Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17FP2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FLUID MECHANICS FOR FOOD ENGINEERS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | One litre of crude oil weighs 9.6 N. Calculate the specific weight, density and specific gravity. | CO1 | 10 |
| b. | An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined plane having an angle of inclination 30o. The weight of the square plate is 300 N and it slides down the plane with a uniform velocity of 0.3 m/s. Find the dynamic viscosity of the oil. | CO1 | 10 |
| **(OR)** | | | | |
| 2. | a. | The surface tension of water in contact with air at 20℃ is 0.0725 N/m. The pressure inside a droplet of water is to be 0.02 N/cm2. Calculate the diameter of the droplet of water. | CO2 | 7 |
| b. | Determine the kinematic viscosity of an oil having density 981 kg/m3. The shear stress at a point in oil is 0.2452 N/m2 and velocity gradient at that point is 0.2 per second. | CO2 | 6 |
| c. | Calculate the capillary effect in a glass tube of 2.5 mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tensions σ = 0.0725 N/m for water and σ = 0.52 N/m for mercury in contact with air. The specific gravity of mercury is 13.6. Consider the angle of contact for water is zero and for mercury 130o. | CO2 | 7 |
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| 3. | a. | Derive the formula to find the differential pressure between two points A and B of two tanks located at different levels and containing liquids of different densities. Tank A is at higher level than tank B. The manometric level is lower in the right limb and higher at left limb. | CO3 | 10 |
| b. | A differential manometer is connected at the two points A and B of two pipes as shown in the figure. The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9. The pressures at A and B are 1 kgf/cm2 and 1.8 kgf/cm2 respectively. Find the difference in mercury level in the differential manometer. | CO3 | 10 |
| **(OR)** | | | | |
| 4. | a. | An open tank contains water upto a depth of 2 m and above it an oil of specific gravity 0.9 for a depth of 1 m. Find the pressure intensity i) at the interface of the two liquids and ii) at the bottom of the tank. | CO3 | 10 |
| b. | A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left from the centre of pipe is 15 cm below. | CO3 | 10 |
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| 5. | a. | A circular plate 3 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and the position of center of pressure. | CO4 | 10 |
| b. | A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when the upper edge is horizontal and a) coincides with water surface and b) 2.5 m below the free water surface. | CO4 | 10 |
| **(OR)** | | | | |
| 6. |  | Find the total pressure and position of center of pressure on a triangular plate of base 2 m and height 3 m which is immersed in water in such a way that the plane of the plate makes an angle 60o with the free surface of the water. The base of the plate is parallel to water surface and at a depth 2.5 m from water surface. | CO4 | 20 |
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| 7. | a. | A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe, if the average velocity in 20 cm diameter pipe is 2 m/s. | CO5 | 10 |
| b. | An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take  Cd = 0.98. | CO6 | 10 |
| **(OR)** | | | | |
| 8. |  | A fluid flow is given by ***V = x2yi + y2zj – (2xyz + yz2)k.*** Calculate the velocity and acceleration at the point (2,1,3). | CO5 | 20 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s using (i) Darcy’s formula and (ii) Chezy’s formula for which C=60. | CO6 | 12 |
| b. | Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200 m and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16 m. If co-efficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting the minor losses. | CO6 | 8 |