ROLL NO: ………………
NAME : ……………….

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION
(2013 Scheme)
13.704 REFRIGERATION & AIR CONDITIONING (M)

Time: 3 Hours **Marks: 100**

PART-A

(***Answer all questions; each question carries 2 marks***)

1. Why a heat pump is preferred to an electric heater for room heating application?
2. Why air cycle refrigeration is preferred for air craft to vapour compression system, even though the COP is very less?
3. Two refrigerator manufacturers claim that they developed a new model, working between -10°C and 40°C. First one claims a COP of 7.0, while the second manufacturer claims a COP of 8.0. Which one you will prefer? Why?
4. What is the effect of a LSHE in a VCRS?
5. What is the effect of change in evaporation temperature on COP of a VCRS?
6. Why low specific heat in liquid state is rated better in selection of refrigerants?
7. Why cooling turbine or expander is not used in VCRS?
8. How the function of a compressor in a vapour compression system is carried out in VARS?
9. Differentiate between specific humidity and relative humidity.
10. Which are the different methods for duct sizing?

(10x2 = 20 marks)

PART-B

(**Answer** ***any one question from each module; each carries 20marks***)

MODULE I

11. a) What are the limitations of reversed Carnot cycle?

b) For a simple air craft refrigeration system, the work output of the cooling turbine is 80 kJ/kg with isentropic efficiency of 0.8 and temperature at its inlet as 45°C.The cabin is maintained at 25°C and 1 bar. The ram air temperature is 27°C and the compression efficiency is 85%. The pressure drop in the heat exchanger is 0.2 bar and the air flow rate is 0.8 kg/s. Determine (1) Tonnage (2) COP (3) Heat exchanger effectiveness (4) Power input and (5) Relative COP compared to reversed Brayton' cycle.

OR

12. a) Explain the working of a cooling system most suitable for a supersonic air craft.

b) Refrigerator working on reversed Joule's cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10°C, compressed and, then it is cooled to 30°C before entering the expansion cylinder. Determine the theoretical C.O.P of the system. If the expansion and compression follows the law $PV^{1.3}$ = Constant, what will be the change in COP?

MODULE II

13. a) (i) Which are the situations where multi pressure systems are used?

(ii) What are the advantages of multiple compression systems?

b) A 5 ton Freon-12 refrigeration plant has saturated suction temperature of (-5) °C. The condensation takes place at 40°C and there is no undercooling of refrigerant liquid. Assuming isentropic compression find (i) COP (ii) Mass flow rate of refrigerant and (iii) power required to drive the compressor in kW. What will be the bore of compressor cylinder, if speed is 3000 rpm, number of cylinders 2 and stroke length is 100 mm?

OR

14. a) What are the deviations in an actual vapour compression cycle compared to a simple saturation cycle?

b) Calculate the power needed to compress 20 kg/min of Ammonia from saturated vapour at 1.4 bar to a condensing pressure of 10 bar by two stage compression with intercooling by liquid refrigerant at 4 bar. Assume saturated liquid to leave the condenser and dry saturated vapour to leave the evaporator.

MODULE III

15. a) Derive the expression for maximum COP of a simple vapour absorption system.

b) A vapour absorption refrigeration system operates between an evaporating temperature of (-10) °C and condensing temperature of 50°C. The capacity of the system is 20 TR. The generator temperature is 120°C. Calculate the maximum COP and heat input to generator. If the actual COP is 65% of maximum COP, calculate the percentage increase in heat input.

OR

16. a) With a neat sketch, explain the working of a Lithium Bromide – Water VARS.

 b) Explain the working of an Electrolux system.

MODULE IV

17. a) List and explain the common sources of heat that supply the load on an air conditioning system.

 b) A mixture of dry air and water vapour is at a temperature of 27°C and under a total pressure of 760 mm of Hg. The dew point temperature is 18°C. Find, with the help of tables, (i) Specific humidity (ii) Relative humidity (iii) Enthalpy of mixture (iv) Vapour density and (v) Volume of air/kg of dry air.

OR

18. a) How the RSHF line and GSHF line are drawn on a Psychrometric chart?

 b) Two and a half cubic meters of lumber is being dried at 60°C dry bulb temperature and 52°C wet bulb temperature. The drying rate of the lumber is 12.5kg of water per hour. If outside air is at 27°Cdry bulb temperature and 80% relative humidity, how much outside air is needed per minute to carry away the evaporated moisture?

(4x20 = 80 marks)