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Sixth Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics and Hydraulic Structures

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Define the following properties of fluid with their SI units. (04 Marks)
 - i) Specific weight ii) Specific volume
 - b. Classify and define different types of fluids. Also show the graphical representation between shear stress and deformation rate. (10 Marks)
 - c. Calculate the capillary effect in mm in a glass tube of 4mm diameter when immersed in water. The temperature of the liquid is 20°C and a value of the surface tension of water at 20°C in contact with air is 0.073 N/m. The angle of contact is zero and density of water at 20°C = 998kg/m³. (06 Marks)
- 2 a. With a neat sketch define different types of pressure. Also give the relationship between absolute Gauge and vacuum pressures. (08 Marks)
 - b. A 3.6m × 1.5m wide rectangular gate is vertical and is hinged at point 0.15m below the centre of gravity of the gate. The depth of water 6m. What horizontal force must be applied at bottom of the gate to keep the gate closed? (08 Marks)
 - c. Write a note on mechanical gauges. (04 Marks)
- 3 a. Derive Euler's equation of motion along a streamline. (06 Marks)
 - b. In a smooth pipe of uniform diameter 25cm, a pressure of 50KPa was observed at section 1 which was at elevation 10.00m. AT another section 2 at elevation 12.00m, the pressure was 20KPa and the velocity was 1.25 m/s. Determine the direction of flow and the head loss between these two sections. The fluid in the pipe is water. (10 Marks)

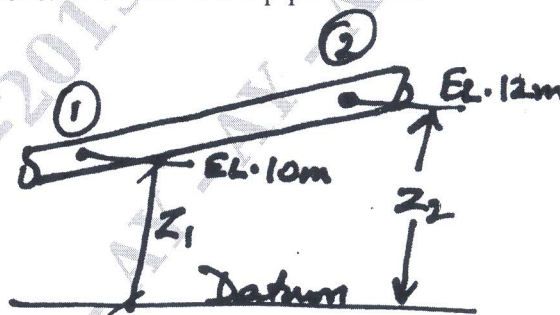


Fig Q3 (b)

- c. Obtain Darcy Weisbach Equation for head loss to friction in pipe. (04 Marks)
- 4 a. Define the following and give the expression for each. (06 Marks)
 - i) Coefficient of velocity (C_v)
 - ii) Coefficient of Contraction (C_c)
 - iii) Coefficient of Discharge (C_d)

- b. A reservoir discharges through a slice 0.915m wide by 1.22m deep. The top of the opening is 0.61m below the water level in the reservoir and the downstream water level is below the bottom of the opening. Calculate :
- The discharge through the opening if $C_d = 0.60$
 - Percentage error if the opening is treated as a small orifice. (08 Marks)
- c. List the classification of weirs. (06 Marks)

PART – B

- 5 a. A jet of water 75mm diameter having velocity of 20m/s, strikes normally a flat smooth plate. Determine the thrust on the plate.
- If the plate is at rest
 - If the plate is moving in the same direction as the jet with a velocity of 5m/s. Also find the work done per second on the plate in each case and the efficiency of the jet when the plate is moving. (10 Marks)
- b. Determine the expression for force exerted by a jet on a moving target. (10 Marks)
- 6 a. Define the following with expression.
- Hydraulic efficiency, η_u
 - Mechanical efficiency, η_m
 - Volumetric efficiency, η_v
 - Overall efficiency, η_o
 - Net load. (10 Marks)
- b. Write short notes on:
- Kaplan Turbine
 - Pelton wheel (10 Marks)
- 7 a. Comment on the classification of open channel flow. (06 Marks)
- b. A circular drainage pipe 0.80m in diameter conveys a discharge at a depth of 0.3m. If the pipe is laid on a slope of 1 in 900, estimate the discharge. Take Manning's $n = 0.015$. (07 Marks)
- c. Derive the expression for conditions for most economical Rectangular channel section. (07 Marks)
- 8 a. Write short notes on :
- Priming and methods
 - Cavitations in centrifugal pumps (10 Marks)
- b. A centrifugal pump delivers water against a net head of 14.5meters and a design speed of 1000rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outlet width 50mm. Determine the discharge of the pump if mono-metric efficiency is 95%. (10 Marks)

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