

Code: ME6T4

III B.Tech-II Semester–Regular/Supplementary Examinations–March 2019

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

Duration: 3 hours

Max. Marks: 70

PART – A

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

11x 2 = 22 M

1.

- a) Represent reversed Brayton cycle on p - V and T - s charts.
- b) Define one ton of refrigeration.
- c) Write the effect of sub-cooling on COP of a VCR system.
- d) What are the desirable properties of refrigerants?
- e) Write the difference between capillary tube and expansion device.
- f) What are the limitations of steam jet refrigeration over conventional refrigeration systems?
- g) What is Peltier effect?
- h) Show sensible cooling, heating and humidification processes on psychrometric charts.
- i) Show the calculation of RSHF using psychrometric chart.
- j) Write the effect of oxygen supply on human comfort in air-conditioning systems.
- k) How would you differentiate between Summer Airconditioning and Winter Airconditioning.

PART – B

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

3 x 16 = 48 M

2. a) Explain the working of Bell Coleman refrigeration system with neat diagram. Also represent the cycle on T-s and p-H chart. 8 M
- b) A refrigeration system of 20 TOR capacity is designed for an air-craft when the surrounding temperature is 15°C. The pressure and temperature of air after ramming are 0.94 bar and 30°C. The rammed air is further compressed in the main compressor to 4.5 bar and then cooled in the heat exchanger to 64°C and then expanded in a cooling turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at 25°C. Assuming $\eta_r = 98\%$, $\eta_e = 90\%$, $\eta_c = 88\%$. Calculate (i) The mass of air circulated in the cabin/min, (ii) COP of the system. 8 M
3. a) An ammonia VCR refrigerator operates between -15°C to 40°C. The vapour is dry and saturated at the entry to the compressor and compression is isentropic. Assuming there is 5°C of undercooling, calculate (i) Mass flow rate and power input per kW of refrigeration and (ii) COP of the system. 8 M
- b) Explain the working of (i) Flooded evaporator, (ii) Natural convection evaporator with neat sketches. 8 M

4. a) Explain the working of Electrolux refrigerator with a neat sketch. 8 M
- b) With a neat sketch explain the working of Vortex tube to produce refrigeration effect. 8 M
5. a) 125 m^3 of air/min at 40°C DBT and 55% R.H is cooled to 25°C DBT by passing over a cooling coil. Calculate the following:
- i. R.H and WBT of out coming air,
 - ii. Capacity of the cooling coil in TOR, and
 - iii. Amount of water vapour removed from air. 8 M
- b) Explain the procedure to calculate GSHF using psychrometric chart. 8 M
6. a) In air-conditioning what are the various human comfort conditions? Explain. 8 M
- b) Air handling system of an air-conditioned plant supplies total $540 \text{ m}^3/\text{min}$ of dry air which contains 25% of fresh air at 40°C DBT and 27°C WBT and the condition of recirculated air is 25°C DBT and 50% R.H. The air comes out of cooling coil at 15°C saturated condition. Calculate (i) Total cooling load on the coil and (ii) Room heat gain. 8 M