Student Exam No._____

# GANPAT UNIVERSITY

## B.TECH SEM. 3RD MECHANICAL ENGINEERING

## CBCS Regular Examination November – December 2014

## FLUID MECHANICS (2ME 306)

**TIME:-3 Hrs.** **TOTAL MARKS-70**

**Instructions:** (1) Attempt all questions.
(2) Figure to the right indicates full marks.
(3) Assume required data if necessary.

## SECTION-I

**Q-1 Answer the following questions.**

(a) Define: (i) Specific Volume, (ii) Specific gravity, (iii) Weight density, (iv) Kinematic viscosity, (v) Dynamic viscosity, (vi) Surface tension. **[06]**

(b) State and prove Pascal's law. **[06]**

**OR**

**Q-1 Answer the following questions.**

(a) The velocity distribution for flow over a flat plate is given by $u = \frac{2}{3}y - y^2$, where u is the point velocity in meter per second at a distance y meter above the plate. Determine the shear stress at y=0, 0.1 cm and 0.2 cm. Assume dynamic viscosity as 6 poise. **[04]**

(b) Explain the phenomenon of surface tension with neat sketch. Prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $p = \frac{4\sigma}{d}$ **[04]**

(c) Explain the different types of fluids with neat sketch. **[04]**

**Q-2 Answer the following questions.**

(a) With neat sketches explain the conditions of equilibrium for floating bodies. **[05]**

(b) Define meta-centre. Derive an expression for the meta-centric height of a floating body. **[06]**

**OR**

**Q-2 Answer the following questions.**

(a) Write a short note on U-tube differential manometer with neat sketch. **[04]**

(b) Prove that rate of increase of pressure in a vertical downward direction is equal to weight density of the fluid at that point. **[04]**

(c) A simple manometer is used to measure the pressure of oil of sp. Gr. 0.8 flowing in a pipe line. Its right limb is open to the atmosphere and left limb is connected to the pipe. The centre of the pipe is 9 cm below the level of mercury of sp. Gr. 13.6 in the right limb. If the difference of mercury level in the two limbs is 15 cm, determine the absolute pressure of the oil in the pipe in $N/cm^2$. **[03]**

**Q-3 Answer the following questions.** **[12]**

(a) Derive the continuity equation in three dimensions.

(b) Derive Bernoulli's equation from the Euler's equation of motion.

## SECTION-II

**Q-4 Answer the following questions.**

(a) What is dimensional homogeneity? Explain the method of selecting repeating variables. [06]

(b) An oil of viscosity 0.1 $Ns/m^2$ and relative density 0.9 is flowing through a circular pipe of diameter 50mm and of length 300m. The rate of flow of fluid through the pipe is 3.5 liter/s. Find the pressure drop and shear stress at the pipe wall. [06]

**OR**

**Q-4 Answer the following questions.**

(a) Derive an expression for the Hagen-poiseullie equation. [06]

(b) State Buckingham's $\pi$-theorem. The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft l, velocity V, air viscosity $\mu$, air density $\rho$ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. [06]

**Q-5 Answer the following questions.**

(a) Derive the equation for velocity of sound in terms of bulk modulus. [06]

(b) A projectile is travelling in air having pressure and temperature as 8.829 $N/cm^2$ and 2°C. If the mach angle is 40°, find the velocity of projectile. Take $\gamma$=1.4 and R = 287 J/Kg° K. [05]

**OR**

**Q-5 Answer the following questions.**

(a) Derive the equation for velocity of sound for adiabatic process. [06]

(b) Define (i) Mach No. (ii) Zone of action (iii) Zone of silence (iv) Mach cone (v) Mach angle. [05]

**Q-6 Answer the following questions.** [12]

(a) Define (i) Weber's no. (ii) Froude's no. (iii) Velocity defect (iv) Euler's no. (v) Reynolds no. (vi) Stagnation point.

(b) Derive Darcy-Weisbach equation for turbulent flow.

**END OF PAPER**