PAPER ID-410312

Subject Code: KME601

Roll No: | | | | | | | | | | | | | |

**BTECH**
**(SEM VI) THEORY EXAMINATION 2023-24**
**REFRIGERATION AND AIR CONDITIONING**

**TIME: 3 HRS** **M.MARKS: 100**

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt *all* questions in brief.**

| | | |
|---|---|---|
| a. | Define the terms refrigerating effect and COP. | 02 |
| b. | Compute the COP range for the refrigerator and heat pump during a thermodynamiccycle. | 02 |
| c. | COP of vapour compression cycle is higher than COP of air-refrigeration cycle. Summarize your answer. | 02 |
| d. | What is sub-cooling and superheating in VCRS? | 02 |
| e. | Name the components of VAR system that performs the same function as that of compressor in VCR system | 02 |
| f. | What type of compressor is preferred with refrigerant R-113 ? | 02 |
| g. | What do you understand by apparatus dew point (ADP)? | 02 |
| h. | Define sensible heat factor (SHF) and bypass factor (BPF). | 02 |
| i. | What is a hermetically sealed compressor? | 02 |
| j. | What do you understand by cooling tower | 02 |

**SECTION B**

**2.Attempt any *three* of the following:**

| | | |
|---|---|---|
| a. | A machine working on a Camot cycle operates between 305 K and 260 K Determine the C.O.P. when it is operand as: 1. a refrigerating machine; 2. a heat pump; and 3. a heat engine. | 10 |
| b. | How does the actual VCR cycle differ from the ideal VCR? Plot the actual VCR on p-h and T-s diagram andexplain the associated losses. | 10 |
| c. | In an absorption type refrigerator, the heat is supplied to $NH_3$ generator bycondensing 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.,findthe mass of steam required per hour. Take the temperature of the atmosphere as 30° C | 10 |
| d. | Air at l0°C DBT and 90% RH is to be brought to 35°C DBT and 22.5°C WBT with the help of winter air conditioner. If the humidified air comes out of the humidifier at 90% RH, draw the various processes involved on a skeleton psychrometric chart and find : 1. the temperature to which the air should be preheated, and 2. the efficiency of the air-washer | 10 |
| e. | Explain the applications of refrigeration for food preservation. Explain how refrigeration controls the spoilage of food. | 10 |

**SECTION C**

**3. Attempt any *one* part of the following:**

| | | |
|---|---|---|
| a. | Enumerate the classification of refrigeration systems and differentiate between a simple aircraft refrigeration system and a bootstrap refrigerationsystem. Comparethe variousair-cooling systems used for aircraft on the basis of DART. | 10 |
| b. | Derive an expression for COP of an air refrigerator working on Bell-Coleman | 10 |

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| | | |
|---|---|---|
| | cycle, if the compression and expansion processes take place according to the law $pv^n$ = constant. | |

**4.Attempt any *one* part of the following:**

| | | |
|---|---|---|
| a. | In an ammonia vapour compression system, the pressure in the evaporator is 2 bar. Ammonia at exit is 0. 85 dry and at entry its dryness fraction is 0.19. During compression., the work done per kg of ammonia is 150 kJ. Calculate the C.O.P. and the volume of vapourentering the compressor per minute, if the rate of ammonia circulation is 4.5 kg/min. The latent heat and specific volume at 2 bar are 1325 kJ/kg and 0.58 $m^3$/kg respectively. | 10 |
| b. | Derive the expression for C.O.P. of a refrigerating system consisting of three evaporators at the sametemperature with a single compressorandexpansion valve. | 10 |

**5.Attempt any *one* part of the following:**

| | | |
|---|---|---|
| a. | What is the basic function of a compressor in vapour compression refrigeration system? How this function is achieved in vapour absorption refrigeration system? | 10 |
| b. | Differentiate between physical and thermodynamic properties of a refrigerant. Explain which are more important giving specific examples. | 10 |

**6.Attempt any *one* part of the following:**

| | | |
|---|---|---|
| a. | An air conditioning plant is required to supply 60 $mm^3$ of air per minute at a DBT of 21ºC and 55% RH. The outside air is at DBTof 28°C and 60% RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then to cool the air. | 10 |
| b. | The amount of air supplied to an air conditioned hall is 300 $m^3$ /min. Theatmospheric conditions are 35°C DBT and 55% RH. The required conditions are 20°C DBT and 60% RH. Find out the sensible heat and latent heat removed from the air per minute. Also find a sensible heat factor for the system. | 10 |

**7.Attempt any *one* part of the following:**

| | | |
|---|---|---|
| a. | Write short notes on frictional losses and dynamic losses in flow through a duct. Write the expression for frictional pressure drop in ducts with proper nomenclature | 10 |
| b. | Explain in Brief about<br>**a.** Steam jet refrigeration system, **b**.Magnetic refrigeration system | 10 |