



Semester –VI

Subject Name: Electrical Energy Utilization

Subject Code: 09EE2601

Diploma Branch in which this subject is offered: Electrical Engineering

Objective:

The aim of this course is to apply electric energy to impart knowledge on illumination including studies of various types of sources, domestic appliances, various types of heating and welding with comparative analysis, various applications of Electric drives, Electric traction and motors used in traction.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able

1. To troubleshoot problem in various domestic appliance
2. To understand illumination and select lamps as per application.
3. To apply electrical energy in various types of welding and heating equipment.
4. To understand operation of elevator and electrical drives.
5. To apply electrical energy for traction application

Pre-requisite of course: DC circuit, AC circuit, electrical DC machine and transformer, electrical rotating AC machine, power electronics.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
3	2	0	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	<p>Electrical appliances and illumination</p> <ul style="list-style-type: none"> • Introduction • Different domestic electrical appliance • Working of different electrical appliance Electric Iron, electrical water heater, electric toaster, ceiling fan, Table fan, Microwave oven, vacuum cleaner, air conditioner etc. • Energy conservation techniques used in various domestic appliances • Concept of star system applied for domestic electrical appliances 	18	43



	<p>like Refrigerator, Television, Air conditioner.</p> <ul style="list-style-type: none">• Illumination terminology: Lux, luminous flux, luminous intensity, lumen, candle power, plane angle, solid angle, efficiency of lamp, glare, utilization factor, space height ratio, absorption factor, maintenance factor,• Law of Illumination: Law of Inverse Square and Lambert's Cosine Law• Working and application of different lamps and fittings• Incandescent lamp, halogen lamp, low pressure mercury vapour lamp, high pressure mercury vapour lamp, compact florescent lamp, metal halide lamp, LED lamp		
2	<p>Electrical heating and welding</p> <ul style="list-style-type: none">• Introduction• Principle of electrical heating• Requirements of electrical heating and heating elements• Different types of electrical heating: resistance heating, arc heating, induction heating, dielectric heating• Principle and working of resistance heating: Direct and indirect resistance heating with application• Principle and working of arc heating : Direct and indirect arc furnace with applications• Principle and working of induction heating: Core type and coreless induction furnace with application• Principle and working of dielectric heating with application• Stiffen's law of heat transfer• Numerical problem on heating application• Electric Welding: Principle of welding, Different quality and defects in weld• Different types of welding• Principle of resistance welding and its types: Seam welding, spot welding, projection welding butt welding, percussion and flash butt welding.• Principle of arc welding and it's types: metal arc welding, carbon arc welding, atomic hydrogen welding , inert gas welding,• Comparison of DC welding and AC welding.• Comparison of resistance welding and arc welding.	10	25
3	<p>Electrical drives</p> <ul style="list-style-type: none">• Introduction• What is electrical drive• Block diagram of electrical drive with function of major parts• Selection of electrical motors for electrical drives: Nature of load torque, electrical characteristics of motor, mechanical factor, size and cost.• Speed vs torque characteristics, steady state and transient characteristics of different motors.• Comparison of AC drive and DC drives• Comparison of individual and group drives	4	9



4	Electrical elevators <ul style="list-style-type: none"> • Introduction • What is electrical elevator • Block diagram of electrical elevator • Classification of elevator machines and their motor • Safety in elevator • Features of modern lifts • Lift and elevator act: Gujarat lift act and others 	4	9
5	Electric traction <ul style="list-style-type: none"> • Introduction • Concept of electric traction in compare with other types • Need of electric traction • Requirement of ideal traction system • Traction mechanism : types of train services and speed time curve • Supply system in electric traction: DC system, composite system, single phase and three phase system 	6	14

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
35%	35%	15%	15%	0%	0%

Suggested List of Practical/Exercise/Tutorial:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Prepare a comparative chart of electrical quantities, size and cost for electrical iron manufacture by two different companies.	2
2	1	Prepare report on manufacturing of electrical appliance by visiting any manufacturing industry.	2
3	1	Write a procedure of servicing of electrical fan.	2
4	1	Demonstration of any three domestic electrical appliance, and study their specification, power consumption, testing and maintenance.	6
5	2	Understand different types of resistance welding.	2
6	2	Understand different types of arc welding.	2
7	2	Understand different methods of induction heating.	2
8	2	Understand different methods of resistance heating	2



9	3	Prepare a comparison study of different drives used for transportation system	2
10	4	Prepare a report on functions and use of elevator after visiting any elevator using site.	2
11	5	Prepare report on various traction systems.	2
12	5	Prepare report on comparative study of AC and DC drive system for traction.	2

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- e. Show video or animation of working of various types of wiring system and electrical transmission and distribution network

References:

1. S. Sivanagaraju, "*Power system operation and control*", Dorling Kindersley(India) pvt ltd, 2010
2. N V Ramana, "*Power system operation and control*", Dorling Kindersley(India) pvt ltd, 2011
3. Allen J wood, "*Power generation operation and control*", John wiley and sons , second edition,1996.
4. P S R Murty, "*Operation and control in power system*", Book Syndicate, second edition, 2011

Supplementary Resources:

1. <https://circuitglobe.com/power-system.html>
2. <https://www.sciencedirect.com/topics/engineering/power-system-operation>
3. <https://posoco.in/en/>
4. https://www.researchgate.net/publication/327968078_Introduction_to_Power_System_Operation
5. <https://electrical-engineering-portal.com/download-center/books-and-guides/electricity-generation-t-d/power-system-control-operation>
6. <https://www.aipnpc.org/>