NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B Tech (All Except Electrical Engineering)**
Semester:	**VI**
Course Code:	**3EE203OE26**
Course Title:	**Electrical Power Utilisation and Safety**
Course Type:	**Open Elective-I**
Year of Introduction:	**2020 – 21**

L	T	Practical component				C
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Course Learning Outcomes (CLOs):

After successful completion of the course, student will be able to

1. infer the importance various parameters in electrical system (BL2)
2. apply suitable electric heating, welding, refrigeration, and air conditioning methods for a given system. (BL3)
3. analyze illumination schemes to achieve the required flux level. (BL4)
4. appreciate the significance of electrical safety and earthing systems in minimizing hazards (BL2)

Unit	Contents	Teaching Hours (Total 45)
Unit- I	**Electric Heating and Welding** Advantages of electric heating, resistance heating, types of furnaces, induction heating, types of induction furnaces, dielectric heating, types of welding- arc and resistance	**08**
Unit – II	**Refrigeration and Air Conditioning** Introduction to refrigeration and air-conditioning, principles of a refrigerator, domestic refrigerator, electrical circuit of refrigerator, need of voltage regulator, water cooler, air conditioner, thermo-electric refrigeration, air purification, central air conditioning systems	**06**
Unit-III	**Illumination Scheme** Basic terms used in illumination scheme, electric lamps, recommended levels of illumination, types of lighting schemes, design of lighting schemes, factory lighting, street lighting, flood lighting	**07**
Unit-IV	**Electrical Installation, Estimating and Costing** Types of load, load assessment, electrical supply systems, wiring systems, permissible voltage drops and conductor size calculations, estimating and costing for residential and commercial service connections (single phase and three phase)	**08**

Unit-V	**Power Factor** Effects of power factor, causes of low power factor, disadvantages of low power factor, methods of improving power factor, most economical power factor	**05**
Unit-VI	**Electrical Safety, Earthing System and Protective Devices** Electrical shock mechanisms, factors influencing the electric shock, body current thresholds (tolerable body current limit), thevenin's concepts and accidental equivalent circuits (step and touch potentials), protection against electric shock, purpose of earthing, IS rules for earthing of electrical installations, factors governing the resistance of earth electrode, methods of earthing, measurement of earth resistance, methods of reducing earth resistance, fuse, miniature circuit breakers (MCB) and earth leakage circuit breakers (ELCB), sensor-based safety systems	**11**

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. Openshaw Taylor, *Utilisation of Electrical Energy*, Universities Press.
- H. Partab, *Art and Science of Utilisation of Electrical Energy*, Dhanpat Rai & Co.
- J. B. Gupta, *Utilization of Electric Power and Electric Traction*, S. K. Kataria & Sons, New Delhi.
- G. C. Garg, *Utilization of Electric Power and Electric Traction*, Khanna Publishers, Delhi.
- R. K. Rajput, *Utilisation of Electrical Power*, Laxmi Publications (P) Ltd., New Delhi.
- N. V. Suyranarayana, *Utilisation of Electric Power Including Electric Drives and Electric Traction*, New Age Publishers, New Delhi.
- J. B. Gupta, *A Course in Electrical Installation Estimating and Costing*, S. K. Kataria & Sons, New Delhi.

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.	To determine power factor in and its improvement using capacitors	2
4.	Evaluating the efficiency and characteristics of different lamp technologies	2
5.	Practical application of illumination principles to design lighting layouts for various settings (residential, commercial, industrial, street lighting, flood lighting).	2
6.	Demonstration of IoT-based lighting control using motion sensors or timers.	2
7.	To study the comparison of Earthing Systems.	2

8.	Measurement of Earth Resistance using Earth Tester	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