3EE15: ELECTRICAL POWER UTILIZATION AND TRACTION
CREDITS - 3 (LTP: 3,0,0)

Course Objective:
The subject aims to provide the student of electrical engineering to understand of selection of drives for industrial application, the heating and welding methods for industrial application, concepts of electrolysis processes, illumination engineering and electric traction system.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
01	**Electric Drives:** 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.	10
02	**Electrical Heating:** 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.	08
03	**Electric Welding:** Different types of resistance and arc welding. Electric welding equipment, Comparison between AC and DC Welding.	02
04	**Electrolytic Process:** 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.	04
05	**Illumination:** 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,	06

Unit No.	Topics	Teaching Hours
	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.	
06	**Electrical Traction**: 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	42

List of References:

1. J. B. Gupta, "Utilization of Electrical Power and Electric Traction", S. K. Kataria & Sons, 2002.
2. H. Partab, "Art And Science of Utilization of Electrical Energy" , Dhanpat Rai & Co, 2017.
3. G. C .Garg, "Utilization of Electrical Power and Electric Traction", Khanna Publishers.
4. Soni, Gupta, Bhatnagar, "A course in Electrical Power", Dhanpat Rai & Sons.
5. S. L. Uppal, "Electrical Power", Khanna Publishers.
6. Wadhwa. C.L. "Generation, Distribution and Utilization of Electrical Energy", Third Edition, New Age International Pvt Ltd**.**

Web Resources:

1. The National Academy of Indian Railways/Study Materials
www.nair.indianrailways.gov.in
2. Indian Railways Service of Electrical Engineers (IRSEE)/Lecture Note
http://www.irieen.indianrailways.gov.in

Course Outcomes (COs):

At the end of this course students will be able:

1. To interpret the working and applications of various devices used by industry for effective utilization of electrical power.
2. To acquire the knowledge regarding the fundamentals and elementary design aspects of illumination, heating and welding.
3. To practice the fundamentals of electrolytic processes and illumination engineering.
4. To address the underlying concepts of electrical traction drives.