Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER (Arrear) EXAMINATIONS, Nov / Dec 2024

Mechanical Engineering

Semester – VI (Regulation 2019)

ME5003 Refrigeration and Air Conditioning
(Professional Elective)

(Use of Steam tables, Refrigerants tables / chart and Psychrometric chart permitted)

Time: 3hrs Max. Marks: 100

CO 1	Understand different types of refrigerant, their properties, and select appropriate refrigerant for a HVAC system.
CO 2	Classify different types of compressor and evaporator systems.
CO 3	Adopt appropriate psychrometric processes and arrive at the heat load for a system.
CO 4	Describe types of air-conditioning system and air distribution configurations.
CO 5	Understand various non-conventional refrigeration systems, and adopt suitable instrumentation / control, safety in HVAC systems

BL – Bloom's Taxonomy Levels (L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Mks/CO/BL
1	Differentiate heat pump and refrigerator?	2/1/L1
2	What is meant by Total Equivalent Warming Index (TEWI)?	2/1/L2
3	Mention few expansion valves used in refrigeration system?	2/2/L1
4	What are cascade refrigeration system?	2/2/L2
5	What is comfort air-conditioning?	2/3/L1
6	Define Room Sensible Heat Factor.	2/3/L2
7	What is UFAD systems?	2/4/L1
8	What are the components present in AHU?	2/4/L2
9	Mention few applications of thermoelectric refrigeration systems.	2/5/L1
10	What is meant by green buildings?	2/5/L2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Mks/CO/BL
11 (a)	Discuss important thermodynamic and environmental properties required for an ideal refrigerant.	13/1/L3
	OR	
11 (b)	Discuss the applications of air-conditioning and refrigeration in various engineering field.	13/1/L3

12 (a)	Discuss about the types of compressors used in refrigeration industry.	13/2/L3
	OR	
12 (b)	Refrigerant R134a enters the compressor of a refrigerator as superheated vapour at 0.14 MPa and -12°C at a rate of 0.076 kg/s and leaves at 1 MPa and 70°C. The refrigerant is cooled in the condenser to 36°C and 1 MPa and is throttled to 0.15 MPa. Ignoring any heat transfer and pressure drop in the connecting lines between the components, determine the following: (a) The rate of heat removal from the refrigerated space (b) The power input to the compressor (c) The isentropic efficiency of the compressor (d) The coefficient of performance.	13/2/L3
13 (a)	Discuss the various loads considered in cooling load estimation of an air conditioning buildings.	13/3/L3
	OR	
13 (b)	Discuss the following psychrometric process. (i) Cooling and dehumidification process. (ii) Heating and humidification process.	13/3/L3
14 (a)	Compare the salient features of unitary, package and central air conditioning systems.	13/4/L3
	OR	
14 (b)	Discuss the concept of heat recovery systems.	13/4/L3
15 (a)	Discuss the working principle vapour absorption refrigeration system.	13/5/L3
	OR	
15 (b)	Discuss the salient features of vortex tube refrigeration system.	13/5/L3

PART- C (1 x 15 = 15 Marks)

Q. No	Questions	Marks/ CO/BL
16.	A summer air-conditioning system for a small office building is to be designed. The design is to be based on the following information: Outside design condition: 35°C Tdb, 28°C Twb Inside design condition: 26°C Tdb, 50% RH Room sensible heat gain: 45 kW Room latent heat gain: 9 kW Ventilation air: 0.95 m3/s A four-row direct-expansion refrigerant 134a coil with bypass factor of 0.2 will be used. Analyze the problem on a psychrometric chart and determine the following: (a) The room apparatus dew point (ADP) (b) The temperature of the air leaving the coil (c) The total quantity of air required (m^3/s) (d) The temperature of mixed air entering the coil (e) The coil apparatus dew point (ADP) temperature.	15/2/L4