

Code: ME6T4

**III B.Tech - II Semester – Regular/Supplementary Examinations
March 2020**

**REFRIGERATION AND AIR CONDITIONING
(MECHANICAL ENGINEERING)**

Note: Refrigerant and Psychrometric Properties data books are allowed.

Duration: 3 hours

Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1.

- a) Define COP and Ton of refrigeration.
- b) What are the advantages of Air refrigeration system.
- c) List out any three causes for the need of air craft air conditioning.
- d) Show simple vapour compression refrigeration cycle on T-s and P-h diagrams.
- e) What type of expansion device is used in home refrigerators? Why?
- f) State the applications of Vortex tube.
- g) List out three fluids used in Electrolux vapour absorption system.
- h) Define the terms Relative humidity and Degree of saturation.
- i) What is the need of ventilation in Air conditioning?
- j) List out any four sources of heat in the air conditioned space.
- k) Give the comfort conditions for human beings in both summer and winter seasons.

PART – B

Answer any *THREE* questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Explain different applications of refrigeration in detail.

4 M

b) A cold storage plant is required to store 20 tonnes of fish.

The fish is supplied at a temperature of 30°C . The specific heat of fish above freezing point is 2.93 kJ/kgK . The specific heat of fish below freezing point is 1.26 kJ/kgK .

The fish is stored in cold storage which is maintained at -8°C . The freezing point of fish is -4°C . The latent heat of fish is 235 kJ/kg . If the plant requires 75 kW to drive it,

Find: (i) The capacity of the plant and (ii) Time taken to achieve cooling. Assume actual COP of the plant as 0.3 that of Carnot COP.

8 M

c) Explain briefly about simple air craft refrigeration system with the help of a neat sketch.

4 M

3. a) Explain how the COP of vapour compression refrigeration system varies with the following parameters (i) Suction pressure (ii) Deliver pressure (iii) Sub-cooling of the refrigerant (iv) Superheating of the refrigerant.

6 M

b) An ammonia refrigerator produces 30 tonnes of ice from and at 0°C in 24 hours. The temperature range of the

compressor is from 25°C to -15°C . The vapour is dry saturated at the end of compression and an expansion valve is used. Assume a coefficient of performance to be 60% of the theoretical value. Calculate the power required to drive the compressor. Latent heat of ice = 335 kJ/kg . Properties of ammonia are: 10 M

Temperature, $^{\circ}\text{C}$	Enthalpy, kJ/kg		Entropy, kJ/kg	
	Liquid	Vapour	Liquid	Vapour
25	298.9	1465.84	1.1242	5.0391
-15	112.34	1426.54	0.4572	5.5490

4. a) Explain the working of Vapour Absorption refrigeration system with the help of a neat sketch and also derive expression for its Coefficient of Performance. 8 M
- b) Define the following terms connected with steam jet refrigeration system (i) Nozzle efficiency (ii) Entrainment efficiency. 4 M
- c) Explain the principle of Thermoelectric refrigeration system and give its advantages. 4 M
5. a) Can you explain how the following Psychrometric processes can be achieved? Show them on Psychrometric chart also. (i) Cooling and dehumidification (ii) Heating and humidification. 6 M

b) 20 m^3 of air per minute at 30°C and 60% RH is cooled to 22°C DBT maintaining specific humidity constant. Find the following (i) Heat removed from air (ii) RH of cooled air (iii) WBT of the cooled air. Take air pressure = 1 bar.

6 M

c) Define the following terms (i) GSHF (ii) ESHF 4 M

6. a) What is Effective temperature? Explain the factors affecting effective temperature in detail. Draw comfort chart. 4 M

b) An office is to be air conditioned for staff of 25 when the outdoor conditions are 29°C DBT and 73% RH. If the quantity of outdoor air supplied is $0.5 \text{ m}^3/\text{min}/\text{person}$, find the capacity of the cooling coil in Tonnes of refrigeration and capacity of the heating coil in kW. Also find the amount of water removed if the required comfort conditions are 21°C DBT and 59% RH. Air is conditioned first by cooling and dehumidifying and then by heating.

8 M

c) What is the difference between Refrigerator and Heat pump? Show them with simplified sketches. Also show that $\text{COP}_{\text{HP}} = \text{COP}_{\text{REF}} + 1$. 4 M