronous machine by conducting slip test.
11. Determination of V curves and inverted V curves of synchronous motor.
12. Power angle characteristics of a synchronous machine.
13. Speed control of BLDC motor.
14. Speed control of SRM motor.
15. Dynamic braking of 3-phase induction motor

Note: At least ten experiments should be conducted in the Semester.

Suggested Reading:

1. Kothari D.P. & Nagrath I.J. - Electrical Machines - Tata McGraw Hill, 2004.
2. Bhimbra P.S. - Generalized Theory of Electrical Machines, Khanna Publications, 2000.
3. Peddapelli Satish Kumar & Sridhar Gaddam – Electrical Machines-a practical approach, De-gruyter publications, Germany.
4. Say MG. - The Performance and Design of AC. Machines - Pitman Publication, 2002.
5. Irving L. Kosow - Electric Machinery and Transformers, PPH, Pearson Education, 2nd Edition. 2009.

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B. Tech. (EEE) V
SEMESTER PC3110EE
MEASUREMENTS AND INSTRUMENTATION LAB

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks :25
0	0	2	1	External Marks :50

The following experiments are required to be conducted as Compulsory experiments

1. Calibration and Testing of single-phase energyMeter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMCvoltage meter.
4. Kelvin’s double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testingKit.
6. Schering Bridge & AndersonBridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

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

9. Measurement of frequency and Phase angle using Lissajous figures.
10. Measurement of frequency using CRO.
11. Measurement of 3 - Phase power with three wattmeter method.
12. Measurement of strain using strain gauge
13. Transformer turns ratio measurement using AC bridges.
14. Measurement of % ratio error and phase angle of given CT by comparison.

TEXT BOOKS:

1. “G. K. Banerjee”, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition, 2016
2. “S.C. Bhargava”, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.

REFERENCES:

1. “A. K. Sawhney”, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co. Publications, 2005.
2. “R.K. Rajput”, “Electrical & Electronic Measurement & Instrumentation”, S. Chand and Company Ltd., 2007.
3. “Buckingham and Price”, “Electrical Measurements”, Prentice – Hall, 1988.
4. “Reissland, M.U”, “Electrical Measurements: Fundamentals, Concepts, Applications”, New Age International (P) Limited Publishers, 1st Edition 2010.
5. “E.W. Golding and F. C. Widdis”, “Electrical Measurements and measuring Instruments”, fifth Edition, Wheeler Publishing, 2011.