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| **Name:**<br><br>**Enrolment No:** | UPES UNIVERSITY OF TOMORROW |

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, May 2022**

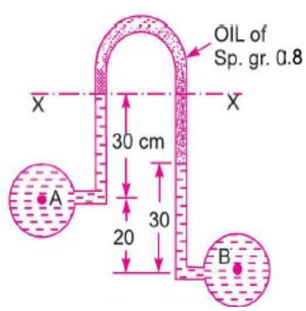
**Course: Fluid Mechanics in Petroleum Engineering** — **Semester : $4^{th}$**
**Program: B.Tech. APE-UP** — **Time : 03 hrs.**
**Course Code: PEAU 2005** — **Max. Marks: 100**

**Instructions: Assume if any data missing.**

**SECTION A**
**(5Qx4M=20Marks)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Explain types of fluids with the shear stress and shear rate diagram. | 4 | CO1 |
| Q 2 | An open circular tank of 20 cm diameter and 100 cm long contains water up to a height of 60 cm. The tank is rotated about its vertical axis at 300 RPM. Find the depth of parabola formed at the free surface of the water. | 4 | CO1 |
| Q 3 | The diameters of a pipe at the sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s. Determine also the velocity at section 2. | 4 | CO2 |
| Q 4 | A pontoon of 15696 kN displacement is floating in water. A weight of 245.25 kN is moved through a distance of 8 m across the deck of pontoon, which tilts the pontoon through an angle 4 degree. Find meta-centric height of the pontoon. | 4 | CO2 |
| Q 5 | The diameters of a pipe at the sections A and B are 15 cm and 10 cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section A is 10 m/s. Determine also the velocity at section B. | 4 | CO2 |

**SECTION B**
**(4Qx10M= 40 Marks)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 6 | In Fig. 1, an inverted differential manometer is connected to two pipes A and B which convey water. The fluid in manometer is oil of sp. gr. 0.8. For the manometer reading shown in the figure, find the pressure difference between A and B.   *Figure 1. Inverted differential manometer* | 10 | CO1 |

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|---|---|---|---|
| Q 7 | A 20 cm × 10 cm venturimeter is inserted in a vertical pipe carrying oil of sp. gr. 0.8, the flow of oil is in upward direction. The difference of level between the throat and inlet section is 50 cm. The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil. Neglect losses. | **10** | **CO2** |
| Q 8 | Water flows through a triangular right – angled weir first and then over a rectangular weir of 1 m width. The discharge co-efficient of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360 mm, find the depth of water over the rectangular weir. | **10** | **CO4** |
| Q 9 | State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation from first principle and state the assumptions made for such a derivation.<br>**OR**<br>The rate of flow of water through a horizontal pipe is 0.25 $m^3/s$. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 $N/cm^2$. Determine the loss of head due to sudden enlargement, | **10** | **CO3** |
| **SECTION-C**<br>**(2Qx20M=40 Marks)** | | | |
| Q 10 | Derive an expressions for the viscous fluid flowing through a circular pipe.<br>(i) Velocity distribution in a pipe.<br>(ii) Ratio of maximum velocity to the average velocity.<br>(iii) Drop of pressure for a given length of the pipe | **20** | **CO3** |
| Q 11 | Derive and expression for the loss of head due to sudden contraction of pipe.<br>**OR**<br>The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm, and 400 mm respectively, is 12 m. Determine the rate of flow of water is co-efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses also (ii) neglecting minor losses. | **20** | **CO4** |