

Total No. of Questions : 8]

SEAT No. :

P1476

[6002]- 103

[Total No. of Pages : 3

S.E. (Civil)

FLUID MECHANICS

(2019 Pattern) (Semester - III) (201003)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2 Q.3 or Q.4 Q.5 or Q.6 Q.7 or Q.8.
- 2) Answers to the all questions should be written in single answer-book.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

- Q1) a) The resistance force R experienced by a partially submerged body depends upon the velocity V , length of the body L , viscosity of the fluid μ , density of the fluid ρ , and gravitational acceleration g . Using Buckingham-Pi method, prove that: [8]

$$R = \rho V^2 L^2 \phi \left(\frac{\rho V L}{\mu}, \frac{V}{\sqrt{g l}} \right)$$

- b) Explain following similarities as applicable to model studies: [6]
- i) Geometric similarity
 - ii) kinematic similarity
 - iii) dynamic similarity
- c) The velocity distribution in a boundary layer is given by [4]

$$\frac{u}{U} = \frac{y}{\delta}$$

Calculate displacement thickness.

OR

- Q2) a) The velocity and discharge for a $\frac{1}{50}$ scale model of a spillway are 0.35 m/sec and 0.11 m³/sec, respectively. Calculate corresponding velocity and discharge in the prototype. [6]

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- b) Explain the growth of boundary layer over a thin flat plate held parallel to the direction of flow in a real fluid. [6]
- c) Explain following similarity laws [6]
- Reynold's model law
 - Froude's model law

- Q3)** a) Explain all types of minor losses in pipe. [7]
- b) The water surface levels of two reservoirs differ by 12 m. They are connected by a 55 m long pipe. For the first 25 m length the diameter is 120 mm and for the remaining length diameter is 150 mm. The Darcy - Weisbach friction factor f for 120 mm diameter and 150 mm diameter pipes are respectively 0.024 and 0.02. Determine the discharge. Neglect minor losses. [7]
- c) Draw typical velocity distribution diagrams for fully developed laminar and turbulent flow through pipe. Also state the nature of velocity profile for each. [3]

OR

- Q4)** a) Define following term applicable to turbulent flow through pipe: [6]
- instantaneous velocity
 - temporal mean velocity
 - Prandtl's mixing length
- b) Prove that for steady uniform laminar flow through circular pipe, the velocity distribution diagram is parabolic. [9]
- c) Calculate the value of Darcy Weisbach friction factor if Reynold's Number for flow through pipe is 100. [2]

- Q5)** a) Explain specific energy curve. [5]
- b) A trapezoidal channel has side slope of 1 V: 1.5 H and the slope of the channel bottom is 1 : 5000. Determine the dimensions of most efficient channel section, if it has to carry water at 10 m³/sec. Take Manning's $n=0.012$. [8]
- c) Explain different four types of flows in open channel. [4]

OR

- Q6)** a) Calculate minimum specific energy and maximum discharge corresponding to specific energy of 1.8 m that may occur in a rectangular channel 5 m wide. [8]
- b) Define following terms applicable for uniform flow computation: [3]
- normal depth
 - conveyance
 - section factor
- c) Explain velocity distribution in open channel flow. [6]
- Q7)** a) Explain M1, M2, and M3 profiles of GVF. Give their practical example. [9]
- b) A flat plate 1 m × 1 m moves through air of density 1.2 kg/m³ at 30 kmph. Determine: [9]
- drag force
 - lift force
 - resultant force
 - power required to maintain the plate in motion.
- Take $C_D = 0.18, C_L = 0.70$.

OR

- Q8)** a) In a wide rectangular channel of 100 m wide and 3 m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Take Manning's $n = 0.035$. Use direct step method and take two steps only. Sketch the water surface profile. [10]
- b) Differentiate between bluff body and streamlined body with neat sketch. [5]
- c) Draw a neat sketch showing variation of drag coefficient with Reynolds Number for flow around circular cylinder. [3]

