Code: 13A03501 **R13**

B.Tech III Year I Semester (R13) Regular Examinations December 2015

HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Explain how hydropower plants are classified.
(b) How do you estimate hydropower potential?
(c) Explain Impulse-Momentum equation.
(d) Define the inlet and outlet velocity triangles.
(e) Differentiate between Impulse and Reaction turbines.
(f) What is draft tube? What are its functions?
(g) Differentiate specific speed, and unit speed of a turbine.
(h) Define: governing of turbines, water hammer.
(i) Differentiate centrifugal and reciprocating pumps.
(j) Differentiate turbines and pumps.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Draw the general layout of a hydro electric power plant and explain the working of the plant.

OR

3 What do you understand by pumped storage type of power station? What are its merits and demerits when compared with other types?

UNIT – II

4 A jet of water 50 mm diameter strikes a flat plate held normal to the direction of jet. The discharge through the nozzle is 76 lps. Estimate the force exerted and work done by the jet, if:
(i) The plate is stationary.
(ii) The plate is moving with a velocity of 1 m/s away from the jet along the line of jet.
(iii) When the plate is moving with a velocity of 1 m/s towards the jet along the same line.

OR

5 A jet of water impinges a curved plate with a velocity of 20 m/s making an angle of 20^{o} with the direction of motion of vane at inlet and leaves at 130° to the direction of motion at outlet. The vane is moving with a velocity of 10 m/s. Compute: (i) Vane angles, so that water enters and leaves without shock. (ii) Work done/sec.

UNIT – III

6 (a) With a neat sketch explain the parts of an impulse turbine.
(b) A Pelton wheel has to develop 13230 kW under a net head of 800 m while running at a speed of 600 rpm. If the coefficient of Jet *Cy* = 0. 97, speed ratio Ø = 0. 46 and the ratio of the jet diameter is 1/16 of wheel diameter. Calculate: (i) Pitch circle diameter. (ii) The diameter of jet. (iii) Number of jets required. Assume overall efficiency as 85%.

OR

7 (a) Briefly explain various efficiencies used to express the performance of hydraulic turbines.
(b) A Kaplan turbine develops 9000 kW under a net head of 7.5 m. Overall efficiency of the wheel is 86%. The speed ratio based on outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of the runner and the specific speed of the runner.

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UNIT – IV

8 (a) What is cavitation? How can it be avoided in reaction turbine?

(b) What is the basis for selection of a turbine at a particular place?

OR

9 (a) What is kinematic similarity? What is its significance?

(b) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the efficiency is 90%, determine the performance of the turbine under a head of 20 m.

UNIT – V

10 (a) Explain the classification of centrifugal pumps.

(b) A centrifugal pump running at 800 rpm is working against a total head of 20.2 m. The external diameter of the impeller is 480 mm and outlet width is 60 mm. If the vane angle at outlet is 40° and manometric efficiency is 70% determine: (i) Absolute velocity of water leaving. (ii) Flow velocity at outlet of the vane. (iii) Angle made by the absolute velocity at outlet with the direction of motion at outlet.

OR

11 Differentiate the following:

(a) Pumps in series and parallel.

(b) Section head and delivery head.

(c) Manometric and overall efficiency.

(d) Single stage and multi stage pump.

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