

**F.E. FIRST SEMESTER**  
**Course Code – 210106**  
**Course Name: Basic Electrical Engineering**

Credit Points		Teaching Hrs/Week	Practical Hrs/Week
3		3	2
Objective		<p>To understand the basic concepts of electrical engineering.            To understand various applications using electricity.            To have an introduction of GTDU system &amp; safety to human life.            To gain knowledge of solving numerical problems related to electrical circuits.</p>	
Prerequisites			
Unit	Topic Name	Details	Hrs
1	<b>General</b>	<p>Electric Current &amp; E.M.F. :            Concept of e.m.f., p.d., &amp; current, resistance, effect of temperature on resistance, resistance temperature coefficient, Insulation resistance, Ohm's law.            Batteries &amp; Cells:            Batteries &amp; cells, their types, primary cells &amp; secondary cells, current capacity &amp; cell ratings, charging &amp; discharging of batteries, series &amp; parallel connections, maintenance procedure.</p>	7
2	<b>DC Circuits</b>	<p>Classification of electrical networks, current &amp; voltage sources &amp; their conversions, Kirchhoff's laws &amp; their applications for network solutions, Simplifications of networks using series &amp; parallel combinations , star &amp; delta conversions.            Theorems: Superposition Theorems, Thevenin's Theorems, Norton's Theorems, Maximum Power Transfer Theorems.</p>	8
3	<b>Magnetism</b>	<p>Classical theory of magnetism, magnetic effect of electric current, cross and dot convention, right hand thumb rule, nature of magnetic field of a long straight conductor, solenoid and toroid. (no mathematical treatment)            Concept of mmf, flux, flux density, reluctance, permeability, field strength - their units and relationships, simple series and parallel magnetic circuits, comparison between electric and magnetic circuits.            Concept of coupling, energy stored in a magnetic field, BH curve, Hysteresis loss and Eddy current loss.</p>	4

4	<b>Electromagnetic Induction</b>	<p>Electromagnetic induction, Faraday's laws of electromagnetic induction, statically and dynamically induced emf, self &amp; mutual Induction, coefficient of coupling, force on a current carrying conductor placed in a magnetic field, Fleming's left hand rule, Fleming's right hand rule,</p> <p>Concept of Transformer: construction, working, emf equation, voltage &amp; current ratio, losses, calculation regulation &amp; efficiency by direct loading test, dimmer-stats &amp; autotransformer, introduction of generating &amp; motoring action (no mathematical treatment).</p>	
5	<b>AC Fundamentals and AC Circuits</b>	<p>A.C. Fundamentals :Concept of AC quantities, sinusoidal voltages and currents, their mathematical and graphical representations, concept of instantaneous, peak, average and rms value of AC quantity. Concepts of cycle, period, frequency, peak factor, form factor, phase difference, phasor diagrams, rectangular and polar representation of phasors.</p> <p>A.C. Circuits : Study of AC through purely resistive, purely inductive and purely capacitive circuits with corresponding voltage and current phasor diagrams, concept of reactance and capacitance and impedance, study of R-L,R-C,R-L-C series and R-L, R-C, R-L-C parallel circuits, resonance in R-L-C series and R-L-C parallel circuits (no mathematical treatment). Concept of conductance, susceptance and admittance. Concepts of active, reactive and apparent power, volt-amperes, power factor, Power Factor Improvement (no mathematical treatment).</p>	
6	<b>Three-Phase Circuits</b>	<p>Three phase circuits: Concept of three phase supply and poly-phase electric circuits, phase sequence, concepts of line, phase, neutral etc., power relations in a three phase balanced star and delta connected loads along with phasor diagrams.</p> <p>WPE: SI units of work, power and energy, conversion of electrical energy from one form to another in electrical, mechanical and thermal systems. (inclusive of mathematical problems). Grid system in India, power flow in GTDU system, typical voltage levels, concept of receiving station and sub-station, non-conventional energy sources like wind, tidal, geothermal, solar etc., study of a typical single phase consumer bill, &amp; Introduction to tariff.</p>	

Lab/ Term Work
<p>The term work shall consist of record of minimum eight exercises and experiments, out of which Group A is compulsory and any five experiments from Group B should be conducted.</p> <p><b>Group A</b></p> <ol style="list-style-type: none"> <li>1. Wiring Exercises:           <ol style="list-style-type: none"> <li>(a) Study of various wiring components (wires, switches, fuse, sockets, plugs, lamp holders, lamps etc. their uses and ratings).</li> <li>(b) Control of one lamp, two lamps from two switches (looping system, Staircase wiring)</li> <li>(c) Use of Megger for insulation test and continuity test of wiring installations and machines.</li> </ol> </li> <li>2. Study of Lamps           <ol style="list-style-type: none"> <li>a) Study of fluorescent tube circuit.</li> <li>b) Study of lamps such as mercury vapour lamp /sodium vapour lamp.</li> </ol> </li> <li>3. a) Study of safety precautions while working on electric installations and necessity of earthing.           <ol style="list-style-type: none"> <li>b) Introduction to energy conservation and simple techniques to achieve it.</li> </ol> </li> </ol> <p><b>Group B</b></p> <ol style="list-style-type: none"> <li>1. Determination of temperature rise of medium resistance such as shunt field winding.</li> <li>2. Verification of Kirchhoff's laws</li> <li>3. Superposition theorem.</li> <li>4. Verification of Thevenin's theorem.</li> <li>5. Study of R-L-C series circuits.</li> <li>6. Verification of current relations in three phase balanced star and delta connected loads.</li> <li>7. Single phase transformer           <ol style="list-style-type: none"> <li>(a) Voltage and current ratios.</li> <li>(b) Efficiency and regulations by direct loading.</li> </ol> </li> <li>8. Visit to a sub-station to study Transformer, lightning arrestor, earthing &amp; typical electrical control panel.</li> </ol>

Text Books	<ol style="list-style-type: none"> <li>1. Electrical Technology - Edward Hughes, 7<sup>th</sup> edition, Perason Education</li> <li>2. A Textbook of Electrical Technology – Volume - I - B. L. Theraja, S. Chand &amp; Company Ltd., New Delhi.</li> <li>3. Theory &amp; Problems of Basic Electrical Engineering – I.J. Nagrath &amp; Kothari, prentice-Hall of India Pvt. Ltd.</li> <li>4. Basic Electrical Engineering – V. K. Mehta, S. Chand &amp; Company Ltd., New Delhi.</li> </ol>
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Reference Books	<ol style="list-style-type: none"> <li>1. Electrical Power - Soni, Gupta, Bhatnagar.</li> <li>2. Delmar's standard textbook on electricity (2<sup>nd</sup> edition) by Stephan Herman, Delmar publications.</li> <li>3. Principals of electrical engineering by Vincent Del Toro, PHI publications.</li> <li>4. Electrical Technology by H. Cotton, CBS publication.</li> <li>5. Basic Circuit Analysis – John Omalley Shawn, Mc Graw Hill.</li> </ol>
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Examination Scheme	Internal Assessment – 20 marks	
	Term Work – 25 marks	
	Final Theory Paper – 30 marks	