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



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

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| **Code :** | **17BT2013** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FLUID MECHANICS FOR BIOTECHNOLOGISTS** | **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. | A liquid when poured into a graduated cylinder is found to weigh 8N when occupying a volume of 500ml. Determine its specific weight, density and specific gravity. | CO1 | 8 |
| b. | Explain the concept of fluid-continuum. What is the advantage of assuming fluid-continuum concept? | CO1 | 12 |
| **(OR)** | | | | |
| 2. | a. | Explain the property of the fluid - dynamic viscosity and kinematic viscosity. | CO1 | 6 |
| b. | The kinematic viscosity and specific gravity of a liguid are 3.5X10-4m2/s and 0.79 respectively. What is the dynamic viscosity of the liquid in SI unit? | CO1 | 7 |
| c. | Explain Newton’s Law of Viscosity. The velocity distribution for flow over a flat plate is given by u=-|-y-y2m where u is velocity in m/s at a distance y(m) above the plate. Determine the shear stress at y = 0.15 M. Take dynamic viscosity of fluid as 8.6 poise. | CO1 | 7 |
|  |  |  |  |  |
| 3. | a. | A U-tube manometer is connected to a closed tank as shown in Fig. The air pressure in the tank is 0.50 psi and the liquid in the tank is oil (specific weight = 54.0 lb/ft3). The pressure at point A is 2.00 psi.  Determine:  (i) the depth of oil, z, and  (ii) the differential reading, on the manometer.  A U-tube manometer is connected to a closed tank a | CO1 | 10 |
| b. | A single column vertical manometer with a reservoir to is connected to a pipe containing oil of specific gravity 0.9. The area of reservoir is 100 times the area of the manometric tube. The reservoir contains mercury of specific gravity 13.6. The level of mercury in the reservoir is at depth 30cm below the centre of pipe. If the difference of mercury levels in the reservoir and the right limb is 50cm, calculate the pressure in the pipe. | CO1 | 10 |
| **(OR)** | | | | |
| 4. |  | Derive Navier Stoke equation. | CO5 | 20 |
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| 5. | a. | What do you mean by dimensionless numbers? Define and explain Reynold’s number and Froude’s number. | CO2 | 8 |
| b. | Assume that the flowrate, Q, of a gas from a smokestack is a function of the density of the ambient air, ρair, the density of the gas, ρgas, within the stack, the acceleration gravity, g, and the height and diameter of the stack, h and d, respectively. Use ρair, d, and g as repeating variables to develop a set of pi terms that could be used to describe this problem | CO2 | 12 |
| **(OR)** | | | | |
| 6. |  | A thin, flat plate containing a series of holes is to be placed in a pipe to filter out any particles in the liquid flowing through the pipe. There is some concern about the large pressure drop that may develop across the plate, and it is proposed to study this problem with a geometrically similar model. The following data is applied: Assume that the pressure drop depends on the variables listed, use dimensional analysis to develop a suitable set of dimensionless parameters for this problem. Determine values for d,V. What will be the pressure drop scale?   |  |  | | --- | --- | | Prototype | Model | | d hole diameter= 1.0mm | d=? | | D pipe diameter | D=10m | | µ viscosity 0.002Ns/m2 | µ=0.002Ns/m2 | | ρ density 1000kg/m3 | ρ=1000kg/m3 | | V- velocity= 0.1m/s to 2m/s | V=? | | CO2 | 20 |
| 7. |  | Derive equation for pressure drop in packed bed. | CO3 | 20 |
| **(OR)** | | | | |
| 8. |  | Explain the concept of Boundary Layer. What do you mean by Laminar, boundary layer, transition boundary layer, turbulent boundary layer and laminar sub layer? Explain with the help of neat sketch. | CO3 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | Classify the different flow meters and comment on the advantages and limitations of each. | CO3 | 20 |