Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR543	HVAC Systems	3	0	0	3

Course Objective

This course aims to impart fundamental understanding about heating, ventilation and air-conditioning in buildings. Basic principles of thermodynamics and air-conditioning are covered with a specific orientation towards human comfort. The course enables the student to calculate and estimate the heating or cooling load of a building and design the air-conditioning system in an effective manner. Different types of air-conditioning systems and ducting systems are also taught in the course.

Anticipated Learning Outcomes:

Ability to workout HVAC loads and space requirements for equipment; interpret and depict fire safety requirements in design & drawings, estimate lift numbers and lobby sizes, incorporate parking systems in project planning.

Module 1 Definitions and laws

Definition and Units of Thermodynamic quantities - Heat (Specific heat and Latent heat), Pressure (Absolute, Gauge and Atmospheric Pressure), Absolute Temperature (Scales and measurement). PH diagram of water to understand Latent heat, Sensible heat, Superheat and Enthalpy, Degree of Superheat and Dryness Fraction.

Laws of Thermodynamics with respect to refrigerators and heat pumps, COP and EER of HVAC systems. Working principle of a Vapour Compression Refrigeration system with schematics and TS diagram. Application, Properties and Dupont Nomenclature of refrigerants.

Module 2 Air conditioning principles

Heat Gains in Building Systems – Thermal Conductivity and U value of Building Materials. Conductive heat transfer through composite walls and pipes. Solar Heat Gain through Fenestration systems. Numerical.

Sensible and Latent Gains, Humidification and Dehumidification, Thermal comfort conditions and Comfort Chart.

	Classification, Principle, construction and working of Summer and Winter Air-conditioning systems. Cooling load calculations. Numerical using Psychrometric chart.
Module 3 **Heating systems**	Space Heating: Conventional and Unconventional Heating systems, Radiant panel and Hydronic Heating systems. Passive heating and cooling techniques, green heating systems.
Module 4 **Cooling systems**	Air Distribution Systems – Natural and Mechanical ventilation systems, Supply, Return and Recirculation Ducts. Indoor air quality and Air Filters. Thermostats and Humidistat. Centrifugal blowers and Exhausters. Different types of air-conditioning systems. Window, split, ductable AC, etc. Introduction to central air conditioning systems. Understanding 2 pipe and 4 Pipe CV and VAV systems. Chilled Air and Water systems, Spatial requirement of HVAC plants and duct layout.
Module 5	Design of Air-conditioning system for a building as decided by the subject teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Bovay, H. E. (1981). Handbook of Mechanical and Electrical systems for Buildings. McGraw-Hill Higher Education.*
2. *Sawhney, G. S. (2006). Fundamentals of Mechanical Engineering: Thermodynamics, Mechanics and Strength of Materials. New Delhi: Prentice Hall of India.*
3. *Willim, J. McG. (1971). Mechanical and Electrical Equipment for Buildings.*
4. *Ambrose, E.R. (1968). Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.*
5. *Handbook for Building Engineers in Metric systems (1968), NBC, New Delhi.*
6. *William H. Severns and Julian R. Fellows. Air conditioning and refrigeration. John Wiley and sons, London*
7. *Khurmi, Gupta and Arora. Refrigeration and Air Conditioning, S Chand and Co.*