



10CT63

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Fluid Mechanics and Hydraulic Structure

Time: 3 hrs.

Max. Marks:100

Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.
2. Missing data if any may be suitably assumed.

PART – A

- 1 a. Define the following terms along with symbols, equation and units : (06 Marks)
- i) Density
 - ii) Relative density
 - iii) Surface tension (06 Marks)
- b. Define capillarity and derive the expressions for capillary rise and fall.
- c. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost if the bearing for a sleeve length of 90mm, the thickness of oil film is 1.5mm. (08 Marks)
- 2 a. Define Pascal's law and prove that pressure at a point is same in all directions. (06 Marks)
- b. Differentiate between :
- i) Absolute pressure and gauge pressure
 - ii) Simple manometer and differential monometer. (06 Marks)
- c. A rectangular plate 1.2m × 1.8m size is immersed in water in an inclined position makes an angle of 30° with horizontal. The 1.2m side being horizontal. Calculate the magnitude of the net force on one face and position of centre of pressure when :
- i) The top edge of the plate is at the water surface
 - ii) 30cm below the water surface. (08 Marks)
- 3 a. State and prove the Bernoulli's theorem. List the assumptions made in deriving the Bernoulli's equations. (10 Marks)
- b. 250 litres per second of water is flowing in a pipe having a diameter of 300mm. If the pipe is bent by 135°. Find the magnitude and direction of the resultant force in the bend. The pressure of water flow is 400kN/m². The specific weight of water is 9.81kN/m³. (10 Marks)
- 4 a. Derive the discharge equation for triangular notch. (08 Marks)
- b. Differentiate between ogee weir and Broad crested weir. Discuss the ventilation of weir. (06 Marks)
- c. A horizontal venturimeter with inlet diameter 200mm and throat diameter 100mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180mm of mercury. If the co-efficient of discharge is 0.98 determine the rate of flow. (06 Marks)

PART – B

- 5 a. Derive the equation for force exerted by a jet on a series of radial curved vanes. (10 Marks)
- b. A nozzle of 50mm diameter deliver a stream of water at 20m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find : i) the force on the plate ii) the work done. (04 Marks)

- c. A jet of water of diameter 7.5cm strikes a curved plate at its centre with a velocity of 20m/s the curved plate is moving with a velocity of 8m/s in the direction of the jet. The jet is deflection through an angle of 165° . Assuming the plate to be smooth. Find the power of the jet and efficiency of jet. (06 Marks)
- 6 a. Classify and briefly explain different types of turbines. (10 Marks)
b. With the help of a neat sketch, explain the component parts of Kaplan turbine. (10 Marks)
- 7 a. Explain the classification of flow in open channels. (06 Marks)
b. Derive the conditions for most economical trapezoidal channel section. (10 Marks)
c. Find the best slope of a trapezoidal channel of bed width 4m, depth of water 3m and side slope of 2 horizontal to 3 vertical. When discharge is $20\text{m}^3/\text{s}$. Take Manning's $N = 0.03$. (04 Marks)
- 8 a. Explain briefly the various types of efficiencies of a centrifugal pump. (06 Marks)
b. With neat sketch, explain the working principles of centrifugal pump. (06 Marks)
c. Find the power required to drive a centrifugal pump which delivers 40 lit of water per second to a height of 20m through a 150mm diameter and 100mm long pipeline. The overall efficiency of pump of 70% and Darcy's $f = 0.06$ for the pipeline. Assume inlet losses in section pipe equal to 0.33m. (08 Marks)
