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SE-8119

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

May / June - 2011

Fluid Mechanics

(New Syllabus)

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. (SEM. 3) (MECH.)**

Name of the Subject :

☛ **FLUID MECHANICS (NEW)**

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

Seat No. :

Student's Signature

(2) Assume suitable data if necessary

(3) Attempt all questions.

(4) Figure to the right indicate full marks.

(5) Draw neat sketch if necessary.

1 (a) State true or false from the given statement : **4**

(1) For an ideal fluid, bulk modulus of elasticity $K = \infty$ (Infinity)

(2) The dynamic viscosity of perfect gas increases when it is compressed iso thermally.

(3) An oil jet flows without breakup due to viscosity.

(4) If cohesion predominates, the liquid gets liftal up at the line of contact.

(b) Define the following terms : **6**

(1) Bulk modulus

(2) Vapour pressure

(3) Compressibility

(4) Cavitation

(5) Cohesion

(6) Surface tension.

(c) An inclined manometer was used to find the pressure of water in a pipeline as shown in fig. 1. Find out the Absolute water pressure in the pipe if the inclination of limb to the horizontal is 30°. The ratio of area of reservoir tube is 20°. 5

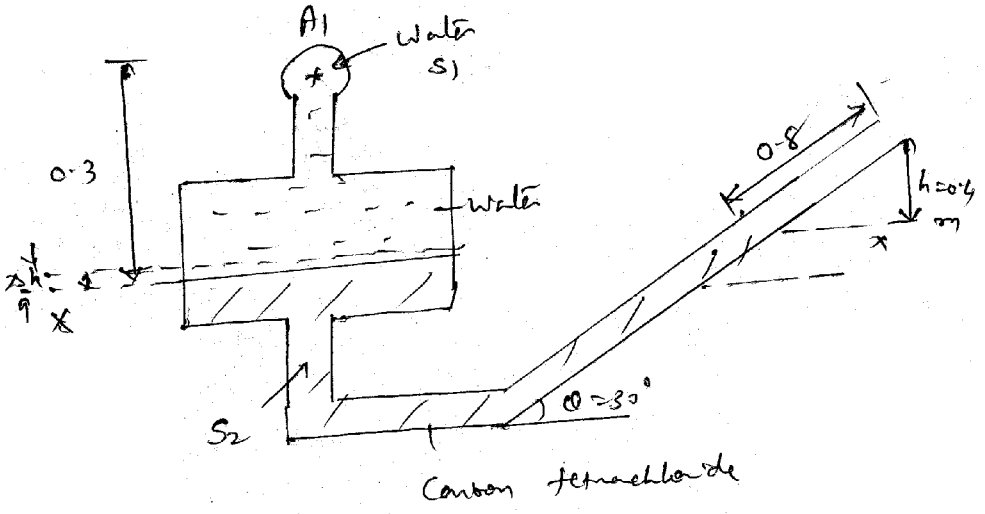

Fig. 1 (Inclined Manometer)

(d) Differentiate between the following : 5
(1) Specific weight and mass density
(2) Cohesion and Adhesion

2 (a) Derive the Analytical method for finding metacentric height for a floating body in liquid. 8

(b) The water is flowing through a taper pipe of length 100 m having diameters 500 mm and 250 mm at upper end and lower end respectively, at the rate of 600 litres/sec. The pipe has a slope of 1 in 25. Find the pressure at the lower end if the pressure at the higher level is 150 kN/m^2. 7

OR

(b) Derive the equation for time required to empty a tank with relington reservoir. 7

3 Attempt any three from following : 15
(1) Euler's equation of motion
(2) Venturimeter
(3) Pitot tube
(4) Differential manometer
(5) Continuity equation

4 (a) Answer the following system : **10**

(1) _____ is defined as the line integral of the tangential velocity about a closed path.

(a) Circulation
(b) Vorticity
(c) Either of the above
(d) None of the above

(2) The motion is described as _____ when the components of rotation or vorticity are zero throughout certain point of the fluid.

(a) rotational (b) irrotational
(c) both of above (d) none of above

(3) If a closed cylindrical vessel completely filled with water is rotated about its vertical axis, the total pressure force acting on a top is equal to

(a) $\rho/4\, w^2 \pi R^4$ (b) $\frac{\rho^2}{4} w\pi R^2$

(c) $\frac{\rho}{4} w^2 \pi R^3$ (d) $\rho/4\, w^2 \pi R^4$

(4) Dynamic similarity between the model and prototype is the

(a) similarity of motion
(b) similarity of length
(c) similarity of force
(d) none of the above

(5) The scale effect in models can be

(a) Positive only (b) Negative only
(c) Both (d) none of above

(6) In laminar flow the pressure drop per unit length of pipe $(\Delta P/l)$ is given as

(a) $\frac{32\mu\bar{u}}{D^2}$ (b) $\frac{2\mu\bar{u}}{D^2}$

(c) $\frac{32\mu\bar{u}}{D^3}$ (d) none of above

(7) The maximum velocity in a circular pipe when flow is laminar occurs at

(a) the top of the pipe
(b) the bottom of the pipe
(c) the centre of the pipe
(d) not necessarily at the centre

(8) For viscous flow the coefficient of friction is given by

(a) $F = \frac{8}{R_e}$ (b) $f = \frac{16}{R_e}$

(c) $f = \frac{3z}{R_e}$ (d) $f = \frac{60}{R_e}$

(9) The shear in turbulent flow is mainly due to
(a) heat transfer
(b) mass transfer
(c) momentum transfer
(d) all of above

(10) Sonic velocity for adiabatic process is given as

(a) $\sqrt{VRT^2}$ (b) $\sqrt{VRT}$

(c) $\sqrt{V^2RT}$ (d) $\sqrt{V^2R^2T}$

(b) Define Reynold's No. and explain Raynolds experiments. **5**

(c) Derive an equation for stagnation pressure. **5**

5 (a) Attempt any **two :** **10**

(i) A pipe of 25 cm in diameter and 900 m long is carrying an oil of mass density 940 kg/m^3 and dynamic viscosity 1NS/m^2. The oil flow rate is 0.15 m^3/s. Due to increase in atmospheric temp. the viscosity of oil changes by a factor of 8. If the same quantity of oil is to be conveyed compare the cost of pumping.

(ii) Air at 43°C flows from a large tank through a converging nozzle of 38 mm diameter. The tank contains air at 2 bar absolute pressure and the discharge is to atmosphere of pressure 1 bar absolute. Calculate the mass flow rate through nozzle. Assume for air R = 287 J/kg K and γ=1.4.

(iii) Crude oil of $\mu = 1.5$ poise and relative density 0.9 flows through a 20 mm diameter vertical pipe. The pressure gauges fixed 20 m apart read 600 kN/m^2 and 200 kN/m^2. Find direction and rate of flow through pipe.

(b) Derive an equation for the velocity distribution of the flow of viscous fluid between two parallel plate. **5**

OR

(b) Explain velocity potential and potential flow.

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

(i) Flow net

(ii) Rayleigh's method for dimensional analysis.

(iii) Rotating cylinder viscometer.

(iv) Area velocity relation for compressible flow.