

# 17612

15116

**3 Hours / 100 Marks**

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
  - (8) Use of psychrometric chart is permitted.

**Marks**

1. a) Attempt any THREE of the following: 12
- (i) Define:
    - 1) Refrigeration
    - 2) EER
  - (ii) In a vapour compression cycle the refrigerant absorbs heat till it reaches in superheated state and it is undercooled in the condenser. Draw P-H and T-S diagrams for this cycle.
  - (iii) Draw a neat labelled sketch of vortex tube refrigerator and explain its working in brief. State any one application of it.
  - (iv) Describe any two situations or conditions when secondary refrigerants are used. State its any two applications.

P.T.O.

**b) Attempt any ONE of the following:****06**

- (i) Classify vapour compression cycle w.r.t. the state of refrigerant and plot it on P-H and T-S diagram (any three)
- (ii) Compare air cooled condensers with water cooled condensers on the basis of following points with justification.
  - 1) Power consumption per TR capacity
  - 2) COP of refrigeration system
  - 3) Noise level
  - 4) Day-night and seasonal performance consistency.

**2. Attempt any TWO of the following:****16**

- a) Show Bell Coleman air refrigeration cycle on P-V and T-S diagram showing directions of processes and name of equipment used for each process. Also state COP of this refrigerator in terms of temperatures.
- b) Refrigerant R134a enters the compressor of a refrigerator as superheated vapour at 0.14 MPa and  $-12^{\circ}\text{C}$  (at  $h = 398$  kJ/kg) at a rate of 0.076 kg/s and leaves at 1 MPa and  $70^{\circ}\text{C}$  (at  $h = 450$  kJ/kg). The refrigerant is undercooled in the condenser to  $36^{\circ}\text{C}$  and 1 MPa and is throttled to 0.15 MPa (at  $h = 255$  kJ/kg). Assuming compression as nearly isentropic.
  - (i) Draw P-H and T-S diagram of cycle. Show all the given pressures and temperatures at appropriate points on the diagram.
  - (ii) Calculate the coefficient of performance (COP) of cycle.
- c) Draw a neat labelled schematic sketch of Electrolux refrigerator. Explain why expansion valve is not required in this system.

**3. Attempt any FOUR of the following:****16**

- a) Comment on what is desirable in following properties of refrigerant with justification.
  - (i) Critical temperature
  - (ii) Latent heat of vapourization
- b) State reasons for suitability of capillary tube as an expansion device for domestic refrigerator.
- c) Draw a neat schematic sketch of air washer. State the use of air washer in connection with psychrometric process.
- d) Show adiabatic mixing of air streams on skeleton psychrometric chart. State the location where this process takes place in air conditioning system.
- e) Define :
  - (i) Air conditioning
  - (ii) Dalton's law of partial pressures.

**4. a) Attempt any THREE of the following:****12**

- (i) State major controlling factors affecting human comfort.
- (ii) State any four components of cooling load which are responsible for only sensible heat gain, for a large restaurant.
- (iii) Discuss the material for thermal insulation called polyurethane foam (PUF) in respect of type of insulation, temperature range application areas and thermal conductivity and vapour permeability.
- (iv) Explain in brief revolving wick type humidifier with neat schematic sketch.

**b) Attempt any ONE of the following:****06**

- (i) Explain working of flooded type evaporator with neat sketch.
- (ii) Describe the heat sources considered for estimating the cooling load of a cinema theatre. Suggest the suitable air conditioning system. (State name only). The max capacity of cinema theatre is 500 persons.

**5. Attempt any TWO of the following:****16**

- a) Draw a neat sketch of screw type compressor used in refrigeration and state any four advantages of it.
- b) Air at 27°C DBT and 65% RH is cooled and dehumidified to 17°C DBT and 40% RH by performing no. of operation on it. Plot the process on Psychrometry chart and find out all properties of conditioned air.
- c) With a neat schematic labelled sketch describe the working of year round air conditioning system.

**6. Attempt any FOUR of the following:****16**

- a) Draw a neat sketch of closed perimeter duct system. Where is it preferred?
  - b) Enlist any four types of insulating materials used in refrigerations and air-conditioning with one example of each type.
  - c) Explain the necessity of refrigeration in ice factory.
  - d) Classify the ducts used in air distribution system of air conditioning.
  - e) Draw a neat labelled schematic layout of car air conditioning system. State the name of device used to connect or disconnect engine with compressor of this system.
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