PANDIT DEENDAYAL PETROLEUM UNIVERSITY

SCHOOL OF TECHNOLOGY

COURSE STRUCTURE FOR B.TECH. ELECTRICAL ENGINEEING

SEMESTER III			**B.TECH. ELECTRICAL ENGINEEING**											
Sr. No	**Course Code**	**Course Name**	**Teaching Scheme**					**Exam Scheme**						
			L	**T**	**P**	**C**	**Hrs/wk**	**Theory**			**Practical**		**Total**
								MS	**ES**	**IA**	**LW**	**LE/Viva**	**Marks**
1	MA 201T	Maths-III	3	1	0	7	4	30	60	10	--	--	100
2	EE 202T	Network Theory	3	0	--	6	3	30	60	10	--	--	100
	EE-202P		--	--	2	1	2	--	--	--	25	25	50
3	EE 203T	Electronics Devices and Circuits	3	0	--	6	3	30	60	10	--	--	100
	EE 203P		--	--	2	1	2	--	--	--	25	25	50
4	EE 204T	Electro-Mechanical Energy Conversion I	3	0	--	6	3	30	60	10	--	--	100
	EE 204P		--	--	2	1	2	--	--	--	25	25	50
5	EE 205T	Electrical and Electronics Engineering Materials	3	0	--	6	3	30	60	10	--	--	100
	EE 205P		--	--	2	1	2	--	--	--	25	25	50
6	EE 206T	Electrical Measurement and Measuring Instruments	2	0	--	4	2	30	60	10	--	--	100
	EE 206P		--	--	2	1	2	--	--	--	25	25	50
		Total	**17**	**1**	**10**	**40**	**28**						850

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)
LW = Laboratory work; LE = Laboratory Exam

EE 202T NETWORK THEORY										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **10**

NETWORK CONCEPTS: Network element symbols and conventions, active elements, current and voltage conventions, loops and meshes, nodes, coupled circuits and dot conventions.

NETWORK ANALYSIS TECHNIQUES AND THEOREMS: Mesh currents analysis, node voltage analysis, solutions of linear node equations and circuit analysis using matrices, linearity and superposition, independent sources and their transformations, Thevenin Theorem, Norton Theorem, Millman Theorem, Tellengen Theorem, Reciprocity Theorem and Maximum power transfer theorems, use of these theorems in circuit analysis, duality and concept of dual network, magnetically couples circuit analysis.

UNIT II **10**

LAPLACE TRANSFORMATION: Laplace transform fundamentals, properties and theorems, unit step function, other unit function, the impulse, ramp and doublet, Laplace transform for shift and singular functions, initial and final value theorems, waveform synthesis, convolution integral.

TWO PORT NETWORK: Characteristic of two port network Impedance and Admittance parameters, ABCD and h parameters. Symmetrycity and reciprocity. Inter relationship between the parameters, Ladder and lattice network, T and PI representation. Connection of two port network.

UNIT III **09**

GRAPH THEORY AND ITS APPLICATIONS: Fundamental concepts, definitions of a graph and various related terms, paths and circuit connections, trees of a graph, cut sets and tie sets, non separable planner and dual graphs, matrices of oriented graphs, properties and inter relationships of incidence, tie and cut set matrices, complete circuit analysis using tie set and cutest matrices

UNIT IV **10**

NETWORK FUNCTIONS: Concepts of Complex Frequency, Transform Impedance, Network functions of one and two port network, concepts of poles and zeros, properties of driving point and transfer functions, time response stability from pole zero plot

AC AND DC TRANSIENTS: Initial and final conditions of networks, R-L, R-C and R-L-C - DC transients, two mesh transients, R-L, R-C and R-L-C sinusoidal transient analysis using Laplace transform methods, two mesh AC transients, complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations.

TOTAL HOURS	**39**

Texts and References:

1 Hayt W.H., Kemmerly J. E., Durbin S. M., "***Engineering Circuit Analysis***", Tata Mcgraw Hill, 6th Edition, 2006

2 Edminister Joseph A., "***Electrical Circuits, Schaum's Outline Series***", Tata Mcgraw Hill, 2nd

Edition, 1983.
3 Van Valkenburg M.E., "***Network Analysis***", Prentice Hall, India, 3rd Edition, 2002.
4 A. Chakarbrati, "***Circuit Theory***", Dhanapat Rai and Co.

