Total No. of Questions : 8]

SEAT No. :

PA-1181

[Total No. of Pages : 3

[5925]-203

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) *Answer 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) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

Q1) a) A 1:15 model of a flying boat is towed though water. The prototype is moving in seawater of density 1025kg/m^3 at velocity of 21 m/s. Find the corresponding speed of the model. Also, determine the resistance due to waves on model if the resistance due to waves of the prototype is 610N. **[9]**

b) Explain the phenomenon of Boundary Layer Separation and Methods to control to it. **[8]**

OR

Q2) a) The resisting force R of a supersonic plane during the flight can be considered as dependent upon the length of the aircaft l, velocity V, air viscosity μ, air density ρ, and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. Use Buckingham's Π Method **[9]**

b) Explain with the help of neat sketch **[8]**

i) Laminar boundary layer

ii) Turbulent boundary layer

iii) Laminar Sub-layer.

P.T.O.

Q3) a) A pipe of 110 mm diameter is carrying water. If the velocities at the pipe center and 30 mm from the pipe centre are 2.1 m/s and 1.6 m/s respectively and flow in the pipe is turbulent. Calculate the shear friction velocity and wall shearing stress. **[9]**

b) Derive with usual notations the following Darcy-Weisbach equation for the loss of energy due to friction. **[8]**

$$h_f = \frac{4.f.LV^2}{2.g.D}$$

OR

Q4) a) A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 211 N/m^2. Find: **[9]**

i) The pressure gradient,

ii) The average velocity, and

iii) Reynolds number of the flow

b) Explain the procedure of Hardy Cross method for the analysis of pipe network. **[8]**

Q5) a) The discharge of water through a rectangular channel of width 8 m, is 15.5 m^3/s when the depth of flow of water is 1.25 m. Calculate: **[10]**

i) Discharge per unit width

ii) Velocity of flow

iii) Specific energy of the flowing water

iv) Critical depth

v) Critical velocity and

vi) Value of minimum specific energy.

b) Derive with usual notations the basic governing "energy equation" of channel flow. **[8]**

OR

Q6) a) A trapezoidal channel has side slope of 3 horizontal to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions for the channel sections and show it with neat sketch, if it is carry water at 0.55 m^3/s. Take Chezy's constant as 80. **[9]**

b) i) Explain the Specific energy curve with neat sketch. **[5]**

ii) Find the rate of flow of water through a V-shaped channel as shown in Figure 6 b. Take the value of C=56 and slope of the bed 1 in 2000. **[4]**

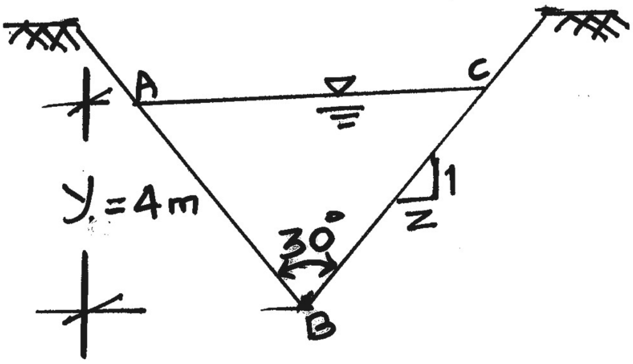

Fig:- 6 b

(NOT TO SCALE)

Q7) a) A metallic ball of diameter 2×10^{-3} m drops in a fluid of sp. gr. 0.96 and viscosity 15 poise. The density of the metallic ball is 12000 kg/m^3. Find: **[10]**

i) The drag force exerted by fluid on metallic ball,

ii) The pressure drag and skin friction drag, and

iii) The terminal velocity of ball in fluid.

b) Explain Classification of channel bottom slopes with neat sketches. **[8]**

OR

Q8) a) A rectangular channel is 20 m wide and carries a discharge of 65 m^3/s. It is laid at a slope of 0.0001. At a certain section along the channel length, the depth of flow is 2m. How far U/S or D/S will the depth be 2.6m? Take n=0.02. Use direct step method with three steps. Consider the depth increment in the interval of 0.1m. Classify and sketch the profile. **[10]**

b) A flat plate 1.5 m×1.5 m moves at 51 m/hr in stationary air of density 1.16 kg/m^3. If the co-efficient of drag and lift are 0.16 and 0.76 respectively, determine: **[8]**

i) The lift force,

ii) The drag force

iii) The resultant force, and

iv) The power required to keep the plate in motion.

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