

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023****Subject Code:2161908****Date:24-07-2023****Subject Name:Refrigeration and Air Conditioning****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Use of Refrigerant Tables with refrigerant charts and Steam Table is permissible.

|            |                                                                                                                                                                                                                                                                                                                                                                                                                    | MARKS     |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | (a) How is reversed Brayton cycle used for refrigeration?                                                                                                                                                                                                                                                                                                                                                          | <b>03</b> |
|            | (b) What is 1 Ton of refrigeration? What is coefficient of performance of refrigeration cycle?                                                                                                                                                                                                                                                                                                                     | <b>04</b> |
|            | (c) Explain in details the regenerative air refrigeration system. Derive an expression for its COP.                                                                                                                                                                                                                                                                                                                | <b>07</b> |
| <b>Q.2</b> | (a) List the different types of compressors. Specify the application of each in refrigeration systems.                                                                                                                                                                                                                                                                                                             | <b>03</b> |
|            | (b) What are the desirable properties of refrigerants? Mention some names of eco-friendly refrigerants.                                                                                                                                                                                                                                                                                                            | <b>04</b> |
|            | (c) A standard vapour compression refrigerator using R-12 as the refrigerant operates between the condenser pressure of 10 bar and the evaporator pressure of 1.5 bar. The evaporator absorbs 75 kJ/min of energy as heat and the vapour is dry saturated at exit from the compressor. Represent the cycle on T-s diagram and calculate: (a) flow rate of refrigerant (b) power consumed and (c) COP of the cycle. | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|            | (c) Explain the influence of evaporator temperature and condenser temperature on COP of the vapour compression refrigeration system. Which of the two temperatures has more influence on COP?                                                                                                                                                                                                                      | <b>07</b> |
| <b>Q.3</b> | (a) What is Dalton's law of partial pressure? How is it useful in calculations of psychrometric properties?                                                                                                                                                                                                                                                                                                        | <b>03</b> |
|            | (b) Explain with neat sketch the Cascade refrigeration system. Mention its applications.                                                                                                                                                                                                                                                                                                                           | <b>04</b> |
|            | (c) With neat sketch explain working of water-lithium bromide absorption system.                                                                                                                                                                                                                                                                                                                                   | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                                                                                                                                                                                                                          |           |
| <b>Q.3</b> | (a) Explain the working of automatic expansion valve. Will it work satisfactorily under changing load conditions?                                                                                                                                                                                                                                                                                                  | <b>03</b> |
|            | (b) State the functions of following components in a vapour absorption refrigeration system: (i) absorber (ii) rectifier (iii) analyzer (iv) heat exchanger.                                                                                                                                                                                                                                                       | <b>04</b> |
|            | (c) Establish the following expression for air-vapour mixture, Specific humidity (w)                                                                                                                                                                                                                                                                                                                               | <b>07</b> |
|            | $w = 0.622 \times \frac{p_v}{p - p_v}$                                                                                                                                                                                                                                                                                                                                                                             |           |
|            | where, $p_v$ is partial pressure of water vapour and                                                                                                                                                                                                                                                                                                                                                               |           |
|            | p is the barometric pressure                                                                                                                                                                                                                                                                                                                                                                                       |           |

- Q.4** (a) State the importance of indoor air quality in a building. **03**  
 (b) Which are the main factors affecting thermal comfort, and how can these be categorized? **04**  
 (c) Calculate, (i) relative humidity (ii) humidity ratio (iii) dew point temperature (iv) density (v) enthalpy of atmospheric air when the DBT is 35°C, WBT is 23°C and barometer reads 750 mm of Hg. **07**
- OR**
- Q.4** (a) How split air conditioners differ from windows air conditioners? Compare their functionalities. **03**  
 (b) Define the following terms as used in air distribution system: Grille, register, diffuser, throw and drop. **04**  
 (c) Briefly explain different sources of internal heat gain in an enclosed space. **07**
- Q.5** (a) With neat sketch explain thermostatic expansion valve and its working. **03**  
 (b) State the principle of air distribution system. What is an air handling system? **04**  
 (c) With neat sketch explain the packaged air conditioning system with its applications. **07**
- OR**
- Q.5** (a) Explain the concept of equivalent temperature differential. **03**  
 (b) What are hermitically sealed compressors? Point out their salient features. **04**  
 (c) Calculate the cooling load in kW (or TR) of your classroom of college assuming suitable data wherever required. **07**

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