

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Electrical Power Utilization and Traction (Professional Elective-I)
Course Code:	2ET1090505T
Pre-requisite Course:	Electrical Machines

Course Objectives:

1. The objective of the course is to apply various energy utilization methods to obtain heating, welding, illumination, refrigeration and electrolysis process for various household and industrial application.
2. To analyze the heating and welding techniques for specific applications and calculate the heat developed in different electrical furnaces and ovens.
3. To Understand the different types of tractive mechanism.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Illumination: Nature of light, Visibility spectrum curve of relative sensitivity of human eye and wave length of light, Different type of lamps, Construction and working of incandescent and discharge lamps & their characteristics, Fittings required for filament lamp, Mercury vapor lamp, Fluorescent lamp, Metal halide lamp, Neon lamp, General ideas about street lighting, Flood lighting, Monument lighting and decorative lighting, Light characteristics etc., LED lighting.	09	20
2	Electric Heating: Advantages of electrical heating, Heating methods, Resistance heating, Direct and indirect resistance heating, Electric ovens and their temperature range, Properties of resistance heating elements, Domestic water heaters and other heating appliances and thermostat control circuit, Induction heating, Principle of core type and coreless induction furnace, Electric arc heating, Direct and indirect arc heating, Construction, Working and applications of arc furnace, Dielectric heating, Applications in various industrial fields, Infra-red heating and its applications, Microwave heating, Simple design problems of resistance heating element.	09	20
3	Electric Welding: Advantages of electric welding, Welding methods, Principles of resistance welding, Types: spot, projection, seam and butt, welding and welding equipment used, Principle of arc production, Electric arc welding, Characteristics of arc, Carbon arc, Metal arc, Hydrogen arc welding and their applications, Power supply required, Advantages of using coated	08	15

	electrodes, Comparison between AC and DC arc welding, Welding control circuits, Welding of aluminum and copper, Introduction to TIG, MIG welding.		
4	Electrolytic Processes: Need of electro-deposition, Laws of electrolysis, Process of electro deposition, Clearing, Operation, Deposition of metals, Polishing, Buffing, Equipment and accessories for electroplating, Factors affecting electro deposition.	04	10
5	Electric Traction: Electric traction, Advantages of electric traction, Different systems of electric traction, DC and AC systems, Diesel electric system, types of services: Urban, Sub-urban and main lines and their speed time curves, Different accessories for track electrification such as overhead capacitor wire, Conductor rail system, Current collector-pantograph, Factors affecting scheduled speed, Electrical block diagram of an electric locomotive with description of various equipment and accessories, Types of motors used for electric traction, Starting and braking of traction motors, Introduction to EMU and metro railways.	11	25
6	Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers: Principle of air conditioning, Vapor pressure, Refrigeration cycle, Eco friendly refrigerants, Description of electrical circuit used in refrigerator, Air conditioner and water cooler.	04	10

Text Books:

1. C.L. Wadhwa., “Generation, Distribution and utilization of electrical energy”, Wiley Easter Limited, 4th edition-2012.
2. Taylor E Openshaw, “Utilization of Electric Energy”, Orient Longman, 6th edition-2016.

Reference Books:

1. Soni, Gupta, Bhatnagar, “A course in electric power”, Dhanapat Rai & sons, 2nd edition-2005.
2. S. L. Uppal, “Electrical Power”, Khanna pulishers, 4th edition-2001.
3. H. Partab, “Art and Science of Utilization of Electrical Energy”, Dhanpat Rai and Sons, 5th edition-2005.
4. S. C. Tripathy, “Electric Energy Utilization And Conservation”, Tata McGraw Hill.
5. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha, “Generation and utilization of electrical energy”, Pearson.
6. R. K. Rajput, “Utilization of Electrical Power”, Laxmi Publications(P)ltd, 4th edition-2009.

ICT/MOOCs Reference:

1. <https://nptel.ac.in/courses/108/105/108105060/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Apply various energy utilization methods to obtain heating, welding, illumination, refrigeration and electrolysis process for various household and industrial application.	3 Applying

CLO2	Design illumination scheme to fulfill lighting requirement of particular location.	5 Evaluating
CLO3	Select appropriate heating and welding techniques for specific applications and calculate the heat developed in different electrical furnaces and ovens.	1 Remembering
CLO4	Understand the different types of tractive mechanism for different locomotives.	2 Understanding
CLO5	Evaluate the rating of electrical equipment used in refrigeration and air conditioning system.	5 Evaluating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M	M	L	L	H	M					M	H	L	M	L
CLO2	H	H	H	H		M	M				M		H	H	H	
CLO3	H	H	M	M		M	M		L			L	H	H	M	L
CLO4	H	M	M	M	L	M	M		L		M	M	M	M	H	M
CLO5	H	H	H	M	L	H	H				L	M	H	H	H	

H: High, M: Medium, L: Low