4E4113

Roll No. _____ Total No of Pages: 4

4E4113

B. Tech. IV Sem. (Main/Back) Exam., June/July-2014

Civil Engineering

4CE3A Hydraulics & Hydraulic Machines

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1._____ 2._____

UNIT – I

Q.1 (a) What do you understand by distorted river model? Explain with stating its advantages and disadvantages. [6]

(b) A river model is to be constructed to a vertical scale of 1:50 and a horizontal of 1:20. At the design flood discharge of 450m^3/s, the average width and depth of flow are 60m and 4.2 m respectively. Determine the corresponding discharge in model using Reynold's similarity. [10]

OR

Q.1 (a) What do you mean by dynamic similarity and dimensional homogeneity? Write down Reynold's Number, Froude's Number, Weber Number, Euler Number and Mach Number. [8]

(b) A pipe of diameter 1.5m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 lit/sec. Tests were conducted are a 15cm diameter pipe using water at 20°C ($\mu_\omega = 1 \times 10^{-2}$ poise). Find the velocity and rate of flow in the model. [8]

UNIT – II

Q.2 (a) Write the expression of velocity distribution in the flow between two infinite parallel plates clearly stating the assumptions and explaining the terms used. [8]

(b) For a laminar fully developed flow between infinite parallel plates, $\mu = 0.5$ N-s/m^2, $\frac{\partial p}{\partial x} = -1200$ N/m^2/m. The gap between plates = 3mm. Find shear stress in upper plate and volumetric flow rate / unit width. [8]

OR

Q.2 (a) What do you mean by hydro dynamically smooth and rough boundaries? How the velocity is distributed in pipes of smooth & rough boundaries? [6]

(b) A smooth pipe of 90mm dia and 1000m length is carrying water at the rate of 0.009 m^3/sec. Calculate the head loss, wall shearing stress. Also calculate the thickness of laminar sublayer and velocity at centre of pipe. [10]

UNIT – III

Q.3 (a) What are the differences between open channel & pipe flow. [6]

(b) What do you understand by most economical section? [2]

(c) Derive the conditions of most economical trapezoidal section and triangular section. [8]

OR

Q.3 (a) What do you understand by critical, subcritical and super critical flow. Explain with reference to specific energy curve. [6]

(b) What is the equation of gradually varied flow? What are assumptions taken in deriving the equation? [6]

(c) Enumerate with neat sketches various profile of gradually varied flow. [4]

UNIT – IV

Q.4 (a) What are the assumptions in deriving the general expression of hydraulic jump. [4]

(b) Derive the expression $\frac{y_2}{y_1} = \frac{1}{2}\left(-1+\sqrt{1+8F_1^2}\right)$, starting from momentum principle. y_1& y_2 are conjugate depths and F_1 is Froude number at start of jump. [12]

OR

Q.4 (a) What do you understand by inlet and outlet velocity diagram? Explain with neat sketches. [6]

(b) A 4cm diameter water jet with a velocity of 35m/sec impinges on a single vane moving in the same direction at a velocity of 20m/s. The jet enters the vane tangentially along x-direction. The vane deflects the jet by 150°. Calculate the force exerted by water on wheel. [10]

UNIT – V

Q.5 (a) What are the differences between reaction and impulse turbines? [6]

(b) Describe manometric, mechanical and overall efficiency of centrifugal pump. [6]

(c) Write down the importance of characteristic curve of centrifugal pump. [4]

OR

Q.5 (a) What are the functions of draft tube? Briefly write about various types of draft tubes. [6]

(b) Find the power required to drive a centrifugal pump which delivers $0.04m^3$/sec of water to a height of 20m through a 15mm dia pipe and 100m long. The overall efficiency of pump is 70%. f = 0.15 in Darcy's Weisbach equation for loss of head in pipe. [12]
