

Code: 13A01402

B.Tech II Year II Semester (R13) Regular & Supplementary Examinations May/June 2016

HYDRAULICS & HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- (a) Define energy correction factor and momentum correction factor.
 - (b) What is specific energy and specific force?
 - (c) Write any four characteristics of surface profiles.
 - (d) Explain about various applications of hydraulic jump.
 - (e) State the angular momentum principle.
 - (f) Explain different types of Heads in hydraulic turbines.
 - (g) What is cavitation in case of turbines?
 - (h) What is meant by Net Positive suction head (NPSH)?
 - (i) What is meant by dimensional homogeneity?
 - (j) Define laminar, laminar sub-layer and turbulent boundary layer.

PART – B
(Answer all five units, 5 X 10 = 50 Marks)**UNIT – I**

- 2 (a) Derive expression for kinetic energy correction factor
(b) Velocity distribution in an open rectangular channel is given by $V = 3y^{1/2}$. If the width of the channel is 10 m and the depth of flow is 1 m, find the average velocity of the cross section, energy correction factor and momentum correction factor.

OR

- 3 (a) Define specific energy. Derive the condition for maximum discharge for a given specific energy.
(b) A trapezoidal channel with a base of 6 m and side slope 2H:1V convey water at 17 m³/sec with a depth of 1.5 m. Is the flow situation is sub or super- critical?

UNIT – II

- 4 (a) Giving suitable examples discuss the various types of gradually varied flow in open channel.
(b) A stream, 45 m wide has a normal depth of 3 m at a slope of 1 in 12000. Determine the length of backwater curve caused by an afflux of 2.4 m. Assume manning's coefficient as 0.03.

OR

- 5 (a) Explain the terms alternative depths and conjugate depths.
(b) If Fr_1 and Fr_2 are the Froude numbers corresponding to alternate depths y_1 and y_2 at certain discharge through a rectangular channel, show that $y_1/y_2 = (Fr_2/Fr_1)^{1/2} = 2 + Fr_2^2 / 2 + Fr_1^2$

UNIT – III

- 6 (a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%.
(b) A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of 150°. Assuming the plate smooth, find: (i) Force exerted on the plate in the direction of the jet. (ii) Power of the jet. (iii) Efficiency.

OR

- 7 (a) Explain the classification of hydraulic turbines.
(b) Design a pelton wheel which is required to develop 1500 kW, when working under a head of 160 m at a speed of 420 rpm. The overall efficiency may be taken as 85% and assume other data required.

Contd. in page 2

UNIT – IV

- 8 (a) What are the uses of a draft tube? Describe with neat sketches different types of draft tubes.
(b) Define the term unit power, unit speed and unit discharge with reference to a hydraulic turbine. And also derive the expression for these terms.

OR

- 9 (a) What is the difference between single-stage and multistage pumps? Describe multistage pump with:
(i) Impellers in parallel. (ii) Impellers in series.
(b) The diameter of an impeller of a centrifugal pump at inlet and outlet are 20 cm and 40 cm respectively. Determine the minimum speed for starting the pump if it works against a head of 25 m.

UNIT – V

- 10 (a) What are different types of dimensionless numbers? Explain them.
(b) The pressure difference Δp in a pipe of diameter D and length d due to turbulent flow depends on the velocity V , viscosity μ , density ρ and roughness k . Using Buckingham's π -theorem, obtain expression for Δp .

OR

- 11 (a) Define Boundary layer and derive the expression for energy thickness.
(b) Find the displacement thickness, the momentum thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 3/2 \left(\frac{y}{\delta} \right) - 1/2 \left(\frac{y}{\delta} \right)^3$

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