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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 04- 01- 2025 **Time:** 1:00 pm – 04:00 pm |

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| **School:** SOE | **Program:** B.Tech MEC/MCM | |
| **Course Code :** MEC2010 | **Course Name :** Fluid Mechanics | |
| **Semester:** III | **Max Marks:** 100 | **Weightage:** 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **26** | **26** | **24** | **24** |

**Instructions:**

1. ***Read all questions carefully and answer accordingly.***
2. ***Do not write anything on the question paper other than roll number.***

**Part A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Answer ALL the Questions. Each question carries 2marks. 2Mx10Q=20M** | | | | |
| **1** | The value of specific gravity of water and mercury is …………. and ……………….respectively | **2 Marks** | **L1** | **CO1** |
| **2** | The value of the surface tension of an ideal fluid is ………….. | **2 Marks** | **L1** | **CO1** |
| **3** | Pressure intensity or force due to pressure gradient for fluid at rest is considered as which force? | **2 Marks** | **L1** | **CO1** |
| **4** | Define kinematic viscosity. | **2 Marks** | **L1** | **CO2** |
| **5** | What is fluid mechanics? | **2 Marks** | **L1** | **CO2** |
| **6** | Reynolds number is dimensionless number. True or False | **2 Marks** | **L1** | **CO2** |
| **7** | What are the application of fluid mechanics? | **2 Marks** | **L1** | **CO3** |
| **8** | If a person studies about a fluid which is at motion, what will you call his domain of study? | **2 Marks** | **L1** | **CO3** |
| **9** | When is a fluid called transition flow? | **2 Marks** | **L1** | **CO4** |
| **10** | What is drag force and lift force? | **2 Marks** | **L1** | **CO4** |

**Part B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Answer ALL Questions. Each question carries 20 marks. 4QX20M=80M** | | | | | |
| **11** | **11a** | Define compressibility, Bulk modulus, surface tension and shear stress. | **10Marks** | **L2** | **CO1** |
| **11b** | Sketch and deduce the relationship between all types of pressure. | **10Marks** | **L2** | **CO1** |
| **or** | | | | | |
| **12** | **12a** | The diameter of a small piston and large piston of a hydraulic jack are 3cm and 6cm respectively. A force of 40N is applied on the small piston. Find the load lifted by large piston, When the pistons are at same level and when the small piston is 20cm above. | **10Marks** | **L2** | **CO1** |
| **12b** | Write the relationship between Velocity potential function and stream function. | **10Marks** | **L2** | **CO1** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **13** | **13a** | A cubical block of 40 cm side and of 40 kg weight is allowed to slide down along a plane inclined at 45° to the horizontal on which there is a film of oil having viscosity 2.16×10⁻³ N·s/m². What will be the terminal velocity of the block if the film thickness is 0.03 mm? | **10Marks** | **L3** | **CO2** |
| **13b** | The water is flowing through a pipe having diameter 45 cm and 20 cm respectively at section 1 and 2. The rate of flow through the pipe is 35 litre/s. The section 1 and 2 is 6m and 4m above the datum. If the pressure at section 1 is 59.24N/cm2, find the pressure at section 2. | **10Marks** | **L3** | **CO2** |
| **or** | | | | | |
| **14** | **14a** | A hydraulic lift consists of 80 cm diameter ram and slides in a cylinder of diameter 87.02 cm, while the annular space is filled up with oil having kinematic viscosity of 0.89 cm2s, and specific gravity of 0.85. If the rate of travel of ram 20m/min. Find the frictional resistance when 4m of ram is engaged in the cylinder. | **10Marks** | **L3** | **CO2** |
| **14b** | An oil of specific gravity 0.85 is flowing through a venturi meter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 45cm. Calculate the discharge of oil through the horizontal venturi meter. | **10Marks** | **L3** | **CO2** |
|  |  |  |  |  |  |
| **15** | **15a** | A U-tube differential manometer is used to measure the pressure difference between two points A and B in a pipeline. The manometer contains mercury and water. The left limb of the manometer, connected to point A, contains water up to a height of 1.3 m. The right limb, connected to point B, contains mercury with a height difference 0.7 m between the two limbs. Calculate the pressure difference between the pipe A and B. | **10Marks** | **L3** | **CO3** |
| **15b** | **In the figure mentioned below find ‘h’, using manometric analysis.** | **10Marks** | **L3** | **CO3** |
| **or** | | | | | |
| **16** | **16a** | **Explain the different types of fluid flow.** | **10Marks** | **L3** | **CO4** |
| **16b** | **The velocity vector in a fluid flow is given V = 10x3i - 12xyj + 6tk. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t = 3.** | **10Marks** | **L3** | **CO4** |
|  |  |  |  |  |  |
| **17** | **17a** | A rectangular pontoon is 4 m long, 2.5 m wide, and 1.0 m high. The depth of immersion of the pontoon is 0.6 m in seawater. If the center of gravity is 0.5 m above the bottom of the pontoon, determine the metacentric height. The density of seawater = 1028 kg/m³. | **10Marks** | **L3** | **CO4** |
| **17b** | Find the volume of the water displaced and the position of the center of buoyancy for a wooden block of width 2.5 m and of depth 1.5 m, when it floats horizontally in water. The density of the wooden block is 980 kg/m³ and its length is 6.0 m. | **10Marks** | **L3** | **CO4** |
| **or** | | | | | |
| **18** | **18a** | A solid cylinder of 1.5 m diameter and 1.2 m height is made up of a material of specific gravity 0.6 and floats in water. Find its metacentric height. | **10Marks** | **L3** | **CO4** |
| **18b** | The velocity potential function Φ is given by the expression:    (i) Determine the velocity components in the X and Y directions. (ii) Demonstrate that this represents a valid case of fluid flow. | **10Marks** | **L3** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***