Annexure – I

Syllabus for B.Tech. III Semester

B.Tech – Electrical Engineering

Scheme

Sr. No.	Course Code	Courses	L	T	P	Credit
1	EE3CO01	Generation of Electric Power	3	0	0	3
2	EE3CO03	Electrical Measurement and Instrumentation	3	0	2	4
3	EE3CO05	Electro-Magnetic Theory	3	1	0	4
4	EE3CO07	Circuit Analysis and Synthesis	3	1	2	5
5	EE3CO09	Electronic Devices and Digital Circuits	3	1	2	5
6	EE3ES09	Engineering Materials	3	0	0	3
7	EE3CO17	Seminar/Group Discussion	0	0	2	1
		Total	**18**	**3**	**8**	25
		Total Contact Hours	29			

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO01	Generation of Electric Power	3	0	0	3

UNIT-I STEAM GENERATORS, CONDENSERS AND TURBINES-
Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control. Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air pre heaters, Feed water heaters, Evaporators.

UNIT-II HYDRO-ELECTRIC POWER PLANTS-
Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classification of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydro-station, layout of hydro power plant.

UNIT-III NUCLEAR POWER PLANT-
Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Site selections, safety measures, plant layout, Fusion reaction, Future of nuclear power.
Gas Turbine- Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.

UNIT-IV SOLAR POWER PLANT-
Solar photovoltaic energy conversion - Principles -Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants. Basic and Advanced control of solar plants- basic control algorithms, adaptive and optimal controls. Applications of Solar Photovoltaic systems-Battery charging , Pumping, Lighting, Green Building (Solar thermal, Solar PV)

UNIT-V WIND ENERGY-
Basic principles of wind energy conversion, forces on the blade, power in the wind , maximum power, wind energy conversion, wind data and (qualitative treatment only) energy estimation , Basic components of wind energy conversion systems, classifications of WECS,HAWT, VAWT, Geared wind power plants (WPPs), direct drive WPPs and Hybrid (semigeared) WPPs, scheme of electric generation, Squirrel Cage Induction Generators (SCIG), wound rotor (WRIG), doubly fed (DFIG), wound rotor synchronous generator (WRSG), Permanent magnet synchronous generator (PMSG), Comparison/ advantages and disadvantages of WECS, Site selection considerations.

TEXT-BOOKS-

1. B. R. Gupta. Generation of Electrical Energy (4/e), S. Chand Publication. 2013
2. S. L. Uppal. Electrical Power (13/e), Khanna Publishers
3. V. K. Mehta, Principles of Power system (3/e), S. Chand Publication 2005
4. Soni, Gupta and Bhatnagar, Generation of Electrical Power, Dhanpat Rai & Sons

REFERENCE BOOKS:-

1. L. Elgerd Olle, Electric Energy Systems Theory, PHI 2013
2. C. A. Gross, Power System Analysis, TMH

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO03	Electrical Measurement and Instrumentation	3	0	2	4

UNIT-I

Fundamentals of Measurement system, Static and Dynamic Characteristics of measurement systems: Measurement error, Loading effects due to shunt connected and series connected instruments, Testing & calibration of instruments. Theory, principle of operation and construction of galvanometer, Classification of analog instruments, their operating principle, Operating force, Types of supports, Damping, Controlling. PMMC, MI, Induction type, Expression for control & deflection torque, Extension of range of instruments using shunt & multiplier.

UNIT-II

Power in Single phase and three phase AC, Electrodynamometer type of wattmeter: Low power factor & UPF wattmeter, Measurement of power in three phase circuit, one, two & three wattmeter method, Measurement of reactive power by single wattmeter, Single phase and three phase energy meter – Ampere hour meter. Power factor meter– Single phase and three phase, Frequency meter

UNIT-III INSTRUMENT TRANSFORMERS:

Potential and current transformers, ratio and phase angle errors, Measurement of power using CTs & PTs.

Resistance Measurement – Classification of low, medium & high resistance – , Ohmmeter – series & stunt type, Megger & Ratio meter. Wheatstone Bridge, Kelvin's double bridge & loss of charge methods for resistance measurement, Earth resistance measurement.

Magnetic Measurement – Lloyd Fischer square for measurement of power loss.

