

4E4113

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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 $450\text{m}^3/\text{s}$, 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 in a 15cm diameter pipe using water at 20°C ($\mu_w = 1 \times 10^{-2}$ 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/m², $\frac{\partial p}{\partial x} = -1200$ N/m²/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 m³/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 $0.04\text{m}^3/\text{sec}$ 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]