EE 202P NETWORK THEORY

Teaching Scheme					Examination Scheme					
					Theory			Practical		Total
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Marks
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1 Study and verification of Thevenin's Theorem.
2 Study and verification of Norton Theorem.
3 Study and verification of Superposition theorem.
4 Study and verification of Maximum power transfer Theorem.
5 Transient analysis of RL/RC circuits.
6 Transient analysis of RLC circuits.
7 Study of Two Port Network.
8 Study of Two Port Ladder Network.
9 Study and verification of T and π Networks.
10 Study of Inter Connection of Two Port Network.

EE 203T ELECTRONIC DEVICES AND CIRCUITS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **08**

P-N JUNCTION DIODE CHARACTERISTICS AND CIRCUITS: Introduction of Semiconductors, Electrons and Holes in an Intrinsic Semiconductors, Donor and Acceptor Impurities, P-Type and N-Type Semiconductors, Formation of a P-N Junction Diode, Biasing of P-N Junction Diode, Diode V/I Characteristic, Diode Resistance, Load-Line Concept, Piecewise Linear Model, Diode Clipper and Clamper Circuits, Diode Comparators, Diode Rectifier Circuits, Reverse recovery characteristics of diode, Schotky Diode.

BIPOLAR JUNCTION TRANSISTOR CHARACTERISTICS: Junction Transistor, Transistor Current Components, Working of a BJT, Transistor as an Amplifier, CB, CE Configuration and CC Configuration, Input and Output Characteristics, Early Effect, Punch Through Effect.

UNIT II **11**

TRANSISTOR BIASING AND THERMAL STABILIZATION: Operating Point, Load Line Analysis (AC load line and DC load line), Bias Stability, Factors affecting Bias Stability, Biasing Methods, Stability Factor, Bias Compensation.

FIELD EFFECT TRANSISTORS: Junction FET, Pinch-Off Voltage, JFET Operating and Transfer Characteristics, the FET as a Voltage Variable Resistor, FET Small-Signal Model, Biasing the FET, Different FET configurations, MOSFET.

UNIT III **10**

TRANSISTOR AT LOW FREQUENCIES: Transistor Hybrid Model, h-Parameters, Conversion Formulas for the Parameters of Three Transistor Configurations, Analysis of a Transistor Amplifier Circuit Using h Parameters, Thevenin's and Norton's Theorems and Corollaries, Emitter Follower, Comparison of Transistor Amplifier Configurations, Linear Analysis of a Transistor Circuit, Miller's Theorem and its Dual, Cascading Transistor Amplifiers, Simplified Calculations for CE and CC configuration.

TRANSISTOR AT HIGH FREQUENCIES: Hybrid –pi CE Transistor Model, Hybrid –pi Conductance, Hybrid –pi Capacitances, CE Short-Circuit Current Gain, Current Gain with Resistive Load, Single-Stage CE Transistor Amplifier Response, Gain-Bandwidth Product, Emitter Follower at High Frequencies.

UNIT IV **10**

FEEDBACK AMPLIFIERS: Classification of Amplifiers, Feedback Concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback Amplifiers, Input and Output Resistance, Method of Analysis of a Feedback Amplifier, Voltage Series Feedback, Current Series Feedback, Current Shunt Feedback, Voltage Shunt Feedback.

OSCILLATORS: Damped and Un-damped Oscillations, Barkhausen's criteria for Oscillators, Various Oscillator Circuits.

POWER AMPLIFIERS: Classification of Power Amplifiers, Class A, Class B, Class AB and Class C power amplifiers.

TOTAL HOURS	**39**

Texts and References:

1 Millman and Halkias, "***Integrated Electronics***", McGraw Hill Publications, 1992.

2 Boylestad and Nashlesky, "***Electronic Devices and Circuit Theory***", PHI, 10th Edition.

3 Albert Malvino and David J. Bates, "***Electronic Principles***", Tata McGraw Hill, 7th Edition 2007.

4 Floyd, "***Electronic Devices***", PHI, 7th Edition.

EE 203P ELECTRONIC DEVICES AND CIRCUITS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1. Study and verification of Diode VI Characteristics.
2. Application of Diode as shaping circuit - Clipper Circuits.
3. Application of as shaping circuit - Diode Clamper Circuits.
4. Conversion of A.C. to DC using Diode Rectifier Circuits.
5. Study and verification of Transistor in CB configuration (Input and Output Characteristics)
6. Study and verification of Transistor in CE configuration (Input and Output Characteristics)
7. Importance of Biasing of Transistor.
8. Study and experimental verification of FET characteristics.
9. Study and experimental verification of Hartley Oscillator.
10. Study and experimental verification of Colpitts Oscillator.

