6. (a) Water flows in a steel pipe (d = 40 mm, $k = 0.045 \times 10^{-3}$, $\mu = 0.001$ k/ms) with a rate of 1 lit/s. Determine the friction coefficient and the head loss due to friction per meter length of the pipe using: 1. Moody's chart? 2. Smooth pipe formula? (10)

(b) A pipe of dia 15 mm is required to transmit an oil of specific gravity 0.9 and viscosity 3×10^{-2} poise at 3000 lps. Tests were conducted on 150 mm dia pipe using water at 20°C. Find Velocity and rate of flow of model if 'μ' water at 20°C, is 0.01 poise. (5)

7. A model for a spillway has to be built in a laboratory where the maximum capacity of the pump is 9 cfs. The prototype has 300 cfs maximum dischargeand 5 ft head on the crest.

(i) Determine the scale ratio for the model?

(ii) Calculate the head on the crest of the model?

(iii) Find the time in model corresponding to 36 hours in prototype?

(iv) Determine the loss of power in prototype corresponding to observed 0.05 HP in model? (15)

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002602

August/September 2022
B.Tech. (Civil) VI SEMESTER
Hydraulic Engineering (PCC-CE302)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Explain GVF and RVF. (1.5)

(b) State the relation between Manning's constant and Chezy's Constant. (1.5)

(c) Define different types of flow. (1.5)

(d) Determine the maximum discharge through a rectangular open channel of area 8 m^3 with a bed slope of 1/2000. Assume manning's constant 0.022. (1.5)

(e) Differentiate between most economical and most efficient channel. (1.5)

(f) Sketch the velocity distribution in rectangular and triangular channel. (1.5)

(g) What is the Back Water Curve? (1.5)

(h) What are the classifications of flow profile? (1.5)

(i) Consider two parallel plates placed in horizontal condition 1.2 cm apart and the space between them is filled with the oil of viscosity 15.0 poise. The upper plate is moved with a velocity of 3.25 m/s. Calculate the shear stress in the oil? (1.5)

(j) What is Stoke's law and Reynold number? (1.5)

PART-B

2. (a) Prove that Hydraulically most efficient trapezoidal section is half of regular Hexagon. (10)

(b) A pipe, 40 m long, is connected to a water tank at one end and flows freely in atmosphere at the other end. The diameter of pipe is 15 cm for first 25 m from the tank, and then the diameter is suddenly enlarged to 30 cm. Height of water in the tank is 8 m above the centre of pipe. Darcy's coefficient is 0.01.

Determine the discharge neglecting minor losses? (5)

3. (a) What is the main assumption of boundary layer theory? (5)

(b) A rectangular channel carrying a super critical stream is to be provided with a hydraulic jump type of energy dissipater. It is desired to have an energy loss of 5 m in hydraulic jump when inlet Froude's number is 8.5. What are the segment depths of this jump? (10)

4. A thin rectangular plate having a width w and a height h is located so that it is normal to a moving stream of fluid. Assume that the drag, D, that the fluid exerts on the plate is a function of w and h, the fluid viscosity, u, and ρ, respectively, and the velocity, V, of the fluid approaching the plate. Determine a suitable set of pi terms to study this problem experimentally. (15)

5. (a) Derive an expression for depth of hydraulic jump in terms of upstream Froude's number. (5)

(b) An open channel to be made of concrete is to be designed to carry 1.5 m^3/s at a slope of 0.00085. Find the most efficient cross-section for (i) Rectangular section (ii) Trapezoidal section (iii) Semicircular section. (10)