

Code No: RT32037A

R13

SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April - 2018
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours

Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)

2. Answering the question in **Part-A** is compulsory

3. Answer any **THREE** Questions from **Part-B**

(Refrigeration and Psychrometric tables and charts allowed)

PART -A

- 1 a) Explain the term “ton of refrigeration”. [4M]
- b) Explain the effect of sub-cooling in vapour compression refrigeration system [4M]
- c) What is purpose of condenser in vapour compression system? [3M]
- d) What are the refrigerant and absorbent in Li-Br and water absorption system? [4M]
- e) List psychometric properties of air. [3M]
- f) What is the function of a humidifier? [4M]

PART -B

- 2 a) A Bell-Coleman refrigerator operates between pressure limits of 1 bar and 8 bar. Air is drawn from the cold chamber at 9°C, Compressed and then it is cooled to 29°C before entering the expansion cylinder. Expansion and compression follows the law $PV^{1.35} = \text{constant}$. Calculate the theoretical COP of the system. For air take $\gamma = 1.4$, $C_p = 1.003 \text{ kJ/kg.K}$. [8M]
- b) With a neat sketch explain the working of Bell-Coleman cycle and derive the expression for its COP [8M]
- 3 An ammonia ice plant operates between condenser temperature of 35°C and an evaporator temperature of -15°C. It produces 5 tonnes of ice per day from water at 25°C to ice at -5°C. The ammonia enters as dry saturated vapor and leaves the condenser as saturated liquid. Determine: [16M]
 - (i) The capacity of the refrigerating plant
 - (ii) Mass flow of the refrigerant
 - (iii) Discharge temperature of ammonia from the compressor
 - (iv) Power of the compressor motor if the isentropic efficiency of the compressor is 85% and mechanical efficiency of the compressor is 90%
 - (v) Relative efficiency. The latent heat of formation of ice is 335 kJ / kg and specific heat of ice is 2.1 kJ / kg-k.
- 4 a) Classify the Evaporators used in refrigeration system and explain the working of flooded type Evaporator with a neat diagram. [8M]
- b) List the commonly used refrigerants in practice and explain in detail desirable chemical properties of refrigerants. [8M]

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- 5 a) Draw the T-s and h-s diagrams representing steam jet refrigeration system. [8M]
b) Explain with help of neat sketches, vapour absorption cycle for refrigeration. How is it different from vapour compression refrigeration system. [8M]
- 6 a) Sketch the psychrometric chart and represent the different psychrometric properties on the same. [8M]
b) What is comfort air-conditioning? Draw a rough comfort chart. [8M]
- 7 a) Explain any two types of humidifiers. [8M]
b) Explain the principle of various dehumidification methods. [8M]

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R13**SET - 2**

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(Refrigeration and Psychrometric tables and charts allowed)

PART -A

- | | | | |
|---|----|---|------|
| 1 | a) | If in an air refrigeration plant, the temperatures of air entering and leaving the expander are 300K and 200K respectively, determine the COP of the plant assuming isentropic compression and expansion. | [4M] |
| | b) | List out the components of vapour compression refrigeration system and which component of the vapour compression Refrigeration system produces the refrigeration effect | [3M] |
| | c) | List the different types of expansion devices. | [3M] |
| | d) | What is the function of an absorber in an vapour absorption system. | [4M] |
| | e) | Write a short note on by-pass factor for cooling coils. | [4M] |
| | f) | What is the difference between fan and blower in air conditioning system. | [4M] |

PART -B

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|---|----|--|-------|
| 2 | a) | Explain Air refrigeration system working on Bell-Coleman cycle with P-V and T-S diagrams. | [8M] |
| | b) | An aircraft is cruising with a speed of 900 kmph at an altitude of 11,000 metre where the ambient conditions are 0.3 bar and -30°C. Assuming the compression ratio 5, cabin pressure 0.8 bar and air leaving the cabin at 27°C, obtain the power for pressurization and refrigeration and COP. The flow rate through the system is 1.0 kg/s. | [8M] |
| 3 | a) | Explain the effect of sub cooling and superheating on the performance of vapour compression refrigeration system. | [8M] |
| | b) | Explain with a flow diagram, the working of vapour absorption refrigeration system. | [8M] |
| 4 | a) | What are the advantages of thermostatic expansion valve? Describe its operation. | [8M] |
| | b) | Discuss why CFC refrigerants needs to be phased out. | [8M] |
| 5 | a) | Explain working principle and components of thermo electric refrigerating system. | [8M] |
| | b) | Explain, with the help of a neat diagram, the working of Ammonia-Water absorption system. | [8M] |
| 6 | a) | Calculate the following when the DBT is 35°C, WBT is 23°C and the barometer reads 750mm Hg: (i) Relative humidity (ii) Humidity ratio (iii) DPT (iv) Density (v) Enthalpy of atmospheric air | [8M] |
| | b) | Briefly explain the requirements of comfort air conditioning | [8M] |
| 7 | | What are the different types of fans used in air-conditioning systems? Discuss their applications with their relative advantages and disadvantages. | [16M] |



