18ARC53-BUILDING SERVICES-II (Electrical Services and Illumination)

CONTACT PERIODS: 3 (1 Lecture + 2 Pract./Tuto./Semi.) per week
THEORY MARKS: 100
PROGRESSIVE MARKS: 50
DURATION OF EXAM: 3 Hrs

OBJECTIVE: *To introduce students to electrical services and illumination and to sensitize them with respect to their integration into Architectural Design.*

OUTLINE:

MODULE 1

Electrical Services - Electricity Generation; Transmission and Distribution

1. **Introduction to Electrical Services**: Introduction to commonly used terminology – Voltage, Current, Power, Connected Load, Max. Demand, Load Factors, Diversity Factor Etc.; Importance of Electrical Services and Its implications on building design; Introduction to Codes and Standards like National Building Code, National Electric Code, IS Rules, State Electricity Board and Chief Electrical Inspectorate Guidelines.
2. **Supply and distribution of electricity to buildings:** Brief introduction to various Sources for Electricity generation. Introduction to Transmission and Distribution system (from generation to Building's main) - Cables–HT/LT, Voltage Levels, Sub-Stations, Ring Main Units, Metering Panels, HT Panel, Transformers.

MODULE 2

Electrical Services - Internal Electrical distribution systems and Renewable Energy Systems

3. **Residential Building internal electrical distribution system & Commercial Building internal electrical distribution system:** Power Requirement, Incoming Power Source Voltage, RMU, Transformers, HT Metering & Sub Metering Panels, LT Panels, Rising Mains, Sub-Mains, Circuit-Mains, Generators, UPS requirements, Server power requirements, Point Wiring, Point Matrix, Utility Loads, Wiring Systems, Wiring Installation systems.
4. **Introduction to Renewable Energy Systems (On-Site and Off-Site)**: Solar, Wind, Bio-Mass, Achieving Net Zero Building design through utilization of above natural resources; Energy Conservation techniques in Electrical systems.

MODULE 3

Electrical Services - Protection Systems

5. **Switchgear & Protection Devices – Fuses, Breakers:** Miniature Circuit Breakers; Earth Leakage Circuit Breakers; Moulded Case Circuit Breakers & Air Circuit Breakers and Protection Relays.

6. **Earthing & Lightning Protection System:** Definition, Purpose; Types of Earthing Systems, Factors affecting selection and system specification - Type of Soil, water table, soil resistivity etc. Brief about new advances in earthing systems; Lightning system design - Factors affecting the system specification, basic rules as per NBC and other relevant codes.

MODULE 4

ILLUMINATION

7. **Fundamentals:** Quality & Quantity of Lighting; Recommended Lux Levels; Type of Lamps – Incandescent, Discharge Lamps, Fluorescent, CFL, LED and OLED. Integration of Day lighting with Artificial Lighting, Control Systems, Laws of illumination.
8. **Techniques, Principles and Applications:** Lighting Methods - Ambient, Task & Accent lighting; Systems of Luminaries - Up-Lighting, Down-Lighting, Spot Lighting etc.; Street Lighting, Façade Lighting, Landscape Lighting, Architectural Typologies; Preparation of Lighting Layout.

MODULE 5

EXTRA LOW VOLTAGE SYSTEMS AND LOAD ESTIMATION

9. **Extra Low Voltage systems:** Telephone; Data & Cable TV Networking; Service provider requirements; Point matrix for Individual residential / Apartment.
10. **Electrical Layout Design and Load Estimation**: Residential Electrical Layout Design (using symbols as per IS codes), Compliance to local building codes; and Electrical Load Calculations.

Case studies: Typical Layouts & Layout Generation for Lighting, Transformers Yards, Generator Rooms, Lighting layouts for shops/clinic.

Site Visits: Sub-Stations, Transformer Yards, Generator Yards and Panel Rooms etc. of Multi-storeyed Residential Buildings/Campus, Hotels, Hospital & IT Buildings etc.

NOTE: For Progressive marks, submissions to contain a) Calculation of required load and preparation of Electrical lay out design for a 3-bedroom house with standard notations (Plan). b) Study Portfolio relating to modules 1, 2, 3, 4 and 5.

REFERENCES:

1. L.Uppal ; Electrical Wiring, Estimating & Costing.
2. Aly. S. Dadras (1995), Electrical Systems for Architects by N.G.A.R.B. McGraw-Hill.
3. Anwari ; Basic Electrical Engineering.
4. National electric Code, Indian Electricity Rules 1956, Energy Conservation and Building Code.
4. Handbook of Lighting Design by Ruediger Ganslandt, Harald Hofmann; ERCO Edition
5. Fundamentals of Lighting by Susan M. Winchip.
6. National Building Code, 2016 – Part 8 (Section 1, 2, 6).
7. Code of Practice for Interior Illumination (IS 3646-1 (1992); Indian Standard - BIS.