



22562

12223

3 Hours / 70 Marks

Seat No.

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- 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 psychrometry chart is allowed.

- |  | <b>Marks</b> |
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| <b>1. Attempt any FIVE of the following :</b>  | <b>10</b>    |
| (a) Define :   |              |
| (i) Indicated Power  | <b>1</b>     |
| (ii) Octane Number   | <b>1</b>     |
| (b) Name the components used in vapour compression refrigeration cycle.                |              |
| (c) Define BSFC and state its unit.  |              |
| (d) Define the term "FAD".   |              |
| (e) State any two applications of gas turbine.   |              |
| (f) Name the main components used in constant pressure cycle gas turbine.              |              |
| (g) State any two advantages of "VVT-I".   |              |
| <b>2. Attempt any THREE of the following :</b>   | <b>12</b>    |
| (a) Represent Otto cycle on p-v & T-S diagram.   |              |
| (b) State the effect of compression ratio ( $R_c$ ) on Air standard efficiency of      |              |
| (i) Otto cycle (ii) Diesel cycle   |              |
| (c) Explain the working of single stage single acting air compressor with neat sketch. |              |
| (d) Represent Joule's cycle on p-v & T-S diagram.                                      |              |



- 3. Attempt any THREE of the following : 12**
- (a) State the advantages of CRDI system used in CI engines.
  - (b) Explain the terms :
    - (1) Compression ratio 2
    - (2) B.S.F.C. 2
  - (c) Explain with neat sketch the working of Domestic Refrigerator.
  - (d) Differentiate between theoretical Otto cycle and actual Otto cycle on p-v diagram.
- 4. Attempt any THREE of the following : 12**
- (a) A four stroke engine has piston diameter of 80 mm, stroke length 200 mm and Indicated mean effective pressure 4.5 bar. Engine produces 420 explosions per minute.  
  
Determine the mechanical efficiency of the engine if power available at the shaft of engine is 1.8 kW.
  - (b) Draw the neat labelled valve timing diagram for four stroke petrol engine.
  - (c) Explain the following terms used in refrigeration :
    - (i) One tonne refrigeration
    - (ii) COP
  - (d) Explain the following terms :
    - (i) Isothermal efficiency 2
    - (ii) Volumetric efficiency w.r.t. air compressor 2
  - (e) Explain the working of closed cycle gas turbine.

## 5. Attempt any TWO of the following :

12

- (a) In a test on 6 cylinder four stroke Diesel engine following readings are obtained ;

Diameter of piston 9.5 cm,

Stroke length 12 cm,

Engine Speed 2400 rpm,

Barometer reading 75 cm of Hg,

Orifice diameter 3 cm,

Co-efficient of discharge for orifice is 0.6,

Mercury (Hg) Manometer reading 14.5 cm

Ambient temperature 25°C,

Find out

- (i) Volumetric efficiency 4
- (ii) Mass of air supplied to engine 2
- (b) A single stage single acting air compressor cylinder diameter 38 cm and stroke 20 cm the clearance volume is 3.4% of the swept volume. The compression and expansion carried out according to law  $p v^{1.3} = \text{constant}$ , the pressure and temperature of air during suction stroke are 9.6 N/cm<sup>2</sup> & 21°C and delivery pressure is 28.84 N/cm<sup>2</sup>. Speed of compressor is 150 rpm.
- Determine :
- (i) Volumetric efficiency
- (ii) FAD m<sup>3</sup>/min
- (iii) Indicated Power
- (c) In an electrically heated chamber, 300 m<sup>3</sup> of moist air is heated to 313°K. The initial conditions of the air are as follows :
- Dry bulb temperature = 303°K
- Wet bulb temperature = 298°K
- Pressure = 101.325 KPa
- Determine the
- (i) Amount of Sensible heat added
- (ii) Final relative humidity
- (iii) Final Wet bulb temperature
- (Use Psychrometric chart)

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

- (a) A single stage single acting air compressor delivers air at 7 bar. The amount of FAD is  $1\text{m}^3/\text{min}$  and 300 rpm. The pressure and temperature at the end of suction stroke are 1 bar &  $27^\circ\text{C}$ . The clearance volume is 5% of the stroke volume. Determine
- Brake Power – required to run the compressor for mechanical efficiency of 80%.
  - Diameter and stroke of the cylinder if diameter and stroke both are equal and assume the compression & expansion follow the law  $PV^{1.3} = \text{constant}$ .

- (b) Moist air at the rate of  $30,000\text{ m}^3/\text{h}$  (on a dry air basis) is blown through an adiabatic humidifier.

Inlet conditions : DBT  $40^\circ\text{C}$  & RH 15%

Exit Conditions : DBT  $25^\circ\text{C}$  & WBT  $20^\circ\text{C}$

Determine the

- Dew point
- Rate of moisture addition to air stream.

(Use Psychrometric chart)

- (c) Trial on a single cylinder 4 stroke oil engine, the following observations are made Bore – 30 cm; Stroke = 45 cm, duration of trial = 1 hour; Total fuel consumption = 7.6 kg; Calorific value of fuel =  $45,000\text{ kJ/kg}$ , total revolutions made = 12,000 rpm; Mean effective pressure = 6 bar, net brake load = 1.47 kN; Brake drum diameter = 1.8 m, rope diameter = 3 cm; mass of jacket water circulated = 550 kg, water enters at  $15^\circ\text{C}$  and leaves at  $60^\circ\text{C}$ ; total air consumption =  $360^\circ\text{Kg}$ ; room temperature =  $20^\circ\text{C}$ ; Exhaust gas temperature =  $300^\circ\text{C}$ ; specific heat for gas =  $1.25\text{ kJ/Kg}^\circ\text{K}$  & for water =  $4.186\text{ kJ/Kg}^\circ\text{K}$ . Determine
- Indicated & Brake power
  - Mechanical efficiency
  - Draw the heat balance sheet on minute basis.



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