RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

PROGRAMME: B.E. Electrical Engineering, III-Semester

Electrical Measurements and Instrumentation

COURSE OBJECTIVE

The primary objective of the course is to introduce operation principles of instruments, terminology related to measurements and to have an adequate knowledge in measurement techniques for voltage, current, power and energy.

COURSE CONTENT

Introduction, History and overview of measurement system, Fundamentals of Measurement system, Static and Dynamic Characteristics of measurement systems: Systematic Characteristics, Generalized model, Transfer function, Techniques for dynamic compensation, Accuracy of measurement systems in steady state: Measurement error, Error probability function, Error reduction techniques, Reliability, Choice and Economics of measurement systems. Loading effects due to shunt connected and series connected instruments, calibration curve, Testing & calibration of instruments.

Galvanometers – Theory, principle of operation and construction of ballistic galvanometer, D'arsonal galvanometer, Definition of analog & digital instruments, Classification of analog instruments, their operating principle, Operating force, Types of supports, Damping, Controlling.

Different types of Ammeter & Voltmeter – PMMC, MI, Electrodynamometer, Induction, Expression for control & deflection torque, their advantages, disadvantages & error, Extension of range of instruments using shunt & multiplier.

Digital Voltmeter, Ammeter, Multimeter and Wattmeter.

Instrument transformers: Potential and current transformers, ratio and phase angle errors, testing of instrument transformers, Difference between CT and PT, errors and reduction of errors.

Measurement of power: Power in AC and DC Circuit, Electrodynamometer type of wattmeter, Construction, theory, operation & error, Low power factor & UPF wattmeter, Double element and three element dynamometer wattmeter, Measurement of power in three phase circuit, one, two & three wattmeter method, Measurement of reactive power by single wattmeter, Measurement of power using CTs & PTs.

Measurement of Energy: Single phase and three phasedigital / Electronic energy meter – construction & operation – Energy flow and power calculations, errors – Testing by phantom loading, Tri-vector meter, Maximum demand meter, Ampere hour meter.

Power factor meter– Single phase and three phase Electro-dynamometer type & moving iron type.
Frequency meter – Vibrating reed, Resonance type & Weston type, Synchronoscope,
Ohmmeter –series & stunt type, Megger & Ratio meter.
Resistance Measurement – Classification of low, medium & high resistance – Voltmeter-Ammeter

method, Wheatstone Bridge, Kelvin’s double bridge & loss of charge methods for resistance measurement, Earth resistancemeasurement.
Magnetic Measurement – B-H Curve, Hysteresis Loop determination, Power loss in sheet metal – Lloyd Fischer square for measurement of power loss.

Topics for the laboratory (Expandable):

1. Measurement of low resistance using Kelvin’s Double bridge
2. Measurement of medium resistance using Wheatstone’s bridge
3. Measurement of high resistance by loss of charge method
4. Measurement of Insulation resistance using Megger
5. Measurement of earth resistance by fall of potential method and verification by using earth tester
6. Measurement of power in a single phase ac circuit by 3 voltmeter/ 3 Ammeter method
7. Calibration of a dynamometer type of wattmeter with respect to a standard/Sub Standard wattmeter
8. Calibration of single phase digital/ Electronic type energy meter.
9. Calibration of a dynamometer type of wattmeter by Phantom Loading method.
10. Measurements using Instrument Transformers.
11. Study of various types of Indicating Instruments.
12. Measurement of Power in three phase circuit by one, two & three wattmeters.

COURSE OUTCOME:

After successful completion of course, Students are expected to possess an in-depth understanding and Knowledge of the concepts and principles of measurement of electrical and non electrical viz. physical quantities and instruments.

EVALUATION
Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on external assessment, assignments, presentations, and interview of each candidate.

Text book:-

1. A.K. Sawhney; ‘A course in Electrical & Electronic Measurements & Instrumentation’; Dhanpat Rai & co(p) Ltd ,New Delhi

Reference books:-

1. G. K. Banerjee,’ Electrical and Electronic Measurements’. PHI Learning Pvt.Ltd.
2. R. B. Northrop,’ Introduction to Instrumentation and Measurement’; CRC press Taylor & Francis
3. Vijay Singh;’ Fundamentals of Electrical & Electronic Measurements’, New Age International Publishers.

