Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–III(NEW) EXAMINATION – SUMMER 2023**

**Subject Code:3131307 Date:01-08-2023**

**Subject Name:Basics of Environmental Hydraulics**

**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.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | Marks |
|---|---|---|---|
| **Q.1** | **(a)** | Define following terms:<br>Specific weight(ii) specific gravity(iii) adhesion | **03** |
| | **(b)** | Explain the effect of temperature on viscosity of liquids and gases. | **04** |
| | **(c)** | If the velocity profile of a fluid over a plate is parabolic with vertex 20cm from the plate, where the velocity is 120cm/s. Calculate the velocity gradients and shear stress at a distance of 0,10,20 cm from the plate, if the viscosity of the fluid is 8.5 poise. | **07** |
| **Q.2** | **(a)** | Define the following terms:<br>(i)Absolute pressure (ii)gauge pressure(iii) centre of pressure | **03** |
| | **(b)** | With a neat sketch explain the U tube manometer. | **04** |
| | **(c)** | A u tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to the atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U tube is 10 cm and the free surface of mercury is in the level with Centre of the pipe. if the pressure of water in pipe line reduced to $9810 N/m^2$. Calculate the new difference in the level of mercury. Sketch the arrangements in both cases. | **07** |
| | | **OR** | |
| | **(c)** | Derive an expression for the force exerted on submerged vertical plane surface by the static liquid and locate the position of center of pressure. | **07** |
| **Q.3** | **(a)** | Define following terms:<br>(i)steady flow (ii) Laminar flow (iii) Uniform flow | **03** |
| | **(b)** | The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation:<br>(i) $u= x^2 +y^2+z^2$ ; $v = xy^2-yz^2+xy$<br>(ii) $v=2y^2$ ;$w = 2xyz$ | **04** |
| | **(c)** | A fluid flow field is given by $V = x^2yi+ y^2zj-(2xyz+yz^2)k$ prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at point (2,1,3). | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | State Bernoulli's equation of motion. Also mention the assumption made for such derivation. | **03** |

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|---|---|---|---|
| | **(b)** | A pipe through which water is flowing is having diameters 20 cm and 10 cm at the cross section 1 and 2 respectively. The velocity of water at section 1 is 4 m/s. find the velocity head at section 1 and 2 and also rate of discharge. | **04** |
| | **(c)** | Derive the equation of discharge for orifice meter. | **07** |
| **Q.4** | **(a)** | Explain losses of energy in pipe | **03** |
| | **(b)** | Prove that rectangular channel will be most economical when hydraulic depth is half of the depth of flow. | **04** |
| | **(c)** | Derive an equation of loss of head due to sudden enlargement. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Explain the minor energy losses in pipe. | **03** |
| | **(b)** | Derive an equation for loss of head due to sudden contraction. | **04** |
| | **(c)** | Write a short note on (i) flow through pipes in series<br>(ii) flow through parallel pipes. | **07** |
| **Q.5** | **(a)** | Give the classification of orifices | **03** |
| | **(b)** | Derive an equation of coefficient of velocity ($C_v$) and co efficient of vena contracta. | **04** |
| | **(c)** | Derive an equation for time emptying a hemispherical tank. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Give the classification of mouthpieces. | **03** |
| | **(b)** | Derive an equation for discharge over a rectangular notch or weir. | **04** |
| | **(c)** | Derive an expression for discharge through a triangular notch. | **07** |