B. Tech. Sem - III (Mechanical Engg.) (2014 COURSE) (CBCS) :
SUMMER - 2019
SUBJECT - FLUID MECHANICS

Day: Monday | Time: 02.30 PM TO 05.30 PM
Date: 13/05/2019 | S-2019-2577 | Max. Marks: 60

N.B.:

1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10 and Q.11 or Q.12
2) Figures to right indicate **FULL** Marks.
3) Assume suitable **DATA** if necessary.

Q.1 **a)** Distinguish between following types of fluid flows: **(05)**
i) Compressible & incompressible flow
ii) Uniform & non-uniform flow
Give suitable examples for each type of flow.

b) What is continuity equation? **(05)**
Derive an expression for continuity equation in Cartesian coordinates.

OR

Q.2 **a)** What do you understand by convective & local acceleration? **(05)**

b) The velocity components in the dimensional steady flow are given as: **(05)**
$u = x - 4y$ and $v = -y - 4x$
Find out velocity potential (ϕ) and stream function (ψ) for the given flow field.

Q.3 **a)** State and derive Pascal's law. Also give applications of Pascal's law. **(05)**

b) A wooden block of specific gravity 0.7 & having a size of 2 m × 0.5 m × 0.25 m is floating in water. Determine the volume of concrete of specific weight 25 KN/m^3, that may be placed on the wooden block which will immerse (i) the block completely in water, and (ii) the block & concrete completely in water. **(05)**

OR

Q.4 **a)** Drive an expression for total pressure and centre of pressure on inclined plane surface immersed in liquid. **(05)**

b) What do you understand by Metacentre and Metacentric height? **(05)**

Q.5 **a)** What is a pitot tube? (05)
How is it used to measure velocity of flow at any point in a pipe or channel?

b) A 0.3 m × 0.15 m venturimeter is mounted on a vertical pipe with flow upwards. 63 LPS of oil of specific gravity 0.8 and dynamic viscosity 1 Poise flows through the pipe line. The throat section is 0.1 m above the inlet section. What is the pressure difference between the inlet & the throat? **(05)**

OR

Q.6 **a)** State and derive Bernoulli's equation. **(05)**
Mention clearly the assumptions underlying it.

b) A rectangular notch has a discharge of 0.24 m^3/s when head of water is 800 mm. Find the length of the notch. Assume $C_d = 0.6$ **(05)**

P.T.O.

Q.7 **a)** In case laminar flow through a circular pipe, prove that **(05)**

$$V = V_{max} \times \left[1 - \left(\frac{r}{R}\right)^2\right]$$

b) Describe with the help of a sketch, the variation of drag coefficient for a cylinder over a wide range of Reynolds number. **(05)**

OR

Q.8 **a)** For a laminar flow between fixed parallel plates, prove that $V = \frac{2}{3} V_{max}$ **(05)**

b) Define coefficient of drag and lift. **(05)**
State the factors on which these coefficients depend.

Q.9 **a)** What do you understand by equivalent pipe? **(05)**
In case of an equivalent pipe prove that:

$$\frac{L}{D^5} = \frac{L_1}{D_1^5} + \frac{L_2}{D_2^5} + \frac{L_3}{D_3^5} + \ldots\ldots\ldots$$

b) Derive formulae for calculating loss of head due to **(05)**
- **i)** Sudden enlargement &
- **ii)** Sudden contraction

OR

Q.10 **a)** Drive an expression for the power transmission through the pipes. Find also the condition for maximum transmission of power and corresponding efficiency of transmission. **(05)**

b) Explain briefly the Following: **(05)**
- **i)** Hydraulic Gradient Line (HGL)
- **ii)** Energy Gradient Line (EGL)

Q.11 **a)** What do you understand by separation of boundary layer? **(05)**
Describe with the help of neat sketches the methods to control boundary layer separation.

b) What are repeating variables? **(05)**
How are they selected in dimensional analysis?
Explain any one case for selection of repeating variables.

OR

Q.12 **a)** Explain the characteristics of laminar and turbulent boundary layers. **(05)**

b) Define the following dimensionless numbers & state their significance for fluid flow problems. **(05)**
- **i)** Reynolds number
- **ii)** Froude's number
- **iii)** Mach number

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