Student Exam No._____

GANPAT UNIVERSITY

B.TECH SEM. 3rd MECHANICAL ENGINEERING

REGULAR EXAMINATION NOV/DEC-2012

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-1

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

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

(b) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through the pipe is 40 lit/sec.

OR

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

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

(b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s.

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

(a) Define viscosity. Explain the effect of temperature on viscosity of water and air. **06**

(b) An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes. **05**

OR

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

(a) Write a short note on differential U-tube manometer. **05**

(b) A cylinder of 0.6 m^3 in volume contains air at 50 ^{0}C and 0.3 N/mm^2 absolute pressures. The air is compressed to 0.3 m^3. Find (i) pressure inside the cylinder assuming isothermal process and (ii) pressure and temperature assuming adiabatic process. Take k = 1.4 **06**

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

(a) Derive an expression for co-efficient of discharge for orifice meter.

(b) State and prove Pascal's law.

(c) Define meta centre. Derive an expression of analytical method for the meta-centric height of a floating body.

SECTION-II

Q-4 Answer the following questions. **[12]**

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

(b) The variables controlling the motion of a floating vessel through water are the drag force F, the speed V, the length L, the density ρ, dynamic viscosity μ of water and acceleration due to gravity g. Derive an expression for F by dimensional analysis.

OR

Q-4 Answer the following questions. **[12]**

(a) Define model analysis. Explain the different types of similarities.

(b) State Buckingham's π-theorem. The resisting force R of a supersonic plane during flight can be considered as dependent upon the length or the aircraft l, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force.

Q-5 Answer the following questions. **[11]**

(a) Derive an expression for Bernoulli's equation for compressible flow when the process is (i) isothermal and (ii) adiabatic. **06**

(b) A gas is flowing through a horizontal pipe at a temperature of 4 ^{0}C. The diameter of the pipe is 8 cm and at a section 1-1 in this pipe, the pressure is 30.3 N/cm^2 (gauge). The diameter of the pipe changes from 8 cm to 4 cm at the section 2-2, where pressure is 20.3 N/cm^2 (gauge). Find the velocities of the gas at these sections assuming an isothermal process. Take R = 287.14 Nm/kg K, and atmospheric pressure = 10 N/cm^2. **05**

OR

Q-5 Answer the following questions. **[11]**

(a) Derive an expression for the loss of head due to friction in pipes. **06**

(b) Write a short note about hydrodynamically smooth and rough boundaries. **05**

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

(a) Define Mach number. Derive an expression for area velocity relationship for a compressible fluid in the form, $\frac{dA}{A} = \frac{dV}{V}[M^3 - 1]$

(b) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5 N^2 \rho \, \phi \left[\frac{\mu}{D^2 N \rho}\right]$

(c) Explain the phenomenon of capillarity. Derive the expression for capillary rise of a liquid.

(d) Define: (i) specific gravity (ii) surface tension (iii) weight density (iv) specific volume (v) Ideal fluid.

END OF PAPER