## PACE INSTITUTE OF TECHNOLOGY \& SCIENCES::ONGOLE (AUTONOMOUS)

II B.TECH I SEMESTER END SUPPLEMENTARY EXAMINATIONS, MARCH/APRIL - 2023 FLUID MECHANICS (CE Branch)
Time: 3 hours
Max. Marks: 70
Answer all the questions from each UNIT (5X14=70M)

| Q.N |  | Questions | Marks | CO | KL |
| :---: | :---: | :---: | :---: | :---: | :---: |
| UNIT-I |  |  |  |  |  |
| 1. | a) | Explain the phenomena surface capillarity. Obtain an expression for capillarity rise of a liquid. | [7M] | 1 | 3 |
|  | b) | Fig. shows a U-tube differential manometer connecting two pressure pipes at A and B contains a liquid of specific gravity 1.5 under a pressure of 115 $\mathrm{kN} / \mathrm{m}^{2}$. The pipe B contains oil of specific gravity 0.9 under a pressure of $220 \mathrm{kN} / \mathrm{m}^{2}$ Find the difference of pressure measured by mercury as fluid filling U-tube. | [7M] | 1 | 2 |
| OR |  |  |  |  |  |
| 2. | a) | State and prove the Pascal's law | [7M] | 1 | 3 |
|  | b) | Determine the total pressure and depth of center of pressure on a plane rectangular surface of 3.5 m wide and 4.5 m deep when its upper edge is horizontal and (i) coincides with water surface <br> (ii) 2.5 m below the free surface of water. | [7M] | 1 | 4 |
| UNIT-II |  |  |  |  |  |
| 3. | a) | Distinguish between: <br> (i).Stream line and Path line (ii). Streak line and Stream tube (iii). Laminar flow and Uniform flow. | [7M] | 2 | 2 |
|  | b) | The velocity potential function $(\phi)$ is given by an $\varnothing=-\left(\frac{x y^{3}}{3}\right)-x^{2}+\left(\frac{x^{3} y}{3}\right)+y^{2}$ <br> (i)Find the velocity components in x and y directions. | [7M] | 2 | 4 |
| OR |  |  |  |  |  |
| 4. | a) | State and derive three dimensional (3D) continuity equation for incompressible fluid. | [10M] | 2 | 3 |



|  | b) | The diameter of a pipe at the section 1-1 and 2-2 are 150 mm and 300 mm respectively. If the velocity of water flowing through the pipe at section 1-1 is $3 \mathrm{~m} / \mathrm{s}$, find (i). Discharge through the pipe and <br> (ii). Velocity of water at section 2-2. | [4M] | 2 | 4 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| UNIT-III |  |  |  |  |  |
| 5. | a) | Draw a neat sketch of Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of the apparatus. | [7M] | 3 | 3 |
|  | b) | Derive the expression for the loss of head in a pipe due to friction? | [7M] | 3 | 3 |
| OR |  |  |  |  |  |
| 6. | a) | What do you understand by the total energy line, hydraulic gradient line, pipes in series, pipes in parallel and equivalent pipe? | [7M] | 3 | 2 |
|  | b) | Explain the procedure of pipe net work problems by using Hard-Cross Method. | [7M] | 3 | 3 |
| UNIT-IV |  |  |  |  |  |
| 7. | a) | Explain the principle of orifice meter with neat sketch? Derive an expression for the rate of flow of fluid through it. | [10M] | 4 | 2 |
|  | b) | Explain the fallowing terms <br> (i). Coefficient of velocity (ii). coefficient of contraction (iii). coefficient of Discharge (iv). Vena-contracta | [4M] | 4 | 2 |
| OR |  |  |  |  |  |
| 8. | a) | Derive an expression for the discharge over a Triangular notch in terms of head of water over the crest of the notch. | [7M] | 4 | 3 |
|  | b) | Water flows through a rectangular notch of 2.5 m width and depth of water over the notch is 500 mm , find discharge of the rectangular notch. Take coefficient of discharge is 0.6 . | [7M] | 4 | 4 |
| UNIT-V |  |  |  |  |  |
| 9. | a) | Derive an expression for the displacement thickness | [7M] | 5 | 2 |
|  | b) | Explain the phenomenon of separation of boundary layer with a neat sketch | [7M] | 5 | 3 |
| OR |  |  |  |  |  |
| 10. | a) | Obtain Von Karman momentum integral equation | [7M] | 5 | 3 |
|  | b) | Find the displacement thickness and the momentum thickness for velocity distribution in the boundary layer given by $\frac{u}{\tau \tau}=2\left(\frac{y}{c}\right)-\left(\frac{x^{2}}{c^{2}}\right)$ | [7M] | 5 | 4 |

