

Total No. of Questions : 8]

PE4237

SEAT No. :

[Total No. of Pages : 3

[6582]-8

S.E. (Civil)

FLUID MECHANICS

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt 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 side 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 7.25 m height and 15.5 m long spillway discharges 95 m<sup>3</sup>/s discharge under a head of 2.1 m. If a 1 : 9 scale model of this spillway is to be constructed, determine model dimensions, head over the spillway model and the model discharge. If model experiences a force of 7550 N, determine the force on prototype. [9]

- b) Explain in brief : [8]
- i) Boundary layer thickness
  - ii) Displacement thickness
  - iii) Momentum thickness and Energy thickness

OR

Q2) a) What is meant by Similitude? Explain in brief : [9]

- i) Dynamic similarity
- ii) Kinematic similarity and
- iii) Geometric similarity

b) Find the momentum thickness, displacement thickness and energy

thickness for velocity distribution in the boundary layer given by  $\frac{u}{U} = \frac{y}{\delta}$ ,

where  $u$  is the velocity at a distance  $y$  from the plate and  $u = U$  at  $y = \delta$ ,

where  $\delta =$  boundary layer thickness. Also calculate the value of  $\frac{\delta^*}{\theta}$ . [8]

P.T.O.

**Q3) a)** In case of flow of viscous fluid through circular pipe, show that the ratio of maximum velocity to average velocity = 2.0. [9]

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

OR

**Q4) a)** In case of velocity distribution in turbulent flow in pipes, derive the following equation with usual notations. [9]

$$\frac{u_{\max}}{u_*} = 5.75 \log_{10} \left( \frac{R}{y} \right)$$

b) A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in the discharge if  $4f = 0.04$ . The head at the inlet is 310mm. [8]

**Q5) a)** Derive with usual notations the basic governing “Continuity Equation” of channel flow. [9]

b) Derive the conditions for most economical triangular channel section. [9]

OR

**Q6) a)** A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is 41 m<sup>2</sup>. Find the dimensions of the section and draw the sketch of it, if it is most economical. Determine the discharge of the most economical section if  $C = 50$ . [9]

b) i) Explain with neat sketch “Velocity distribution in open channel”. [4]

ii) Derive with usual notations the following expression for critical depth. [5]

$$h_c = \left( \frac{q^2}{g} \right)^{1/3}$$

- Q7) a) Derive the following equation of GVF with usual notations. State also the assumption made for it. [10]

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - \frac{Q^2 T}{g A^3}}$$

- b) A jet plane which weighs 29450 N and has a wing area of 20 m<sup>2</sup> flies at a velocity of 250 km/hr. When the engine delivers 7358 kW, 65% of the power is used to overcome the drag resistance of the wing. Calculate the co-efficient of lift and co-efficient of drag for the wing. Take density of air equal to 1.21 kg/m<sup>3</sup>. [8]

OR

- Q8) a) A wide rectangular channel carries a flow of 11 m<sup>3</sup>/s/m width of the channel with bed slope of 1 in 3500 and Manning's n = 0.015. If the depth at a section is 4.5m, determine how far upstream or downstream of the section, the depth of flow would be within 5% of the normal depth. Use direct step method with two steps. Classify and sketch the profile. [12]

- b) Explain with neat sketch:

i) Karman Vortex Trail [3]

ii) Polar Diagram [3]

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