

EE405: UTILIZATION OF ELECTRICAL ENERGY
CREDITS = 5 (L=3, T=0, P=2)

Course Objective:

The subject aims to provide the student of electrical engineering with:

C1: Understanding of selection of drives for industrial application.

C2: Understanding the heating and welding methods for industrial applications.

C3: Understanding of the concepts of Electrolysis processes and illumination engineering.

C4: Understanding of electric traction system and drives.

C5: To focus on the recent illumination practices adopted.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p><u>Electric Drives:</u></p> <p>Introduction concept of electric drives, Classification of electric drives, Nature of load, Factors effecting selection of drive. Characteristics of different motors. Mechanical features of electric drive, Load equalization, Flywheel calculations, examples. Temperatures rise of electric drives, heating and cooling curves, Standard ratings of motors, Examples Applications of electric drives and selection of drives for particular service, Conservation approach to be considered. Energy efficient drives.</p>	06
2	<p><u>Electrical Heating:</u></p> <p>Advantages of electric heating, Modes of transfer of heat, Classification of electric heating methods, Resistances heating methods, Requirements of heating elements, Design of heating elements, Methods of temperature control, Problems, Induction heating: principle, types of induction furnaces, Direct core type, Vertical core type, Indirect core type, Core less type, Advantages and disadvantages, eddy current heating, Applications examples., Arc-furnace: principle, Types, direct and indirect arc furnaces, Power supply and control, Condition for maximum output, Examples., Dielectric heating: principles, advantages and disadvantages, Applications, Choice of frequency, Examples.</p>	08

Unit No.	Topics	Teaching Hours
3	<u>Electric Welding:</u> Different types of resistance and arc welding. Electric welding equipment, Comparison between AC and DC Welding.	04
4	<u>Electrolytic Process:</u> Principle, Faraday's laws of electrolysis, Current efficiency, Energy efficiency etc., Rating of metals, Production of chemicals, Electro-deposition, Electroplating, Power supply for electrolytic processes.	06
5	<u>Illumination:</u> Nature of light, Definitions, Laws of illumination, Design of lighting scheme, methods of lighting, Calculations, examples., Flood lighting, Factory lighting and street lighting, Examples. Advanced Light Sources: LEDs, electrical and optical properties, energy saving potential, LED drivers, intensity control technique, LEDs in communications, remote control Utility services for large building/office complex. Selection of cable/wire sizes; wiring, switching and control circuits. Conservation approach to be considered.	08
6	<u>Electrical Traction:</u> Introductions, Different traction systems, Various systems of electric traction. Locomotives, Tramways, trolleys, Track electrification, Comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, Examples. Mechanics of train movement, Tractive effort, power, Output, examples., Energy output from driving axles, Energy output using simplified speed-time curves, Examples, Factors affecting energy consumption, dead weight, accelerating weight, Adhesion weight, examples., Traction motors and their characteristics, Starting and speed control of D.C series and shunt motors, Examples, Starting and speed control of A.C. series and 3-phase induction motors, Braking of traction motors and mechanical considerations, Conservation approach to be considered. Modern three phase electric locomotive, Block Diagram, advantages.	12
TOTAL		44

List of References:

1. J.B.Gupta, "*Utilization of Electrical Power and Electric Traction*", 10th Edition, S.K.Kataria & Sons, 2012.
2. H.Partab, "*Art and Science of Utilization of Electrical Energy*", 3rd Edition, Pritam Surat & Sons. 1980.
3. G. C .Garg, "*Utilization of Electrical Power and Electric Traction*", Khanna Publishers, 2004.
4. Soni, Gupta, Bhatnagar, "*Principle of Electrical Engineering*", Dhanpatrai & Sons, 2008.

Course Outcomes (COs):

At the end of this course students will be able:

CO1. To interpret the working and applications of various devices used by industry for effective utilization of electrical power.

CO2. To acquire the knowledge regarding the fundamentals and elementary design aspects of illumination, heating and welding.

CO3. To practice the fundamentals of electrolytic processes and illumination engineering.

CO4. To address the underlying concepts of electrical traction drives.