Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2019

ME2CO16 Refrigeration and Air Conditioning

Programme: Diploma Branch/Specialisation: ME

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Cooling of substance below -140° C is known as **1**
(a) Refrigeration (b) Air conditioning
(c) Cryogenics (d) All of these

ii. Which one of the following is a CFC refrigerant? **1**
(a) R 744 (b) R 290 (c) R 502 (d) R 718

iii. In heat pump, desired effect is **1**
(a) Heat taken from source (b) Heat rejected to sink
(c) Both (a) and (b) (d) None of these

iv. A refrigerating machine of 3-ton capacity will remove heat at the rate of **1**
(a) 50 kcal/min (b) 100 kcal/min
(c)150 kcal/min (d) 200 kcal/min

v. During which component of vapour compression refrigeration system, the enthalpy remains constant: **1**
(a) Evaporator (b) Compressor
(c) Throttle valve (d) None of these

vi. Oil separator is fitted in between **1**
(a) Condenser and evaporator
(b) On the suction line
(c) Compressor and condenser
(d) At the receiver outlet

vii. Which of the following refrigerant is generally used in Aeroplanes **1**
(a) Carbon dioxide (b) Freon-11
(c) Freon-12 (d) Air

P.T.O.

viii. A refrigerator R-500 is the mixture of refrigerants **1**
(a) R-22 and R-12 (b) R-12 and R-152
(c) R-22 and R-115 (d) R-12 and R-115

ix. In sensible cooling process the relative humidity **1**
(a) Decreases (b) Increases
(c) Remains constant (d) None of these

x. In psychrometric chart, dew point temperature lines are **1**
(a) Horizontal
(b) Vertical
(c) Curved
(d) Straight lines slopping downwards to the right

Q.2 i. List the methods of refrigeration. **2**

ii. State difference between refrigeration and cryogenics. **3**

iii. Explain the working principle of thermo-electric refrigeration system. List out the merits and demerits of thermo-electric refrigeration system over other refrigeration systems. **5**

OR iv. Explain the working principle of vortex tube refrigeration system with the help of a neat sketch. **5**

Q.3 i. Differentiate between refrigerator and a heat pump. **2**

ii. A reversed Carnot cycle working as heat pump is delivering 40000 kJ/min to heat the conditioned space & maintaining it at 25°C when the outside temperature of atmosphere is 15°C. Determine the heat absorbed from the atmosphere air and the power required to operate the cycle. If the same space is to heat by electric coil heaters, determine the power consumed by the electric heater. **8**

OR iii. The capacity of a refrigerator is 200 TR when working between -6°C and 25°C. Determine the mass of ice produced per day from water at 25°C. Also find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is 335 KJ/Kg. **8**

Q.4 i. What are the components of vapour compression refrigeration cycle? **3**

ii. Vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no under cooling of the liquid before the expansion valve. Determine: **7**
(a) COP of the cycle
(b) Capacity of the refrigerator if the fluid flow is at the rate of 5 Kg/min.

Pressure, bar	Sat. Temp..., K	Enthalpy, KJ/Kg		Entropy, KJ/Kg	
		Liquid	Vapor	Liquid	Vapor
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

OR iii. (a) Distinguish between dry and wet compression. What are the advantages of one over the other? **7**
(b) Describe the working of actual vapour compression refrigeration cycle.

Q.5 i. What are the desirable properties of an ideal refrigerant? **4**

ii. What is an azeotrope? Name one azeotropic mixture with its properties which is used to replace halocarbon refrigerant. **6**

OR iii. What are brines? How can we minimize corrosion caused by them? Also give desirable properties of brines. **6**

Q.6 Attempt any two:

i. Define the term enthalpy of moist air and write the expression for calculating the enthalpy. **5**

ii. Write a brief note on By-pass factor of cooling coil. **5**

iii. Write the names of different psychometric processes. Explain any two with the help of sketches. **5**

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Marking Scheme
ME2CO16 Refrigeration and Air Conditioning

Q.1	i.	Cooling of substance below -140̊ C is known as (c) Cryogenics	**1**
	ii.	Which one of the following is a CFC refrigerant? (c) R 502	**1**
	iii.	In heat pump, desired effect is (b) Heat rejected to sink	**1**
	iv.	A refrigerating machine of 3-ton capacity will remove heat at the rate of (c)150 kcal/min	**1**
	v.	During which component of vapour compression refrigeration system, the enthalpy remains constant: (c) Throttle valve	**1**
	vi.	Oil separator is fitted in between (c) Compressor and condenser	**1**
	vii.	Which of the following refrigerant is generally used in Aeroplanes (d) Air	**1**
	viii.	A refrigerator R-500 is the mixture of refrigerants (b) R-12 and R-152	**1**
	ix.	In sensible cooling process the relative humidity (b) Increases	**1**
	x.	In psychrometric chart, dew point temperature lines are (d) Straight lines slopping downwards to the right	**1**
Q.2	i.	Methods of refrigeration.	**2**
	ii.	Difference between refrigeration and cryogenics.	**3**
	iii.	Working 2 marks Principle 1 mark Merits and demerits of thermo-electric refrigeration system 2 marks	**5**
OR	iv.	Vortex tube refrigeration system Working 2 marks Principle 1 mark Sketch. 2 marks	**5**
Q.3	i.	Differentiate between refrigerator and a heat pump.	**2**
	ii.	Heat absorbed 3 marks Power required 2 marks Power consumed by the electric heater 3 marks	**8**
OR	iii.	Mass of ice 4 marks Power required 4 marks	**8**
Q.4	i.	Components of vapour compression refrigeration cycle	**3**
	ii.	(a) COP of the cycle 3.5 marks (b) Capacity of the refrigerator if the fluid flow is at the rate of 5 Kg/min. 3.5 marks	**7**
OR	iii.	(a) Distinguish between dry and wet compression 1.5 marks Advantages of one over the other 1.5 marks (b) Working of actual vapour compression refrigeration cycle 4 marks	**7**
Q.5	i.	Properties of an ideal refrigerant	**4**
	ii.	Azeotrope 2 marks One azeotropic mixture 1 mark Its properties 3 marks	**6**
OR	iii.	Brines 1.5 marks Minimize corrosion caused by them 1.5 marks Properties of brines. 3 marks	**6**
Q.6		Attempt any two:	
	i.	Enthalpy of moist air 2.5 marks Expression for calculating the enthalpy. 2.5 marks	**5**
	ii.	By-pass factor of cooling coil.	**5**
	iii.	Names of different psychometric processes 2 marks Any two with sketches 1.5 mark for each (1.5 mark * 2) 3 marks	**5**

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