D 90034 (Pages : 2) Name.....

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THIRD SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, NOVEMBER 2015

EE 14 306—MECHANICAL ENGINEERING

Time : Three Hours Maximum : 100 Marks

Use of standard steam tables and HMT *data book is permitted.*

Part I

Answer any **eight** *questions.*

1. Define kinematic viscosity and dynamic viscosity.
2. Define system and explain the types of systems.
3. What is a draft tube and mention its types ?
4. Differentiate between the centrifugal pump and reciprocating pump.
5. Explain the Rankine cycle with P-V and T-S Diagram.
6. Explain the regeneration and inter-cooling system.
7. Explain the modes of heat transfer with examples.
8. Explain the types of fins with examples.
9. What is meant by cavitation and explain its effects ?
10. The Carnot engine working between 200°C and 20°C produces 90 kJ of work. Determine thermal efficiency and heat rejected during the cycle.

(8 × 5 = 40 marks)

Part II

I. (a) The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft of the diameter is 0.4 m and rotates at 190 r.p.m. Calculate the power lost in the bearing for the sleeve length of 90 mm. The thickness of oil film is 1.5 mm.

Or

(b) A certain gas occupies a space of 0.3 m^3 at a pressure of 2 bar and a temperature of 77°C. It is heated at a constant volume, until the pressure is 7 bar. Determine the temperature, mass of the gas, change in internal energy and change in enthalpy during the process.

II. (a) Briefly explain the working principle of pelton wheel with neat diagram.

Or

(b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angle of the impeller at inlet and outlet is 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

III. (a) Derive the expression for the efficiency of Otto cycle.

Or

(b) A refrigerator working on Bell-Colman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10°C, compressed and then it is cooled to 30°C before entering the expansion cylinder. The expansion and compression follows the law $pv^{1.3} = C$. Determine the theoretical COP of the system.

IV. (a) (i) Explain the following : (a) thermal conductivity ; (b) Fourier law of heat conduction ; (c) critical thickness of insulation.

(ii) Determine the heat transfer through the plane of length 6 m, height 4m and thickness 0.30 m. The temperature of inner and outer surfaces is 100°C and 40°C. The thermal conductivity of wall is 0.55 W/mK.

Or

(b) Air at 290°C flows over a flat plate at a velocity of 6 m/s. The plate is 1 m long and 0.5 m wide. The pressure of the air is 6 kN/m^2. If the plate is maintained at a temperature of 70°C, estimate the rate of heat removed from the plate.

(4 × 15 = 60 marks)