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[3963] - 220

T.E. (Mechanical Engineering) (Semester II) Examination, 2011
REFRIGERATION AND AIR CONDITIONING (New)
(2008 Pattern)

Time : 3 Hours

Max. Marks : 100

Instructions : 1) Answer 3 questions from Section I and 3 questions from Section II.

- 2) Answers to the two Sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Black figures to the right indicate full marks.
- 5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

SECTION – I

UNIT – I

1. a) Define : COP, EER, One Ton Refrigeration.

6

b) Write a note on 'Magnetic Refrigeration'.

4

c) Derive an expression for COP of Bell Coleman cycle.

6

OR

2. a) Write a note on 'vortex tube refrigeration'.

4

b) What are the advantages and limitations of Air Refrigeration Systems ?

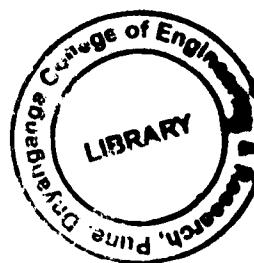
4

c) A Bell Coleman air refrigeration cycle is working between the pressure of 1 bar and 8 bar. Temperature at the compressor inlet is 20°C and at the inlet to expander is 30°C. Index of compression and expansion is 1.3. Estimate the net work done per cycle, refrigerating effect and COP.

If the system is designed to produce 10 tons of refrigeration having actual COP as 60% of the theoretical COP, find the actual power required to run the refrigerator.

8

P.T.O.



UNIT - II

3. a) Derive an expression for COP of an ideal vapour absorption system. 6
- b) What is under cooling of refrigerant ? Which methods are used to achieve this ? 4
- c) A vapour compression refrigeration plant operates between evaporator and condenser temperature at -15°C and 40°C respectively. The refrigerant is dry and saturated at the suction. Discharge temperature of refrigerant is 98°C . The bore and stroke of compressor are 85 mm each. It runs at 750 rpm with volumetric efficiency of 82%. The liquid enters the expansion valve at 32°C . Calculate i) COP ii) Mass flow rate of refrigerant and iii) capacity use following properties of refrigerant.

Saturation Temperature $^{\circ}\text{C}$	V_g m^3/kg	h_f kJ/kg	h_g kJ/kg	S_f kJ/kgk	S_g kJ/kgk
-15	0.24	43.4	458.7	0.18	1.742
40	0.043	131	468.6	0.48	1.567

Take C_p of liquid refrigerant as 1.62 kJ/kgk .

6

OR

4. a) Explain actual VCR cycle with the help of T-s diagram. 6
- b) What is the effect of super heating of refrigerant vapour on COP of VCR cycle ? Explain with the help of p-h and T-s diagrams. 6



- c) In an absorption system heating, cooling and refrigeration takes place at 150°C , 30°C and -20°C respectively. Find the theoretical COP of the system.

If the generator temperature is increased to 190°C and evaporator temperature is decreased -30°C , find the percentage change in theoretical COP. 4

UNIT – III

5. a) Explain : GWP, ODP. 6
- b) Write a note on desirable properties of refrigerants. 6
- c) A two stage ammonia plant is used to achieve a temperature of -40°C when the ambient temperature is 48°C . The intermediate pressure is 3.4 bar. Calculate the COP and capacity of the system if the flow of refrigerant through the evaporator is 0.5 kg/s. 6

OR

6. a) Write a note on 'TEWI'. 4
- b) What is a secondary refrigerant ? Name two secondary refrigerants. 3
- c) What are the advantages of cooling refrigerant vapour in between stages of multistage compression ? What are the different methods used to achieve this ? 4
- d) Explain cascade system with a neat sketch and p-h diagram. 7

SECTION – II

UNIT – IV

7. a) Write a note on ‘Evaporative cooling’. 4
- b) Define : ADP, RSHF, GSHF. 6
- c) Air at 25°C and 60% RH is supplied to the drug formulation unit. It is conditioned to this state, first by cooling and dehumidifying and then by reheating it. Cooling coil surface temperature is 13°C and ambient conditions are 32°C DBT and 65% RH. If the air supply rate is 15,000 m³/hr, determine :
- i) Cooling coil capacity in TR
 - ii) Bypass factor of cooling coil
 - iii) Heating capacity in kW
 - iv) Heating coil surface temperature if bypass factor is 0.3
 - v) Mass of water vapour removed per hour. 6

OR

8. a) What are the factors influencing human comfort ? Explain the concept of effective temperature. 6
- b) What is infiltration load and ventilation load ? 4
- c) Two air streams are mixed steadily and adiabatically. The first air stream enters at 32°C DBT and 40% RH while second enters at 12°C and 90% RH. The flow rates of the two streams are 20 m³/min and 25 m³/min respectively. Determine the specific humidity, RH and mass flow rate after mixing. 6

