CE8302 FLUID MECHANICS

Important 2-Mark Questions

Part-B

1. Find the density of a metallic body which floats at the interface of mercury of sp.gr. 13.6 and water such that 40% of its volume is sub – merged in mercury and 60% in water.
2. Two large plane surfaces are 2.4 cm apart. The space between the gap is filled with glycerin. What force is required to drag a thin plate of size 0.5 m between two large plane surfaces at a speed of 0.6 m/sec. if the thin plate is
   a) In the middle gap
   b) Thin plate is 0.8 cm from one of the plane surfaces?
   Take dynamic viscosity of fluid is 8.1 poise.
3. If the Velocity distribution of a fluid over a plate is given by u = ay2+by+c with a vertex 0.2m from the plate, where the velocity is 1.2 m/s. Calculate the velocity gradient and shear stress at a distance of 0m 0.1m 0.2m from the plate. If the viscosity of the fluid is 0.85 Ns/m2.
4. A plate 0.05 nm distance from a fixed plate moves at 600 mm/s and requires a force of 3N per unit area to maintain this speed. Determine the fluid viscosity between the plates. Also find the specified weight of the above fluid, if the kinetic viscosity of the fluid is 0.003× 10-4 m2/s.
5. Water flow through a pipe AB 1.2 diameter at 3m/s and then passes through a pipe BC 105m diameter. At C, the pipe branch CD is 0.8m in diameter and carries one third of flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate in B.C, the velocity in CD and the diameter of CE.
6. State Bernoulli's theorem for steady flow of a incompressible third. Derive an expression for Bernoulli's equation from first principle and state the assumption made for such a derivation.
7. The stream function for a dimensional flow is given by Ψ =2xy. Calculate the resultant velocity at P(3,4). Also, the velocity potential function ϕ.
8. A venture meter of inlet diameter 300mm and throat diameter 150mm is inserted in vertical pipe carrying in the upward direction. A different mercury manometer

connected to the inlet and throat gives a reading of 200mm. Find the discharge if the coefficient of discharge of meter is 0.98.

9. The efficiency η of a fan depends on density „ρ", dynamic viscosity „μ", and angular velocity „ω", diameter D of the rotor and the discharge Q. Evaluate η in terms of dimensionless parameters using Buckingham's π method.
10. A 7.2 m height and 15 m long spillway discharge 94 m3/s, under a head of 2 m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experience a force of 7500N, Calculate the force on the prototype.
11. A spillway model is to be built to a scale ratio of 1:40 across a flume of 600 mm width. The prototype is 10 m high and maximum head expected is 1.5 m. Calculate the height of the model and the head on the model. Calculate the flow over the prototype when the flow over the model is 12 lps. If a negative pressure of 0.15 m occurs in the model, what will be the negative pressure in the prototype? Is this practically possible to occur. State it.
12. Quarter scale turbine model is tested under ahead of 12 m. The full-scale turbine is to work under a head of 30 m and to run at 428 rpm. Find N for model. If model develops 100 kW and uses 1100 l/s at this speed, what power will be obtained from full scale turbine assuming its n is 3% better than that of model.
13. An oil of Sp. Gr 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/sec. Identify the head lost due to friction for a 500 m length of pipe. Also identify the power required to maintain this flow.
14. Examine the head lost due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3m/s using (i) Darcy formula, (ii) Chezy"s formula for which C = 60.
15. An oil of viscosity 0.1NS/m2 and relative density 0.9 is flowing through a circular pipe of diameter 5cm and of length 300m. The rate of flow of fluid through the pipe is 3.5 liters/sec. Examine the pressure drop in a length of 300 m and also the shear stress at the pipe wall.
16. The rate of flow of water through a horizontal pipe is 0.25 m3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller is 11.772 N/cm2. Identify the (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe, (iii) power lost due to enlargement.

17. For the velocity profile for laminar boundary layer $u/U = (3/2)(y/\delta) - (1/2)(y/\delta)^3$. Identify the boundary layer thickness, shear stress, drag force and coefficient of drag in terms of Reynold Number.
18. Air is flowing over a flat plate 500 mm long and 600 mm wide with a velocity of 4 m/s. The kinematic viscosity of air is given as 0.15×10^{-4} m2/s. Identify i) the boundary layer thickness at the end of the plate, ii) shear stress at 200 mm from the leading edge and iii) drag force on one side of the plate. Take the velocity profile over the plate as $u/U = \sin(\pi/2 y/\delta)$ and density of air is 1.24 kg/m3.
19. For the following velocity profiles, whether the flow has or on the verge of separation or will attach with the surface:

    i) $u/U = 3/2 (y/\delta) - 1/2 (y/\delta)^3$

    ii) $u/U = 2 (y/\delta)^2 - (y/\delta)^3$

    iii) $u/U = - 2 (y/\delta) + (y/\delta)^2$
20. Discuss the concept of boundary layer formation, derive the expression for displacement thickness and list the methods of boundary layer separation.
21. Calculate the thickness of the boundary layer at the trailing edge of smooth plate of length 4 m and of the width 1.5 m, when the plate is moving with a velocity of 4 m/s in stationary air. Take kinematic viscosity of air as 1.5×10^{-5} m2/s. (7) Oil with a free-stream velocity of 3 m/s flows over a thin plate of 1.25 m wide and 2 m long. Calculate the boundary layer thickness at mid length and also calculate the total double-sided resistance of the plate. Take density as 860 kg/m3 and kinematic viscosity as 10^{-5} m2/s. (6)
22. A plate of length 750 mm and width 250 mm has been placed longitudinally in a stream of crude oil which flows with a velocity of 5 m/s. If the crude oil has a specific gravity of 0.8 and kinematic viscosity of 1 stoke, Estimate: Boundary layer thickness at the middle of the plate. Shear stress at the middle of the plate. Friction drag on one side of the plate.
23. Analyze the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and u = U at y = δ, where δ = boundary layer thickness. Also calculate the value of δ^*/θ

24. Analyze the following boundary layer parameters for the velocity distribution u/U = (y/δ)2/3: i) Displacement thickness, ii) Momentum thickness, iii) Energy thickness, iv) Shape factor.