

Total No. of printed pages = 3

CE 131305 NR

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B.Tech. 3rd Semester End-Term Examination

CE

BASIC FLUID MECHANICS

(New Regulation)

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.

(10 × 1 = 10)

1. (i) The velocity at which the flow changes from laminar flow to turbulent flow is called
- (a) Critical velocity (b) Velocity of approach
(c) Sub-sonic velocity (d) Super-sonic velocity
- (ii) An opening in the side of a tank or vessel such that the liquid surface with the tank is below the top edge of the opening, is called
- (a) Weir (b) Notch
(c) Orifice (d) None of the above
- (iii) The major loss of energy in long pipes is due to
- (a) sudden enlargement
(b) sudden contraction
(c) gradual contraction or enlargement
(d) friction
- (iv) Dimensions of surface tension are
- (a) ML^2T^{-2} (b) ML^2T
(c) MLT^2 (d) ML^2T^2

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- (v) The property of fluid by virtue of which it offers resistance to shear is called
- (a) Surface tension (b) Adhesion
(c) Cohesion (d) Viscosity
- (vi) Center of buoyancy is the
- (a) Centroid of the displaced volume of fluid
(b) Center of pressure of displaced volume
(c) Does not exist
(d) None of the above
- (vii) According to Darcy's formula, the loss of head due to friction in the pipe is (where f = Darcy's coefficient, l = Length of pipe, v = Velocity of liquid in pipe, and d = Diameter of pipe)
- (a) $flv^2/2gd$ (b) flv^2/gd
(c) $3flv^2/2gd$ (d) $4flv^2/2gd$
- (viii) A floating body is said to be in a state of stable equilibrium
- (a) when its metacentric height is zero
(b) when the metacentre is above the centre of gravity
(c) when the metacentre is below the centre of gravity
(d) only when its centre of gravity is below its centre of buoyancy
- (ix) 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.
- (a) $h/4$ (b) $h/3$
(c) $h/2$ (d) $2h/3$
- (x) The viscosity of a gas
- (a) decreases with increase in temperature
(b) increases with increase in temperature
(c) is independent of temperature
(d) is independent of pressure for very high pressure intensities
2. (a) Find the expression for surface tension in a liquid droplet. Define Real fluid, Ideal fluid, Newtonian fluid and Non Newtonian fluid. (3+6=9)
- (b) One litre of crude oil weighs 9.6 N. Calculate its specific weight, density and specific gravity. (3)
- (c) Determine the specific gravity of a fluid having viscosity of 0.05 poise and kinematic viscosity of 0.035 stokes. (3)

3. (a) Define Atmospheric pressure, gauge pressure, absolute pressure, vacuum pressure. What is metacentric height? (5)
- (b) A wooden block of width 4 m, depth 2 m and length 6 m is floating in water. Find the volume of water displaced and position of centre of buoyancy. Specific weight of wood is 8 kN/m^3 . (10)
4. (a) Derive Euler's equation of motion. Derive Bernoulli's equation from Euler's equation of motion. (10)
- (b) Define hydraulic grade line and total energy line with neat sketch. Define flow net. (5)
5. (a) Derive an expression for discharge over a triangular weir. (5)
- (b) State the advantages of a triangular notch over a rectangular notch. (5)
- (c) Derive the Darcy-Weisbach equation of friction loss. (5)
6. (a) Explain "Rayleigh's method of dimensional analysis". Explain the term "Dimensionally homogeneous equation". (4+2 = 6)
- (b) What are the conditions of equilibrium body? Explain with neat diagram. (5)
- (c) Find the discharge through a trapezoidal notch which is 1.2 m wide at the top and 0.5 m at the bottom and is 0.4 m height. The head of water on the notch is 0.3 m. Assume C_d for rectangular portion is 0.62 and for triangular portion is 0.60. (4)
7. (a) Derive the continuity equation in Cartesian co-ordinates. (5)
- (b) Derive the equation of centre of pressure for an inclined plane surface immersed under water. (10)

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