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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, November 2013
(2008 Scheme)
08.303 : HYDRAULIC MACHINES AND HEAT ENGINES (E)

Time : 3 Hours Max. Marks : 100

Instructions : *Answer **all** questions from Part – **A** and **any one** question from **each** of the Module of Part – **B**. Include neat sketches **wherever** necessary.*

PART – A

Answer **all** questions.

1. Explain the effect of variation in temperature on absolute viscosity of liquids and gases.
2. Explain the terms : Intensity of pressure and pressure head. What is relationship between them ?
3. Describe how the co-efficient of velocity of an orifice is determined experimentally.
4. Obtain the condition for maximum efficiency in transmission of power through a pipe line.
5. Why a draft tube is used with reaction turbine ? Explain how the net head on the reaction turbine increased with the use of draft tube.
6. Define specific speed of a turbine. What is the significance of specific speed ?
7. What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump ?
8. Explain the term negative slip as used in connection with reciprocating pump. Why and when negative slip occurs ?
9. Define mean effective pressure of an I.C. engine. Distinguish between IMEP and BMEP.
10. What are the methods of governing a steam turbine ? **(10×4=40 Marks)**

P.T.O.

PART – B

Module – 1

11. a) Derive Euler's equation of motion along a stream line and hence derive the Bernoullis Theorem. List the assumptions which are made-whole deriving Bernoullis Theorem.

b) In a 50 mm long Journal bearing arrangement, the clearance between the two at concentric condition is 0.1 mm. The Journal (shaft) is 20 mm in diameter and rotates at 3000 rpm. The dynamic viscosity of the lubricant used is $0.01 \frac{N - Sec}{m^2}$ and the velocity variation on the lubricant is linear. Considering the lubricant to be Newtonian; calculate the frictional torque the shaft has to overcome and the corresponding power loss.

12. a) Derive the Hagen-Poiseuillie equation and state the assumptions made.

b) An oil of specific gravity 0.85 and viscosity 0.05 poise flows through a 20 cm diameter pipe at the rate of 75 litres per second. Find the head loss due to friction for a 500 m length of pipe. Also calculate the power required to maintain the flow. Assume friction factor $4f = \frac{0.3164}{(Re)^{0.25}}$, where Re = Reynold's number.

Module – 2

13. a) Derive an expression for hydraulic efficiency for a Pelton wheel in terms of peripheral velocity, jet velocity and the blade angle. Proceed further to get the best bucket speed for maximum hydraulic efficiency.

b) An inward flow reaction turbine is supplied 0.233 m^3/sec of water under a head of 11 m. The wheel vanes are radial at inlet and the inlet diameter is twice the outlet diameter. The velocity of flow is constant and equal to 1.83 m/sec. The wheel makes 370 r.p.m.

Determine :

i) Guide vane angle

ii) Inlet and outlet diameters of wheel

iii) The width of the wheel at inlet and exit.

Assume that the discharge is radial and there are no losses in wheel. Take speed ratio = 0.7. Neglect the thickness of vanes.

14. a) Derive an expression for pressure head due to acceleration of the piston of a reciprocating pump. Assume motion of the piston to be simple harmonic.

    b) The diameter and width of a centrifugal pump impeller are 300 mm and 60 mm respectively. The pump is delivering 144 litres of liquid per second with a manometric efficiency of 85%. The effective outlet vane angle is 30°. If the speed of rotation is 950 r.p.m, calculate the specific speed of the pump.

Module -- 3

15. a) Explain the following methods for finding friction power of an I.C. engine

        i) Willan's Line method

        ii) Morse test.

    b) The power output of an I.C. engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 700 mm and the rope diameter is 25 mm. The load on the tight side of the rope is 50 kg mass and spring balance reads 50 N. The engine running at 900 r.p.m., consumption of fuel is 4 kg/hour. The calorific value of fuel is 44000 kJ/kg. Assume g = 9.81 m/sec^2. Calculate

        i) Brake specific fuel consumption

        ii) Brake thermal efficiency.

16. a) What do you mean by compounding of steam turbines ? Discuss various methods of compounding steam turbines.

    b) A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610°C. The isentropic efficiencies of the compressor and turbine are 80% and 82% respectively. Calculate the power output in KW of an electric generator geared to the turbine. When the air enters the compressor at 15°C at the rate of 16 kg/sec. Take C_p = 1.005 kJ/Kg°K and r = 1.14 for the compression process and take C_p = 1.11 kJ/kg°k and r = 1.333 for the expansion process.

(20×3=60 Marks)