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BTECH
(SEM VI) THEORY EXAMINATION 2024-25
REFRIGERATION AND AIR CONDITIONING

TIME: 3 HRS**M.MARKS: 100****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

Q No.	Question	CO	Level
a.	Define refrigeration effect and unit of refrigeration.	1	K2
b.	Explain the term Coefficient of Performance (COP) for a refrigerator.	1	K2
c.	Describe the purpose of intercooling in a multistage vapour compression system.	2	K2
d.	Differentiate between open and closed air refrigeration cycles.	3	K2
e.	What is the role of an expansion device in a vapour compression system?	2	K2
f.	List two desirable properties of a refrigerant.	3	K2
g.	Define psychrometric ratio and its significance in air conditioning.	4	K2
h.	Explain the term Sensible Heat Factor (SHF) in air conditioning.	4	K2
i.	What is the working principle of a vapour absorption refrigeration system?	3	K2
j.	Name two applications of refrigeration systems in industry.	5	K2

SECTION B**2. Attempt any three of the following: 10 x 3 = 30**

Q No.	Question	CO	Level
a.	Explain the working of a Bell Coleman air refrigeration cycle with a neat sketch. Discuss its advantages and limitations.	3	K2
b.	Describe the construction and working of a simple vapour compression refrigeration cycle. Use a T-S diagram to illustrate the process.	2	K2
c.	Explain the ammonia-water vapour absorption refrigeration system with a diagram. Compare it with a vapour compression system.	3	K2
d.	Discuss the psychrometric chart and explain any three psychrometric processes with their representation on the chart.	4	K3
e.	Calculate Capacity, Indicated power and C.O.P of a simple NH ₃ vapour compression system has compressor with piston displacement of 2 m ³ /min, a condenser pressure of 12 bar and evaporator pressure of 2.5 bar. The liquids is sub-cooled to 20°C by soldering the liquid line to suction line. The temperature of vapour leaving the compressor is 100°C, heat rejected to compressor cooling water is 5000 kJ/hour, and volumetric efficiency of compressor is 0.8.	5	K3

SECTION C**3. Attempt any one part of the following: 10 x 1 = 10**

Q No.	Question	CO	Level
a.	Analyze the effect of superheating and subcooling on the COP of a vapour compression refrigeration cycle using a P-H diagram.	6	K4
b.	A simple evaporative air refrigeration system is used for an aeroplane to take 20 tonnes of refrigeration load. The ambient air conditions are 20°C and 0.9 bar. The ambient air is rammed isentropically to a pressure of 1 bar. The air leaving the main compressor at pressure 3.5 bar is first cooled in the heat exchanger having effectiveness of 0.6 and then in the evaporator where its temperature is reduced by 5°C. The air from the evaporator is passed through	3	K4



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M.MARKS: 100

	the cooling turbine and then it is supplied to the cabin which is to be maintained at a temperature of 25°C and at a pressure of 1.05 bar. If the internal efficiency of the compressor is 80% and that of cooling turbine is 75%, determine: (i) Mass of air bled off the main compressor; (ii) Power required for the refrigerating system; and (iii) C.O.P. of the refrigerating system.		
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4. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Apply the first law of thermodynamics to analyze the energy balance in a vapour absorption refrigeration system.	4	K3
b.	Discuss the classification of refrigerants and explain the environmental considerations (ozone depletion and global warming) for selecting refrigerants.	3	K2

5. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Calculate the cooling load for a room with given dimensions, considering heat transfer through walls, infiltration, and internal heat gains. Assume suitable data.	5	K3
b.	The following data refer to air conditioning of a public hall: Outdoor conditions = 40°C DBT, 20°C WBT Required comfort conditions = 20°C DBT, 50% RH Seating capacity of hall = 1000 Amount of outdoor air supplied = 0.3 m ³ /min/person If the required condition is achieved first by adiabatic humidifying and then cooling, find: 1. The capacity of the cooling coil and surface temperature of the coil if the by-pass factor is 0.25; and 2. The capacity of the humidifier and its efficiency.	2	K4

6. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Analyze the effect of evaporator and condenser pressure changes on the performance of a vapour compression refrigeration system.	6	K4
b.	Discuss the construction and working of a cooling tower in an air conditioning system.	2	K2

7. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Draw the temperature-entropy and enthalpy-entropy diagram of a steam jet refrigeration system and write the expressions for the following efficiencies: i. Nozzle efficiency; ii. Entrainment efficiency; and iii. Compression efficiency.	6	K3
b.	Discuss the application of refrigeration in food preservation and transport refrigeration, highlighting key design considerations.	5	K2