Printed Pages : 4

NME-309

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121315

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

THERMAL AND HYDRAULIC MACHINES

Time : 3 Hours] [Total Marks : 100

1 Attempt any FOUR parts : 5x4=20

(a) Obtain an expression for the work done by impeller of a centrifugal pump on water per second per unit weight of water.

(b) Define Centrifugal pump. Differentiate between volute and vortex casing for centrifugal pump.

(c) Define the terms
(i) Suction head
(ii) Static head
(iii) Manometric head

(d) A single acting reciprocating pump has a bore of 200 mm and a stroke of 350 mm and runs at 45 rpm. The suction head is 8 m and the delivery head is 20 m. determine the theoretical discharge of water and power required. If slip is 10%, what is the actual flow rate?

(e) Describe the principle and working of reciprocating pump with neat sketch.

(f) Differentiate between Single acting and double acting reciprocating pump.

2 Attempt any TWO parts : **10x2=20**

(a) Write short notes on the following:
- (i) Heat reservoir
- (ii) Heat engine
- (iii) Heat pump
- (iv) Refrigerator

(b) Define Enthalpy and briefly explain the concept of Entropy in detail.

(c) What do you understand by ideal regenerative cycle? Why is it not possible in practice? Also give actual regenerative cycle.

3 Attempt any TWO parts : **10x2=20**

(a) Describe the governing in steam turbines. Give different methods for governing in steam turbines.

(b) A single stage of simple impulse turbine produces 120 kW at blade speed of 150 m/s when steam mass flow rate is 3 kg/s. Steam enters moving blade at 350 m/s and leaves the stage axially. Considering velocity coefficient of 0.9 and smooth steam entry without shock into blades, determine the nozzle angle and blade angles. Solve using velocity diagram.

(c) A gas turbine unit receives air at 1 bar, 300 K and compresses it adiabatically to 6.2 bar. The compressor efficiency is 88%. The fuel has a heating value of 44186 kJ/kg and the fuel-air ratio is 0.017 kg fuel/kg of air. The turbine internal efficiency is 90%. Calculate the work of turbine and compressor per kg of air compressed and thermal efficiency. For products of combustion
Cp = 1.147 kJ/ kg K, γ = 1.33.

4 Attempt any TWO parts : **10x2=20**

(a) An engine operates on Dual cycle with a compression ratio of 15. At the end of suction the air is available at 1 bar and 27°C. Total heat added is 430 kJ/kg. Heat supply is in ratio of (0.536:1) for heat supply at constant volume and constant pressure. Determine cycle efficiency and mean effective pressure.

(b) Compare the Otto, Diesel and Dual cycles for same compression ratios and same heat inputs.

(c) Explain the main difference between a two stroke cycle and four stroke cycle internal combustion engines.

5 Attempt any TWO parts. : **10x2=20**

(a) A pelton turbine is required to develop 9000 KW when working under a head of 300 m the impeller may rotate at 500 rpm. Assuming a jet ratio of 10 And an overall efficiency of 85% calculate

(i) Quantity of water required.

(ii) Diameter of the wheel

(iii) Number of jets

(iv) Number and size of the bucket vanes on the runner.

(b) Draw a schematic diagram of Francis turbine and explain briefly its construction and working.

(c) A jet of water having a velocity of 45 m/s impinges without shock of vanes moving at 15 m/s. The direction of motion of the vanes is inclined at 200 to that of jet. The relative velocity at outlet is 0.9 of that at inlet and the absolute velocity of water at exit is to be normal to the motion of the vanes find

(i) Vane angels at inlet and exit

(ii) Work done on vanes per kg of water and

(iii) Hydraulic Efficiency.
