313310

12425 3 Hours / 70 Marks

1.

Seat No.

Instructions – (1) All Questions are Compulsory.

- (2) Illustrate your answer 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

10

a)	Define Zeroth law of thermodynamics.
b)	Define Dryness fraction of steam.
c)	What is universal gas constant? State it's unit.
d)	State the Datton's Law of partial pressure.
e)	Write basic function of condenser.
f)	Define Thermal conductivity. Give it's unit.

g) Define mean effective pressure for I.C. Engine.

Attempt any FIVE of the following:

2. Attempt any <u>THREE</u> of the following:

- a) Prove that $(COP)_{Heat pump} = (COP)_{Refrigerator} + 1$
- b) State Kelvin-plank and clausius statement of second law of thermodynamics.
- c) Represent Isobaric process and Isochoric process on P-V and T-S diagram.
- d) A volume of 0.5 m³ of gas at a pressure of 10 bar and 200°C is expanded in a cylinder to 1.2 m³ at a constant pressure. Calculate the amount of workdone by the gas and the increase in internal energy. Assume ($C_p = 1.005 \text{ kJ/kg K}$ and $C_v = 0.712 \text{ kJ/kg K}$).

3. Attempt any <u>THREE</u> of the following:

- a) A vessel of 0.03 m³ capacity contains gas at 350 kN/m². pressure and 35°C temperature. Determine the mass of the gas in the vessel. If the pressure of this gas is increased to 1.05×10^6 N/m² while the volume remains constant, what will be the temperature of the gas? Take R = 290 J/kg K for the gas.
- b) Explain construction and working of surface condenser with neat sketch.
- c) Explain construction and working of forced draught cooling tower with neat sketch.
- d) Give classification of Boiler.

4. Attempt any THREE of the following:

- a) Define various modes of heat transfer with suitable example.
- b) Determine the rate of heat flow through the boiler wall made of 2 cm thick steel and covered with an insulating material of 0.5 cm thick.

K(steel) = 58 w/mk,

K(insulation) = 0.116 w/mk.

the temperature at the inner and outer surfaces of the wall are 300°C and 50°C respectively.

c) Differentiate two stroke and four stroke I.C. engine.

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- d) Explain Diesel cycle with P-V and T-S diagram.
- e) Determine if the steam is wet or superheated and calculate the dryness fraction or the superheated steam temperature for P = 9 bar and $V = 0.30 \text{ m}^3/\text{kg}$.

5. Attempt any <u>TWO</u> of the following:

- a) Write steady flow energy equation and apply it to steam turbine and steam boiler.
- b) Derive characteristics gas equation using Boyle's law and Charle's law.
- c) Explain Benson boiler with neat sketch.

6. Attempt any <u>TWO</u> of the following:

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- a) Differentiate between Impulse turbine and Reaction turbine.
- b) Classify heat exchangers and state their applications.
- c) Define:
 - i) Compression Ratio (Rc)
 - ii) Swept Volume (Vs)
 - iii) Cut off ratio.