SE (Civil) Sem IV R'20 C' scheme 23.05.2025

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3 HOURS Marks: 80

Note: - 1. Q.No.1 is compulsory.
2. Attempt any three questions out of remaining five questions. From Q.No.2 to Q.No .6.
3. Assume any data if required stating clearly.

Q1. Attempt **any four** from the following (20)

a) Explain in brief about major and minor losses through pipe.

b) Write a note on Dimensionless number.

c) Explain hydrodynamic ally smooth and rough boundaries

d) Write a note on Boundary layer separation and its control measures.

e) Explain Moment of momentum principle and its applications in fluid mechanics

f) Derive an expression for Hagen poiseuille equation.

Q.No.2 a) Three reservoirs A, B and C are connected by pipes, out of which water level in the two reservoirs namely A and B are 104.5 m and 100 m respectively above datum. A pipe joins each to a common point D, where pressure is 98 .1 KN/m^2 gauge and height is 83.5 above datum. Another pipe connects D to another tank C. What will be height of water level in C assuming the same value of f for all pipes. Take friction coefficient = 0.0075. The diameter of pipe AD, BD and CD are 300 mm, 450 mm , 600 mm respectively and their length are 240 m, 270 m and 300 m respectively. (10)

b) State assumption in Hardy-Cross method used for solving pipe network problem (5)

c) Derive an expression for Energy thickness and Momentum thickness (5)

Q.No.3 a) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The total length of the syphon is 600 m and summit is 4m above water level in upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of syphon from the upper reservoir to summit. Take f = 0.004 and atmospheric pressure = 10.3 m of water (10)

b) . A smooth pipe of diameter 500mm and 1000m long is carrying water at the rate of 50 liters per second. If the kinematic viscosity is 0.02 stokes. Calculate: (a) loss of head, (b) wall shearing stress, (c) centre line velocity, (d) velocity and shear stress at 150mm from the pipe wall and (e) thickness of laminar sub layer. (10)

Q.No.4 a) Compare pipes in series and parallel (5)

b) A lawn sprinkler with two nozzles of diameter 4 mm each is connected a cross a tap of water. The nozzles are at a distance of 30 cm and 20 cm from the center of the tap. The rate of flow of water through tap is 120 cm^3/s. The nozzles discharge water in the downward direction. Determine the angular speed at which the sprinkler will rotate free. (10)

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c) Find the maximum power transmitted by a jet of water discharging freely out of a nozzle fitted to a pipe 300 m long and 100 mm diameter with coefficient of friction as 0.01. The available head at the nozzle is 90 m **(5)**

Q.No.5 a) The pressure difference Δp in a pipe of diameter D and length L due to turbulent flow depends on the velocity V, viscosity μ, and density ρ and roughness k. Using Buckingham's π theorem, obtain an expression for Δp. **(10)**

b) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/s . Find the pressure drop. **(5)**

c) Calculate i. Pressure gradient along flow, ii) the average velocity and iii) the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2 m/s. **(5)**

Q.No.6 a) Write a note on Water Hammer & Control measures **(5)**

b) Compare laminar and turbulent flow **(5)**

c) The velocity distribution in the boundary layer is given by, $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$ where δ is boundary layer thickness. Find the displacement thickness, momentum thickness and energy thickness **(10)**

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