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# RN-8119

## B. E. II (Sem. III) (Mech.) Examination

### May / June – 2010

## Fluid Mechanics

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

**Instructions :**

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
**Fillup strictly the details of ☛ signs on your answer book.**

Name of the Examination :

☛ **B. E. 2 (Sem. 3) (Mech.)**

Name of the Subject :

☛ **Fluid Mechanics**

☛ Subject Code No. : **8 1 1 9** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt **all** questions.

(3) Figures to the right indicate full marks.

(4) Assume suitable data wherever necessary.

## SECTION - I

**1** Attempt any **five** : **10**

(a) Pitot tube

(b) Specific gravity

(c) Vapour pressure

(d) Pascal's law

(e) Co-efficient of velocity

(f) Flow-net.

**2** Attempt any **five** : **20**

(a) Explain stability of floating body.

(b) Derive an expression for continuity for a three dimensional flow and deduce for steady incompressible two dimensional flow.

(c) Define momentum correction factor and derive its expression.

(d) Explain surface tension. Derive the equation for surface tension on a liquid droplet.

(e) Compare venturimeter and orificemeter. Explain with neat sketch.

(f) What is pitot-tube? How is it used to measure velocity of flow at any point in a pipe?

**3** Attempt any **one** : 8

(a) Derive an expression for total pressure for surface immersed in a fluid at any angle.

(b) Explain orifice meter and derive the equation for discharge through orifice.

**4** Attempt any **three** : 12

(a) A rectangular air duct of 1.5 $m^2$ cross-sectional area is gradually reduced to 0.075 $m^2$ area if the duct is bent by 45°, find the magnitude and direction of force required to hold the duct in position. The velocity of flow at the 1.5 $m^2$ section is 12 m/s, and pressure is 30 $kN/m^2$. Take density of air as 1.15 $kg/m^3$.

(b) In a three dimensional imcompressible flow, the velocity components in Y and z direction are $V = 3x^3 - 2y^2 + 9z^2$, $W = 2x^3 - 9y^2 + 2z^2x$. Find the velocity component in x-direction such that continuity equation is satisfied.

(c) A rectangular plane surface is 1m wide and 1.5 m deep, having circular hole of 0.5 diameter at centre. The upper edge and lower edge are below surface being 1m and 2m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure.

(d) The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5 mt.

## SECTION - II

**5** (a) (i) Define : Circulation, velocity **10**

(ii) What do you mean by dimensionless numbers? Name any **four** dimensionless numbers.

(iii) Explain geometric similarity.

(iv) Give two advantages of distared model.

(v) Sketch the velocity distribution and shear stress distribution across the section of pipe.

(vi) $Re = \frac{\text{force}}{\text{force}}$

(vii) Force = $M^{-}\ L^{-}\ T^{-}$

(viii) $M\ L^{-1}T^{-1}$ = _____

(ix) What type of force can be taken by collar bearing?

(x) Define compressible and incompressible fluid flow.

(b) (i) Write Froude Model law and derive scale ratios for various physical quantities. **6**

(ii) The pressure drop is an aeroplane model of size 1/50 its prototype 40 $N/gm^2$. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density and viscosity of air is as 1.24 $kg/m^3$ and 0.000018 $Ns/Cm^2$ while viscosity of water as 0.001 $H.S./cm^2$.

**6** Attempt any **three** : **15**

(a) The resistance R to the motion of a completely submerged body depends upon the length of the body, velocity of flow, mass density and kinematic viscosity. Find equation of R by using Rayleigh method.

(b) Write various methods of determination of coefficient of viscosity and explain capillary tube method.

(c) Derive equation of velocity for viscous flow through circular pipe.

(d) Explain procedure of Rayleigh method.

7 (a) Model Analysis. **7**

**OR**

(a) Exlain Moody diagram and its application. **7**

(b) Water flow through a pipe of 0.15 mt. diameter, 50 mt. length. Estimate the pressure drop, if flow rate is 0.2 $m^3$/sec. The kinematic viscosity of water is $1 \times 10^{-6}$ $m^2$/sec. The roughness $\varepsilon$ = 0.15 mm. (Use Moody diagram). **8**

**OR**

(b) If $u = \frac{-1}{4x}\frac{\partial p}{\partial a}\left(R^2 - r^2\right)$. Find ratio of maximum velocity to average velocity for viscous flow through circular pipe. **8**