NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**V**
Course Code:	**4EE201CC26**
Course Title:	**Utilization of Electric Power**
Course Type:	**Core**
Year of Introduction:	**2024-25**

L	T	Practical component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. apply different electrical techniques for heating, welding, and refrigeration (BL4)
2. design illumination scheme to obtain required lux level at given location (BL6)
3. analyze various aspects of traction systems based on performance and application (BL4)
4. design solutions complying with energy efficient and green building requirements (BL5)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Electric Heating and Welding** Types of electric furnaces resistance, arc, induction, and dielectric - concept and operation of each type, temperature control of furnaces. Types of welding: arc and resistance, electric supply for arc welding, choice of welding time	**09**
Unit-II	**Electric Traction** General features of electrical traction, Mechanics of train movement, Nature of traction load, Speed-time curves, Calculations of traction drive rating and energy consumption, Train resistance, Adhesive weight and coefficient of adhesion, Tractive effort for acceleration and propulsion, Power and energy output from driving axles, Methods of speed control and braking of motors for traction load	**09**
Unit-III	**Illumination** Nature of light, terminologies and units, basic laws of illumination, determination of luminous flux, light sources and their characteristics, light production by excitation and ionization, sources of light, halogen lamp, LED lamp technologies and their applications, LED drivers, energy considerations, design of energy efficient lighting scheme, photometry, direct, diffused and mixed reflection, reflection factor, transmission factor, refractors, light fittings, street lighting, flood lighting, factory lighting, interior lighting, sports lighting	**09**
Unit-IV	**Refrigeration and Air-Conditioning** Introduction, terminology, refrigeration system, domestic refrigerator, troubleshooting and maintenance of domestic refrigerator, refrigeration	**09**

components and controls, comfort air conditioning, industrial air conditioning, room air conditioners, central air conditioning system, smart air conditioning, rating of electrical equipment in air conditioning

Unit-V **Energy Efficient Buildings** **09**

Significance of energy efficiency in residential and non-residential usage, estimate for electrical energy consumption in existing building, strategies involved in management of electrical energy consumption at consumer end, application of adjustable speed drive and energy efficient motor/pump for residential and industrial applications, smart appliances and application of IoT for lighting and HVAC control in buildings, Load Shifting and use of Battery Energy Storage Systems, Concepts and categories of green building and role of Electrical Engineers

Self-Study: The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- E.O.Taylor, *Utilization of Electric Energy*, Orient Blackswan
- H. Partab, *Art and Science of Utilisation of Electrical Energy*, Dhanpat Rai & Son
- Frank Kreith and Ronald E. West, *Handbook of Energy Efficiency*, CRC Press.
- Jack L. Lindsey, Scott C. Dunning, *Applied Illumination Engineering*, Fairmont Press
- C. L. Wadhwa, *Generation Distribution and Utilization of Electrical Energy*, New Age International
- J. B. Gupta, *Utilization of Electric Power and Electric Traction*, S. K. Kataria & Sons
- R. K. Rajput, *Utilisation of Electric Power*, Laxmi Publications
- J. Nanda and M.L. Kothari, *Emerging Trends in Power System*, Proceedings of the NPSC.

Suggested List of Experiments: Laboratory work will be based on the above syllabus with a minimum 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiment	Hours
1.	To verify the Inverse Square Law of Illumination.	2
2.	To study the temperature-rise pattern of a resistive heating element and evaluate its heating efficiency under controlled conditions.	2
3.	Simulation of speed-time curve for electric train and calculation of energy consumption	2
4.	Evaluating the efficiency and characteristics of different lamp technologies	4
5.	Practical application of illumination principles to design lighting layouts for various settings (residential, commercial, industrial, street lighting, flood lighting).	2
6.	Performing dynamic braking of a DC motor using simulation tools	4
7.	Study of 25 kV AC traction substation – single line diagram and equipment operation.	2
8.	Demonstration of IoT-based lighting control using motion sensors or timers.	2

9.	Estimation of carbon footprint reduction by using energy-efficient appliances.	2
10.	Simulate how changing thermostat settings affects compressor runtime and energy use.	2
11.	Implement intelligent temperature control algorithms.	2
12.	Motor Drive Simulation for Modern Refrigerators	2