Code: 13A01402 **R13**

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)

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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 m^3/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^o. 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

Code: 13A01402 **R13**

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 ue 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 $\frac{u}{U} = 3/2\left(\frac{y}{\delta}\right) - \mathbf{1/2}\left(\frac{y}{\delta}\right)^{\mathbf{3}}$

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