

# 315371

**12526**

**3 Hours / 70 Marks**

Seat No. 

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Illustrate your answer with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data, if necessary.
- (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
- (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
- (7) Use of Steam tables, logarithmic, Mollier's chart is permitted.

**Marks**

- 1. Attempt any FIVE of the following: **10****
- a) Define C.O.P. of refrigerating unit.
- b) List any four factors affecting comfort air conditioning.
- c) State the purpose of Exhaust Gas Recirculation (EGR) system in I.C. engine.
- d) Define the terms compressor capacity and volumetric efficiency related to air compressor.
- e) List the major pollutants regulated under BS VI norms.
- f) Name the components used in the Vapor Absorption Refrigeration System.
- g) Define dry bulb temperature and wet bulb temperature.

P.T.O.

**2. Attempt any THREE of the following:****12**

- a) Represent the Bell-Coleman cycle on P.V. and T.S. diagram and name the processes involved in it.
- b) Represent the following processes on Psychrometric chart :—
  - i) Sensible cooling
  - ii) Humidification
  - iii) Heating and dehumidification
  - iv) Cooling and humidification.
- c) Define the following terms related to I.C. engine :—
  - i) Brake Power
  - ii) Brake Specific Fuel Consumption
  - iii) Indicated Power
  - iv) Mechanical Efficiency.
- d) Select a suitable air compressor for the following applications with justification.
  - i) Operating pneumatic tools in automotive workshop.
  - ii) Gas pipeline station
  - iii) Jet Engine
  - iv) CNC actuators and tool changers.

**3. Attempt any THREE of the following:****12**

- a) Explain the terms subcooling and superheating and state its effect on the performance of vapour compression cycle.
- b) Explain with a neat sketch construction and working of a 2/4-way ceiling-mounted cassette air conditioner.
- c) State the function of any four sensors used in Engine Control Unit (ECU).
- d) Compare reciprocating compressors and centrifugal compressors on the basis of the following parameters :—
  - i) Pressure range
  - ii) Mechanical efficiency
  - iii) Capacity control
  - iv) Applications.

4. Attempt any THREE of the following:

12

- a) Explain with a neat sketch construction and working of axial flow air compressor.
- b) List any four factors affecting the performance of following systems :-
  - i) Compressed air system
  - ii) Refrigeration and air conditioning system.
- c) Recommend any four energy saving opportunities for an office air conditioning system.
- d) Explain the role of main component in a compressed air system.
- e) A single stage air compressor takes in air at a suction temperature of  $25^{\circ}\text{C}$  and a suction pressure of 1.5 bars. The compressor delivers air at a pressure of 4 bars and the volume of air entering the compressor is  $4 \text{ m}^3/\text{min}$ . The index of compression is 1.35. Calculate power required and isothermal efficiency.

5. Attempt any TWO of the following:

12

- a) The temperature limits of an ammonia refrigerating system are  $25^{\circ}\text{C}$  and  $-10^{\circ}\text{C}$ . The gas is dry at the end of compression and there is no under cooling of the liquid ammonia. The fluid flow at the rate of 5 kg/min.

Calculate :-

- i) C.O.P. of cycle
- ii) Capacity of the refrigerator.

Use the following table for properties of ammonia :

Temperature ( $^{\circ}\text{C}$ )	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Liquid entropy (kJ/kg. K)
25	298.9	1166.94	1.1242
-10	135.37	1297.68	0.5443

- b) With the help of a psychrometric chart, find the following properties of air at 30°C DBT and 70% relative humidity :-
- Dew point temperature
  - Wet bulb temperature
  - Specific volume of air
  - Enthalpy of air
  - Specific humidity of air.

Draw a psychrometric chart shown all the above properties.

- c) During a Trial on a single-cylinder 4-stroke oil engine, the following observations were made: Bore = 25cm; Stroke = 40 cm, duration of trial = 1 hour; Total fuel consumption = 8.4 kg; Calorific value of fuel = 45,000 kJ/kg, Engine speed = 1500 rpm; Mean effective pressure = 5.8 bar, net brake load = 1.2 kN; Brake drum diameter = 1.5 m, rope diameter = 2.5 cm; mass of jacket water circulated = 600 kg, water enters at 18°C and leaves at 55°C; total air consumption = 360 kg; Room Temperature = 22°C; Exhaust Gas Temperature = 280°C, Specific Heat of Exhaust Gases = 1.2 kJ/kg. K, Specific Heat of Water = 4.186 kJ/kg.K. Solve to determine :-
- Brake specific fuel consumption
  - Indicated thermal efficiency
  - Draw the heat balance sheet on a minute basis.

**6. Attempt any TWO of the following:**

**12**

- Explain with a neat sketch construction and working of a storage-type water cooler. Write specifications of it.
- Air is supplied to a conditioned room at 17°C DBT and 50% RH. The supply volumetric flow rate is 0.8 m<sup>3</sup>/s. The air leaves the room at 25.0°C DBT, and during this process, the relative humidity decreases by 5%. Find :-
  - Dew-point temperature of the supply air
  - Change in enthalpy and specific humidity during the process
  - Rate of sensible heat gain.

- c) A four cylinder, 4-stroke petrol engine 6 cm bore and 9 cm stroke was tested at constant speed. The fuel supply was fixed to 0.0014 kg/sec and calorific value of fuel is 42000 kJ/kg. The plug of 4-cylinders were successively shortcircuited without change of speed. The power measurement were as follows:-

B.P. developed with all cylinders working = 16.25 kW

B.P. developed when cylinder No. 1 cut off = 11.55 kW

B.P. developed when cylinder No. 2 cut off = 11.65 kW

B.P. developed when cylinder No. 3 cut off = 11.70 kW

B.P. developed when cylinder No. 4 cut off = 11.50 kW

Solve to determine :-

- i) Indicated power of engine.
- ii) Mechanical efficiency.

and State the purpose of conducting Morse Test.

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