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Third Semester B.E. Degree Examination, July/August 2021
Fluid Mechanics

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Differentiate between:
 - i) Ideal fluids and Real fluids.
 - ii) Newtonian and Non-Newtonian fluids
 - iii) Dynamic viscosity and Kinematic viscosity
 - iv) Specific weight and specific volume. (08 Marks)
- b. Derive an expression for capillary fall of a liquid. (04 Marks)
- c. A hydraulic lift consists of a 25cm diameter ram which slides in a 25.015cm diameter cylinder, the annular space being filled with oil having kinematic viscosity of $0.025 \text{ cm}^2/\text{s}$ and specific gravity of 0.85. If the rate of travel of ram is 9.15 m/minute, find the frictional resistance when 3.05m of ram is engaged in cylinder. (08 Marks)

- 2 a. Define the terms gauge pressure, vacuum pressure and absolute pressure. Indicate their relative position on a chart. (06 Marks)
- b. Explain how vacuum pressure can be measured with help of U-tube manometer. (06 Marks)
- c. Two pressure points in a water pipe are connected to a manometer which has the form of an inverted U-tube. The space above water in two limbs of manometer is filled with toluene of specific gravity 0.875. If the difference of level of water columns in two limbs is equal to 0.12m, what is the corresponding difference of pressure? (08 Marks)

- 3 a. Define: i) Total pressure i) Centre of pressure. (04 Marks)
- b. Derive an expression for horizontal and vertical components of resultant pressure on submerged curved surface. (08 Marks)
- c. A 3.8m by 1.8m wide rectangular gate AB is vertical and hinged at a point 0.20m below centre of gravity of gate. The total depth of water is 7m. What horizontal force must be applied at bottom of gate to keep the gate closed? (Refer Fig.Q.3(c)). (08 Marks)

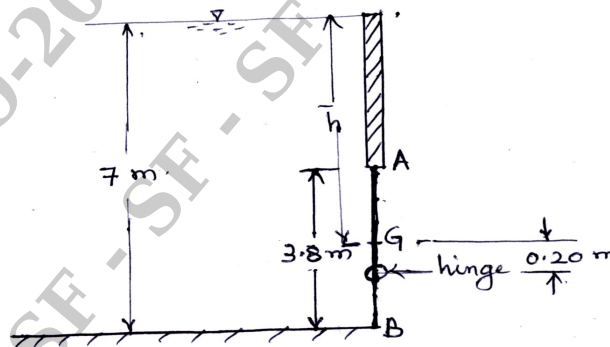


Fig.Q.3(c)



- 4 a. Differentiate:
- i) Path line and stream line
 - ii) Steady and uniform flow
 - iii) Convective and local acceleration. (06 Marks)
- b. Derive the continuity equation for a steady and incompressible flow for three dimensions Cartesian coordinates. (06 Marks)
- c. If two dimensional potential flow, velocity potential is given by: $\phi = 4x(3y - 4)$, determine the velocity at point (2, 3). Determine also the value of stream function ψ at the point (2, 3). (08 Marks)
- 5 a. What is kinetic energy correction factor? Explain. (04 Marks)
- b. Derive Euler's equation of motion from first principle and obtain Bernoulli's equation. (06 Marks)
- c. A bend in a pipe line conveying water gradually reduces from 0.6m to 0.3m diameter and deflects the flow through angle of 60° . At the larger end gauge pressure is 171.675 kN/m^2 . Determine magnitude and direction of force exerted by water on bend when the flow is 876 litres/s. (10 Marks)
- 6 a. What are major energy losses and minor energy losses in pipes? (04 Marks)
- b. The rate of flow of water through horizontal pipe is $0.3 \text{ m}^3/\text{s}$. The diameter is suddenly enlarged from 250mm to 500mm. The pressure intensity in smaller pipe is 13.734 N/cm^2 . Determine: i) Loss of head due to sudden enlargement ii) Pressure intensity in larger pipe and iii) Power lost due to enlargement. (08 Marks)
- c. The water flowing with a velocity of 2 m/s in a pipe length 2000m and diameter 600mm. The thickness of pipe is 10mm, and the valve is closed suddenly. Find rise in pressure if the pipe is considered to be elastic. The value of $E = 19.62 \times 10^6 \text{ N/cm}^2$ for pipe material and $K = 19.62 \times 10^4 \text{ N/cm}^2$ for water. Calculate the circumferential stress and longitudinal stress developed in the pipe wall. (08 Marks)
- 7 a. Explain following with neat sketches:
- i) Staff gauge
 - ii) Weight gauge
 - iii) Float gauge
 - iv) Hook gauge. (08 Marks)
- b. Describe the method of using current meter for measuring discharge of a stream. (05 Marks)
- c. A pitot tube was used to measure the quantity of water flowing in a pipe of 0.3m diameter. The water was raised to a height of 0.25m above the centre line of pipe in vertical limb of tube. If the mean velocity is 0.78 times the velocity at centre and coefficient of pitot tube is 0.98, find quantity of water in litres per second, static pressure head at centre of pipe is 0.2m. (07 Marks)
- 8 a. Differentiate between:
- i) Venturimeter and Venturiflume
 - ii) Rectangular notch and Cipolletti notch
 - iii) Weirs and notches. (06 Marks)
- b. Explain experimental determination of hydraulic coefficients of an orifice. (06 Marks)
- c. A rectangular channel 1.5m wide has a discharge of 200 litres per second, which is measured by right angled V-notch weir. Find the position of apex of notch from bed of channel if maximum depth of water is not to exceed 1m. Take $C_d = 0.62$ (08 Marks)