23242

3 Hours / 70 Marks   Seat No.

Instructions :
(1) All Questions are *compulsory*.

(2) Illustrate your answers 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.

Marks

1.   **Attempt any FIVE of the following :**   **10**

(a)   State the assumptions made for air standard cycle.

(b)   Define COP of refrigerating unit.

(c)   Define Mean Effective Pressure (MEP).

(d)   Define the term : (i) Compression Ratio (ii) Free Air Delivery (FAD).

(e)   Give any four applications of gas turbines.

(f)   Enlist fuels used in gas turbines (any four fuels).

(g)   State the equation of thermal efficiency of Carnot cycle and state the meaning of each term involved in it.

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

   (a) Explain MPFI with neat sketch.

   (b) Define following for IC engine :

      (i) IP

      (ii) BP

      (iii) Mechanical efficiency

      (iv) BSFC

   (c) Give the classification of air compressors.

   (d) Explain working of Turbo Prop engine with neat sketch.

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

   (a) Explain working of EGR with neat sketch.

   (b) Explain with neat sketch two way catalytic converter.

   (c) Explain the effect of superheating on the performance of vapour compression cycle.

   (d) In an ideal Otto cycle, the air at the beginning of the isentropic compression is at 1 bar and 150 °C. The compression ratio is 7. If the heat added during the constant volume process is 200 kJ/kg. Determine : (i) Maximum temperature in the cycle (ii) Air standard efficiency.

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

   (a) Name any four sensors used in I.C. engines and explain working of any one.

   (b) Draw actual valve timing diagram of 4-stroke petrol engine.

   (c) State the any four advantages and disadvantages of vapour compression cycle.

   (d) Explain two stage air compressors with perfect intercooling.

   (e) Draw the schematic diagram of turbojet engine.

5. Attempt any TWO of the following : 12

(a) A four stroke petrol engine develops 5 kW at 2000 rpm when its mean effective pressure is 7.5 bar. If for the engine, L = 1.25 D, Find its dimensions.

(b) Reciprocating air compressor draws 6 kg of air per minute at 250 °C. It compresses the air polytropically and delivers it at 1050 °C. Find the work required for the compression and air power. Also find mechanical efficiency, if shaft power is 14 kW. Assume R = 0.287 kJ/kg K and n = 3.

(c) Draw neat labelled sketch of window air conditioner.

6. Attempt any TWO of the following : 12

(a) The following observations were made while taking trial on a single cylinder I.C. engine :

Brake power = 45 kW, mechanical efficiency = 80 percent, brake thermal efficiency = 35 percent, calorific value of fuel = 42000 kJ/kg.

Determine : (i) Indicator power (ii) Fuel consumption

(b) A single cylinder reciprocating compressor has a bore of 120 mm and a stroke of 150 mm and is driven at a speed of 1200 rpm. It is compressing CO_2 gas from a pressure of 120 KPa and the temperature of 200 °C to a temperature of 2150 °C. Assuming polytropic compression with n = 1.3, no clearance and volumetric efficiency of 100%, Calculate (i) Pressure Ratio (ii) Indicated Power (iii) Shaft power with mechanical efficiency 80%, (iv) Mass flow rate

(c) Draw the layout of ice plant. Name all important components of it and explain its working in brief.

———————————