Reg. No. | | | | | | | | | | | | | |

**B.E / B.TECH. DEGREE EXAMINATION, MAY 2023**

Third Semester

**CE18302 – MECHANICS OF FLUIDS**

*(Civil Engineering)*

**(Regulation 2018A)**

**TIME:3 HOURS** **MAX. MARKS: 100**

**CO1** Summarize the differences between the solid and fluid and apply the fluid properties and its behavior in static conditions to solve problems.

**CO2** Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.

**CO3** Analyze the model for flow studies and to predict the performance of prototype.

**CO4** Analyze the losses in pipe lines for both laminar and turbulent conditions.

**CO5** Apply the boundary layer concepts to find the drag force excreted by fluid on the flat solid surface.

**PART- A(10x2=20Marks)**

(Answer all Questions)

| | | CO | RBT LEVEL |
|---|---|---|---|
| **1.** | Calculate the specific weight and weight of one litre of petrol of specific gravity=0.7. | **1** | **3** |
| **2.** | Differentiate centre of pressure and centre of buoyancy. | **1** | **2** |
| **3.** | Distinguish steady and unsteady flow with example. | **2** | **2** |
| **4.** | State Cauchy Riemann Equation | **2** | **1** |
| **5.** | What is Distorted model? | **3** | **1** |
| **6.** | State Buckingham's Π theorem. | **3** | **1** |
| **7.** | What are the factors influencing the frictional loss in pipe flow? | **4** | **2** |
| **8.** | The discharge through a pipe is 300 litres/sec. Find loss of head when pipe is suddenly contracted from 300 mm to 150 mm diameter. | **4** | **3** |
| **9.** | Define boundary layer thickness. | **5** | **1** |
| **10.** | Compute the lift force in a plate 1.5m x 1.5m moves at 35 km/hr in air of density 1.24 kg/$m^3$. Take Coefficient of lift is 0.7. | **5** | **3** |

**PART- B(5x 14=70Marks)**

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **11. (a)** | The dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 r.p.m. Estimate | **(14)** | **1** | **3** |





the power lost in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5 mm.

**(OR)**

| | | | | |
|---|---|---|---|---|
| **(b)** | A tank contains water upto a height of 0.5 m above the base. An immiscible liquid of specific gravity 0.8 is filled on the top of water upto to a height of 1 m. Calculate (i) total pressure on one side of tank (ii) the position of centre of pressure for one side of the tank. Width of tank is 2m wide. | **(14)** | **1** | **3** |
| **12. (a)** | The stream function for a two dimensional flow is given by Ψ= 2xy. Calculate the resultant velocity at P(1,2). Also determine expression for the velocity potential ø. | **(14)** | **2** | **3** |

**(OR)**

| | | | | |
|---|---|---|---|---|
| **(b)** | A venturimeter is connected to pipeline carrying water in upward direction such that the direction of flow is 300 with the horizontal. The rate of flow is 35 lps and the size of venturimeter is 15 cm x 7.5 cm. The distance between inlet and the throat is 250 mm. Determine the difference in pressure head if the manometric reading is 15 cm. | **(14)** | **2** | **3** |
| **13. (a)** | The Pressure difference Δp in a pipe diameter D and length L due to turbulent flow depends on the velocity V, Viscosity μ, density ρ and roughness k. Using Buckingham's π- theorem, obtain an expression for Δp. | **(14)** | **3** | **3** |

**(OR)**

| | | | | |
|---|---|---|---|---|
| **(b)** | Define and derive expressions for the following dimensionless numbers.<br>i) Froude Number<br>ii) Reynolds Number<br>iii) Mach Number | **(14)** | **3** | **3** |
| **14. (a)** | The difference in water surface levels in two tanks, which are connected by three pipes in series of length 300 m, 170 m and 210 m and of diameters 300 mm, 200mm and 400 mm respectively, is 15m. Determine the rate of flow if co efficient of frictions are 0.005, 0.0052 and 0.0048 respectively. Consider case a) minor losses and case b) neglecting minor losses. | **(14)** | **4** | **3** |

**(OR)**

Q. Code: 480943

| | | | | |
|---|---|---|---|---|
| **(b)** | A pipeline having dia 25 cm and length 4 km connects two water tanks having piezometric heads of 120 m and 80 m at upstream and downstream respectively. Determine the rate of flow. To increase the discharge another pipe of 25 cm dia is connected to existing pipe in parallel pattern on lower 2 km length. Determine the % change in discharge. Consider f=0.04. | **(14)** | **4** | **3** |
| **15. (a)** | Calculate the ratio of Momentum thickness to boundary layer thickness (θ/δ) and displacement thickness to boundary layer thickness (δ*/δ) for the velocity profile distribution u/U=(3/2)(y/δ) – (1/2) (y/δ)2 | **(14)** | **5** | **3** |
| | **(OR)** | | | |
| **(b)** | A kite weighing 8.0 N has an effective area of 0.6 $m^2$. It is maintained in air at an angle of 10° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal and this position the value of coefficient of drag and lift are 0.6 and 0.8 respectively. Find the speed of the wind and the tension in the string. take the density of air is 1.25 $kg/m^3$. | **(14)** | **5** | **3** |

**PART- C(1x 10=10Marks)**

(Q.No.16 is compulsory)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **16.** | Derive the Euler's equation of motion for the steady flow of an ideal fluid along a stream line. | **(10)** | **2** | **3** |