Lok Jagruti Kendra University
University with a Difference

Diploma
in
Electrical Engineering

LJ Polytechnic

Course Code: 025070404
Electrical Traction & Utilization of Energy

Programmme / Branch Name			Diploma in Electrical Engineering			
Course Name	Electrical Traction & Utilization of Energy				**Course Code**	025070404
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week / Credits				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**Total Marks**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Physics and Mathematics (Pre-university level)
- ✓ Basic electrical motor related quantities/parameters/formulas/basic terms
- ✓ Some basic ideas to draw diagram of some electrical approach related concept
- ✓ Use utilization of energy of household circuits and traction related applications

3. Rationale

In the study of this course, the students will understand and learn the concept of traction motors and some train applications. Utilization of electrical energy is core subject for electrical students which are more important for current era. Electrical Traction and Utilization of Energy is a core subject for the knowledge of which is essential for electrical engineering diploma holders and they need to assimilate it to succeed in the industry. In this regard, the basic knowledge of various traction motors and traction system and energy utilization process is essential. The knowledge of this core subject is essential for comprehending the courses that will be introduced later in the diploma program as well as developing requisite skills for effective functioning in the industry.

4. Objectives

- ✓ Analyze various concepts about traction system.
- ✓ Analyze electrical traction motors and its application in various locations for railways.
- ✓ It will develop potential to measure & analysis of electrical energy for utilization purpose for the application in domestic and industrial areas.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1	**Electrical Traction System**	1.1. Requirements of ideal Traction System. 1.2. General arrangement of D.C., A.C. single phase, 3 phase, Composite systems 1.3. Traction Mechanics: Types of Services, Speed Time Curve.	• Explain the concept of Electric Traction and the ideal conditions • Explain the general arrangement of different types of Electric traction systems and their significance. • State the need of single phase 25 kV AC for traction • Draw the speed time curve related to different traction system.	15	05
2.	**Traction Motor and Locomotives**	2.1 Features of traction motors 2.2 Significance of D.C. series motor as traction motor 2.3 A. C. Traction motors-single phase, three phase, Linear Induction Motor 2.4 Comparison between different traction motors 2.5 Important features of electric locomotives 2.6 Different types of locomotives 2.7 Current collecting equipment	• State the desirable features of traction motors. • Explain Significance of D.C. series motor over D.C. Shunt motor. • Explain working of various A.C. motors as traction motors. • Compare different traction motors. • Classify electric locomotive • Describe the function of auxiliaries in traction system • Describe the different current collecting methods in locomotives	25	10

3	**Illumination**	3.1. Illumination terminology: Solid and plane angle, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Lux, Lamp Efficiency, Specific Consumption, Glare, Space Height Ratio, Utilization Factor, Maintenance Factor, Absorption Factor, Reflection Factor 3.2. Law of Inverse Squares and Lambert's Cosine Law 3.3. Incandescent Lamp, 3.4. Compact Fluorescent Lamps (C.F.L.), 3.5. Halogen Lamps	• Define various illumination terminology and its units • Explain the laws of illumination and its significance • Describe the working and applications of the various lamps	20	10
4	**Electrical Heating and Drives**	4.1 Requirements of heating element materials 4.2 Resistance and Arc heating 4.3 Resistance Heating: Direct (Salt Bath Furnace), Indirect Resistance Heating Resistance Ovens) 4.4 Arc Heating and its applications 4.5 Induction Heating and its applications 4.6 Source, Power modulator, Electric motor, Control unit and Load 4.7 Electrical characteristics, Mechanical factors, Nature of load torque, Size and cost 4.8 Comparison of DC & AC Drive	• Explain the requirements of heating element materials • Explain the principle of Resistance Heating • Explain the principle of arc Heating • Describe the working of salt bath furnace • Describe the working of resistance oven • Explain function of major parts of an electric drive with block diagrams • State the factors governing selection of electric motors in a electric drive • Differentiate between AC and DC Drive	25	12

5	**Domestic Electrical Appliances**	5.1 Domestic electrical appliances: i. Electric iron. ii. Electric toaster. iii. Electric water heater. iv. Microwave oven. v. Fans (Ceiling and Table fan) vi. Washing Machine. vii. Grinder/ Mixer/ juicer. viii. Vacuum Cleaner. ix. Flour Mill etc. x. Air conditioner 5.2 Concept of Star System for energy conservation	• Explain the working of various domestic electrical appliances in use. • State the energy conservation measures adopted in using various domestic gadgets.	15	05
				Total Hours	**42**

6. List of Practical's / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises.

Sr. No	Practical / Exercises	Key Competency	Hours
1	Investigate the various traction systems in Indian railways.	Traction system	2
2	Solve numericals on speed time curves.	Speed time curve	2
3	Justify the use of D. C. Series motor as traction motor.	D.C. series motor	2
4	Draw sketch of the current collecting equipment.	Current collecting equipment	2
5	Study of power diagram of A.C. and D.C. locomotive.	Locomotives	2
6	Measure Illumination at different places in college by luxmeter.	luxmeter	2
7	Prepare an industrial visit report after visiting nearby lamp manufacturing industry (otherwise from internet)	Lamps	2
8	Prepare a report of specification of various heating furnaces used in industries.	Heating Furnaces	2
9	Compare various Electric Drives for Traction	Electric Drives	2
10	Prepare a report on manufacturing of a domestic appliance by visiting a manufacturing unit of electrical domestic appliances.	Domestic Appliance	2
11	Prepare test reports & bills for servicing of electrical domestic appliances.	Reports and bills	2
		Total Hours	22

7. Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Electrical Traction System	05	40	20	20	0	10	10
2	Traction Motor and Locomotives	10	20	20	15	20	20	5
3	Illumination	10	20	20	20	15	10	15
4	Electrical Heating and Drives	12	20	20	15	20	10	15
5	Domestic Electrical Appliances	05	30	20	20	10	10	10

Legends: R-Remembering C- Creating
U- Understanding E- Evaluating
App- Applying An- Analyzing

8. Textbooks

1) Utilization of Electric Power by Er. R.K. Rajput
2) Modern Electrical traction system by Er. Tarlok singh

9. Reference Books

1) Utilization of Electrical Energy and Traction by S.K. Kataria & Sons
2) Modern Electrical traction by H. Partab (Dhanpat Rai publications)

10. Open Sources (Website, Video, Movie)

1) https://onlinecourses.nptel.ac.in/
2) https://circuitglobe.com/
3) https://electrical-engineering-portal.com/
4) https://www.electrical4u.com/
5) https://tryengineering.org/profile/electrical-engineering/