Printed Pages : 4   **AG – 126**

B. Tech.

(SEM. II) EXAMINATION, 2006-07

THERMODYNAMICS & HEAT ENGINES

Time : 3 Hours]   *[Total Marks : 100*

Note :   *Attempt all questions.*

1.   Attempt any **five** parts of the following:-   **5×5**

   (a)   How is a steady flow system characterized?

   (b)   Derive an expression for work done during the polytropic expansion of an ideal gas.

   (c)   What do you understand by thermal and thermodynamic equilibrium?

   (d)   Define thermodynamic work, heat and flow work.

   (e)   Determine the work done per cycle by a 10 cm bore, 12.5 cm stroke engine if the area of the indicator card is 9.68 cm^2, the card length is 5.33 cm. and the indicator spring constant is 21.7 MPa per meter of card length.

(f) Air flows steadily through a compressor. It is compressed reversibly from 0.1 MPa and 30° C to 0.9 MPa. Determine the specific work of compression.

(i) If the process is isothermal.

(ii) If the process follows the reversible adiabatic law $PV^{1.4} = C$ for air.

(g) Show following through dynamic processes on P-V and T-S diagrams - isothermal, constant volume, reversible adiabatic, polytropic and constant pressure.

(h) Explain the law of thermodynamics which enables us to measure the temperature.

2. Attempt any **two** parts of the following :   12.5×2

(a) What are the advantages of high pressure boilers? Sketch and describe the working of a high pressure boiler. Explain briefly the different types of safety valves used on boilers.

(b) 5 kg of water at 30°C is mixed with 1 kg of ice at 0°C. The process of mixing is adiabatic and the system is open to atmosphere. Make calculations for the temperature of mixture and the change of entropy for the spontaneous mixing process. Take sp. heat of water = 4.187 kJ/kg K and latent heat of ice = 335 kJ/kg.

(c) Determine the mass of 0.25 m³ of wet steam at 5 bar pressure and 0.85 dryness fraction. Proceed to calculate the heat content of 1m³ of this steam.

3. Attempt any **two** parts of the following: 12.5×2

(a) Explain (i) Equivalent evaporation (ii) Boiler thermal efficiency and (iii) Heat balance for a boiler with the help of equations.

(b) How is the Rankine cycle modified for operation of reciprocating steam engine plants and why, explain. Also discuss various methods of governing for steam engines.

(c) Steam with absolute velocity 360 m/s. enters the stage of an impuse turbine provided with a single row wheel. The nozzles are inclined at 20° to the plane of wheel. The blade rotor with diameter 95.5 cm rotates with speed of 3000 rev/mt. Find

(i) Suitable inlet and outlet angles of the moving blade so that there is no axial thrust on the blade. Assume frictionless passage.

(ii) Power developed in blading for a steam flow of 1 kg/s

(iii) Kinetic energy of steam finally leaving the stage.

4. Attempt any **two** parts of the following : **12.5×2**

(a) Derive an expression for the air standard efficiency and mean effective pressure of a diesel cycle. State the assumptions made.

(b) Compare diesel engine with a petrol engine with special reference to maximum pressure, efficiency, power to weight ratio, cost and head control. Give explanation.

(c) In an air standard diesel cycle, the compression ratio is 15 and the fluid properties at the beginning of compression are 100 kPa and 300 K. For a peak temperature of 1600 K, calculate (i) the percentage of stroke at which cut off occurs (ii) the cycle efficiency and (iii) the work output per kg. air.

——————