UNIT – V

9. a) Compare : Unitary air conditioning and central air conditioning. 4
- b) Write a note on ‘All water system’. 6
- c) Explain air handling unit with a neat sketch. 6

OR



10. a) What is a fan coil system ? 4
- b) Explain automatic expansion valve with a neat sketch. 6
- c) What are the different methods used to control capacity of compressors in air conditioning systems ? Explain any one method. 6

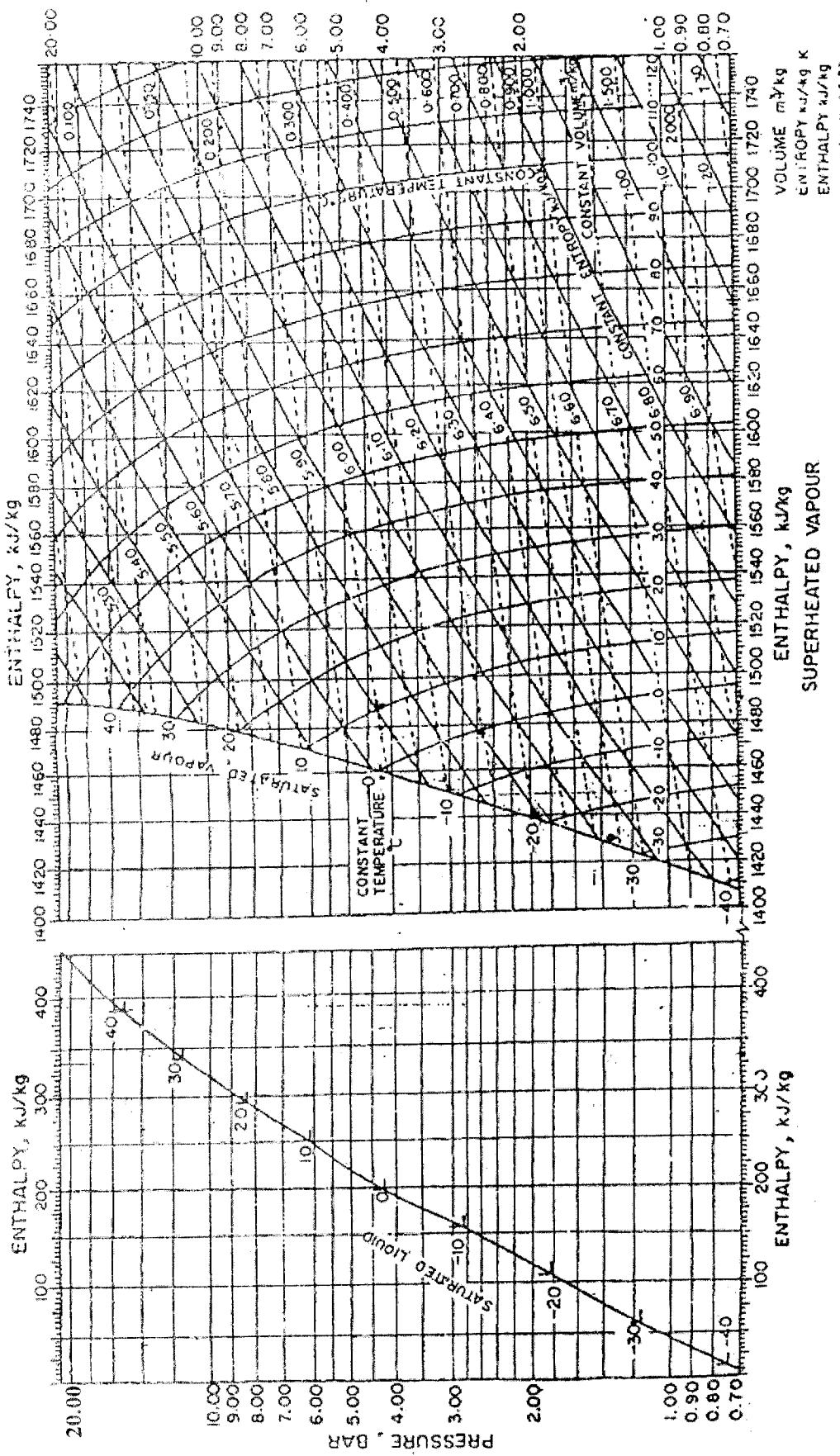
UNIT – VI

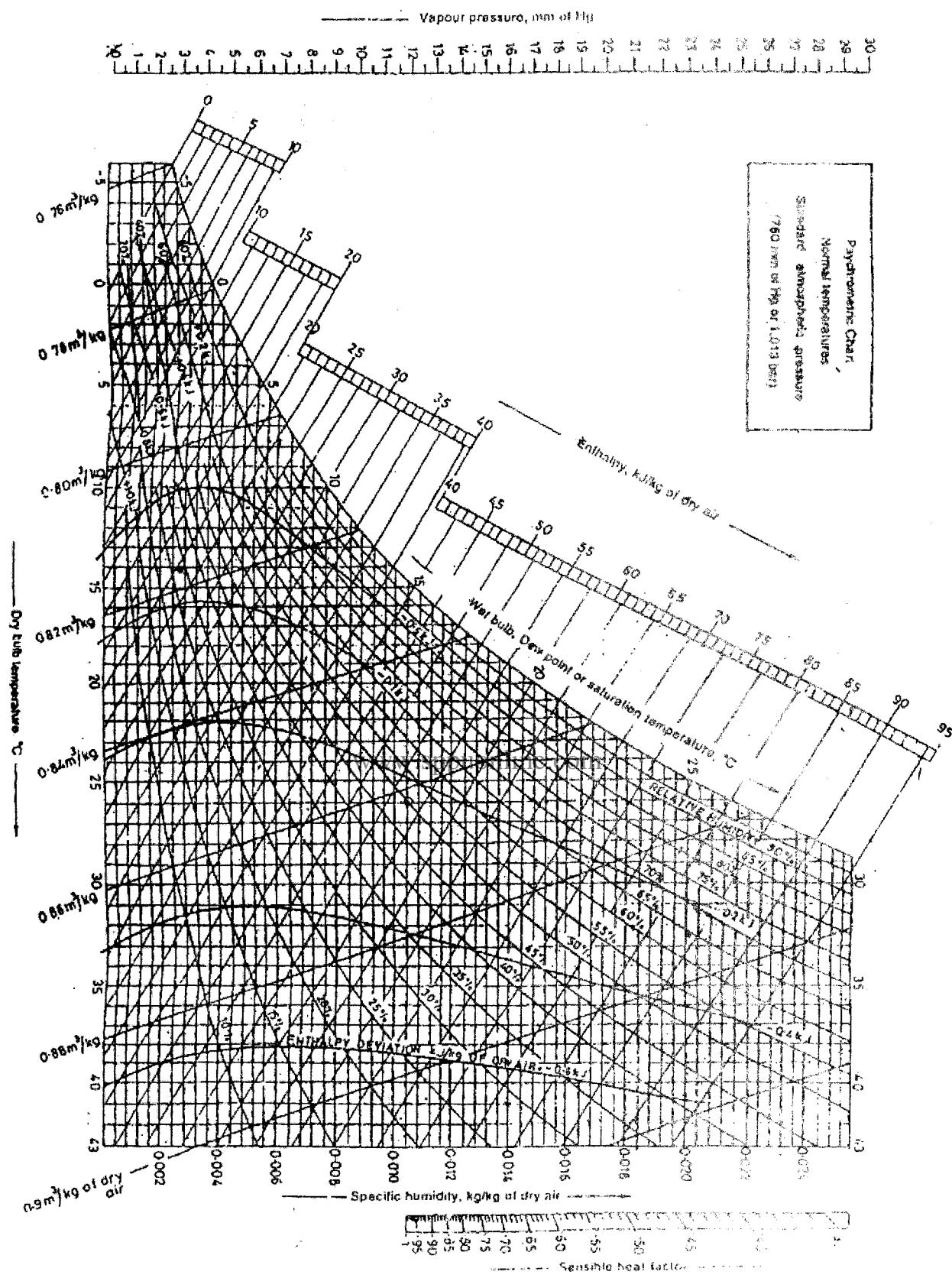
11. a) Write a note on ‘Duct Materials’. 4
- b) Derive an expression for equivalent diameter of a circular duct for a rectangular duct when quantity of air passing through them is same. 6
- c) Write a note on ‘cold storages’. 6
- d) What is ‘CAMA’ ? 2

OR

12. a) Write a note on classification of ducts. 4
- b) Explain the factors which are responsible for spoiling food and vegetables.
What are the methods of preservation of food and vegetables ? 8
- c) A rectangular duct of 800 mm×550 mm size carries 5 m³/s of air having density 1.15 kg/m³. Determine the equivalent diameter of duct if
i) Air flow is same
ii) Air velocity is same.

Also find pressure loss per 100 m length if $f = 0.0015$. 6





B/I/I