(Please write your Exam Roll No.) Exam Roll No. ...4082180346...

END TERM EXAMINATION

THIRD SEMESTER [B.TECH.] NOVEMBER-DECEMBER-2017

Paper Code: ETCE-205 **Subject: Fluid Mechanics**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q.No1 which is compulsory. Select one question from each unit.

Q1 Attempt all the questions:- **(2.5x10=25)**

(a) Define Newtonian and non Newtonian fluids.
(b) Explain the phenomenon of capillarity and give the expression for capillary rise of a liquid.
(c) Explain the significance of dimensional analysis as applied through fluid flow problems.
(d) Explain the following terms:- (i) centre of buoyancy (ii) meta centric height
(e) How can unsteady flow be transformed into a steady flow?
(f) Differentiate between (i) stream function and velocity potential function (ii) rotational and irrotational flows.
(g) If specific gravity of a liquid is 0.8, calculate its mass density, specific volume and specific weight.
(h) What are hydraulic coefficients? Name them.
(i) Define vena contracta.
(j) State the momentum equations.

UNIT-I

Q2 (a) Find out the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2 mm. Consider surface tension of water in contact with air is 0.0736 N/m. **(6.5)**

(b) Define total pressure and centre of pressure. Also define and classify manometers. **(6)**

OR

Q3 (a) Obtain an expression for the bulk modulus of elasticity 'K' of a fluid in terms of pressure 'P' and the mass density 'ρ'. **(6.5)**

(b) Explain the procedure of finding hydrostatic forces on curved surfaces. **(6)**

UNIT-II

Q4 (a) Water flows through a pipe AB 1.2m diameter at 3 m/s and then passes a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third flow in comparison to flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. **(9)**

(b) Write and explain the use of continuity equation in Cartesian coordinates. **(3.5)**

OR

Q5 (a) Explain (i) linear translation, (ii) linear deformation (iii) angular deformation, (iv) rotation with neat sketches. **(6)**

(b) The velocity components in a two dimensional flow field for an incompressible fluid are as follows: $u=y^3/3+2x-x^2y$ and $v = xy^2-2y-x^3/3$. Obtain an expression for stream function. **(6.5)**

UNIT-III

Q6 (a) What is a pitot tube? How will you determine the velocity at any point with the help of pitot tube? **(6)**

(b) Water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 1/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm², find the intensity of pressure at section 2. **(6.5)**

P.T.O.

ETCE-205

OR

Q7 (a) Derive Euler's equation of motion along a streamline for an ideal fluid stating clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream line. **(6)**

(b) The inlet and throat diameters of horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm² while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of C_d for the venturimeter. **(6.5)**

UNIT-IV

Q8 (a) State Buckingham's π theorem. Why this theorem is considered better than Rayleigh's method for dimensional analysis? **(6)**

(b) Estimate for a 1:20 model of a spillway (i) the prototype elocity corresponding to a model velocity of 1.5 m/s (ii) the prototype discharge per unit width of 0.2 m³/s per meter (iii) the pressure head in the prototype corresponding to a model of pressure head of 5 cm of mercury at a point. **(6.5)**

OR

Q9 (a) What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable? If not, why? **(6)**

(b) Using Buckingham's π theorem show that the velocity V for a fluid of mass density ρ and dynamic viscosity μ through a circular orifice of diameter D under the head H is given by $V = \sqrt{2gH}\,\emptyset\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ **(6.5)**

****

ETCE-205
P2/2