

Paper ID [CE204]

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B. Tech. (Sem. - 4th)

FLUID MECHANICS - II (CE - 204)

(Paper - II)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1) (10 × 2 = 20)

- a) What do you mean by boundary layer separation?
- b) What are the ranges of Reynolds number for the flow in the boundary layer to be laminar and turbulent?
- c) What do you mean by Stoke's law in laminar flow?
- d) What do you mean by coefficient of drag and coefficient of lift?
- e) Describe an aerofoil.
- f) Differentiate between steady and unsteady flow in a channel.
- g) State Katter's formula for determining the Constant C.
- h) What do you mean by most economical section?
- i) What do you mean by gradually varied flow?
- j) What are the factors that influence the total drag on a body?

Section - B

(4 × 5 = 20)

Q2) What do you mean by critical depth? Derive expressions for critical depth.

- Q3)** For laminar flow of an oil having dynamic viscosity $\mu = 1.766$ Poise in a 0.3m diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3m/s at the centre of the pipe. Calculate the shearing stress at the pipe wall and within the fluid 50mm from the pipe wall.
- Q4)** A rectangular channel 4 meter wide discharges 16 cumecs of water, if the specific energy head is 2.25 meters, find the possible depth of flow.
- Q5)** A channel has vertical wall 1.20 meters apart and a semi-circular invert. If the centre line depth is 0.90 meter and the bed slope is 0.375 meter per kilometer, find the value of C in Chezy's formula if the discharge is 0.54 cumecs.
- Q6)** A sphere 100mm in diameter is just supported in equilibrium in a vertical air stream. If the velocity of the air stream is 12 meter per second, find the weight of the sphere. Take $C_d = 0.42$ and $\rho = 1.225 \text{ kg/m}^3$ for air.

Section - C

(2 × 10 = 20)

- Q7)** A container full of oil has a horizontal parallel crack in its end walls which is 500mm wide and 50mm thick in the direction of flow. Find the volume of oil leakage per hour through the crack which forms a gap of 0.4mm between the parallel surfaces. The pressure difference between the two faces of the crack is 0.1 kgf/m². Take specific gravity and viscosity of oil equal to 0.85 and 1.8 Poise respectively.
- Q8)** Fresh water at 25°C flows across a smooth plate at a velocity of 3m/sec. The local shear stresses on the plate is found to be 1.35 and 13.2 N/m². Taking that there is no variation in the local shear stresses when boundary is roughened by uniform sand of grain size $k = 0.3\text{mm}$, find the change in velocity at $y = 3\text{mm}$ for a velocity of 3m/sec.
- Q9)** Find the bed slope of a wide rectangular channel for critical flow to reach a given s 0.54 cumecs.