

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2130602
Date: 11/06/2019
Subject Name: Fluid Mechanics
Time: 02:30 PM TO 05:00 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) Explain in brief: Viscosity, Surface tension, Capillarity 03
 - (b) Differentiate Dynamic viscosity & kinematic viscosity 04
 - (c) Calculate dynamic viscosity of oil, which is used for lubrication between a rectangular plate 1.2m x 0.4m and an inclined plane with an angle of inclination of 30° . The weight of the plate is 500N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5mm. 07
- Q.2**
- (a) State and explain Archimedes principle. 03
 - (b) What is manometer? Write its advantages and limitations. 04
 - (c) A door in a tank is in the form of a quadrant of a cylinder of 1.5m radius and 1.8m wide. Calculate the resultant force on the door & its location on the gate. 07
- OR**
- (c) A rectangular pontoon 10m long, 7m wide and 2.5m deep weigh 700kN. It carries on its upper deck an empty boiler of 5m diameter and 600kN weight. The centre of gravity of boiler and the pontoon are at their respective centers along the vertical line. Find the metacentric height. Take sp. wt. of sea water as 10kn/m^3 07
- Q.3**
- (a) Derive Bernoulli's Equation. 03
 - (b) Derive an expression for total pressure & position of center of pressure on a plane surface immersed vertically in a liquid. 04
 - (c) For the velocity components in a fluid flow given by $u = 2xy$, $v = a^2 + x^2 - y^2$, show that the flow is possible. Obtain the relevant stream function. 07
- OR**
- Q.3**
- (a) Prove that the stream lines & equipotential lines are orthogonal to each other. 03
 - (b) What is Metacenter? Explain how Metacentric height can be determined experimentally? 04
 - (c) Find the reading of oil-mercury differential manometer having $C_d = 0.98$. If the discharge of oil is flowing through the horizontal venturimeter is 50litre per second. The venturimeter has inlet & throat diameters 30cm & 15cm respectively. Take sp. Gravity of oil = 0.9 07
- Q.4**
- (a) Classify different types of orifice according to different criteria. 03
 - (b) What are hydraulic co-efficients? Derive relation between them. 04
 - (c) Determine the time required to lower the water level from 3 to 2m in a reservoir of dimensions 60m x 60m, by
 - i) Rectangular notch of 1m length
 - ii) Right angled V-notch
 Take $C_d = 0.62$ 07
- OR**
- Q.4**
- (a) Distinguish between notch & weir. 03
 - (b) Derive equation for discharge over a Broad crested weir. 04
 - (c) Derive an equation of time taken for emptying a circular horizontal tank with orifice at bottom. 07

- Q.5** (a) Explain in brief: Friction drag and Pressure drag **03**
(b) Derive Bernoulli's equation when process is adiabatic **04**
(c) An air stream has a velocity of 162 km/hr at a pressure of 10kPa vacuum and a temperature of 47°C. Compute **07**
i) Stagnation properties
ii) Mach number.
Take $R = 287 \text{ J/kg}^\circ\text{K}$

OR

- Q.5** (a) Explain Hydrostatic Paradox. **03**
(b) Derive equation of velocity of sound in terms of Bulk modulus. **04**
(c) Discuss Drag on a sphere for various range of Reynold's number. **07**

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