BIME-004

B.Tech. – VIEP – Mechanical Engineering / B.Tech. Civil Engineering (BTMEVI/BTCLEVI)

Term-End Examination

June, 2017

00064

BIME-004 : FLUID MECHANICS

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a)   How is the U-tube manometer used for the measurement of fluid pressure ? Explain with a neat sketch.   7

    (b)   A circular opening, 3 m diameter, in a vertical side of a tank is closed by a disc of 3 m diameter which can rotate about a horizontal diameter. Calculate

    (i)   the force on the disc, and

    (ii)   the torque required to maintain the disc in equilibrium in the vertical position when the head of water above the horizontal diameter is 6 m.   7

2. (a) Obtain the expression for continuity equation for a three-dimensional flow for an incompressible fluid. 7

(b) A 40 cm diameter pipe, conveying water, branches into two pipes of diameters 30 cm and 20 cm respectively. If the average velocity in the 40 cm diameter pipe is 3 m/sec, find the discharge in this pipe. Also determine the velocity in the 20 cm pipe, if the average velocity in the 30 cm diameter pipe is 2 m/sec. 7

3. (a) Distinguish between rotational flow and irrotational flow. Give an example of each. 7

(b) A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of a differential manometer connected to inlet and throat is 10 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. 7

4. (a) What is a venturimeter ? Derive an expression for the discharge through a venturimeter. 7

(b) For a turbulent flow in a pipe of diameter 200 mm, find the discharge when the centre line velocity is 30 m/sec and the velocity at a point 80 mm from a centre as measured by a pitot tube is 2·0 m/sec. Also find the coefficient of friction and the average height of roughness projections. 7

5. (a) What is a pitot tube ? How will you determine the velocity at any point using a pitot tube ? 7

(b) A horizontal pipe of diameter 40 cm is suddenly contracted to a diameter of 20 cm. The pressure intensities in the larger and the smaller pipe are given as $14\cdot715$ N/cm^2 and $12\cdot753$ N/cm^2 respectively. If $C_c= 0\cdot62$, find the loss of head due to contraction. Also determine the rate of flow of water. 7

6. (a) What is dimensional analysis ? Describe the Rayleigh's method for dimensional analysis. 7

(b) The rate of flow of water through a horizontal pipe is $0\cdot3$ m^3/s. The diameter of the pipe is suddenly enlarged from 250 mm to 500 mm. The pressure intensity in the smaller pipe is $13\cdot734$ N/cm^2. Determine the

(i) loss of head due to sudden enlargement,

(ii) pressure intensity in the larger pipe, and

(iii) power loss due to enlargement. 7

7. (a) Discuss the separation of boundary layer. What is the effect of pressure gradient on boundary layer separation ? 7

(b) A kite, 60 cm × 60 cm, weighing 2·943 N assumes an angle of 10° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. If the pull on the string is 29·43 N when the wind is flowing at a speed of 40 km/hr, find the corresponding coefficient to drag and lift. Density of air is given as 1·25 kg/m^3. 7

8. Write short notes on any **four** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Laminar Flow

(b) Turbulent Flow

(c) Spillways

(d) Coefficient of Drag and Lift

(e) Weirs

(f) Momentum Correction Factor