

B. TECH.
(SEM VI) THEORY EXAMINATION 2022-23
REFRIGERATION AND AIR CONDITIONING

Time: 3 Hours

Total Marks: 70

- Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.
 2. Use of Psychrometric Chart is allowed.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

- (a) Define Refrigeration Effect and C.O.P.
- (b) Differentiate Open and Close Air Refrigeration System.
- (c) Draw P-H and T-S diagrams for Vapour Compression Refrigeration system when refrigerant is dry and saturated after compression.
- (d) Designate the refrigerant numbers to Trichlorofluoro methane & Dichloro difluoro methane.
- (e) Write down the advantages and disadvantage of LiBr-Water Vapour Absorption Refrigeration System.
- (f) Define Dry Bulb, Wet Bulb and Dew Point Temperatures.
- (g) Classify expansion devices used in Vapour Refrigeration System.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

- (a) Explain the working of Bell-Coleman Air Refrigeration System with diagrams.
- (b) Explain the effect of following on the performance of Vapour Compression Refrigeration System:
 - (i) Super heating of refrigerant before compression
 - (ii) Sub-cooling of refrigerant before expansion.
 - (iii) Effect of discharge pressure.
- (c) Sketch and explain the working of Three fluid Vapour Absorption Refrigeration System (Electrolux Refrigerator)
- (d) An air conditioning plant is required to supply 60 m³ of air per minute at a DBT of 21°C and 55% RH. The outside air is at DBT of 28°C and 60% RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air condition plant first to dehumidify and then to cool the air.
- (e) What is the basic difference between the requirements for Comfort and Industrial air conditioning? Explain in brief, the factors affecting Comfort air conditioning.

SECTION C

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

- (a) An air refrigeration open system operating between 1 MPa and 100 kPa is required to produce a cooling effect of 2000 kJ/min. Temperature of the air leaving the cold chamber is – 5°C and at leaving the cooler is 30°C. Determine:
 - (i) Mass of air circulated per min.
 - (ii) Compressor work, expander work, cycle work
 - (iii) COP and power in kW required.

- (b) Explain Evaporative air refrigeration system with the help of schematic diagram and T-S diagram and write down equation for coefficient of performance.
4. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) A refrigerator operating on standard vapour compression cycle has a coefficient of performance of 6.5 and is driven by a 50 kW compressor. The enthalpies of saturated liquid and saturated vapour refrigerant at the operating condensing temperature of 35°C are 62.55 kJ/kg and 201.45 kJ/kg respectively. The saturated refrigerant vapour leaving evaporator has an enthalpy of 187.53 kJ/kg. Find the refrigerant temperature at compressor discharge. The C_p of refrigerant vapour may be taken to be 0.6155 kJ/kg°C.
- (b) Explain a two stage compression with water inter-cooler and sub cooler.
5. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) Derive the C.O.P. of Vapor absorption Refrigeration system.
In vapour absorption system, heating, cooling and refrigeration take place at the temperatures of 100 °C, 20°C and -5 °C respectively. Find the maximum C.O.P. of the system.
- (b) Define and classify refrigerants. Also write down the desirable properties of an ideal refrigerant.
6. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) With the help of Psychrometric chart, illustrate following processes:
(i) Sensible heating and sensible cooling processes.
(ii) Cooling and dehumidification process.
(iii) Heating and humidification process.
- (b) The atmospheric air at 30°C DBT and 75% RH enters a cooling coil at the rate of 200 m³/min. The coil dew point temperature is 14°C and BPF of the coil is 0.1.
Determine the
(i) Temperature of the air leaving the cooling coil,
(ii) The capacity of the cooling coil in TR and KW,
(iii) The amount of water vapours removed per min and
(iv) Sensible heat factor for the process.
7. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) A rectangular duct section of 500 X 350 mm² size carries 75 m³/min of air having density of 1.15 kg/m³. Determine the equivalent diameter of a circular duct if (a) the quantity of air carried in both the cases is same; (b) the velocity of the air in both the cases is same.
If $f=0.01$ for sheet metal, find the pressure loss per 100 m length duct.
- (b) Explain the working of ice manufacturing in ice manufacturing plant.