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SET - 3

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(Mechanical Engineering)

Time: 3 hours

Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. Answering the question in **Part-A** is compulsory3. Answer any **THREE** Questions from **Part-B**

(Refrigeration and Psychrometric tables and charts allowed)

PART -A

- 1 a) What is the formula for the COP of an air refrigeration cycle? [3M]
- b) What is the effect of super heating of vapor on the COP? [4M]
- c) Explain the designation of refrigerant with an example. [4M]
- d) Write the advantages of vapour absorption refrigeration system [3M]
- e) Define sensible heat factor. [4M]
- f) What are the sources of heat for heat pumps? [4M]

PART -B

- 2 a) Derive the expression for COP of Carnot vapour compression refrigeration system. [8M]
- b) List the advantages and disadvantages of air refrigeration system. [8M]
- 3 a) A simple vapour compression plant produces 5 tonnes of refrigeration. The enthalpy values at inlet to compressor, at exit from the compressor and at exit from the condenser are 183.19, 209.41 and 74.59 kJ/kg respectively. Estimate: [8M]
i) The refrigerant flow rate ii) The C.O.P. iii) The power required to drive the compressor iv) The rate of heat rejection to the condenser
- b) Explain the effect of change in the following operating conditions on the performance of vapour compression refrigeration cycle using p-h chart. [8M]
i) Evaporator pressure ii) Condenser pressure
- 4 a) What are the different types of compressors? Mention the fields for the use of each in refrigeration systems giving reasons. [8M]
- b) Discuss the classification of refrigerants. [8M]
- 5 a) With a neat sketch explain the working principle of a three fluid vapour absorption refrigeration system. [8M]
- b) Explain the working of Vortex tube refrigerator. [8M]
- 6 In an air conditioning system air at a flow rate of 2 kg/s enters the cooling coil at 25°C and 50% RH and leaves the cooling coil at 11°C and 90% RH. The apparatus dew point of the cooling coil is 7°C. Find i) The required cooling capacity of the coil, [16M]
ii) Sensible Heat Factor for the process, and iii) By-pass factor of the cooling coil.
Assume the barometric pressure to be 1 atm. Assume the condensate water to leave the coil at ADP ($h_w = 29.26$ kJ/kg)
- 7 a) What do you understand by Grills and Registers? Explain any two factors which affect Grill performance. [8M]
- b) Describe the following psychrometric processes [8M]
i) cooling with dehumidification ii) cooling with adiabatic humidification



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Time: 3 hours

Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. Answering the question in **Part-A** is compulsory3. Answer any **THREE** Questions from **Part-B**

(Refrigeration and Psychrometric tables and charts allowed)**PART -A**

- 1 a) What are the processes of Air refrigeration cycle? [3M]
- b) Draw the vapour compression refrigeration cycle and indicate the processes. [4M]
- c) Give the classification of compressors. [3M]
- d) List the major disadvantages of steam jet refrigeration system. [4M]
- e) What is the purpose of ventilation in air-conditioning system? [4M]
- f) What is the difference between grill and register used in air conditioning system [4M]

PART -B

- 2 a) An air refrigeration open system operating between 1Mpa and 100kpa 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. Neglect losses and clearance in the compressor and expander. Determine: i) Mass of air circulated per minute
ii) Compressor work, expander work, cycle work iii) C.O.P and power in kW required [10M]
- b) Give a brief description of an ideal cycle of air refrigeration. [6M]
- 3 a) Distinguish between vapour compression refrigeration system and vapour absorption refrigeration system. [8M]
- b) A Freon 12 vapour compression system operating between -5°C and 50°C develops 15 TR. Determine i) mass flow rate of the refrigerant ii) piston displacement per ton iii) the Carnot COP and actual COP of the cycle. [8M]
- 4 a) Write a note on [8M]
i) Shell and tube condenser ii) Screw compressor.
- b) Suggest substitutes for CFC Refrigerants from the point of Ozone Depletion & Global Warming. [8M]
- 5 a) draw a compact diagram of Lithium bromide water absorption refrigeration system and explain its working [8M]
- b) Discuss the advantages of vapor absorption refrigeration system over vapor compression refrigeration system. [8M]
- 6 a) Atmospheric air having DBT=16°C and RH=25% is passed through a furnace and then through a humidifier to maintain a final DBT of 30°C and 50% R.H. Find the heat and moisture added to the air during the process. Also calculate the sensible heat factor of the process. [8M]
- b) What is meant by Effective temperature? List the factors governing optimum effective temperature. [8M]
- 7 Classify the heat pump circuits and explain air-air heat pump circuit with a neat diagram. [16M]

