Code: 13A03501

R13

B.Tech III Year I Semester (R13) Regular & Supplementary Examinations November/December 2016

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) What is operating head with respect to hydroelectric scheme?
- (b) How does the area of a draft tube varies and give the reason?
- (c) When do you call velocity triangle as inlet velocity triangle and when do you call it as outlet velocity triangle?
- (d) If a jet moving with a velocity of 7 m/s strikes a series of vanes fixed radially to a wheel rotating with a velocity of 10 m/s, then what will be efficiency of the system?
- (e) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. if the overall efficiency is 90%. Determine the power generated.
- (f) What is jet ratio in a Pelton wheel?
- (g) Write any two methods to avoid cavitation in turbines.
- (h) What is a surge tank?
- (i) What is an indicator diagram?
- (j) Write any two differences between centrifugal and reciprocating pumps.

PART – B

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

UNIT – I

2 List out the various components of a hydroelectric scheme and explain in brief about each component.

OR

3 (a) Give the concept of pumped storage plants.

(b) How do you assess hydro power potential form a given catchment area?

UNIT – II

4 A wheel consists of radial blades with inner and outer radii of 360 mm and 720 mm respectively. Water enters the blades at the outer periphery with a velocity of 60 m/s and supply jet makes an angle of 25° with tangent to wheel at inlet tip. Water leaving the blade has a flow velocity of 12 m/s. if the blade angle at entrance and exit are 40° and 30° respectively, determine work done per N of water, speed of the wheel and efficiency of blading.

OR

5 (a) Derive the expression for force exerted by a jet on stationary inclined flat plate.

(b) A jet of water of diameter 50 mm moving with a velocity of 30 m/s strikes a fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the out let of the curved plate.

UNIT – III

6 A vertical shaft Francis turbine runs at 420 rpm while the discharge is 15 m^3/s. The velocity and pressure head at entrance of the runner are 10 m/s and 230 m respectively. The elevation above the tail race is 5 m. The diameter of the runner is 2 m and the width at inlet is 270 mm. The overall and hydraulic efficiencies are 92% and 98% respectively. Calculate total head across the turbine, power output and the guide vane angle.

OR

7 Calculate the diameter and speed of the runner of a Kaplan turbine developing 6000 kW under an effective head of 5 m. Overall efficiency of the turbine is 90%. The diameter of the boss is 0.4 times the external diameter of the runner. The turbine speed ratio is 2.0 and flow ratio 0.6. What is the speed of the turbine?

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UNIT – IV

8 (a) Compare and contrast unit and specific quantities.

(b) What is the use of characteristic curves? And what are the different types of characteristic curves?

OR

9 A water turbine delivering 10 MW power is to be tested with the help of a geometrically similar 1:8 model which runs at the same speed as the prototype. Find the power developed by the model assuming the efficiencies of the model and the prototypes are equal. Also find the ratio of the heads and the ratio of mass flow rates between the prototype and the model.

UNIT – V

10 A four-stage centrifugal pump has four identical impellers keyed to the same shaft. The shaft is running at 400 rpm and the total manometric head developed by the multistage pump is 40 m. The discharge through the pump is 0.2 m^3/s. The vanes of each impeller are having outlet angle as 45°. If the width and diameter of each impeller at outlet is 5 cm and 60 cm respectively, find the manometric efficiency.

OR

11 Explain the working of a single acting reciprocating pump with sketch.

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