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25226

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 answer with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (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 of the following:** **10**
- a) Define Heat. Write it's SI unit.
 - b) Define:
 - i) Dry Saturated steam
 - ii) Degree of Superheat.
 - c) Represent Isobaric Process for an Ideal gas on P-V and T-S chart.
 - d) Define Function of steam condenser.
 - e) State any four applications of steam nozzles.
 - f) Define:
 - i) Absorptivity
 - ii) Reflectivity
 - g) Represent otto cycle on P-V & T-S chart

P.T.O.

2. Attempt any THREE of the following: 12

- a) State clausius statement and Kelvin Plank statement of second Law of thermodynamics.
- b) Define system. State it's classification with example.
- c) Draw P-V and T-S diagram of simple Rankine cycle for a thermal power plant. Show all the process on it. (Consider steam at inlet of turbine as Dry saturated).
- d) Two kg of a gas at 50°C is heated at constant volume until the pressure is doubled.

Determine:

- i) Final Temperature
- ii) Change in internal energy.

Take $C_v = 0.718 \text{ kJ/kgk}$.

3. Attempt any THREE of the following: 12

- a) Describe the formation of steam at constant pressure with the help of Temperature enthalpy diagram.
- b) Classify the steam boiler on the basis of:
 - i) Relative Position of hot gases and water.
 - ii) Method of firing.
 - iii) Method of circulation of water.
 - iv) Nature of draught.
- c) Explain the working of Impulse turbine.
- d) Give sources of air leakages in the condenser. What are the effects of air leakages.

4. Attempt any THREE of the following: 12

- a) Differentiate between Force convection and Natural convection. (Any four points)
- b) Determine the rate of heat flow through the boiler wall made of 3 cm thick steel and covered with an insulating material of 0.5 cm thick. The temperature of wall inside boiler is 300°C and temperature on the outer surface is 50°C. Assume K for steel = 60 W/m°k and K for insulation = 0.12 W/mk.

- c) Classify I.C. engine on following basis:
- i) Working cycle
 - ii) Method of ignition
 - iii) Fuel Supply
 - iv) Method of cooling.
- d) Differentiate between four stroke engine and two stroke engine.
- e) A certain quantity of air has a volume of 0.028 m^3 at a pressure of 1.25 bar and 25°C . It is compressed to a volume of 0.0042 m^3 according to the law $PV^{1.3} = \text{constant}$. Find final temperature and work done during compression.

5. Attempt any TWO of the following:

12

- a) Write general steady flow energy equation (SFEE) per unit mass. State significance of each term in it. Apply it to:
- i) Boiler
 - ii) Steam Turbine.
- b) A quantity of gas has volume of 0.14 m^3 pressure 1.5 bar and temperature 100°C . If the gas is compressed at a constant pressure until it's volume becomes 0.112 m^3 .

Determine:

- i) Work done in compression of gas.
- ii) Change in internal energy.
- iii) Heat given out by a gas.

Take $C_p = 1 \text{ kJ/kg}^\circ\text{K}$.

- c) Explain with neat sketch forced draught cooling tower.

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

- a) Explain with neat sketch construction and working of Lamont Boiler.
 - b)
 - i) State Stefan Boltzman law.
 - ii) State any four applications of heat exchangers.
 - c) Compare S.I. and C.I. engine on the basis of:
 - i) Fuel used
 - ii) Air-fuel ratio
 - iii) Calorific value
 - iv) Method of ignition
 - v) Compression ratio
 - vi) Noise and vibrations.
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