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[4459] – 120

Seat No.	

T.E. (Mechanical Engineering) (Semester – II) Examination, 2013
REFRIGERATION AND AIR CONDITIONING
(2008 Course)

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) Explain how practical VCC deviates from carnot cycle ? **6**

   b) Explain thermoelectric refrigeration. **4**

   c) A Bell-Coleman refrigerator works between 4 bar and 1 bar pressure limits. After compression, the cooling water reduces the air temperature to 17°C. What is the lowest temperature produced by the ideal machine ? Compare the co-efficient of performance of this machine with that of the ideal carnot cycle machine working between the same pressure limits, the temperature at the beginning of compression being –13°C. **6**

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2. a) Explain magnetic refrigeration. **5**

   b) Prove that the performance factor of Bell-Coleman cycle refrigeration system is given by $COP = \frac{T_2}{T_3 - T_2}$.

   Where T_2 and T_3 are the temperatures of air at inlet and discharge of compressor respectively. **5**

   c) A refrigerating plant is required to produce 2.5 tonnes of ice per day at –4°C. from water at 20°C. If the temperature range in the compressor is between 25°C and –6°C, calculate power required to drive the compressor. Latent heat of ice = 335 KJ/kg and specific heat of ice = 2.1 KJ/kgk. **6**

UNIT – II

3. a) Describe the effect of superheating, under cooling, suction temperature and condensing temperature on the performance of working of VCC. **8**

   b) An ammonia refrigerator produces 30 tonnes of ice from and at 0°C in 24 hours. The temperature range of the compressor is from 25°C to –15°C. The vapour is dry saturated at the end of compression and an expansion value is used. Assure a coefficient of performance to be 60% of theoretical value, calculate the power required to drive the compressor. Latent heat of ice = 335 kJ/kg. Properties of ammonia are : **10**

Temp°C	Enthalpy, kJ/kg		Entropy, kJ/kg k	
	Liquid	Vapour	Liquid	Vapour
25	298.9	1465.84	1.1242	5.0391
–15	112.34	1426.54	0.4572	5.5490

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4. a) In a vapour absorption system, the heat is supplied to the generator by condensing steam at 3 bar and 85% dry. The temperature in the evaporator is to be maintained at –10°C. If cooling water rejects heat at 30°C in the condenser, find the maximum COP of the system.

   When the refrigeration load is 10 tonnes and actual COP is 40% of the maximum COP, find the mass of steam required per hour. **8**

   b) Explain electrolux refrigeration system. **5**

   c) Compare between VCC and VAC. **5**

UNIT – III

5. a) Explain GWP and ODP. **6**

   b) What are the desirable properties of good refrigerant ? **6**

   c) Draw neat diagram of two stage compression with flash gas removal and liquid intercooler system and explain with the help of P-h diagram the COP of the system. **4**

OR

6. a) Explain cascade refrigeration system with neat diagram and obtain the expression of cascade temperature for equal COP. **6**

   b) Explain TEWI. **4**

   c) Define refrigeration recovery, recycling and reclaiming. **6**

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SECTION – II

UNIT – IV

7. a) The humidity ratio of atmospheric air at 28°C dry bulb temperature and 760 mm of Hg is 0.016 kg/kg of dry air. Determine :
   1) Partial pressure of water vapour
   2) Relative humidity
   3) Dew point temperature
   4) Specific enthalpy use steam table only
   5) Vapour density **10**

   b) What is effective temperature ? Explain on which factors it depends ? **6**

OR

8. a) A small office hall of 25 persons capacity is provided with summer air conditioning system with the following data :

   Outside conditions = 34°C DBT and 28°C WBT

   Inside conditions = 24°C DBT and 50% RH

   Volume of air supplied = 0.4 m^3/min/person

   Sensible heat load in room = 125600 kJ/h

   Latent heat load in room = 42000 kJ/h

   Find the sensible heat factor of the plant. **6**

   b) What is infiltration and ventilation load ? **5**

   c) Saturated air at 21°C is passed through a drier so that its final relative humidity is 20%. The drier uses silica gel adsorbent. The air is then passed through a cooler until its final temperature is 21°C without a change in specific humidity. Determine
      1) The temperature of air at the end of drying process.
      2) The heat rejected during the cooling process.
      3) The relative humidity at the end of cooling process.
      4) The dew point temperature at the end of drying process.
      5) The moisture removed during the process. **5**

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UNIT – V

9. Write short notes on **any three** : **18**
   i) Scroll compressor
   ii) Thermostatic expansion valve
   iii) Air washer
   iv) AHU.

