

18ARC63 - BUILDING SERVICES - III

(AIR-CONDITIONING, MECHANICAL TRANSPORTATION and FIRE PROTECTION)

CONTACT PERIODS: 3 (Lecture) per week

THEORY MARKS: 100

PROGRESSIVE MARKS: 50

DURATION OF EXAM: 3 Hrs

OBJECTIVE: *To develop the knowledge and skills required for understanding the mechanical services in buildings and their integration with architectural design.*

OUTLINE:

MODULE 1

MECHANICAL VENTILATION AND AIR-CONDITIONING - Introduction

- 1) Introduction to Mechanical Ventilation:** Need for mechanical ventilation for spaces like Basements, Kitchen, Toilets , etc. Guidelines as per NBC / ISHRAE: Types of ventilation systems.
- 2) Introduction to Air-conditioning:** Definition, Psychometric processes and requirements, Air & Refrigeration cycles, Basics of Load Calculations, Zoning and Air Distribution, Heating system,

MODULE 2

AIR-CONDITIONING SYSTEMS

- 3) Air Conditioning systems:** Window, Split, Packaged, Basics of Centralized Air-conditioning system, Water & Air Cooled Chillers, Air Handling Units, Basics of duct sizing and routing, preferred locations of equipment and Architectural Requirements of various equipment. Illustration of duct layout through a small example.
- 4) Specialized Air Conditioning Systems:** Clean Rooms, Server, Hub & UPS Rooms, Operation Theaters etc.

MODULE 3

MECHANICAL TRANSPORTATION SYSTEMS IN BUILDINGS

- 5) Elevators:** Types of Elevator systems, design considerations like Peak Handling capacity, Average Waiting Time, Lift speed etc., Architectural Requirements & Details for Elevator shaft - Elevator pit - Elevator Machine Rooms, Automatic Rescue Device for Elevators , Elevator car interiors, Possible Location and arrangements of Elevators in a building. Lift Acts and National Building Code.
- 6) Escalators & Travelators:** Applications, Calculation of Traffic capacity, Location and arrangements of escalators and travelators, inclination factor.

MODULE 4

FIRE SAFETY IN BUILDINGS & PASSIVE FIRE PROTECTION

- 7) **Introduction:** Classification of fire, causes & hazards; Grading of structural elements for its fire resistance as per NBC. Classification of building types as per NBC and brief description of characteristics of combustible and noncombustible materials.
- 8) **Concepts in passive fire protection in buildings:** Escape routes, fire driveways, fire refuge area, fire assembly areas, pressurization, travel distance, fire tower and compartmentation, fire signages etc.

MODULE 5

ACTIVE FIRE PROTECTION AND FIRE SAFETY IN HIGH RISE BUILDINGS

- 9) **Active fire control:** Basic concepts in fixed firefighting installations, Fire sprinklers, Fire Hydrants, Automatic fire detection and alarm systems.
- 10) **National Building Code Requirements for Fire Safety:** Rules for Fire Protection and Fire Fighting Requirements for High Rise Buildings in India.

NOTES: Suggested assessments:

- A. The subject teacher could arrange for visits to relevant facilities to provide an understanding of the various provisions and integration of air conditioning, vertical transportation and fire safety in buildings. Case study reports could be submitted as group assignments.
- B. Conceptual design of air-conditioning systems, mechanical ventilation, mechanical transportation, active & passive fire fighting systems for a high rise building. Ideally the assignment could be integrated with the Architectural Project of ongoing or previous semester.

REFERENCES:

- 1) Roy J Dossat , "Principles of Refrigeration" 1961, John Wiley & Sons.
- 2) Manohar Prasad , "Refrigeration & Air Conditioning Data Hand book" 2013, New Age International, 2nd edition.
- 3) Don Kundwar , "Refrigeration and Air Conditioning", 2016, Dhanpat Rai & Co. (P) Limited.
- 4) "National Building Code of India (NBC)", 2016, Bureau of Indian Standards
- 5) Walter T. Grondzik, Alison G. Kwok, "Mechanical and Electrical Equipment for Buildings", 2010; 11th edition, Wiley Publication.
- 6) Shan K. Wang , "Handbook of Air Conditioning and Refrigeration", 2000, McGraw-Hill Edu.
- 7) "National Building Code of India (NBC) 2016"; Part 8 Section 3 and 5 & Part 3 & 4, BIS.
- 8) NFPA 101
- 9) IS Codes -
 - 1391 (Part 1 & 2) : 1992 - Specification for room air conditioners
 - 8148 : 2003 - Specification for packaged air conditioners
 - 4591 : 1968 - Code of practice for installation and maintenance of escalators
 - 14671 : 1999 - Hydraulic lifts
 - 14665 : 2000 - Traction lift
 - 15259 : 2002 - Home Lifts
 - 15330 : 2003 - Lifts for handicapped persons; IS codes for Fire Services