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10CV35

Third Semester B.E. Degree Examination, June/July 2018
Fluid Mechanics

Time: 3 hrs.

Max. Marks:100

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

PART - A

- Define the following. Also mention their units (i) Specific weight (ii) Relative density (iii) Specific volume (iv) Mass density. (08 Marks)
 - Two vertical parallel plates distance 't' apart are partially submerged in liquid of specific weight 'w' and surface tension σ . Show that capillary rise is given by : $h = \frac{2\sigma \cos\theta}{t w}$ where θ is angle made by surface tension force with vertical. (04 Marks)
 - An oil of viscosity 5 poise is used for lubrication between a shaft and sleeves. The diameter of shaft is 0.5m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100mm. the thickness of oil film is 1mm. (08 Marks)
- Differentiate between: (i) Absolute pressure and gauge pressure (ii) Simple manometer and differential manometer and (iii) Piezometer and pressure gauges. (06 Marks)
 - What is U-tube differential manometer? Obtain an expression for difference of pressure between two pipes at different levels. (06 Marks)
 - A piezometer tube is fitted to a tank containing water at a point 500mm above the bottom of tank as shown in Fig Q2(c). The liquid in manometer is carbon disulphide having a specific gravity 1.9. Find the height of free water surface above the bottom of tank if piezometer reading is 400mm. find also pressure intensity at bottom of tank. (08 Marks)

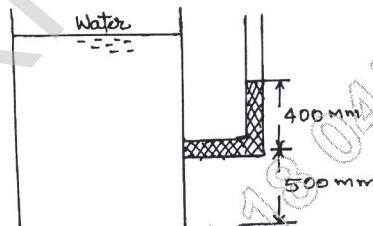


Fig Q2(c)

- What is total pressure and centre of pressure? Explain. (04 Marks)
 - Derive an expression for force exerted on submerged inclined plane surface by static liquid and locate the position of centre of pressure. (06 Marks)
 - An inclined rectangular gate of width 5m and depth 1.5m is installed to control the discharge of water as shown in Fig Q3(c). The end A is hinged. Determine the force normal to the gate applied at B to open it. (10 Marks)

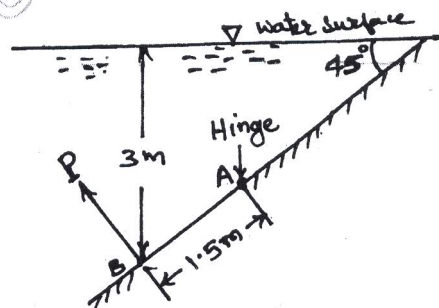


Fig Q3(c)

1 of 2

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Differentiate between :
- (i) Streamline and Streak line
 - (ii) Stream function velocity potential function
 - (iii) Uniform and Non Uniform flow
 - (iv) Rotational and Irrotational flow. (08 Marks)
- b. What are equipotential line and line of constant stream function? Show that they are orthogonal to each other? (04 Marks)
- c. The stream function in a two dimensional flow field is $\Psi = 6x - 4y + 7xy$. Verify whether the flow is irrotational. Determine the direction of stream line at point (1, -1). Determine also expression for velocity potential. (08 Marks)

PART - B

- 5 a. Write Euler's equation of motion along a streamline and integrate it to obtain Bernoulli's equation. State also assumption made. (10 Marks)
- b. At a point in the pipe line where the diameter is 20cm, the velocity of water is 4 m/s and pressure is 343 kN/m². At a point 15m downstream the diameter reduces to 10cm. Calculate the pressure at this point if pipe is (i) horizontal (ii) vertical with flow downwards (iii) vertical with flow upwards. (10 Marks)
- 6 a. Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch. (04 Marks)
- b. Derive an expression for pressure rise due to sudden closure of valve when the pipe is elastic. (08 Marks)
- c. Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses. (08 Marks)
- 7 a. Write Short notes on : (i) Staff gauge (ii) Weight gauge (iii) Float gauge (iv) Hook gauge (08 Marks)
- b. Explain the method of measurement of velocity by current meter. (04 Marks)
- c. A pitot tube records reading of 7.85 KPa as the stagnation pressure, when it is held at centre of pipe of 250mm diameter conveying water. The static pressure pipe is 40mm of mercury (Vacuum). Calculate the discharge in pipe assuming the mean velocity of flow is 0.8 times the velocity at centre. Take $C_v = 0.98$. (08 Marks)
- 8 a. Write a note on cippolletti weir. (04 Marks)
- b. Derive an expression for discharge through a venturimeter. (08 Marks)
- c. A venturimeter is installed in a pipeline 30cm in diameter. The throat pipe diameter ratio is $\frac{1}{3}$. Water flows through installation. The pressure in the pipeline is 137.7 kN/m² and vacuum in the throat is 37.5cm of mercury. If 4% of differential head is lost between the gauges, find the flow in the pipe line. (08 Marks)