OR

10. a) Compare unitary and central air conditioning system. **6**
    b) What is fan coil unit ? Where it is used ? **6**
    c) Discuss the capacity control systems for reciprocating and centrifugal compressors. **6**

UNIT – VI

11. a) Derive an expression for equivalent diameter of circular duct corresponding to a rectangular duct of side a and b for same pressure loss per unit length when the discharge is same and when velocity is same. **6**
    b) Explain methods of food preservation. **6**
    c) What is IQF ? Explain. **4**

OR

12. a) A 20 m long rectangular duct, 200 m × 160 m in size carries air at the rate of 20 m^3/min. Assuming the friction factor f = 0.005 determine :
       i) Total pressure required at the inlet to the duct to maintain this flow
       ii) Air power required **6**
    b) Write short notes on **any two** :
       i) deep freezer
       ii) flake ice plant
       iii) any one micro organism as spoiling agent. **10**

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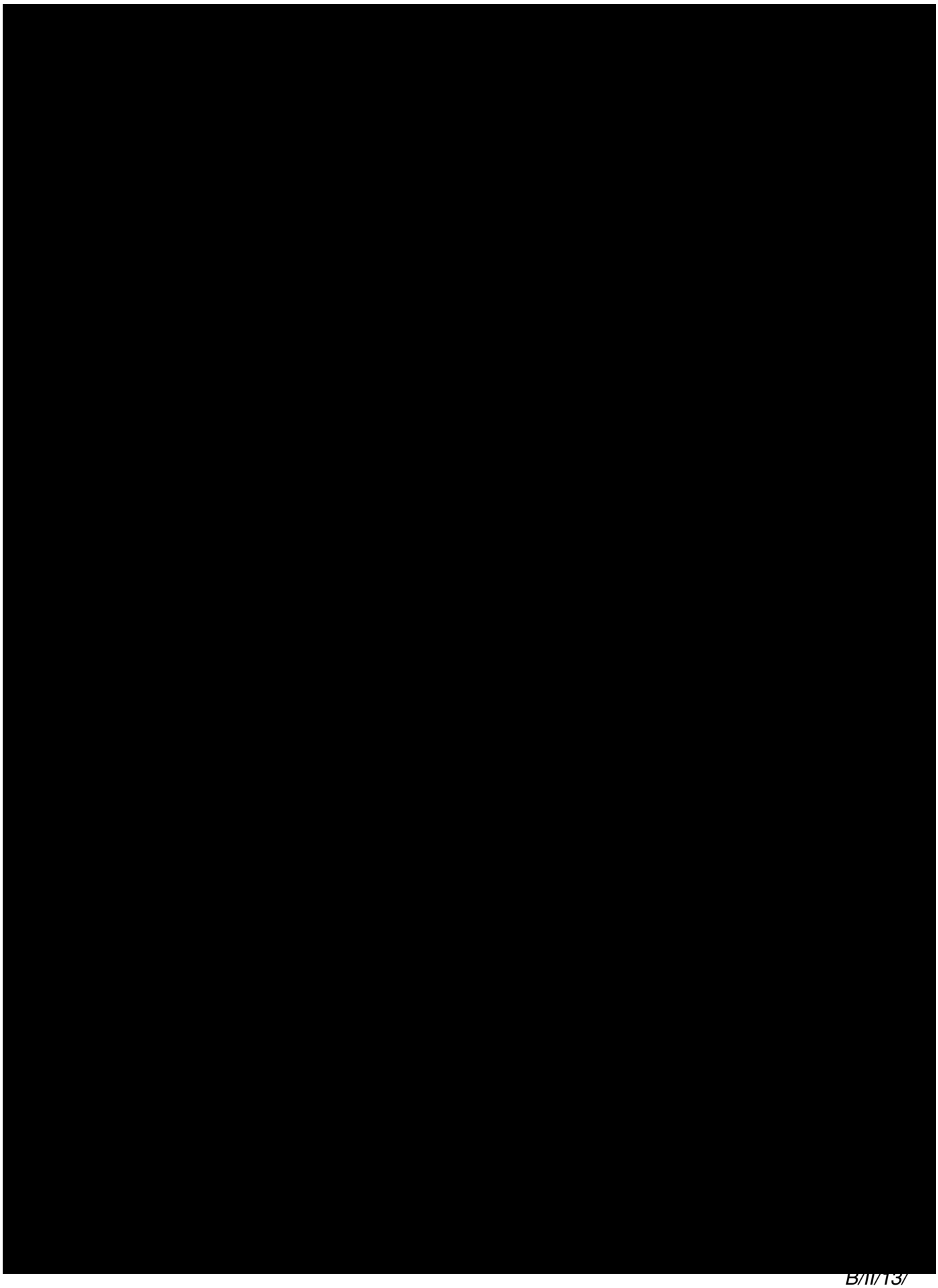

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