UNIT-IV

Measurement of inductance, Capacitance & Q factor, Sources and detectors Maxwells bridge, Maxwells inductance capacitance bridge, Hays bridge, Andersons bridge, Owen's Bridge, De-sauty's Bridge, Schering Bridge, High Voltage Schering bridge, , Weins bridge, Universal bridge, Sources of errors in Bridge circuit, Q meter and its applications and measurement methods.

UNIT-V

CRO: Different parts of CRO, Basic principle operation and construction and subsystem Measurement of voltage, current and frequency, Lissajous patterns, Special purpose CROs-Multi input, Dual trace, Dual beam, Sampling, Storage (Analog & Digital) Oscilloscopes.

Transducers:

Transducers definition and classification, mechanical devices as primary detectors, Characteristic & choice of Transducers, Resistive inductive and capacitive transducers, strain gauge and gauge factor, Thermistor, Thermo couples, LVDT, RVDT, Synchros, Piezo - Electric transducers, Magnet elastic and magnetostrictive Hall effect transducers, Opto-electronic transducers such as photo voltaic, Photo conductive, photo diode and photo conductive cells, Photo transistors, Photo optic transducers.

TEXT BOOK:-

1. A.K. Sawhney; 'A course in Electrical & Electronic Measurements & Instrumentation'; Dhanpat Rai & co(p) Ltd .New Delhi
2. Rajput R.K. ' Electrical Measurements and Measuring Instruments' S Chand Publications.
3. Bell David A., Electronics Instrumentation and Measurements, Prentice Hall.

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.
4. Buckingham & Price; Electrical Measurements; Prentice Hall.

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.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
EE3CO05	Electro-Magnetic Theory	3	1	0	4

UNIT I VECTOR ANALYSIS

Vector analysis, Physical interpretation of gradient, divergence and curl; vector relations in other coordinate systems, integral theorems: divergence theorem, stoke's theorem, green's theorem and Helmholtz theorem.

UNIT II

Laplace's & Poisson's equations, solution of Laplace's equation, Electric dipole, dipole moment, potential & electric field intensity due to dipole, Behavior of conductors in an electric field. Conductor & insulator, electric field inside a dielectric, polarization, Boundary value conditions for electric Field, Capacitance & Capacitances of various types of capacitors, Energy stored and energy density in static electric field, Current density, conduction & convection current density ohms law in point form, equation of continuity.

UNIT III

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire, Relationship between magnetic flux, flux density & magnetic Field intensity; Ampere's circuital law and its applications, magnetic Field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form, Magnetic force, moving charge in a magnetic field, Lorentz Force on straight and long current carrying conductors in magnetic field, force between two long & parallel current carrying conductors. Magnetic dipole & dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, Magnetic Boundary conditions.

UNIT IV

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations; Self and Mutual inductances, determination of self & mutual inductances, self inductance of solenoid, toroid coils, mutual inductance between a straight long wire & a square loop. Energy stored in magnetic Field & energy density, Faraday's Law, transformer & motional EMFs, Displacement current, Maxwell's equations as Generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying Field, static and steady fields, Maxwell's equations in differential & integral form.

UNIT V

Electro Magnetic Waves : Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for material medium, Uniform plane wave in dielectrics and conductors, Pointing Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, energy storage, Polarization of waves, Reflection by conductors and dielectric – Normal & Oblique incidence. Reflection at surface of a conducting medium, surface impedance, transmission line analogy.

TEXT-BOOKS:

1. P.V. Gupta; Electromagnetic Fields; Dhanpat Rai.
2. Jordan Balmian; Electromagnetic wave & Radiating System; PHI.
3. David K. Cheng; Fields and Wave Electromagnetic; Addison Wesley.
4. S.P. Seth; Electromagnetic Field ;Dhanpat Rai & Sons

REFERENCE BOOKS:-

1. Mathew N.O Sadiku; Elements of Electromagnetic; Oxford
2. N.N. Rao; Element of Engineering Electromagnetic; PHI.
3. William H. Hayt; Engineering Electromagnetic; TMH.
4. John D. Kraus; Electromagnetic; TMH.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO07	Circuit Analysis and Synthesis	3	1	2	5

UNIT-I 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.

