Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

ES301	**Energy & Environmental Engineering**	**3L-1T-0P**	**4 Credits**

The objective of this Course is to provide *an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.*

Module 1: Introduction to Energy Science:

- Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

***Module2*: Ecosystems**

- Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

***Module 3*: Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

***Module 4:* Environmental Pollution**

- Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Module 5: **Social Issues and the Environment**

- From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies
  Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Module 6: Field work

- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai,
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R)
6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press.
7. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, III-Semester

EE302 Electromagnetic Field & Materials

Unit –1

Gauss law, its integral and differential forms and its applications, multipoles, potential energy, energy density in an electric field, dielectrics , electric polarization, polarizability, permittivity, Clausius – mossotti equation, electric displacement, Gauss's law in dielectrics, dielectric materials, dielectric function, refractive index and absorption coefficient, dielectric relaxation and losses. Maxwell's first equation, Divergence, poisson's and Laplace equation and their solutions. Capacitance, electrostatic energy conduction at a boundary between dielectrics.

Unit –2

Fields due to moving charge, magnetic field, Ampere's law, particles motion in E and B fields, Hall Effect, electro-static and magnetic focusing, magnetic materials:dia, para and ferromagnetic, soft and hard magnetic materials, B,M and H vectors, Ampere's law for magnetic materials, hysteresis, magnetic circuits.

Unit –3

Electromagnetic waves, plane electromagnetic waves, wave equation and solution, Poynting vector, wave propagation through dielectric and conductors, phase velocity, reflection and refraction absorption skin depth, and energy flow density of a wave. Boundary conditions.

Unit –4

Semiconducting materials, band theory of semiconductors, band-to-band transitions, theory of p-n junction and p-n devices, mobility of charge carriers.

Unit –5

Conductivity of metals, electron scattering and resistivity of metals, heat developed in a current – carrying conductor, superconductivity.

Text Books :

1. A.J.Dekkar**, "** Electrical Engg. Materails", Prentice-Hall of India Pvt. Limited, 2005.
2. C.S. Indulkar, "Electrical Engineering Materials", S.Chand & Company Limited, 2008.
3. E.C. Jordan, K.G. Balmain, "Electromagnetic Waves and Radiating Systems", second edition, Prentice Hall, 1968.

Reference Books :

1. William Hart Hayt, John A. Buck, "Engineering Electromagnetics", eight edition, Mcgraw-Hill, 2012.
2. Matthew N.O. Sadiku, "Elements of Electromagnetics", fifth edition Oxford University Press, 2010.
3. Bhag Singh Guru, Huseyin, "Electromagnetic Field Theory Fundamentals", second edition, Cambridge University Press, 2004.

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Electrical Engineering, III-Semester

EE303 Electrical Measurements and Measuring Instruments

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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Electrical Engineering, III-Semester

EE304 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

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New Scheme Based On AICTE Flexible Curricula

Electrical Engineering, III-Semester

EE305 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