Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022**

**Subject Code:3140110 Date:13-12-2022**

**Subject Name:Fluid Mechanics**

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

| | | | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Define density, viscosity and the bulk modulus. | **03** |
| | **(b)** | Explain Newton's law of viscosity. | **04** |
| | **(c)** | State Hydrostatic Law and prove Pascal's law. | **07** |
| **Q.2** | **(a)** | Define Centre of Buoyancy. | **03** |
| | **(b)** | Explain Centre of pressure in detail. | **04** |
| | **(c)** | What is Pitot tube? How is it used to measure the velocity of flowing water in a pipe? | **07** |
| | | **OR** | |
| | **(c)** | Explain the construction and working of a Venturi meter and also derive an expression for the discharge through it. | **07** |
| **Q.3** | **(a)** | Explain Laminar and Turbulent flow. | **03** |
| | **(b)** | Discuss 1. Source flow, 2. Sink flow and 3. Free vortex flow. | **04** |
| | **(c)** | State Hydrostatic law. Derive equation for variation of pressure vertically for a fluid under gravity. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | What are the applications of CFD? | **03** |
| | **(b)** | Briefly discuss about 1. Uniform flow 2. Unsteady flow. | **04** |
| | **(c)** | Write Euler's equation of motion for a steady and incompressible fluid. Derive an expression for Bernoulli's theorem from Euler's equation. Clearly state assumptions made. | **07** |
| **Q.4** | **(a)** | What the application of dimensional analysis? | **03** |
| | **(b)** | A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at two ends of the pipes, if 100kg of the oil is collected in a tank in 30 seconds. | **04** |
| | **(c)** | Derive Hagen-Poiseuille equation for laminar flow in the circular pipe. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Discuss characteristics of turbulent flow. | **03** |
| | **(b)** | Calculate (i) the pressure gradient (ii) the shear stress at the two horizontal parallel plates, and (iii) the discharge per meter width for the laminar flow of oil with a maximum velocity of 3 m/s between two horizontal parallel fixed plates which are 150 mm apart. Take dynamic viscosity of $\mu$=2.5 Ns/m$^2$. | **04** |
| | **(c)** | Derive momentum equation for 2D and 3D in Cartesian coordinate. | **07** |

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| **Q.5** | **(a)** | How lift is produced on airfoil? | **03** |
| | **(b)** | Explain terms Circulation and Vorticity. | **04** |
| | **(c)** | Explain Buckingham's π theorem in detail. | **07** |

**OR**

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|---|---|---|---|
| **Q.5** | **(a)** | What is the difference between laminar and turbulent boundary layer? | **03** |
| | **(b)** | What are the different minor losses of energy in pipes? | **04** |
| | **(c)** | Explain Darchy-Weishbach equation for coefficient of friction in detail. | **07** |

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