EE 204T ELECTROMECHANICAL ENERGY CONVERSION I										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **05**

PRINCIPLES OF ELECTROMECHANICAL ENERGY CONVERSIONS: Introduction, Flow of Energy in Electromechanical devices, Energy in Magnetic Systems, Singly Excited System, Determination of Mechanical Force, Mechanical Energy, Torque Equation, Doubly Excited System, energy stored in magnetic field, Electromagnetic Torque, Generated EMF in Machines, Torque in Machines with Cylindrical air-gap.

UNIT II **18**

DC MACHINES: Construction, Armature Winding, Equalizer connections, Dummy coils, EMF and Torque Equation, Armature reaction, Demagnetizing and Cross Magnetizing Effects, Commutation, Methods for Improving Commutation, Inter poles and Compensating winding, Performance Characteristics of dc generators, Parallel operation, Performance characteristics of DC Motors, Starting of DC motor, 3 point and 4 point starters, speed control of DC motors, Efficiency and Testing of dc Machines -Brake Test, Swinburne Test, Hopkinson's Test, Field Test, Retardation Test.

UNIT III **08**

SINGLE PHASE TRANSFORMER: Types, Working principle, Construction, EMF equation, Phasor diagrams, Equivalent circuits, losses ,Efficiency and Voltage regulation, All Day Efficiency, O.C./S.C. Test, Sumpner Test, Polarity Test, Parallel Operation and load sharing.

AUTO TRANSFORMER: Single phase and Three Phase Auto-Transformer, VI relation, Regulationand Efficiency, advantages and disadvantages over two winding transformer, applications of auto transformer.

UNIT IV **08**

THREE PHASE TRANSFORMER: Construction, Phase Groups, Connections (including open delta), Parallel Operation and load sharing**,** magnetizing Inrush, harmonics in transformer, Three Winding Transformer.

TOTAL HOURS 39

Texts and References:

1. I J Nagrath and D.P. Kothari, "***Electrical Machines***",3rd Edition, TMH
2. J B Gupta, "***Theory and Performance of Electrical Machines***"4th Edition, S.K.Kataria and Sons
3. Ashfaq Hussain, "***Electrical Machines***" 2nd Edition, Dhanpatrai and Sons
4. M.G.Say, "***The Performance and Design of Electrical Machines***", Pitman and Sons

EE 204P ELECTROMECHANICAL ENERGY CONVERSION I										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1. Study of excitation characteristic of DC machines.
2. O.C. / S.C. Test on single Phase Transformer.
3. Polarity and Voltage ratio Test on Single Phase Transformer.
4. Load Test on Single Phase Transformer.
5. Speed Control Methods of DC shunt motors.
6. Speed Control Methods of DC series motors.
7. Swinburne's Test for DC Machine.
8. Hopkinson's Test for DC Machine.
9. Parallel operation of Single Phase Transformer.
10. Sumpner's Test on Single Phase Transformer.

EE 205T ELECTRICAL AND ELECTRONIC ENGINEERING MATERIALS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I **12**

METAL AND INSULATORS: Electron theory of metals, factor affecting electrical resistance of materials, Matthiessen's rule, mixture, Skin effect: HF resistance of a conductor, thin metal films and integrated circuits interconnections, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effects, dielectrics, polarization and relative permittivity, polarization mechanisms, frequency dependent dielectric constant and dielectric loss, dielectric strength and insulation breakdown, partial discharge, capacitor dielectric materials, ultra-capacitors, properties and applications of electrical conducting and insulating materials, composite conductors, aluminum conductor steel reinforced (ACSR), Aluminum Conductor Composite Reinforced (ACCR).

UNIT II **12**

SEMICONDUCTOR MATERIALS: Introduction to quantum mechanics, number of states, density of energy states in conduction and valance band of semiconductor, types of semiconductors, current carriers in semiconductors, Hall effect, drift and diffusion currents, continuity equations, P-N junction diode, built in potential barrier, electric field, space charge width, junction capacitance, one sided junctions, generation and recombination currents, junction transistor, introduction to silicon carbide, properties of semiconducting materials.

UNIT III **08**

SEMICONDUCTOR OPTICAL DEVICES: Optical absorption, photon absorption coefficient, electron-hole pair generation rate, Solar cells; PN junction solar cells, conversion efficiency and solar concentration, non uniform absorption effects, Light emitting diodes; generation of light, internal quantum efficiency and external quantum efficiency, LED Devices, semiconductor laser diodes.

UNIT IV **07**

MAGNETIC PROPERTIES OF MATERIALS: Origin of permanent magnetic dipoles in matters, classification diamagnetism, Para-magnetism, ferromagnetism, anti-ferromagnetism and ferrimagnetisms, magnetostriction, properties of magnetic materials, CRGO, μ-metal, soft and hard magnetic materials, permanent magnetic materials, super conductivity and superconducting materials.

