Mid-West University

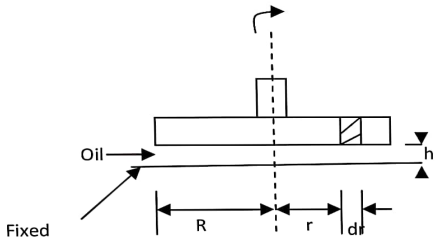
Examinations Management Office

End-Semester Examinations -2080

Bachelor level/ B.E. Civil /3rd Semester — Full Marks: 50
Time: 3 hours — Pass Marks: 25
Subject: Fluid Mechanics (CE432/CE205)

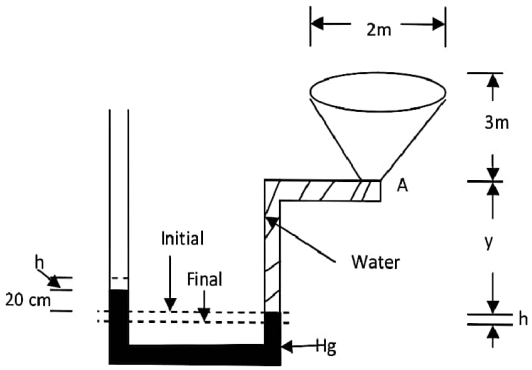
- *Attempt all the questions*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Necessary figures are attached herewith.*
- *Candidates are required to answer the questions in their own words as far as possible.*

1. Describe the effect of temperature on viscosity of fluids. Explain with reasons. A 130 mm circular disc rotates on a table separated by an oil of film of 3 mm thickness. Find the viscosity of the oil if the torque required to rotate the disc at 70 rpm is 5x10-4 Nm. Assume the velocity gradient in the oil film to be linear. **[2+3]**

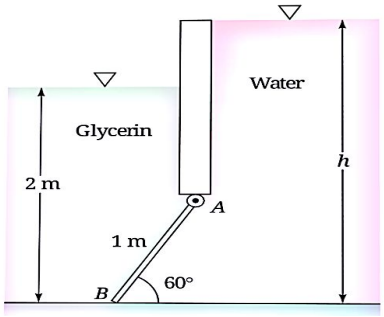


2. Fig. below shows a conical vessel having its outlet at A to which a U-tube manometer is connected. **[4]**

The reading of the manometer given in the fig. shows when the vessel is empty. Find the reading of the manometer when the vessel is completely filled with water.



3. Gate **AB** in given figure is a homogeneous mass of 2010 Kg, 1.5 m wide into the paper, hinged at A, and resting on a smooth bottom at B. All fluids are at 20^0 C. For what water depth **h** will the force at point **B** be zero? Take specific gravity of glycerin at 20^0 C as 1.3. **[5]**

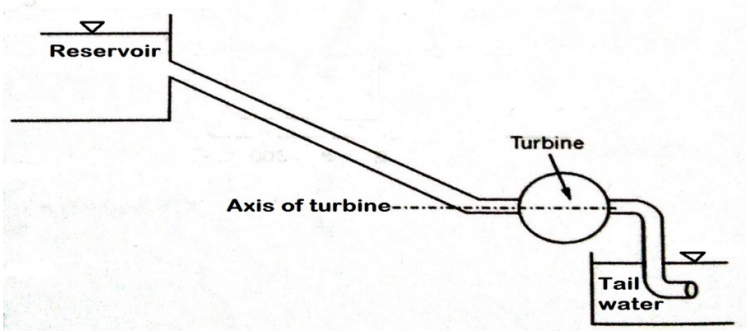


4. Enumerate the concept about absolute and relative equilibrium. Determine the speed of rotation of a cylinder 1000 mm diameter when the liquid contained in it rises to 600 mm height at the sides and leaves a circular space 300 mm diameter on the bottom uncovered. Taking the liquid as water, calculate the total pressure on the bottom. Find also the depth when the vessel is stationary. **[1+5]**

5. Define potential function and stream function. Derive the expression for continuity equation in cylindrical polar co-ordinate system for two dimensional steady incompressible flow. **[1+4]**

6. A pipe connects a reservoir to a turbine which discharges water to the tail race through another pipe. The head loss between the reservoir and the turbine is 15 times the kinetic head in the pipe and that from the turbine to the tail race is 0.89 times the kinetic head in the pipe. The rate of flow is 2.5 m^3/s and the pipe diameter in both cases is 1.80 m. Find the pressure at inlet and exit of the turbine. **[4]**

   Take:
   Elevation of turbine axis = 206.50 m
   Elevation of reservoir water level = 256.00 m
   Elevation of tail water level = 199.00 m.
   Calculate also the power generated byturbine taking efficiency of the turbine as 91%.



7. An orifice of 160 mm in diameter is provided at the bottom of a horizontal boiler drum 8 m long and 4 m in diameter full of water. Determine the time required to empty the drum completely. The coefficient of discharge is 0.72. **[4]**

8. Define the terms displacement thickness and momentum thickness with necessary formula. A kite, which may be assumed to be a flat plate and mass 1.6 kg, soars at an angle to the horizontal. The tension in the string holding the kite is 95 N when the wind velocity is 60 km/h horizontally and the angle of string to the horizontal direction is 38^0. The density of air is 1.25 kg/m3 . Calculate the drag coefficient for the kite in the given position if the lift coefficient in the same position is 0.47. Both coefficients have been based on the full area of the kite. **[2+4]**

9. What are the applications of angular momentum principle? A 0.5 m x 0.4 m, 90^0 vertical bend carries 0.7 m3/s oil of sp gr 0.9 with a pressure of 130 Kpa at inlet to the bend. The volume of the bend is 0.15 m3. Find the magnitude and direction of the force on the bend. Neglect friction and assume both inlet and outlet sections to be at same horizontal level. Also assume that water enters the bend at 50^0 to the horizontal. **[1+5]**

10. Why Buckingham's-π theorem is used over Rayleigh method? The pressure drop in an aero-plane model of size 1/50 of its prototype is 4 N/cm2. The model is tested in water. Find the corresponding pressure drop in prototype. Take density of air = 1.24 kg/m3. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise. **[1+4]**

The End