Paper Code: CE-301	**Roll No.**									

B.Tech.
THIRD SEMESTER EXAMINATION, 2016-17
FLUID MECHANICS

[Time: 3 Hrs] [Max. Marks: 100]

Note: Attempt all questions. All question carry equal marks.

1. Attempt any **four** questions from the following :- **(5x4=20)**

(a) Explain the concept of fluid-continuum.What is the advantage of assuming fluidcontinuumconcept in fluid mechanics?

(b) Explain Newton's Law of Viscosity.The velocity distribution over a plate is given by $u = \frac{2}{3} y - y^2$ in which u is the velocity in m/sec at a distance of y m above the plate. Determine the shear stress at y = 0.2, take $\mu = 0.6$ poise.

(c) Explain the following terms :
- (i) Cavitation
- (ii) Vapour pressure
- (iii)Surface Tension
- (iv)Capillarity
- (v) Kinematic viscosity

(d) What do you understand by Metacentric height? And what arethe three states of equilibrium for floatingbodies. Explain each with neat sketches.

(e) Explain Hydrostatic law and Pascal's law and also find its expression.

(f) Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and for the position of centre of pressure. A rectangular plane surface is 2 m wide and 3m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure when its upper edge is horizontal and coincides with water surface.

2. Attempt any **two** questions from the following:- **(10x2=20)**

(a) Derive the expression for the continuity equation for the steady state 3D flow of a compressible fluid.The following two cases represents the velocity components, determine the third component of velocity such that they satisfy the continuity equation:

$$u = x^2 + y^2 + z^2 \; ; v = xy^2 - yz^2 + xy$$

(b) Explain and distinguish in between the following terms
- (i) Subcritical and super critical flows and
- (ii) Convective acceleration and total acceleration
- (iii)Equipotential line and stream-line constant
- (iv)One, two and three dimensional flow

(c) A jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming the jet remains circular and neglecting any loss of energy, that will be the diameter at a point 4.5 m above the nozzle, if the velocity with which the jet leaves the nozzle is 12 m/s.

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3. Attempt any **two** questions from the following:- **(10x2=20)**

(a) Define orifice. What do you understand by orifice-meter? Derive an expression for the discharge through an orifice-meter.

(b) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem and state the assumption made to derive the equation.

(c) What do you understand by dimensional homogeneity and dimensionless numbers? Write their significance also? Explain Reynolds no., Mach no., and Froude's no. and explain how laminar, sonic and critical flows are related to these no respectively.

4. Attempt any **two** questions from the following:- **(10x2=20)**

(a) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.

(b) Derive an expression for the loss of head due to:

(i) Sudden enlargement of pipe

(ii) Sudden contraction of pipe

(c) Three pipes of lengths of 800 m, 500 m, and 400 m and of diameters 500 mm, 400 mm, and 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700 m Find the diameter of the single pipe.

5. Attempt any **four** questions from the following:- **(10x2=20)**

(a) Explain displacement thickness. And obtain an expression for displacement thickness.

(b) What do you understand by Boundary layer? Briefly explain its different components with neat sketches.

(c) What do you mean by separation of Boundary layer? What are different methods to prevent it?

(d) What is the effect of pressure gradient on boundary layer separation? Explain with neat sketches.

(e) Explain the term Magnus effect and Terminal velocity of a body.

(f) Find an expression for Drag on a sphere.

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