Total No. of Questions: 21

Enrollment No : _____

MEDICAPS UNIVERSITY

Faculty of Engineering

End Semester Examination May 2025

ME3CO50 / ME3CO37 Refrigeration & Air Conditioning

Programme	:	B.Tech.	**Branch/Specialisation**	:	ME
Duration	:	3 hours	**Maximum Marks**	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

Section 1 (Answer all question(s))

Marks CO BL

Q1. What is Refrigeration? **1 1 1**

- (•) Refrigeration is the process of removing heat from a substance and cooling it to a temperature or below the actual temperature
- ( ) Refrigeration is the process of adding heat from a substance and cooling it to a temperature
- ( ) Refrigeration is used to increase the level of humidity in the air by adding heat
- ( ) None of these

Q2. Which of the following is not the advantages of using a closed air refrigeration system? **1 1 1**

- ( ) Compact in construction
- (•) Lower coefficient of performance
- ( ) Lighter in weight
- ( ) Environmental friendly

Q3. Which of the following type of refrigerants take a direct part in the refrigeration system? **1 3 1**

- (•) Primary
- ( ) Secondary
- ( ) Tertiary
- ( ) Mixed

Q4. Why is the evaporator used? **1 2 1**

- (•) To absorb heat
- ( ) To decrease the refrigeration effect
- ( ) To reject heat
- ( ) To improve C.O.P.

Q5. How is the cascade system achieved? **1 3 1**

- ( ) VCR system in a parallel combination
- (•) VCR system in a series combination
- ( ) VAR system in a series combination
- ( ) VAR system in a parallel combination

Q6. In Electrolux refrigerator- **1 2 1**

- ( ) Ammonia is absorbed in hydrogen
- (•) Ammonia is absorbed in water
- ( ) Ammonia is evaporated in hydrogen
- ( ) Hydrogen is evaporated in ammonia

Q7. What is the By-pass factor for heating coil, if td_1 = temperature at entry, td_2 = temperature at exit and td_3 = coil temperature? **1 4 1**

- ( ) $td_3 - td_1 / td_3 - td_1$
- (•) $td_3 - td_2 / td_3 - td_1$
- ( ) $td_3 - td_2 / td_2 - td_1$
- ( ) $td_3 - td_2 / td_1 - td_2$

Q8. Which of the following represents sensible cooling on the psychrometric chart? **1 4 1**

- ( ) Inclined line
- ( ) Curve
- (•) Horizontal line
- ( ) Vertical line

Q9. When the heat stored in the body is _____ the human body feels comfortable. **1 4 1**

- (•) Zero
- ( ) Infinite
- ( ) Positive
- ( ) Negative

Q10. What is air conditioning? **1 5 1**

- ○ Air Conditioning is the process of adding heat and increasing humidity
- ● Air Conditioning is the process of removing heat and controlling the humidity of air in a closed space
- ○ Air conditioning is the process of controlling air moisture in an open area by adding heat
- ○ None of these

Section 2 (Answer all question(s))

Marks CO BL

Q11. Name and discuss the different methods of refrigeration in short. **3 1 1**

Rubric	Marks
Discuss any three methods of refrigeration in short.	3

Q12. (a) In a refrigeration plant working on the Bell Coleman cycle, the air is compressed to 5 bars from 1 bar. Its initial temperature is 10^{o}C. After compression, the air is cooled up to 20^{0}C in a cooler before expanding back to a pressure of 1 bar. Determine the theoretical COP of the plant and net refrigerating effect. Take C_p=1.005 kJ/kg K and C_v= 0.718 kJ/kg K. **7 1 3**

Rubric	Marks
P-V diagram with given data (2 Marks) Determine the theoretical COP of the plant (3 Marks) and net refrigerating effect. (2 Marks)	7

(OR)

(b) Describe the simple air-cooling cycle of air refrigeration system with a schematic diagram and show the cycle on T-s diagram for the system.

