

Total No. of Questions : 8]

SEAT No. :

PD-4044

[Total No. of Pages : 3

[6402]-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) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate marks.
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.
- 5) Assume suitable data, if necessary.
- 6) Answers to the all questions should be written in single answer book.

- Q1) a) Explain Buckingham π theorem method of dimensional analysis. [6]
- b) List out the various Non dimensional numbers along with their mathematical expression. [5]
- c) The drag force F on a partially submerged body depends upon relative velocity V between body and fluid linear dimension l , height of surface roughness k , fluid density ρ , viscosity μ , acceleration due to gravity ' g ', using Buckingham π theorem develop an expression for drag force. [6]

OR

- Q2) a) Explain boundary layer development on flat plate. [6]
- b) What is boundary layer separation. Explain any two methods to avoid boundary layer separation. [6]
- c) A flat plate has a length of 3m and width of 0.8m is moving in a stationary air at an velocity of 3m/s. If the kinematic viscosity of air is 0.10 stokes, find the thickness of boundary layer at the trailing edge. [5]

- Q3) a)** What are characteristics of laminar flow and list out any 4 practical examples of laminar flow. [6]
- b)** Explain 1. Instantaneous velocity, 2. Temporal mean velocity, 3. Intensity of turbulence. [5]
- c)** A laminar flow occurs through a pipe of 20cm diameter. The velocity of flow at a radial distance of 2 cm from axis of pipe was found to be 0.5m/s, find. [6]

- i) Maximum velocity of flow
- ii) Mean velocity of flow
- iii) Discharge flowing through pipe

OR

- Q4) a)** What is the difference between major loss and minor loss of energy in flow through pipe. List out all the types of minor loss along with relevant equations. [5]
- b)** Two pipe of diameter 10cm and length 5m, diameter 15cm and length 7.5m length respectively are connected in series, what is the total loss of energy when fluid flow from one end to another. Also draw the hydraulic gradient and total energy line. [6]
- c)** Three pipes 40cm diameter, 1200m length, 30cm diameter, 1000m length, 20cm diameter, 500m length, are connected in series. [6]
- i) If the pipe system is to be replaced by an equivalent pipe of 30 cm diameter, what would be the equivalent length.
 - ii) What will be the equivalent diameter for the pipe of length 2700m length.

- Q5) a)** What is an open channel flow, its characteristics and what are the different types of flow that occur in an open channel? [6]
- b)** Derive condition for most economical rectangular channel section. [6]
- c)** A trapezoidal channel 2.5m wide and side slope 1.5 horizontal to 1 vertical carries water at a depth of 1.2m. If the channel bed slope is 0.0050 and manning coefficient is 0.020, [6]

Calculate

- i) Velocity of flow
- ii) Discharge carried by channel
- iii) Average shear stress at the boundary

OR

- Q6) a)** What is specific energy? Explain with neat sketch specific energy curve? [6]
- b)** A rectangular channel is 3m wide and carries water at a normal depth of 0.5m. The channel has a longitudinal slope of 1 in 200. If manning coefficient of roughness is 0.018 find [6]
- i) Discharge per unit width
 - ii) Flow is laminar or turbulent
 - iii) Critical depth
 - iv) Specific energy and specific force
 - v) Minimum specific energy
- c)** Explain the following with respect to open channel flow [6]
- i) Prismatic channel
 - ii) Discharge diagram
 - iii) Specific force diagram
- Q7) a)** A flat plate $2.5\text{m} \times 2.5\text{m}$ is moved in a stationary air at 35 km/hr. If the coefficient of drag and lift is 0.10 and 0.50 respectively find [6]
- i) Drag force
 - ii) Lift force
 - iii) Resultant force and its inclination
 - iv) Power required to keep plate in motion
- Take density of air 1.2 kg/m^3
- b)** What are the different type of drag and explain each type. [6]
- c)** What is Magnus effect, and explain how lift can be generated on cylinder using Magnus effect. [6]

OR

- Q8) a)** What are the different channel types and the possible flow profile in each type of channel? [6]
- b)** Sketch the water surface flow profile in mild slope channel. [4]
- c)** A rectangular channel 15m wide carries water at a normal depth of 1.5m with a bed slope of 1/5000. At a certain section the depth of flow is 2.5m. How far upstream or downstream of this section the depth of flow would be 2.1 m. Use step method and take 2 steps. [8]

