Total No. of Questions : 8]

SEAT No. :

P1476

[Total No. of Pages : 3

[6002]- 103

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]**

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

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 m^3/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]**

i) Reynold's model law

ii) 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]**

i) instantaneous velocity

ii) temporal mean velocity

iii) 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 m^3/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]**

i) normal depth

ii) conveyance

iii) 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/m^3 at 30 kmph. Determine: **[9]**

i) drag force

ii) lift force

iii) resultant force

iv) 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]**