INDUSTRIAL ELECTRIFICATION

ENEE 352

Lecture	**: 3**	**Year : III**
Tutorial	**: 1**	**Part : II**
Practical	**: 2**	

Course Objectives:

The objective of this course is to equip students with the knowledge and practical skills required for industrial electrification, including load estimation, power distribution design, installation practices, protection systems, lighting design, and backup power solutions. It enables students to design safe, efficient, and reliable electrical installations for modern industrial facilities.

1 Introduction (5 hours)

1.1 Concept and scope of industrial electrification
1.2 Electrical power requirements and types of loads
1.3 Load terminology and factors
1.4 Methods of electrical load estimation
1.5 Concept and determination of load center
1.6 Layout of electrical supply system and distribution
1.7 Single line diagram and selection of supply voltage

2 Industrial Power Distribution and Power Cables (8 hours)

2.1 Voltage levels and system overview
2.2 Layout of industrial power distribution
2.3 Types of distribution systems
2.4 Distribution substations
2.5 Power cables, sandwich bus and bus trunking
2.6 Cable selection and installation methods

3 Earthing and Lightning Protection (4 hours)

3.1 Purposes of earthing in industrial installations
3.2 Types of earthing systems (Equipment earthing, system earthing)
3.3 Methods of earthing: Plate earthing, pipe earthing, chemical rod earthing and grid earthing.
3.4 Earthing resistance and its measurement, soil resistivity measurement
3.5 Lightning protection methods
3.6 Lightning protection system (Air terminals, down conductors, earth electrodes)

4 Illumination Engineering (8 hours)

4.1 Fundamentals of illumination engineering
4.2 Photometric quantities and units
4.3 Illumination design principles
4.4 Indoor lighting design methods
4.5 Lighting terminology: Lumen, lux, efficacy, color temperature, Color Rendering Index, glare
4.6 Lighting schemes: Direct, indirect, semi-direct, diffuse
4.7 Types of light sources (Conventional light sources, modern solid-state lighting)
4.8 Lighting fixtures and luminaire selection (Luminaire components, LED driver technology, criteria for luminaire selection)
4.9 Modern trends in lighting technology (Smart lighting systems, digital addressable lighting interface (DALI) and wireless lighting control systems, daylight sensors and occupancy sensors, IoT-based lighting control)

5 Electrification of Buildings (4 hours)

5.1 Electrification of industrial and commercial buildings
5.2 Electrical load estimation in buildings
5.3 Wiring systems and accessories
5.4 Distribution hierarchy
5.5 Energy efficiency and modern standards

6 Industrial and Commercial Electric Heating (6 hours)

6.1 Introduction and advantages of electric heating
6.2 Building design considerations
6.3 Decentralized systems
6.4 Variable refrigerant flow (VRF) systems
6.5 Air conditioning units in buildings
6.6 Central control and building integration

7 Outdoor Lighting Design (6 hours)

7.1 Street lighting systems
7.2 Flood lighting and landscaping lighting
7.3 Industrial yard lighting
7.4 Design procedures
7.5 Lighting control and energy-efficient lighting design

8 Backup Power Systems (4 hours)

8.1 Need for backup power in industries
8.2 Types of backup systems (UPS, battery backup systems, diesel generator)
8.3 Selection and sizing of backup systems

8.4 Automatic transfer switch (ATS) and standby system
8.5 Battery installation and safety practices

Tutorial **(15 hours)**

1. Design based on industrial electrification
2. Design examples on industrial power distribution and power cables
3. Solution of problem related to earthing and lightning protection
4. Design on illumination engineering
5. Design on electrification of buildings
6. Design on industrial and commercial electric heating
7. Design on outdoor lighting design
8. Design on backup power systems

Practical **(30 hours)**

1. Study of electrical wiring accessories and protective devices: Identification and study of wiring accessories such as switches, sockets, plug tops, distribution boards, and junction boxes, study of protective devices such as fuse, MCB, MCCB, RCCB, and isolators, construction, working principle, ratings, and applications of these devices, demonstration of installation and safety precautions
2. Market survey of electrical equipment: Conduct a market study of electrical lighting systems, appliances, and industrial equipment, collect brochures, catalogues, and technical specifications of products such as LED lamps and lighting fixtures, switchgear and distribution boards, power cables and wiring accessories, comparison of different brands based on specifications, efficiency and cost
3. Electrical layout preparation for buildings: Preparation of electrical layout for a commercial complex or industrial building, identification of lighting points, power outlets, distribution boards, and cable routes, preparation of single line diagram (SLD) of the electrical system, consideration of load distribution and safety standards
4. Design of electrical installation scheme: Design an electrical installation scheme for a commercial complex or industrial facility, preparation of: Light circuit design, power circuit design, electric fan and heating de, distribution system design, drawing detailed wiring diagrams and electrical layout, Preparation of design report including load calculation and system description
5. Cost estimation of electrical installation: Preparation of bill of quantities (BOQ) for the designed electrical installation (Estimation of quantity of materials such as cables, conduits, switches, distribution boards, lighting fixtures, and protective devices; Preparation of cost estimation based on market price; Preparation of material schedule and project cost summary)

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Mark distribution*
1	5	6
2	8	8
3	4	6
4	5	12
5	8	6
6	6	8
7	4	8
8	5	6
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Gupta, J. B. (2012). A course in electrical installation estimating & costing. New Delhi, India: S. K. Kataria & Sons Publishing House.
2. Gupta, J. B. (2014). Utilization of electric power and electric traction. New Delhi, India: S. K. Kataria & Sons Publishing House.
3. Singh, S. N. (2003). Electric power generation, transmission and distribution (Latest Edition). New Delhi, India: PHI Learning Pvt. Ltd.
4. Wadhwa, C. L. (2017). Generation, distribution and utilization of electrical energy. New Delhi, India: New Academic Science.
5. Illuminating Engineering Society of North America (IESNA). (2011). The lighting handbook. New York, NY: Illuminating Engineering Society.
6. ASHRAE. (2021). ASHRAE handbook—HVAC systems and equipment. Atlanta, GA: ASHRAE.