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.

(7) Use of steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. **Attempt any FIVE :**   **10**

(a) List the various methods to reduce the pollution in diesel engine.

(b) List the various performance parameters of I.C. engine.

(c) Classify the air-conditioning system.

(d) Represent Brayton cycle on P-V and T-S.

(e) Define :

    (i) Compression Ratio

    (ii) Air Standard Efficiency

(f) Define pressure ratio in air compressor.

(g) Define SEER & EER.

2.   **Attempt any THREE :**   12

   (a)   Represent Otto cycle on p-v & T-s diagram.

   (b)   Explain working of a storage type water cooler with a sketch.

   (c)   Represent Joule's cycle on p-v & T-s diagram.

   (d)   Discuss in brief process of combustion in S.I. engines with a sketch.

3.   **Attempt any THREE :**   12

   (a)   Explain with neat sketch the working of Domestic Refrigerator.

   (b)   Explain the terms B.S.F.C., M.P.F.I.

   (c)   Octane number is measure of knock resistance. Justify the statement.

   (d)   Give four classification of air compressor.

4.   **Attempt any THREE :**   12

   (a)   Explain the working of closed cycle gas turbine.

   (b)   Explain the following terms :

      (i)   Isothermal efficiency

      (ii)   Volumetric efficiency w.r.t. air compressor.

   (c)   Draw the neat labelled valve timing diagram for four stroke petrol engine.

   (d)   State formulae to calculate TEWI & LCCP.

   (e)   A four stroke engine has piston diameter of 90 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.

5. **Attempt any TWO :** 12

   (a) A petrol engine uses 0.272 kg of fuel per kW of brake power per hour, with calorific value as 43961 kJ/kg. The mechanical efficiency is 80% and compression ratio is 5.6. Calculate

      (i) Brake thermal efficiency

      (ii) Indicated thermal efficiency

      (iii) Air standard efficiency

   (b) A single stage air compressor deliver air at 5 bar. The suction temperature and pressure is 20°C and 1 bar, respectively, volume of air entering the compressor is 2 m³/min. The index of compression is 1.2. Calculate Isothermal efficiency of the compressor.

   (c) 400 kg of fruits are supplied to a cold storage at 19 °C. The cold storage is maintained to the storage temperature of –5 °C in 10 hours. The latent heat of freezing is 105 kJ/kg and specific heat of fruit is 1.256 kJ/kg K. Find the refrigeration capacity of the plant.

6. **Attempt any TWO :** 12

   (a) Compare reciprocating and rotary air compressor (at least six points).

   (b) Moist air at the rate of 20,000 m³/h (on a dry air basis) is blown through an adiabatic humidifier,

      Inlet conditions : DBT 30 °C & RH 15%.

      Exit conditions : DBT 25 °C & WBT 20 °C.

      Determine the :

      (i) Dew point

      (ii) Rate of moisture addition to air stream.

(c) In a test of a four cylinder four stroke engine 75 mm bore and 100 mm stroke the following results were obtained at full throttle at a particular constant speed and with fixed setting of fuel supply of 6.0 kg/hr.

B.P. with all cylinder working = 15.6 kW

B.P. with cylinder No. 1 cutout = 11.1 kW

B.P. with cylinder No. 2 cutout = 11.03 kW

B.P. with cylinder No. 3 cutout = 11.88 kW

B.P. with cylinder No. 4 cutout = 10.66 kW

If C.V. of fuel is 83600 kJ/kg, calculate :

(1) Mechanical efficiency

(2) Indicated thermal efficiency

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