Register No.:   ……………………………   Name:   …………………………………………………

# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (R), DECEMBER 2023**
**MECHANICAL ENGINEERING**
**(2020 SCHEME)**

**Course Code :**   **20MET471**

**Course Name:**   **Air Conditioning and Refrigeration**

**Max. Marks  :**   **100**                              **Duration: 3 Hours**

---

*Use of refrigeration data book, Psychrometric Chart and Steam Table are permitted*

---

## PART A
### *(Answer all questions. Each question carries 3 marks)*

1. Define COP of a refrigerator.
2. What are the applications of air refrigeration system?
3. Why is the COP of vapour compression refrigeration is significantly higher?
4. What might the refrigerant's possible states be before it enters the compressor, condenser, and expansion device?
5. List any three benefits of vapour absorption system.
6. How is the performance boosted in vapour absorption system?
7. How a cooling tower exchange heat with surroundings?
8. What are the desirable properties of an ideal refrigerant?
9. How does a car's windshield get fogged up? Explain the psychrometric term associated with this phenomenon as well.
10. Which type of air conditioning systems are employed in movie theatres?

## PART B
### *(Answer one full question from each module, each question carries 14 marks)*

### MODULE I

11. With the help of neat diagrams explain boot strap aircraft refrigeration system.   (14)

### OR

12. a) Explain the working of a reduced ambient air cooling system with the aid of a clear sketch and T-s diagram.   (7)

b) A simple air refrigeration system used for an aircraft has a load of 20 TR. The atmospheric pressure and temperature are 0.8 bar and 12°C. The pressure increases to 1.04 bar due to ramming. The pressure of the compressed air is 3.5 bar. The temperature of the air is reduced by 60°C in the heat exchanger. The pressure in the cabin is 1.01 bar and the temperature of air leaving the cabin is   (7)

30°C. Determine the temperature of air at all points of the cycle and mass of air required for the system. Assume that all the expansion and compression process are isentropic. Also $c_p = 1$ kJ/kg K.

## MODULE II

13. a) Explain how subcooling improves the COP of a cycle. (4)
    b) With neat sketches elaborate the effect of operating parameters on COP. (10)

**OR**

14. a) Explain a multiple evaporator system with four evaporators at different temperatures with single compressor, subcooled condenser, individual expansion valves and back pressure valves. (10)
    b) Explain how a liquid suction heat exchanger works using a schematic and a T-S diagram. (4)

## MODULE III

15. a) With the help of neat sketch explain the working of steam jet refrigeration system. Write its merits and demerits. (9)
    b) Explain the working of a vortex tube refrigeration system using a diagram. (5)

**OR**

16. a) Explain the working of a simple vapour absorption system. (7)
    b) What is the principle of adiabatic demagnetization? Describe its working using a neat sketch. (7)

## MODULE IV

17. a) Why is capillary tube preferred for refrigerators in homes? (4)
    b) Describe the working of any two types of condensers used in refrigeration system using neat sketch (10)

**OR**

18. a) What are the possible ways to improve the heat transfer effectiveness of an evaporator? (4)
    b) Describe the construction and working of a reciprocating compressor? List the benefits of multi-stage compression as well. (10)

## MODULE V

19. Draw a psychrometric chart and explain any four psychrometric properties. (14)

**OR**

20. List and explain the various factors affecting human comfort. (14)

*****************************************************