Roll No.

Total No. of Questions: 09]

[Total No. of Pages: 03

B.Tech. (Sem. - 3rd)

THERMAL ENGINEERING

SUBJECT CODE: PE - 205

<u>Paper ID</u>: [A0204]

[Note: Please fill subject code and paper ID on OMR]

Time: 03 Hours

Maximum Marks: 60

Instruction to Candidates:

- 1) Section A is Compulsory.
- 2) Attempt any Four questions from Section B.
- 3) Attempt any Two questions from Section C.

Section - A

Q1)

 $(10 \times 2 = 20)$

- a) State zeroth law of thermodynamics.
- b) Define state, process and cycle.
- c) What do you understand by free expansion process.
- d) State clausius statement of second law of thermodynamics.
- e) Why two stoke engine has smaller flywheel than four stroke engine.
- f) Define the term compression ratio and mean effective pressure.
- g) What do you understand by boiler accessories? Write any four boiler accessories.
- h) Define the term specific humidity, relative humidity.
- i) State clausius inequality for reversible and irreversible process.
- j) What do you mean by the tem entropy? What are the characteristics of entropy?

Section - B

 $(4\times 5=20)$

Q2) When a stationary mass of gas was compressed without friction at constant pressure its initial state of 0.4 m³ and 0.105 MPa was found to change to final state of 0.20 m³ and 0.105 MPa. There was a transfer of 42.5 kJ of heat from the gas during the process. How much did the internal energy of the gas change?

- Q3) In a steam plant, 1kg of water per second is supplied to the boiler. The enthalpy and velocity of water entering the boiler are 800 kJ/kg and 5 m/s. The water receives 2200 kJ/kg of heat in the boiler at constant pressure. The steam after passing through the turbine comes out with velocity of 50 m/s and its enthalpy is 2520 kJ/kg. The inlet is 4 m above the turbine exit. Assuming the heat losses from the boiler and the turbine to the surroundings are 20 kJ/s, calculate the power developed by the turbine. Consider the boiler and turbine as single system.
- Q4) The atmospheric conditions are; 20°C and specific humidity of 0.0095 kg/kg of dry air. Calculate:
 - (a) Partial pressure of vapor.
 - (b) Relative humidity.
 - (c) Dew point temperature.
- Q5) Describe the working of locomotive boiler with neat sketch.
- **Q6)** State the relative advantages and disadvantages of battery and magneto-ignition system.

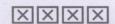
Section - C

 $(2\times10=20)$

- Q7) A fluid undergoes a reversible adiabatic compression from 4 bar, 0.3 m³ to 0.08m³ according to the law, pv^{1.25} = Constant. Determine:
 - (a) Change in enthalpy.
 - (b) Change in internal energy.
 - (c) Change in entropy.
 - (d) Heat transfer.
 - (e) Work transfer.
- Q8) A four cylinder petrol engine has a bore of 57 mm and a stroke of 90 mm. Its rated speed is 2800 r.p.m and is tested at this speed against a brake, which has a torque arm of 0.356 m. The net brake load is 155 N and fuel consumption is 6.74 litres/hour. The specific gravity of petrol used is 0.735 and it has a lower calorific value of 44200 kJ/kg. A Morse test is carried out and the cylinders are cut out in order 1, 2, 3, 4 with corresponding brake loads 111, 106.5, 104.2 and 111 N, respectively. Calculate for this speed:

- (a) Engine torque.
- (b) Brake mean effective pressure.
- (c) Brake thermal efficiency.
- (d) Specific fuel consumption.
- (e) Mechanical efficiency.
- (f) Indicated mean effective pressure.
- **Q9)** An engine working on Otto cycle has a volume of 0.45m³, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of the compression stroke, the pressure is 11 bar. 210 kJ of heat is added at constant volume. Determine:
 - (a) Pressure, temperature and volume at the salient points in the cycle.
 - (b) Percentage clearance.
 - (c) Efficiency.
 - (d) Net work per cycle.
 - (e) Mean effective pressure.

Assume the cycle is reversible.



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