

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- IV EXAMINATION – SUMMER 2020****Subject Code: 3140611****Date:04/11/2020****Subject Name: Fluid Mechanics & Hydraulics****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define density, specific volume & surface tension. **03**
- (b) The velocity distribution for flow over a flat plate is given by **04**
 $u = 0.75 y - y^2$ in which u is the velocity in metre per second at a distance y metre above the plate. Determine the shear stress at $y = 0.20$ m. Take dynamic viscosity of fluid as 8.0 poise.
- (c) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid. **07**
- Q.2** (a) Define atmospheric, absolute & vacuum pressure. **03**
- (b) Explain hydrostatic paradox. **04**
- (c) Write short note on manometers. **07**
- OR**
- (c) State & prove Pascal's law. **07**
- Q.3** (a) Define total pressure, centre of pressure & buoyancy. **03**
- (b) A rectangular plane surface is immersed vertically in water such that its upper edge is touching free surface of liquid. Show that the depth of centre of pressure is $2/3 d$ for rectangular surface of width b and depth d . **04**
- (c) Define metacentre & metacentric height. How will you determine metacentric height of a floating body experimentally? Explain with neat sketch. **07**
- OR**
- Q.3** (a) Define stream lines, streak lines & flow net. **03**
- (b) Differentiate between (i) Uniform & non uniform flow (ii) Sub critical & super critical flow. **04**
- (c) State & prove Bernoulli's equation & write assumption made for such a derivation. **07**
- Q.4** (a) Define orifice, mouthpiece & notches. **03**
- (b) Find the discharge of water flowing over a rectangular notch of 2.0 m length when the constant head over the notch is 500 mm. Take $C_d = 0.62$ **04**
- (c) Differentiate between small & large orifice. Obtain an expression for discharge through large orifice. **07**
- OR**
- Q.4** (a) Define major energy losses in pipe, hydraulic gradient line & total energy line. **03**
- (b) Three pipes of lengths 800 m, 500 m and 400 m and of diameters 500 mm, 400 mm & 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700 m. Find the diameter of the single pipe. **04**
- (c) Define viscous flow. Derive expression for Hagen-Poiseuille's formula. **07**

- Q.5** (a) Define turbulent flow in open channel, specific energy curve & hydraulic jump. **03**
- (b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 10 m/sec & depth of flow of 1 m. Determine the depth of flow after the jump & consequent losses in total head. **04**
- (c) Define gradually varied flow. Derive equation of gradually varied flow. **07**

OR

- Q.5** (a) Define dimensional homogeneity, similitude & undistorted models **03**
- (b) Explain method of selecting repeating variables. **04**
- (c) The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V , viscosity μ & density ρ . Using Buckingham's π theorem obtain an expression for Δp . **07**

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