G 1599 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2016

Fourth Semester

Branch : Mechanical Engineering

HYDRAULIC MACHINES (M)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Derive an expression for force excerted by a jet on a fixed vertical plate.
2. Briefly explain Rayleigh method in Dimensional Analysis.
3. Differentiate working principle of an Impulse Turbine and Reaction turbine ? Give examples for each turbine also ?
4. What is meant by specific speed of a turbine ? Give its significance.
5. What is meant by a pump ? Write down the classification of pumps ? Give suitable examples also.
6. What is meant by cavitation and NPSH ? How they relate each other ?
7. What is meant by "slip" in Reciprocating pump ?
8. Write down the factors affecting cavitation in pumps and turbines.
9. Write neat figure Briefly explain working of a gear pump.
10. Briefly explain working principle of a hydraulic press.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. A jet of water 80 mm diameter having a velocity of 30 m/s strikes normally a flat smooth frictionless plate. Determine the force excerted by the jet on the plate :
    (a) If the plate is at rest.
    (b) Plate is moving in the same direction as that of jet with a velocity of 5m/s.
    (c) Work done per second on the plate in each case and efficiency of the jet when the plate is moving.

(12 marks)

Or

12. The pressure drop 'Δp' in a pipe of diameter 'D' and length 'l' depends on mass density 'ρ' and viscosity 'μ' of the flowing fluid, mean velocity of flow 'V' and average height 'h' of roughness projections on the pipe surface. Obtain dimensionless expression for 'Δp' by Buckingham's π theorem method. Hence show that :

$$h_f = \frac{f\,LV^2}{2\,gD}$$

where, h_f – head loss due to friction $\left(-\frac{\Delta p}{w}\right)$.

w – specific weight of the fluid

'f' – co-efficient of friction.

13. A Pelton wheel has to be designed for the following data. Power to be developed '6000 kW'. Net head available '300 m' speed '550 r.p.m'. Ratio of jet diameter to wheel diameter '1/10' and overall efficiency is 85% :

    (a) Find the number of jets.

    (b) Diameter of the jet.

    (c) Diameter of the wheel.

    (d) Quantity of water required.

Or

14. With neat figure Explain any *one* of governing mechanism in turbines ?

15. A centrifugal pump has an impeller 0.25 m outer diameter and when running at 600 r.p.m. discharges water at the rate of 8000 l/minute against a head of 8.5 m. The water enters the impeller without whirl and shock. The inner diameter is 0.1 m, and vanes are set back at outlet at an angle of 45° and the area of flow which is constant from inlet to outlet of diameter is 0.06 m^2. Determine :

    (a) The manometric efficienty of the pump.

    (b) The vane angle at inlet.

    (c) The least speed at which the pump commences to work.

Or

16. A pump operates at a maximum efficiency of 82% and delivers 2.25 m^3/s under a head of 18 m while running at 3600 r.p.m. Compute the specific speed of the pump. Also determine the discharge head and power input to pump at a shaft speed of 2400 r.p.m. Cite the assumptions made if any.

17. A single acting reciprocating pump has a piston diameter of 150 mm and stroke length 250 mm. The piston makes 50 double strokes per minute. The suction and delivery heads are 5 m and 15 m respectively. Find :

    (a) Discharge capacity of pump in minute.

    (b) Force required to work the piston during the suction and delivery stroke if efficiency of suction and delivery stroke are 60% and 70% respectively and

    (c) Power required to operate the pump.

Or

18. Explain the function of air vessel in a reciprocating pump with neat sketch.

19. Explain working of a screw, vane and root pumps with neat sketch. Draw its performance curves also.

Or

20. With neat figure explain working of a hydraulic intensifier and cranes.

(5 × 12 = 60 marks)