

B.MECHANICAL ENGINEERING 4TH YEAR 1ST SEMESTER SUPPLE EXAM. 2017
REFRIGERATION & AIR CONDITIONING

Time : Three Hours

Full Marks – 100

Answer any FIVE questions.

Use of Refrigeration tables, Steam tables and Psychometric Chart are permitted.

For problems on Psychometry, Psychometric chart on which the problems are worked out should be attached with the answer script.

- Q.1.a) Explain the difference between a refrigerator and a heat pump. 6
 b) What will be the relation between the COP of a refrigerator and that of a heat pump working in reversed carnot cycle between the same two thermal reservoirs. 4
 c) The ambient air temperatures during summer and winter in a particular locality are 45⁰C and 15⁰C respectively. Find the values of reversed Carnot COP of an air conditioner for cooling and heating, corresponding to refrigeration temperature of 5⁰C for summer and heating temperature of 55⁰C for winter. Assume temperature difference 10⁰C in summer and 5⁰C in winter for the heat exchangers that exchanges heat with the surroundings. 10
- Q.2.a) With a neat sketch explain the use of a liquid refrigerant in suction vapour heat exchanger used in a simple vapour compression refrigeration system. What are the advantages for the use of such a heat exchanger? 10
 b) A Freon 12 simple saturation cycle operates at temperatures of 35⁰C and – 15⁰C for the condenser and evaporator respectively. Determine the COP and HP/TR of the system. Use only refrigeration table of Freon 12. 10
- Q.3.a) Why the COP of a Bell Coleman air refrigeration cycle is less than the reversed Carnot Cycle. 6
 b) Why is air refrigeration system particularly suitable for cabin cooling in an aircraft? 4
 c) With a simple sketch, explain a vapour absorption refrigeration system. 10
- Q.4.a) Explain the differences between a vapour absorption refrigeration system and a vapour compression refrigeration system. 8
 b) What are the effects of subcooling of refrigerant before entry to expansion valve? 4
 c) Derive the expression for maximum COP of a vapour absorption system. 8
- Q.5.a) Define “Bypass Factor”. Drawing sketches of sensible heating and sensible cooling processes on psychometric charts, show the effect of bypass factor on changing the exit condition from a cooling coil and a heating coil. 10
 b) Explain the psychometric process of ‘adiabatic mixing of two air streams’ with a suitable sketch. 10

Q.6.a) $30\text{m}^3/\text{min}$ of a stream of moist air at 15°C DBT and 13°C WBT are mixed with $12\text{m}^3/\text{min}$ of a second stream at 25°C DBT and 18°C WBT. Barometric pressure is one standard atmosphere. Determine the dry bulb and wet bulb temperatures of the resulting mixture. 10

b) Moist air enters a chamber at 5°C DBT and 2.5°C thermodynamic WBT at a rate of $90\text{ cum}/\text{min}$. The barometric pressure is 1.01325 bar , While passing through the chamber, the air absorbs sensible heat at the rate of 40.7 kW and picks up $40\text{ kg}/\text{h}$ of saturated steam at 110°C . Determine the dry and wet bulb temperatures of the leaving air. Solve the problem by using psychrometric chart. 10

Q.7. Write short notes on (any two) of the following : 10 + 10

- a) Determination of actual COP of a vapour absorption refrigeration system
- b) Different methods of compound vapour compression refrigeration system.
- c) Effects of changes of evaporator pressure and condenser pressure on the performance of a simple saturated vapour compression refrigeration system.