**CE-301**

**Roll No.** | | | | | | | | | | |

# B. Tech
## (SEMESTER- III) CIVIL ENGINEERING EXAMINATION, 2015-16
## FLUID MECHANICS

***Time: 3 Hours*** ***Total Marks: 100***

**Note:** **(i)** Attempt ALL questions.
**(ii)** Marks are indicated against each question.
**(iii)** Assume any data suitably, if required and not given.

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| **1.** | Attempt any FOUR parts of the following | | **5x4=20** |
| | **(a)** | Explain the concept of fluid-continuum. Why is it necessary to make the assumption of continuum concept in the study of fluid mechanics? | |
| | **(b)** | Discuss the phenomenon of surface tension and capillarity. Obtain the expression for both. | |
| | **(c)** | What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of $1.53 \times 10^3$ kg/m$^3$, if the atmospheric pressure is equivalent to 750 mm of mercury? | |
| | **(d)** | A square plate 50 cm x 50 cm weighing 200 N slides down an inclined plane of slope 1 vertical: 2.5 horizontal with a uniform velocity of 0.40 m/s. If a thin layer of oil of thickness 0.5 cm fills the space between the plate and the inclined plane, determine the coefficient of viscosity of the oil. | |
| | **(e)** | Define the term Centre of Pressure for a plane lamina immersed in a fluid. What relation it has with its Centre of gravity? At what stage the Centre of pressure and canter of gravity would coincide. | |
| | **(f)** | What is meant by a stability of floating bodies? Explain the stability of a floating body with reference to its Metacentric height. Give neat sketches. | |
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| **2.** | Attempt any TWO parts of the following | | **10x2=20** |
| | **(a)** | Explain and distinguish between<br>(i) Steady and Unsteady flow<br>**(ii)** Uniform and Non-uniform flow<br>**(iii)** Rotational and Irrotational flow<br>**(iv)** Subcritical and Super critical flows<br>**(v)** Laminar and Turbulent flows. | |
| | **(b)** | Derive the expression for the continuity equation for the steady state 3-D flow of a compressible fluid. | |
| | **(c)** | Derive the equation of a stream line for 2-D flow. Determine the missing component of velocity distribution such that they satisfy continuity equation.<br>$u = 2x^2 + 2xy : v = 2yz^2 + 3z^2, w = ?$ | |

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| **3.** | Attempt any TWO parts of the following | | **10x2=20** |
| | **(a)** | State the Bernoulli's Theorem. Also Derive the Energy equation. The water is being discharged through a smooth inclined pipe of uniform diameter 250mm, a pressure of 50 kPa was observed at section-1 which was at an elevation of 10.00m. At another section-2, at elevation 12.00m, the pressure was 20 kPa and the velocity was 1.25 m/s. Determine the direction of flow and the loss of head between these two sections. | |
| | **(b)** | Derive the equation for the discharge through a Venturi meter and define the Vena contracta. Why the discharge coefficient is higher in case of Venturi meter compared to that of Orifice meter. | |
| | **(c)** | Define the Geometric, Kinematic and Dynamic similarities. . | |
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| **4.** | Attempt any Two parts of the following | | **10x2=20** |
| | (a) | Define and explain the Laminar flow. Derive the equation for laminar flow through circular pipe. | |
| | (b) | Define the following;<br>a. Types of turbulence<br>b. Isotropic and Homogeneous turbulence<br>c. Scale and intensity of turbulence<br>d. Dynamic and Eddy viscosity<br>e. Smooth and Rough surfaces. | |
| | (c) | What do you mean by the pipes connected in series and pipes connected in parallel. Three pipes of diameter 200mm, 150mm and 175 mm having lengths of 20m, 22m and 25 m are connected in series. The friction factor for these pipes are 0.014, 0.015 and 0.016 respectively. A discharge of 50 lit/sec is passing through these pipes. Determine the loss of head for these pipes connected in series. | |
| **5.** | Attempt any TWO parts of the following | | **10x2 =20** |
| | **(a)** | Define and explain the Boundary layer thickness. On what basis the boundary layer thicknesses are expressed. Give the expression for each of these. | |
| | **(b)** | Give a neat sketch of the different classes of flow occurring with the boundary layer. Also explain the different types of flows within it and the position of laminar sublayer. | |
| | **(c)** | What are the factors on which the boundary layer thickness depends upon. | |