UNIT II 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 coefficient, tuned circuits, Series & parallel resonance.

UNIT III 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 coefficient of a periodic waveform, symmetries as related to Fourier coefficients, Trigonometric & Exponential form of Fourier series

UNIT IV 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.

UNIT V NETWORK SYNTHESIS-
Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. Filters- Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

TEXT-BOOKS :

1. F.F.Kuo, Network Analysis.
2. Mittal GK; Network Analysis; Khanna Publisher
3. Mesereau and Jackson; Circuit Analysis- A system Approach; Pearson.
4. William D Stanley : Network Analysis with Applications, Pearson Education

REFERENCE BOOKS:-

1. M.E. Van Valkenburg, Network Analysis, (PHI)
2. Sudhakar & Pillai; Circuit & Networks- Analysis and Synthesis; TMH
3. Hayt W.H. & J.E. Kemmerly; Engineering Circuit Analysis; TMH
4. Decarlo lin; Linear circuit Analysis; Oxford

List of Practicals (Expandable):

1. To Verify Thevenin's 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 Verify Tellegen's Theorem.
7. To Determine Open Circuit & short circuit parameters of a Two Port Network.
8. To Determine the ABCD and h parameters of two port network.
9. To determine the time constant of RC circuit.
10. To determine the time constant of RL circuit.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EE3CO09	Electronic Devices and Digital Circuits	3	1	2	5

UNIT-I TRANSISTORS-
Characteristics, Current Components, Current Gains: alpha and beta. Variation of transistor parameter with temperature and current level, Operating point, Hybrid model. DC model of transistor, h-parameter equivalent circuits. CE, CB and CC Configuration. DC and AC analysis of single stage CE, CC (Emitter follower) and CB amplifiers AC & DC load line. Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability.

UNIT-II REGULATED POWER SUPPLIES-
Unregulated power supplies, line and load regulations, Zener diode voltage regulators, transistor series and shunt regulators, current limiting, Op-Amp voltage regulators, integrated circuit (LM-3XX) voltage regulators. Introduction to switching regulators. Working of Switched Mode Power Supply (SMPS).

UNIT-III OSCILLATORS AND ACTIVE FILTERS-
Oscillations, Feedback oscillator Principles,, RC phase shift oscillator, Wein bridge oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillators, frequency stability, negative resistance in oscillators. Active Filters (1st order) with low pass, high pass, band pass, band stop and all pass. Pin configuration of 555 timer, 555 timer as Oscillator: monostable, bistable and astable multivibrator.

UNIT-IV SEQUENTIAL LOGIC CIRCUITS:
Flip-flops, JK flip-flops, D flip-flops, T flip- flops, SR flip- flops, edge triggered and clocked flip-flops. Registers and Counters: Series and Parallel registers; Synchronous & Asynchronous counters, Up and Down counters, Ring counters & Mod- Counters

UNIT-V DIGITAL TO ANALOG (D/A) AND ANALOG TO DIGITAL (A/D) CONVERTERS:
Introduction, weighted register D/A converter, binary ladder, D/A converter, specifications for D/A converters, parallel A/D converter, successive approximation A/D converter single & dual slope A/D converter, AID converter using voltage to frequency conversion, A/D converter using voltage to time conversion, countertype AID converters.

TEXT-BOOKS:-

1. Nashelsky & Boysted; Electronic Devices and Circuits; PHI
2. Millman Halkias; Electronic Devices and Circuits; McGraw- Hill
3. Achuthan MA and Bhatt KN; Fundamentals of semiconductor devices; TMH
4. Neamen Donald; Semiconductor Physics and devices
5. Millman & Grabel; Micro Electronics; McGraw-Hill

REFERENCE BOOKS:-

1. Bogart; Electronic Devices and Circuits; Universal Book Stall, NDelhi
2. Millman & Halkias; Integrated Electronics; McGraw- Hill
3. Malvino Albert Paul, Principles of Digital Electronics, Tata McGraw Hill
4. Mano Morris, Digital Logic and Computer Design, Prentice Hall of India

LIST OF EXPERIMENTS:-

1. To draw V-I characteristics of PN junction diode (Ge, Si, switching and signal).
2. To design half wave rectifier.
3. To design full wave and bridge rectifiers.
4. To study transistor characteristics in common base and common emitter configurations.
5. To study the FET characteristics.
6. To design, study and compare various transistor biasing techniques.
7. To design regulated power supply using zener diode/ voltage regulator IC.
8. To study of an emitter follower circuit.
9. To study the response of constant K-filters.
10. To study the response of m-derived filters
11. Diode clippers and clampers.

