

Total No. of printed pages = 6

ME 131701

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2018

B.Tech. (ME) 7th Semester End-Term Examination

REFRIGERATION AND AIR CONDITIONING

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question.No.1 and any *six* from the rest.

1. Answer the following: (MCQ / Fill in the blanks) :
(10 × 1 = 10)

- (i) Which one of the following cycles uses air as refrigerant?
- (a) Ericsson cycle (b) Stirling cycle
(c) Carnot cycle (d) Bell-Coleman cycle
- (ii) Ammonia absorption refrigeration cycle requires
- (a) Very little work input
(b) Maximum work input
(c) Nearly same work input as Vapour compression cycle
(d) Zero work input

[Turn over

- (iii) The relative coefficient of performance is
- Actual COP/Theoretical COP
 - Theoretical COP/Actual COP
 - $1 - \text{Actual COP} \times \text{Theoretical COP}$
 - $1 - \text{Actual COP}/\text{Theoretical COP}$
- (iv) In vapour compression cycle, the condition of refrigerant is saturated liquid
- After passing through the condenser
 - Before passing through the condenser
 - After passing through the expansion valve
 - Before entering the expansion valve
- (v) One ton of refrigeration equal to
- 50 kJ/min
 - 50 kJ/hr
 - 211 kJ/min
 - 211 kJ/hr
- (vi) Refrigeration in aeroplanes usually employs the following refrigerant
- CO₂
 - Freon 12
 - Freon 22
 - Air
- (vii) Domestic refrigerator working on vapour compression cycle uses the following type of expansion device
- Electrically operated throttling valve
 - Manually operated valve
 - Thermostatic valve
 - Capillary tube

- (viii) The bank of tubes at the back of domestic refrigerator are
- Condenser tubes
 - Evaporator tubes
 - Refrigerant cooling tubes
 - Capillary tubes
- (ix) Freon group of refrigerants are
- Inflammable
 - Toxic
 - Non- Inflammable and Toxic
 - Non- Inflammable and Non-toxic
- (x) The COP of a vapour compression plant in comparison to vapour absorption plant is
- More
 - Less
 - Same
 - Unpredictable

2. (a) What is 1 TR of refrigeration? (3)
- (b) Explain how refrigerants are classified and designated? (6)
- (c) A refrigerating system operates on the reversed Carnot cycle between temperature limits of 25°C and -10°C. The capacity of the plant is 8 tonnes.
- Determine :
- COP
 - Power rating of the compressor motor if overall efficiency is 85%
 - Heat rejected from the system. (2 + 2 + 2)

3. (a) Differentiate between heat pump and refrigerating machine. (5)
- (b) An R134a Carnot refrigerator is working between -30°C and 35°C . Find its :
 (i) COP
 (ii) Work done is expansion and compression process
 (iii) Refrigerating effect. (10)
4. (a) Explain why isentropic expansion process is replaced by throttling process in VCR cycle. (5)
- (b) For a vapour compression refrigeration system using R22 as refrigerant, condenser outlet temperature is 40°C and evaporator temperature is -20°C . In order to avoid flashing of refrigerant, a liquid suction vapour heat exchanger is provided where liquid is subcooled to 26°C . The refrigerant leaves the evaporator as saturated vapour. The compression process is isentropic. Find the power requirement and COP if the capacity of the system is 10 kW, $c_p = 1.03 \text{ KJ/Kg.K}$. (10)
5. (a) Explain with neat diagrams how COP of Air-refrigeration cycle depends on pressure ratio. (5)
- (b) In a refrigerator, working on Bell-Coleman cycle, the air is drawn into the cylinder of the compressor from the cold chamber at a pressure of 1.03 bar and temperature 12°C . After isentropic compression to 5.5 bar, the air is cooled at constant pressure to a temperature of 22°C . The polytropic expansion $pv^{1.25} = \text{constant}$ then follows and the air expanded to 1.03 bar is passed to cold chamber. Determine :

- (i) Work done per kg of air flow
 (ii) Refrigerating effect per kg of air flow
 (iii) COP
 (iv) Refrigerating capacity of the plant in tonnes for mass flow rate of 90 kg/h.
 $\gamma = 1.4$ and $c_p = 1.003 \text{ kJ/kg.K}$. (10)

6. (a) Explain lithium bromide absorption refrigeration system. (10)
- (b) Differentiate between VCR and VAR systems. (5)
7. Explain any three : (3 × 5 = 15)
 (a) Condenser
 (b) Basic of duct design
 (c) Expansion Devices
 (d) Refrigerant compressor
 (e) Evaporators.
8. (a) Explain bypass factor, sensible heat factor and dew point temperature. (5)
- (b) Atmosphere air at 15°C DBT and 30% RH passes through a furnace and through a humidifier, in such a way that the final DBT is 32°C and 40% RH. Determine
 (i) Heat and moisture added to air
 (ii) Sensible heat factor of the process. (10)

9. Write short notes on any *three* : (3 × 5 = 15)

- (a) Dry bulb and wet bulb temperature
 - (b) Primary refrigerant
 - (c) Actual VCR cycle
 - (d) Heat pump vs. heat engine
 - (e) Limitations of VAR systems.
-