Total No. of Questions : 8]

SEAT No. :

# PB3603

[Total No. of Pages : 3

## [6261]-8
## 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 and Q.7 or Q.8.*
2) *Answers to the all questions should be written in single answer - book.*
3) *Neat diagram 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) Using Buckingham - Pi method, prove that the drag force F on a sphere of diameter D moving at a constant speed V through a fluid of density ρ and dynamic viscosity μ may be expressed as **[8]**

$$F = \rho V^2 D^2 \phi\left(\frac{\mu}{\rho V D}\right)$$

b) Explain following similarities as applicable to model studies: **[4]**

i) kinematic similarity

ii) dynamic similarity

c) The velocity distribution in boundary layer is given by

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

Calculate displacement and momentum thickness. **[6]**

OR

***Q2)*** a) The velocity and discharge for a $\frac{1}{40}$ scale model of a spillway are 0.45m/sec and 0.102 m3/sec, respectively. Calculate corresponding velocity and discharge in the prototype. **[6]**

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) Derive an expression for displacement thickness. **[6]**

***P.T.O.***

***Q3)*** a) Explain in brief Moody's diagram. **[7]**

b) The difference of water levels of two reservoirs is 8m They are connected by a 40 m long pipe. For the first 25m length, the diameter of the pipe is 120 mm and for the remaining length, the diameter is 200 mm, the change in diameter being sudden. Calculate the discharge into the reservoir. Also calculate head loss in individual pipe Take Darcy - Weisbach friction factor f = 0.032. Neglect minor losses. **[8]**

c) Draw typical velocity distribution diagrams for fully developed laminar and turbulent flow through pipe. Also state the nature of velocity profile for each. **[2]**

OR

***Q4)*** a) Explain in brief all types of minor losses in pipe. **[6]**

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 V : 0.75 H and the slope of the channel bottom is 1: 2000. Determine the dimensions of most effcient channel section, if it has to carry water at 0.5 $m^3$/sec. Take Chezy's C = 80. **[8]**

c) A triangular gutter of 60° angle conveys water at a uniform depth of 0.3m. If bed slope is 1 in 150, calculate discharge. Take Manning's n = 0.018. **[5]**

OR

*Q6)* a) Derive Chezy's formula for uniform flow through open channel. **[8]**

b) Write five characteristics of critical flow in open channel. **[5]**

c) Water flows at the rate of $16m^3$/sec in a rectangular channel 10 m wide at a velocity of 1.6m/s. calculate

i) specific energy head,

ii) Froude Number and state the type of flow. **[5]**

*Q7)* a) Derive dynamic equation of GVF. **[9]**

b) A flat plate 1 m ×1 m moves through air of density 1.15 $kg/m^3$ at 36kmph. Determine:

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. **[8]**

OR

*Q8)* a) In a wide rectangular channel of 100 m wide and 3m 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 stream lined and bluff body with suitable sketches. **[4]**

c) Draw a neat figure showing variation of drag coefficient ($C_D$) with Reynold's Number ($R_e$) for flow around a sphere of real fluid. Show appropriate vales of $C_D$ and Re. **[3]**

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