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Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
EE3ES09	Engineering Materials	3	0	0	3

UNIT-I INTRODUCTION TO MATERIAL

Atomic structure and bonding in materials. Types of material, Recent advances and future trends: (Smart & Nano materials) Crystal structure of materials, crystal systems, unit cells and space lattices, crystalline solids and their role in influencing various properties.

UNIT-II METALS AND ALLOYS

Solid solutions, solubility limit, phase rule, binary phase diagrams, intermediate phases, intermetallic compounds, iron-iron carbide phase diagram, heat treatment of steels, cold, hot working of metals, recovery, recrystallization and grain growth. Microstrcture, properties and applications of ferrous and non-ferrous alloys.

UNIT-III DIELECTRICS

Physical properties, Electrical properties, SF6 as a dielectric and insulating material, Specification of SF6 gas for GIS application, Handling of SF6 gas before use, Equipment for handling the SF6 Gas, Advantages and Applications of SF6.

Ceramics, Polymers, Composites: Structure, defects and properties of Ceramics materials, processing and applications of traditional and advanced ceramics. Thermal, electrical, magnetic, optical and mechanical behavior of ceramics. Classification of Polymers, Polymerization, Structure and Properties, additives for polymer products, Homo polymers and co-polymers, Elastomers and Thermoplastic elastomers, Polymer Blends and Alloys, Liquid crystal polymers, Polymer foams, Properties and applications of polymers. Properties and applications of various composites, metal matrix and ceramic matrix composite, Bone-a natural composite materials.

Classification of composite materials, Laws of mixtures, Factors affecting composite properties, Interfacial bonding, Mechanical Behavior of Composites: Young's Modulus and strength considerations for continuous FRCs and short FRCs.

UNIT-IV CONDUCTOR, SEMICONDUCTOR AND MAGNETIC MATERIALS

Electrical conduction in metals, Concept of energy band diagram for materials - conductors, semiconductors and insulators, electrical conductivity, effect of temperature on conductility, intrinsic and extrinsic semiconductors, dielectric properties. Compound semiconductors, Electrical properties of ceramics, Nano-electronics.

Origin of magnetism in metallic and ceramic materials, Paramagnetism, diamagnetism, anti-ferro magnetism, ferromagnetism, ferrimagnetism, magnetic hysteresis, effect of temperature, soft and hard magnetic materials and their properties. Reflection, refraction, absorption and transmission of electromagnetic radiation in solids.

UNIT-V ADVANCED MATERIALS AND TOOLS

Smart materials, exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials , synthesis, properties and applications, biomaterials, superalloys, shape memory alloys. Materials characterization techniques such as, scanning electron microscopy, transmission

electron microscopy, atomic force microscopy, scanning tunneling microscopy, atomic absorption spectroscopy, differential scanning calorimetry.

TEXT BOOK:

1. William D. Callister, David G. Rethwisch 'Callister's Material Science and Engineering', Willey.
2. William F Smith, Javad Hashemi, Ravi Prakash 'Material science and engineering', McGraw Hill.
3. Elements of Material Science and Engineering: VanVlack, Wesley Pub. Comp.
4. Introduction to Engineering Materials: B. Agarwal, McGraw Hill Publication

REFERENCES:

1. L. Solymar, D. Walsh & R. R.A. Syms 'Electrical Properties of Materials', Oxford university press.
2. James F. Shackelford, Madanapalli K. Muralidhara 'Introduction to Materials Science for Engineers', Pearson
3. V. Rajendran ' Materials Science' McGraw Hill education Pvt. Limited.
4. K. M. Gupta and Nishu Gupta 'Advanced Electrical and Electronics Materials' Willey.
5. M. S. Naidu, "Gas Insulated Substations", IK International Publishing House.