

22562

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- 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.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define :
 - (i) Compression Ratio
 - (ii) Air standard Efficiency
- (b) List the various methods to reduce the pollution in diesel engine.
- (c) List the various performance parameters of I.C. engine.
- (d) Define :
 - (i) Free Air Delivery (FAD)
 - (ii) Volumetric efficiency related to air compressor
- (e) Represent Brayton cycle on P–V and T–S chart.
- (f) Classify the gas turbines on the basis of
 - (i) Combustion Process
 - (ii) Path of working substance
- (g) Classify the air-conditioning systems.

- 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) List the polluting emissions in exhaust of I.C. engine. Explain their effect on environment.
 - (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 the actual and theoretical indicator diagram for 4 stroke engine. State the reasons of change in diagram.
 - (b) Explain with neat sketch the CRDI system used in diesel engine, controlled by ECU.
 - (c) “Octane number is measure of knock resistance.” Justify the statement.
 - (d) Represent vapour compression refrigeration cycle with subcooling on P–h and T–S chart. Explain the effect of subcooling on system performance.
- 4. Attempt any THREE of the following :** **12**
- (a) State the objectives and advantages of supercharging.
 - (b) Explain the procedure of fault finding in two wheelers with diagnostic tool.
 - (c) Compare the rotary compressor with reciprocating type air compressor on the following basis.
 - (i) Delivery pressure
 - (ii) Discharge
 - (iii) Balancing & Vibration
 - (iv) Running Speed of compressor
 - (d) Draw label schematic diagram of liquid propellant system used in rockets. List the points which differentiates this system from solid propellant system.

- (e) Plot the psychrometric chart and show the following processes on it :
- (i) Sensible heating
 - (ii) Latent cooling
 - (iii) Latent heating
 - (iv) Sensible cooling
 - (v) Heating with humidification
 - (vi) Heating with dehumidification
 - (vii) Cooling with dehumidification
 - (viii) Cooling with humidification

5. Attempt any TWO of the following :

12

- (a) Explain the methods to control the exhaust emissions of light motor vehicle to achieve euro norms.
- (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) A refrigeration system using R-12 as refrigerant works on Vapour compression cycle. Temperature in condenser and evaporator are 37°C and -18°C respectively. Enthalpy of refrigerant after compression is 595.7 kJ/kg and mass flow rate is 100 kg/hect. Find – (i) COP (ii) Capacity of plant in tones of refrigeration (iii) Power required by compressor.

Show the process on P–h chart. Take the values from chart –

| Temp. T °C | Pressure P bar | Sp. Volume v m ³ /kg | Enthalpy liquid Hf. | Enthalpy Vapour Hg kJ/kg. |
|---------------|-------------------|------------------------------------|------------------------|------------------------------|
| - 18 | 1.6627 | 0.1030 | 402.28 | 565 |
| 37 | 9.0726 | 0.0203 | 455 | 589 |

6. Attempt any TWO of the following :

- (a) In a test on single cylinder four stroke petrol engine, the following results are obtained – Cylinder bore = 15 cm, length of stroke = 25 cm, Indicated mean effective pressure = 7.353×10^5 N/cm², Engine speed = 400 RPM, Brake Torque = 225 N.m, Fuel consumption = 3 kg/hec., Calorific value of fuel = 44200 kJ/kg.

Determine :

- (i) Mechanical efficiency
 - (ii) Brake thermal efficiency
 - (iii) Specific fuel consumption of engine
- (b) A single acting two stage compressor with complete intercooling delivers 5 kg/min of air at 15 bar. The conditions at intake are 1 bar and 15°C. The compression follow the law $PV^{1.3} = C$. Calculate the power required and the isothermal efficiency, if the compressor run at 400 rpm speed.
- (c) Draw the layout of ice plant. Name all important components of it and explain its working in brief.
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