4111 – UTILIZATION OF ELECTRICAL ENERGY

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	-	3	25	-	3 Hrs	100	-	125

Pre-requisite	Source	Semester	Theory	Test	Total	TW	PR	Gr Total
4109	ELL		75	25	100	-	-	100

Rationale: This course enable a learner to understand the various uses of electrical energy in domestic and Industrial heating, welding and railways. It also helps a learner to understand the various controllers used for heating, welding and railway traction. A learner is also introduce with the important concepts of a good illumination scheme

COURSE CONTENTS	Hrs	Mks
1. HEATING	4	8
Modes of heat transfer- conduction, convection, radiation, formula for heat transfer & calculation (no derivation), Advantage of electric heating and methods of electric heating.		

2. RESISTANCE HEATING Resistance heating – Direct and Indirect resistance heating, Infra-red heating, their applications, types of elements for resistance heating, materials used and their properties, designs of heating element, effect of shape, size and placement of heating elements on the quality of heating, effect of supply voltage variation on heat generation, Heat control – Method of heat control a) using selector switch, b)Tapped transformer, Construction and working of heating device – Heat treatment plant, oven furnace etc. & typical control circuit for these.	6	20
3. OTHER HEATING METHODS Induction heating – principles of operation, basic construction and application of induction furnace, High frequency, Eddy current heating, choice of frequency and application, Dielectric heating –Principle and application, Arc heating – basic principle, types, operation and control of arc furnaces.	4	12
4. ELECTRIC WELDING Principle of arc welding, arc formation and its control, phenomenon of arc blow and methods for reducing it, Comparison of A..C.. &D.C.. arc welding w.r.t. quality of weld & welding source. Requirement of an arc welding source, Current controllers for welding source and their working principle.	8	16
5. RESISTANCE WELDING Principle and its comparisons with arc welding, Operation and current controlling devices of resistance welding set.	4	4
6. TRACTION (Descriptive treatment only) System of traction-systems of electric traction, systems of track electrification. Comparison among different systems of track electrification. Speed time curve for trains for different Electric traction services (e.g. suburban, main line)(no numericals), Traction motors: DC and AC motors for traction-Performance requirement of traction motor- starting, energy loss at starting , series parallel control of traction motor Calculation of efficiency of starting by series parallel control (limited to four motors) transition methods such as shunt and bridge transition. (numerical on above topics), Traction Equipment, Current collecting equipment, Catentary construction of overhead wires.	10	16
7. ELECTRIC LIGHTING Nature of light, terms related to lighting and their definition such as luminous flux, Lumen, candle power, Illumination, brightness, MHCP, MSCP, MHSCP. Reflection factor, absorption factor, Maintenance factor, utilization factor, Principles of production of light in filament lamps, gas discharge lamps. Qualities of good lighting, Types of electric lighting source such as Incandescent lamps Fluorescent lamp (tubular and CFL) HPMV, HPSV, Neon, Halogen & mixed light lamp their working principles, control circuitry and characteristics such as efficiency, colour rendering starting and restriking time, effect of voltage fluctuation and stroboscopic effect. Lamp fitting –Reflector type, diffusive type and dispersive type; terms related with fixtures for interior lighting and street lighting.	12	24
Total	48	100

DEMONSTRATION ON:

1. Working of lamps such as Incandescent lamp, Fluorescent lamp, HPMV & HPSV, Mixed light lamp.
2. Resistance welding set.
3. High capacity heating devices.
4. Various arc welding source