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Choice Based Credit System

PROGRAMME: B.E. Electrical Engineering, III-Semester

Network Analysis

COURSE OBJECTIVE

This Course introduces examination of electrical & electronic circuit analysis & synthesis tools & techniques such as the Laplace transform, nodal analysis & two port network theory.

COURSE CONTENT

Introduction to circuit elements R,L,C and their characteristics in terms of linearity & time dependent nature, voltage & current sources controlled & uncontrolled sources KCL and KVL analysis, Nodal & mesh analysis, analysis of magnetically coupled circuits, Transient analysis :- Transients in RL, RC&RLC Circuits, initial conditions, time constants. Steady state analysis- Concept of phasor & vector, impedance & admittance, Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices, dual networks, Dot convention, coupling co- efficient, tuned circuits, Series & parallel resonance.

Network Theorems for AC & DC circuits- Thevenins & Norton's, Superpositions, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

Frequency domain analysis – Laplace transform solution of Integro-differential equations, transform of waveform synthesized with step ramp, Gate and sinusoidal functions, Initial & final value theorem, Network Theorems in transform domain

Concept of signal spectra, Fourier series co-efficient of a periodic waveform, symmetries as related to Fourier coefficients, Trigonometric & Exponential form of Fourier series.

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z, Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters, Interconnection of two ports networks, Terminated two port network.

Topics for the laboratory (Expandable):

1. To Verify Thevenin Theorem.
2. To Verify Superposition Theorem.
3. To Verify Reciprocity Theorem.
4. To Verify Maximum Power Transfer Theorem.
5. To Verify Millman's Theorem.
6. To Determine Open Circuit parameters of a Two Port Network and to Determine Short Circuit

parameters of a Two Port Network.

7. To Determine A,B, C, D parameters of a Two Port Network
8. To Determine h parameters of a Two Port Network
9. To Find Frequency Response of RLC Series Circuit.
10. To Find Frequency Response of RLC parallel Circuit.

COURSE OUTCOME

Student after successful completion of course must be able to apply the Thévenin, Norton, nodal and mesh analysis to express complex circuits in their simpler equivalent forms and to apply linearity and superposition concepts to analyze RL, RC, and RLC circuits in time and frequency domains and also to analyze resonant circuits both in time and frequency domains.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on external assessment, assignments, presentations, and interview of each candidate.

REFERENCES

1. M.E. Van Valkenburg, Network Analysis,Pearson
2. William H Hayt. & Jack E. Kemmerly, Steven M Durbin; Engineering Circuit Analysis;McGrawHill
3. Richard C Dorf, James A Svoboda, Introduction to Electric Circuits, Wiley India, 2015
4. Charles K. Alexander & Matthew N.O. Sadiku: Electrical Circuits; McGrawHill
5. J David Irwin, Robert M Nelms, Engineering Circuit Analysis, Wiley India,2015
6. Robert L Boylestad, introductory circuit analysis, Pearson,2016
7. M S Sukhija, T K Nagsarkar; Circuits and Networks, Oxford University Press, 2015
8. Samarajit Ghosh, Network Theory Analysis and Synthesis

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Choice Based Credit System

PROGRAMME: B.E. Electrical Engineering, III-Semester

Analog Electronics

COURSE OBJECTIVE

The primary objective of this course is to develop an in-depth understanding of the design principles and applications of integrated analog circuits.

COURSE CONTENT

Semiconductor Diodes: Theory of P-N junction, temperature dependence and break down characteristics, junction capacitances, Zener diode, Varactor diode, Tunnel diode, PIN diode, LED, Photo diode, Schottky diode, Diode applications: series –parallel configurations, full wave and half wave rectification, voltage multiplier circuits, diode testing

Transistors: BJT, types& configuration, working principal, characteristics, and region of operation, load line, biasing methods, Small signal analysis of transistor (low frequency) using h-parameters, thermal runaway and thermal stability.FET, MOSFET, Transistor as an amplifier, gain,bandwidth, frequency response,

Feedback amplifierand Oscillators: Feedback amplifier, negative feedback, voltage-series, voltage shunt,current series and current shunt feedback, Sinusoidal oscillators, L-C (Hartley-Colpitts) oscillators, RC phase shift, Wien bridge, and Crystal oscillators. Power amplifiers, class A, class B, class A B, C amplifiers, their efficiency and power Dissipation, Push-pull and complimentary symmetry push-pull amplifier.

