Paper Code & Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | | |

Odd Semester Examination-2016

B.Tech (Semester-III)

FLUID MECHANICS

[Time : 3 Hours] [Maximum Marks : 100]

Note : Attempt **all** questions in Unit 1 to 5.

UNIT - I

1. Answer **any four** questions : [5x4=20]

(a) Calculate the density, specific weight and weight of one litre of petrol of specific gravity=0.7.

(b) Explain the variation of viscosity with temperature in liquids and gases.

(c) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of oil film is 12.5 mm. The upper plate, which moves at 2.5 m/sec requires a force of 98.1 N to maintain the speed. Determine :

(i) The dynamic viscosity of the oil in poise

(ii) The kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95.

(d) Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in (a) water, (b) mercury. The temperature of the liquid is 20°C and the values of surface tension of water and mercury at 20°C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is 0 and that for mercury is 130°. Take density of water at 20°C as equal to 998 kg/m³.

(e) The velocity vector in a fluid flow is given as $V = 4x^3i - 10x^2yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2,1,3) at t=1.

UNIT - 2

2. Answer **any four** questions : [5x4=20]

(a) A stone weighs 392.4 N in air and 196.2 N in water. Calculate the volume of stone and its specific gravity.

(b) A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2.×1 m×0.8 m.

(c) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60l/sec. Find the reading of oil-mercury differential manometer. Take Cd=0.98.

(d) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre of pressure also.

(e) What are the gauge pressure and absolute pressure at a point 3 m below the free surface of a liquid having a density of 1.53×10^{3}kg/m^{3} if the atmospheric pressure is equivalent to 750 mm of Hg? The specific gravity of mercury is 13.6 and density of water= 1000 kg/m^{3}.

UNIT - 3

3. Answer **any two** questions : [10x2=20]

(a) Define the following dimensionless numbers and their significance for fluid flow problems.

(i) Mach number

(ii) Froude number

(iii) Reynolds number

(iv) Euler number

(v) Weber number

(b) Derive an expression using Buckingham's π theorem for the efficiency which depends on density, dynamic viscosity, angular viscosity, diameter of rotor and the discharge.

(c) A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 lit/sec. Tests were conducted on a 15 cm diameter pipe using water at 20^0C. Find the velocity and rate of flow in the model. Viscosity of water at 20^0C=0.01 poise.

UNIT - 4

4. Answer **any two** questions : [10x2=20]

(a) Derive an expression for velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.

(b) Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/sec using (i) Darcy formula (ii) Chezy's formula for which C=60. And kinematic viscosity for water=0.01 stoke.

(c) Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of pipe is connected to a tank and other end of the pipe is open to atmosphere. The pipe is horizontal and height of water is 4 m above the centre of the pipe. Consider all minor losses and take friction factor f=0.009.

UNIT - 5

5. Answer **any two** questions : [10×2=20]

(a) What do you mean by separation of boundary layer? What is effect of pressure gradient on boundary layer separation? What are the different methods of preventing the separation of boundary layer?

(b) A kite 0.8m×0.8m weighing 3.924 N assumes an angle of 12° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. The pull on the string 24.525 N when the wind is flowing at a speed of 30 km/hr. Find the corresponding coefficient of drag and lift. Density of air is given as 1.25 kg/m³.

(c) Explain the following terms :

(i) Boundary layer thickness

(ii) Bluff body

(iii) Displacement thickness

(iv) Streamlined body

(v) Momentum thickness

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