

22562

24225

3 Hours / 70 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 steam tables, logarithmic, Mollier's chart is permitted.
 - (9) Use of psychrometric chart is allowed.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define :
 - (i) Swept volume
 - (ii) Compression ratio
- (b) Classify the air conditioning system.
- (c) State the function of catalytic converter.
- (d) Define :
 - (i) Free Air Delivery (FAD)
 - (ii) Volumetric efficiency related to air compressor



- (e) Classify the gas turbine on the basis of –
 - (i) Combustion process
 - (ii) Path of working substance
- (f) List the different solid propellant used in rocket engine.
- (g) List diagnostic tools used in fault finding of MPFI engines.

2. Attempt any THREE of the following :

12

- (a) Compare the SI engine with CI engine on following basis :
 - (i) Working cycle
 - (ii) Ignition system
 - (iii) Compression ratio
 - (iv) Applications
- (b) State the effect of 'Air-Fuel Ratio' on Exhaust emission.
- (c) Explain working of two stage reciprocating air compressor with P-V diagram.
- (d) Explain with neat sketch the working of turbojet engine.

3. Attempt any THREE of the following :

12

- (a) Draw actual indicator diagram for 4-stroke petrol engine.
- (b) List the method of reducing pollution in diesel engine as per BS6.
- (c) Explain with neat sketch storage type water cooler.
- (d) An engine working on Otto cycle has temperature and pressure at the beginning of compression as 25 °C and 1.4 bar. Find the compression ratio and air standard efficiency of the cycle if the pressure at the end of compression is 10 bar.

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

- (a) Draw inline fuel injection pump. Name different components.
- (b) State the objectives and advantages of supercharging.
- (c) Plot the psychrometric chart and show the following process on it :
 - (i) Sensible heating
 - (ii) Sensible cooling
 - (iii) Heating with humidification
 - (iv) Cooling with dehumidification
- (d) Explain the working of 'Lobe Type Air Compressor' with neat sketch.
- (e) Explain the working of 'Turbo Prop' with neat sketch.

5. Attempt any TWO of the following :**12**

- (a) Following observations were recorded during a trial on single cylinder four stroke oil engine.

Cylinder bore = 15 cm

Length of stroke = 25 cm

Mean effective pressure = 7.35 bar

Engine speed = 400 rpm

Brake torque = 225 N-m

Fuel consumption = 3 kg/hr

Calorific value of fuel = 44200 kJ/kg

Determine :

- (i) Mechanical efficiency
- (ii) Brake thermal efficiency
- (iii) Brake specific fuel consumption

- (b) Single acting two stage air compressor with complete intercooling delivers 6 kg/min of air at 16 bar. Assuming an intake at 1 bar and 15 °C. Compression has index $n = 1.3$.

Calculate :

- (i) Power required to drive the compressor.
 - (ii) Isothermal efficiency
 - (iii) Free Air Delivered
- (c) Refrigeration system works on VCR system. Enthalpies at various points are given below :

Compressor Inlet = 1460 kJ/kg

Compressor Outlet = 1796 kJ/kg

Inlet to expansion valve = 322 kJ/kg

The refrigerant is superheated by 15 °C before it enters the compressor and sub-cooled by 3 °C before expansion. Show the cycle on p-h and T-S chart. Find (i) COP (ii) Power required for 1 kg of refrigerant circulated/min.

6. Attempt any TWO of the following :

12

- (a) An IC engine uses 6 kg of fuel per hour having CV of 43,000 kJ/kg. The brake power developed is 21 kW. The temperature rise of cooling water is 23 °C. When the rate of flow is 11 kg/min. the temperature rise of Exhaust gas is 250 °C, when rate of flow of Exhaust gases is 4.6 kg/min. specific heat of water and exhaust gas are 4.187 kJ/kg K and 1 kJ/kg K respectively. Prepare heat balance sheet on minute basis.
- (b) State the methods to improve efficiency of air compressor. Explain working of two stage air compressor with perfect intercooling with the help of P-V diagram.
- (c) Atmospheric air at a dry bulb temperature of 16 °C and 30% relative humidity passes through a furnace and then through a humidifier, in such a way that the final dry bulb temperature is 30 °C and 50% relative humidity. Plot the process on psychrometric chart and find :
- (i) Heat added to the air
 - (ii) Moisture added to the air
 - (iii) Sensible heat factor of the process.
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