Wave Shaping circuits: Switching characteristics of diode and transistor, turn ON, OFF time, reverse recovery time, transistor as switch, Multivibrators, Bistable, Monostable, Astable multivibrators. Clipper and clamper circuit, Differential amplifier, calculation of differential, common mode gain and CMRR using h- parameters, Darlington pair, Boot strapping technique. Cascade and cascade amplifier.

Operational Amplifier: Operational amplifier basics, practical Op-amp circuits & characteristics, slew rate , bandwidth, offset voltage ,basic current, application, inverting, non-inverting amplifier, summer, average, differentiator, integrator, differential amplifier, instrumentation amplifier, log and antilog amplifier, voltage to current and current to voltage converters, comparators Schmitt trigger , active filters, 555 timer and its application.

Topics for the laboratory (Expandable):

1. Design & measure the frequency response of an RC coupled amplifier using discrete components.
2. Design a two stage RC coupled amplifier and determine the effect of cascading on gain and bandwidth.

3. Study the effect of voltage series, current series, voltage shunt and current shunt feedback on amplifier using discrete components.
4. Design & realize inverting, non-inverting and buffer amplifier using 741 op-amps.
5. Verify the operation of a differentiator circuit using op amp IC 741 and show that it acts as a high pass filter.
6. Verify the operation of a integrator circuit using op amp 741 and show that it acts as a low pass filter.
7. Design & Verify the operation of adder and subtractor circuit using op amp 741.
8. Plot frequency response of AC coupled amplifier using op amp 741 and study the effect of negative feedback on the bandwidth and gain of the amplifier.
9. Study of IC 555 as astable and monostable multivibrator.
10. Design & realize using op amp 741, wein-bridge oscillator

COURSE OUTCOME:

After successful completion of course, Students are expected to able in applying theory and realize analog filter circuits, Understand the circuit operation of the 555 timer IC and regulator IC and identifying the faulty components within a circuit.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on external assessment, assignments, presentations, and interview of each candidate.

REFERENCES

1. Robert L Boylestad, Louis Nashelsky; Electronic Devices and Circuits; Pearson
2. Jacob Millman, Cristos C Halkias, Satyabrata Jit; Electronic Devices and Circuits; McGraw- Hill
3. Anil K Maini, Electronic Devices and Circuits, Wiley
4. S Salivahanan, N Suresh Kumar; Electronic Devices and Circuits; McGraw- Hill

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

PROGRAMME: B.E. Electrical Engineering, III-Semester

Signals and Systems

COURSE OBJECTIVE

This course introduces students about the signals and systems mathematically and understands how to perform mathematical operations on them.

COURSE CONTENT

Classification of signals and systems: Continuous time signals (CT signals), Discrete time signals (DT signals) - Step, ramp, pulse, impulse, sinusoidal and exponential signals, basic operations on signals, classifications of CT and DT signals- Periodic and aperiodic signals, energy and power signals, random signals, CT systems and DT systems, basic properties of systems, basic properties of systems, linear time invariant systems and properties.

Analysis of continuous time signals: Time and frequency domain analysis, Fourier series analysis, spectrum of CT signals, Fourier transform and Laplace transform, region of convergence, wavelet transform.

Linear time invariant continuous time systems: Differential equations representation, block diagram representation, state variable representation and matrix representation of systems, impulse response, step response, frequency response, relizability of systems, analog filters.

Analysis of discrete time signals: Convolution sum and properties, sampling of CT signals and aliasing, DTFT and properties, Z transform and properties, inverse Z transform.

Linear time invariant discrete time systems: Difference equations, block diagram representation, impulse response, analysis of DT LTI systems using DTFT and Z transform, state variable equations and matrix representation of systems, Digital filters.

COURSE OUTCOME

Student after successful completion of course must possess an Understanding of various signals and systems properties and be able to identify whether a given system exhibits these properties and its implication for practical systems.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

1. Alan V. Oppenheim, Alan S. Willsky, S Hamid Nawab, 'Signals and Systems', 2nd edition 2015 Pearson New International Edition
2. A. Anand Kumar, Signals and Systems, PHI, III edition, 2015
3. Mahmood Nahvi, Signals and Systems, McGraw Hill
4. Simon Haykins and Barry Van Veen, Signals and Systems, Wiley India
5. A. Nagoor Kani; 'Signals and Systems' McGraw Hill
6. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, Wiley.
7. Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. Signals & systems, Pearson Education.