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CE 131305

Roll No. of candidate | | | | | | | | | | | | |

2019

B.Tech. (CE) 3rd Semester End-Term Examination

BASIC FLUID MECHANICS

(New Regulation)

(w.e.f. 2017–2018)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. Answer the following : (Fill in the blanks) $(10 \times 1 = 10)$

   (i) The mass per unit volume of a liquid at a standard temperature and pressure is called ————————.

   (ii) The unit of surface tension is ————————.

   (iii) Falling drops of water become spheres due to the property of ————————.

   (iv) The height of a water column equivalent to a pressure of 0.15 MPa is ————————.

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(v) The imaginary line drawn in the fluid in such a way that the tangent to any point gives the direction of motion at that point is known as _____.

(vi) Barometer is used to measure _____.

(vii) An orifice is said to be large if the available head of liquid is _____ than 5 times the height of the orifice.

(viii) A vertical triangular area with vertex downward and altitude 'h' has its base lying on the free surface of a liquid. The centre of pressure below the free surface is at a distance _____.

(ix) $\Delta\Psi$ between two stream lines represents _____.

(x) The major loss of energy in long pipes is due to _____.

2. (a) Define the following terms: Fluid mechanics, Specific weight, Specific gravity, Steady flow, Uniform flow, Non-newtonian fluid. (6)

(b) Explain the Newton's law of viscosity. (5)

(c) Calculate the specific weight, density and specific gravity of one litre of a liquid which weighs 7 N. (2)

(d) Calculate the density, specific weight and weight of one litre of petrol of specific gravity 0.7. (2)

3. (a) Derive the hydrostatic force and centre of pressure for a vertical plane surface immersed in liquid. (6)

(b) 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 4 m below the free surface of water. Find the position of centre of pressure also. (5)

(c) Explain the conditions of equilibrium of a floating body with diagram. (4)

4. (a) A wooden log of 0.5 m diameter and 5 m length is floating in river water. Find the depth of the wooden log in water when the specific gravity of the log is 0.7. (8)

(b) What do you mean by rate of flow? Derive the continuity equation. (1 + 2)

(c) A 30 cm diameter pipe conveying water branches into two pipes of diameter 20 cm and 15 cm. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if average velocity in 20 cm pipe is 2 m/s. (4)

5. (a) What do you mean by velocity potential function and stream function? (3)

(b) What is flow net? Explain uses and limitations of flow net. (4)

(c) Define vortex flow. Differentiate between forced vortex flow and free vortex flow. (3)

(d) Derive the Bernoulli's equation from Eular's equation of motion and also state the assumptions made in the derivation of Bernoulli's theorem. (5)

6. (a) Define an orifice and a mouthpiece. What is the difference between the two? (4)

(b) Derive the expression of velocity of flow through an external cylindrical mouthpiece. (5)

(c) An external cylindrical mouthpiece of diameter 150 mm is discharging water under a constant head of 6 m. Determine the discharge and absolute pressure head of water at vena-contracta. Take C_d = 0.855 and C_c for vena-contracta 0.62. Atmospheric pressure head = 10.3 m of water. (6)

7. (a) Derive the expression of discharge over a triangular notch or weir. (5)

(b) What are the advantages of a triangular notch over a rectangular notch? (2)

(c) Derive the Chezy's formula for loss of head due to friction in pipes. (5)

(d) Find the diameter of a pipe of length 2000 m when the rate of flow of water through the pipe is 200 litres/s and head lost due to friction is 4 m. Take value of C = 50 in Chezy's formulae. (3)
