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



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

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| **Code :** | **17ME2013** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FLUID MECHANICS AND MACHINERY** | **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. | Calculate the capillary effect in millimetres in a glass tube of 4 mm diameter, when immersed in (i) Water (ii) Mercury. The temperature of the liquid is 20oC and the values of the surface tension of water and mercury at 20oC in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130o. Take density of water at 20oC as equal to 998 kg/m3. | CO1 | 10 |
|  | b. | A rectangular plane surface 2 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30 ° with the free surface of water. Determine the total pressure and position of centre of pressure when the upper edge is 1. 5 m below the free water surface. | CO2 | 10 |
| **(OR)** | | | | |
| 2. |  | A U-Tube manometer is used to measure the pressure of water in a pipe line. Which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U -tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases. | CO2 | 20 |
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| 3. | a. | If for a two-dimensional potential flow;the velocity potential is given by φ = x(2y-1).Determine the velocity at the point P(4,5). Determine also the value of stream function ψ at the point P. | CO2 | 10 |
| b. | The water is flowing through a pipe having diameters 20cm and 10cm at sections 1 and 2 respectively. The rate of flow through a pipe 35liters/sec. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm2. Find the intensity of pressure at section 2. | CO2 | 10 |
| **(OR)** | | | | |
| 4. | a. | Derive Euler's equation of motion. From Euler's equation derive Bernoulli's equation and state the assumptions made for it. | CO3 | 12 |
| b. | A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15 cm is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take coefficient of discharge as 0.98. | CO3 | 8 |
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| 5. | a. | Find the displacement thickness, momntum thickness and energy thickness for the vlelocity distribution in the boundary layer given by where u is the velocity at a distance y from the plate and u = U at y = ᵟ where ᵟ = boundary layer thicness. Also calculate the value of ᵟ\*/θ. | CO3 | 10 |
| b. | 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 formula, (ii) Chzy's fromula for which C = 60. Take kinematic viscosity for water = 0.01 stoke. | CO4 | 5 |
| c. | Three pipes of lengths 800 m,500 and 400 m and of diameters 500 mm, 400 mm and 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700 m. Find the diameter of the single pipe. | CO4 | 5 |
| **(OR)** | | | | |
| 6. |  | A horizontal pipe line 40m long is connected to a water tank at one end and discharge freely into the atmosphere at the other end. For the first 25m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300mm. The height of water level in the tank is 8m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both the sections of the pipe. | CO4 | 20 |
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| 7. | a. | A Jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/s, The plate is moving with a velocity of 6 m/s in the direction of the Jet and away from the Jet. Find the (i) the force exerted by the jet on the plate (ii) work done by the jet on the plate per second (iii) Power of the jet (iv) Efficiency of the jet. | CO5 | 15 |
| b. | Write short note on Cavitation of Pumps. | CO6 | 5 |
| **(OR)** | | | | |
| 8. |  | A centrifugal pump having outer diameter qual to two times the inner diameter and running at 1000 r.p.m works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at ouitlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine (a) Vane angle at inlet, (b) Work done by the impeller on water per second (c) Manometric efficiency. | CO6 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | A pelton wheel is working under a gross head of 400 m. The water is supplied through a penstock of diameter 1 m and length 4 km from reservoir to the plton wheel. The co-efficient of fricition for the penstock is given as 0.008. The jet of water of diameter 150 mm strikes the buckets of the wheel and gets deflected through an angle of 165°. The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of bucket and water. If the velocity of the buckets is 0.45 times the jet velocity at the inlet and mechanical efficiency as 85 % determine: (i) Power given to the runner (ii) Shaft power (iii) Hydraulic Efficiency and overall efficiency. | CO6 | 20 |