Rubric	Marks
System with a schematic diagram (2 Marks) Describe the simple air cooling cycle (3 Marks) and cycle on T-s diagram for the system. (2 Marks)	7

Section 3 (Answer all question(s))

Marks CO BL

Q13. In an ideal vapour compression refrigeration cycle, the specific enthalpy of refrigerant (in kJ/kg) at the following states is given as: Inlet of condenser: 283, exit of condenser: 116, exit of evaporator: 232, find out COP of this cycle. **3 2 2**

Rubric	Marks
P-h diagram (1 Mark) COP (2 Marks)	3

Q14. (a) How does the actual vapour compression cycle differ from theoretical cycle? Explain with P-h and T-s diagram. **7 2 2**

Rubric	Marks
P-h (2 Marks) T-S (2 Marks) Description of processes. (3 Marks)	7

(OR)

(b) A vapour compression uses R-40 and operates between temperature limits of -10^0C and 45^0C. At entry to the compressor the refrigerant is dry saturated and after compression it temperature is 60^0C. Find COP of the refrigerator by using following property table.

Saturation temperature in ^{0}C	Enthalpy in kJ/kg		Entropy in kJ/kg K	
	Liquid	Vapour	Liquid	Vapour
-10	45.4	460.7	0.183	1.637
45	133	483.6	0.485	1.587

Rubric	Marks
Given data with P-h diagram (2 Marks) Calculation (3 Marks) COP (2 Marks)	7

Section 4 (Answer all question(s)) **Marks CO BL**

Q15. What do you mean by cryogenics? What is the limitation of VCR system for the production of low temperature? **3 2 1**

Rubric	Marks
What do you mean by Cryogenics? (1 Marks) What is the limitation of VCR system for the production of low temperature? (2 Marks)	3

Q16. (a) In a VAR system, heat is supplied to a generator at a temperature of 90°C. The cooling in the condenser and refrigeration evaporator takes place at 20°C and -10°C respectively. Find the maximum COP of the system. **7 2 3**

Rubric	Marks
Given data with formula (2 Mark) Maximum COP of the system.(5 Marks)	7

(OR)

(b) Describe with the help of schematic and P-h and T-S diagram, the working of a two stage compression flash chambers and subcooler.

Rubric	Marks
System Diagram (1 Marks) P-h and T-S diagram (4 Marks) working (2 Marks)	7

Section 5 (Answer all question(s)) **Marks CO BL**

Q17. What is important of psychometry? Discuss in detail. **3 4 1**

Rubric	Marks
Definition of psychometry, (1 Mark) Detail applications and uses. (2 Marks)	3

Q18. (a) The humidity ratio of atmospheric air at 28^0 C DBT and 760 mm of Hg is 0.016 kg/ kg of dry air. Determine- **7 4 3**

- Partial pressure of water vapour
- Relative humidity
- Dew point temperature
- Sp. Enthalpy
- Vapour density

Rubric	Marks
Determine 1. Partial pressure of water vapour (1 Marks) 2. relative humidity (1 Marks) 3. Dew point temperature (1 Marks) 4. Sp. Enthalpy (2 Marks) 5. Vapour density (2 Marks)	7

(OR)

(b) The atmospheric air with DBT of 28°C and WBT of 17°C is cooled by 15°C without changing its moisture content. Find: -

- Original relative humidity.
- Final relative humidity
- Final WBT

Rubric	Marks
1. Original relative humidity (3 Marks) 2. Final relative humidity (2 Marks) 3. Final WBT. (2 Marks)	7

Section 6 (Answer any 2 question(s))

Marks CO BL

Q19. Explain the factor involve in complete air conditioning. **5 5 2**

Rubric	Marks
5 factors involved in complete air conditioning.	5

Q20. Explain the working of the summer air conditioning system with a labelled diagram. **5 5 2**

Rubric	Marks
working of the summer air conditioning system (3 Marks) labelled diagram.(2 Marks)	5

Q21. The amount of air supplied to an air-conditioned hall is 300 m^3/min. The atmospheric conditions are 35^0C DBT and 55% RH. The required conditions are 20^0C DBT and 60%RH. Find out the sensible heat and latent heat removed from the air per minute and sensible heat factor for the system. **5 5 3**

Rubric	Marks
Graph plot (1 Marks) Find out the sensible heat (1Marks) latent heat removed from the air per minute (1 Marks) and sensible heat factor for the system.(2 Marks)	5

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