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**B TECH****(SEM VI) THEORY EXAMINATION 2018-19  
REFRIGERATION & AIR CONDITIONING****Time: 3 Hours****Total Marks: 70**

Note: Attempt all sections. If require any missing data; then choose suitably. Use of refrigeration tables and psychrometric charts and steam tables is permitted.

**SECTION-A****1. Attempt all questions in brief. (2x7=14)**

- What do mean by one tonne of refrigeration?
- Define COP.
- Classify refrigerants.
- Define GSHP and ADP.
- What is the function of expansion device?
- What do you mean by bypass factor?
- Define cascade system applied to vapour compression system.

**SECTION-B****2. Attempt any three of the following: (7x3=21)**

- A cold storage is to be maintained at  $-5^{\circ}\text{C}$  while the surroundings are at  $35^{\circ}\text{C}$ . The heat leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual COP of the refrigeration plant is one-third of an ideal plant working between the same temperatures. Find the power required to drive the plant.
- What is the significance of multistage vapour compression system? Also explain the function liquid intercooler in multistage compression system.
- Draw a neat diagram of lithium bromide water absorption system and explain its working. List the major field of applications of this system.
- The readings from a sling psychrometer are as follows: Dry bulb temperature =  $30^{\circ}\text{C}$ ; Wet bulb temperature =  $20^{\circ}\text{C}$ ; Barometer reading = 740 mm of Hg. Determine:
  - Dew point temperature.
  - Relative humidity.
  - Specific humidity.
  - Degree of saturation.
  - Vapour density.
  - Enthalpy of mixture per kg of dry air.
- Explain the working of Cold storage with neat sketch.

**SECTION-C****3. Attempt any one part of the following: (7x1=7)**

- The cock pit of a jet plane flying at a speed of 1200 km/h is to be cooled by a simple air cooling system. The cock pit is to be maintained at  $25^{\circ}\text{C}$  and the pressure in the cock pit is 1 bar. The ambient air pressure and temperature are 0.85 bar and  $30^{\circ}\text{C}$ . The other data available is as follows: Cock-pit cooling load = 10 TR; Main compressor pressure ratio = 4; Ram efficiency = 90%; Temperature of air leaving the heat exchanger and entering the cooling turbine =  $60^{\circ}\text{C}$ ; pressure drop in the heat exchanger = 0.5 bars; Pressure loss between the cooler turbine and cock pit = 0.2 bar. Assuming the isentropic efficiencies of main compressor and cooler turbine as 80%, find the quantity of air passed through the cooling turbine and C. O.P. of the system. Take  $\gamma = 1.4$  and  $C_p = 1 \text{ kJ/kg K}$ .
- Explain, with a neat sketch, the working principle of boot-strap type of air refrigeration system with T-S diagram.



- 4. Attempt any one part of the following: (7x1=7)**
- Discuss the effect of change in Suction and discharge pressure in vapour compression refrigeration system?
  - In a 15 TR ammonia plant, compression is carried out in two stages with water inter-cooling and flash inter-cooling and water sub-cooling. The particulars of the plant are as follows: Condenser pressure = 12 bar, Evaporator pressure = 3 bar, Flash intercooler pressure = 6 bar, limiting temperature for inter-cooling and sub-cooling = 20°C. Draw the cycle on p-h chart and estimate (a) the coefficient of performance of the plant, (b) the power required for each compressor, (c) the swept volume for each compressor if the volumetric efficiency of both the compressors is 80%.
- 5. Attempt any one part of the following: (7x1=7)**
- In an absorption type refrigerator, the heat is supplied to NH<sub>3</sub> generator by condensing steam at 2 bar and 90% dry. The temperature in the refrigerator is to be maintained at -5° C. Find the maximum C.O.P. possible, if the refrigeration load is 20 tonnes and actual C.O.P. is 70% of the maximum C.O.P, find the mass of steam required per hour. Take temperature of the atmosphere as 30° C.
  - Define between primary and secondary refrigerant. Give the refrigerant number for the following: CHClF<sub>2</sub>, CH<sub>2</sub>F-CF<sub>3</sub>, and NH<sub>3</sub>.
- 6. Attempt any one part of the following: (7x1=7)**
- What is the basic difference between the requirements for Comfort and Industrial air conditioning? Explain in brief, the factor affecting Comfort air conditioning.
  - Discuss thermal analysis of human body.
- 7. Attempt any one part of the following: (7x1=7)**
- What is the function of Cold storages and what is their importance in today's life? 2000 tonnes of potato are available at a temperature of 30 °C. It has to be preserved in a cold storage at a temperature of 2°C. How much refrigeration is necessary? If this refrigeration is to be obtained in 3 days, what should be the capacity of the plant?
  - Explain the working of ice manufacturing in ice manufacturing plant.