Student Exam No._____

GANPAT UNIVERSITY

B.TECH SEM. 3rd MECHANICAL ENGINEERING

CBCS REGULAR EXAMINATION NOV/DEC-2013

FLUID MECHANICS (2ME 306)

TIME:-3 HOURS **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.** **[12]**

(a) Define Orificemeter. Derive an expression for the discharge through Orificemeter.

(b) A fluid flow is given by $V = xy^2 i - 2yz^2 j - \left(2y^2 - \frac{2z^3}{3}\right)k$. Prove that it is a case of possible steady incompressible fluid flow.

OR

Q-1 **Answer the following questions.** **[12]**

(a) Explain the different types of the flow of a fluid.

(b) A pipe through which water is flowing is having diameters 40 cm and 20 cm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 5.0 m/s. Find the velocity head at the sections 1 and 2. Also find the rate of discharge.

Q-2 **Answer the following questions.** **[11]**

(a) Explain the different types of fluid with neat sketch. **04**

(b) Define: (i) Viscosity (ii) Specific weight (iii) Specific gravity (iv) Surface tension. **04**

(c) Calculate the capillary rise in a glass tube of 3.0 mm diameter when immersed vertically in mercury. Take surface tension for mercury as 0.0725 N/m in contact with air. Specific gravity for mercury is given as 13.6. Angle of contact is given 128^0. **03**

OR

Q-2 **Answer the following questions.** **[11]**

(a) State and prove Pascal's law. **04**

(b) Write a short note on U-tube differential manometer for two points at same level. **04**

(c) A simple U-tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to the atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 20 cm and height of oil in the left limb from the centre of the pipe is 15 cm below. **03**

Q-3 **Answer the following questions. (Any two)** **[12]**

(a) Derive an Euler's equation for motion. Also derive Bernoulli's equation from it.

(b) Define capillarity. Derive an expression for the capillary rise of liquid.

(d) Explain the condition of equilibrium of floating & submerged body.

SECTION-II

Q-4 Answer the following questions. [12]

(a) The efficiency of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters.

(b) Define similitude. Explain the different types of similarities.

OR

Q-4 Answer the following questions. [12]

(a) The force exerted by a flowing fluid on a stationary body depends upon the length L of the body, velocity V of the fluid, density ρ of fluid, viscosity μ of the fluid and acceleration g due to gravity. Show that the force $F = \rho L^2 V^2 \emptyset \left(\frac{\mu}{\rho V L}, \frac{L \times g}{V^2}\right)$ using dimensional analysis.

(b) Explain the method of selecting repeating variables.

Q-5 Answer the following questions. [11]

(a) Derive Bernoulli's equation for (i) Isothermal process (ii) Adiabatic process for compressible flow. 06

(b) A gas with a velocity of 300 m/s is flowing through a horizontal pipe at a section where pressure is 6×10^4 N/m^2 (absolute) and temperature 40 ^{0}C. The pipe changes in diameter and at this section the pressure is 9×10^4 N/m^2. Find the velocity of the gas at this section if the flow of the gas is adiabatic. Take R=287 J/kg K and k=1.4 05

OR

Q-5 Answer the following questions. [11]

(a) Derive Darcy-Weisbach equation. 06

(b) The velocity of flow in badly corroded 7.5 cm pipe is founded to increase 20% as a pitot tube moves from a point 1 cm from the wall to point 2 cm to the wall. Determine height of roughness element. 05

Q-6 Answer the following questions. (Any three) [12]

(a) Derive an expression for area velocity relationship for a compressible flow in the form, $\frac{dA}{A} = \frac{dV}{V}[M^2 - 1]$.

(b) Find the energy correction factor for viscous flow through a circular pipe.

(c) Obtain an expression for mean velocity in terms of u_{max} of $\frac{u}{u_{max}} = 1 - \left(\frac{r}{R}\right)^n$

(d) The resistance R, to the motion of a completely sub-merged body depends upon the length of the body L, velocity of flow V, mass density of fluid ρ and kinematic viscosity of fluid ν. By dimensional analysis prove that, $R = \rho V^2 L^2 \emptyset \left(\frac{VL}{\nu}\right)$.

END OF PAPER