TOTAL HOURS	**39**

Texts and References:

1. S.O. Kasap, "***Principles of electronic materials and devices***", Tata McGraw Hill publications
2. Donald. A. Neamen, "***Semiconductor physics and devices***", Tata McGraw Hill publications
3. A.J. Dekker, "***Electrical Engineering Materials***", Prentice Hall of India
4. R.K. rajput, "***Electrical Engineering Materials"***, Laxmi Publications
5. Solymar, "***Electrical properties of materials***", Oxford University press.

6	Ian p. Hones, "***Material Science for electrical and electronic engineering***", Oxford University Press.
7	T.K. Basak, "***Electrical Engineering materials***", New Age International.

EE 205P ELECTRICAL AND ELECTRONIC ENGINEERING MATERIALS										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
--	**--**	**2**	**1**	**2**	**--**	**--**	**--**	**25**	**25**	**50**

List of Experiments:

1	Resistivity of unknown materials by four probes or wander paws method.
2	Carrier Charge density by four probe method.
3	Measurement of thermal expansion coefficient of materials.
4	Susceptibility of paramagnetic materials by quinck method.
5	Measurement of energy band gap of semiconductor diode.
6	Concept of diamagnetic, paramagnetic and Ferro-magnetism.
7	Study of thermocouples.
8	Study of transition Temperature of YBCO Superconductor.
9	I-V characteristics of silicon solar cells.
10	Study of series and parallel combination of solar cells.
11	Charge of electron to mass ratio measurement by Thomson Method.
12	Measurement of Dielectric constant of various materials.

EE 206T ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	--	4	2	30	60	10	--	--	100

UNIT I **08**

STANDARDS: Standards and their classification, Electrical Standards: EMF, current, resistance and capacitance standards.

MEASUREMENT OF RESISTANCE: Classification of resistances, Kelvin's bridge, Wheatstone's bridge, Carey Foster's bridge, direct deflection method and loss of charge method for measurement of insulation resistance, meg-ohm bridge, measurement of surface resistivity, earth resistance.

MEASUREMENT OF INDUCTANCE AND CAPACITANCE: General four arm AC bridge network, Maxwell, Hay Anderson, Schering and Wien bridge networks, Wagner earthling device, headphone and vibration galvanometer as detector.

UNIT II **12**

INDICATING AND INTEGRATING INSTRUMENTS: Classification, operating principles, general construction details of indicating instruments, balancing, control and damping method, theory and construction of PMMC, moving iron electrostatic and rectifier instruments, electrodynamics wattmeter, induction energy meter, measurement of three phase power.

INSTRUMENT TRANSFORMERS: Theory of current and voltage transformer, ratio error and phase angle, burden, turns compensation Performance characteristics, testing and application of CT and PT.

UNIT III **02**

MAGNETIC MEASUREMENTS: Theory and calibration of ballistic galvanometer; use of it for measurement of flux, measurement of iron loss by wattmeter method, Hibbert's magnetic standard.

UNIT IV **04**

POTENTIOMETERS: Construction, operation, types, standardization and application of DC and AC Potentiometers, VR box.

CATHODE RAY OSCILLOSCOPE: Basic CRO circuit (Block Diagram), Cathode Ray Tube (CRT) and its components, application of CRO in measurement, Lissajous Pattern, Dual Trace and Dual Beam Oscilloscopes.

TOTAL HOURS	**26**

Texts and References:

1. Golding and Widdis, "***Electrical measurements and Measuring instruments***", Wheeler Books
2. W. D. cooper and A.P. Helfrick, "***Modern Electronic Instrumentation and Measurement Techniques***", PHI.
3. A.K. Sawhney, "***Electrical and Electronic Measurements and Instrumentation***", Dhanpat Rai and Co.
4. R.K. Rajaput, "***Electrical and Electronics Measurements and Instrumentation***", S. Chand and Company Ltd.

EE 206P ELECTRICAL MEASUREMENT AND MEASURING INSTUMENTS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

List of Experiments:

1. Measurement of resistance using Wheatstone Bridge
2. Measurement of Inductance and Capacitance using Wein Bridge
3. Measurement of Inductance and Capacitance using Hay's Bridge
4. Measurement of Resistance using Kelvin Double Bridge
5. Measurement of Resistance using Carey foster Bridge
6. Measurement of Inductance and Capacitance using Maxwell Bridge
7. Measurement of Inductance and Capacitance using Anderson Bridge
8. Measurement of Capacitance using Schering Bridge
9. Measurement of Capacitance using De-Sauty's Bridge
10. Single Phase Energy meter Demonstration