HYDRAULICS ENGG. & IRRIGATION ENGG. QUESTION BANK

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PROPERTIES OF FLUID

2MARKS

1. Distinguish between gauge pressure and vacuum pressure
2. Write down the expression for capillary fall in terms of surface tension
3. Explain Newton‟s Law of Viscosity.
4. Classify the Types of fluids
5. What are the properties of real fluid?
6. Define Centre of Pressure
7. Define Mass Density
8. Define specific gravity
9. Define Buoyancy
10. Define Compressibility
11. Define Surface tension and Capillarity
12. Name the devices that are used to measure the pressure of a fluid
13. Relate absolute pressure and gauge pressure
14. How does solid and fluid response to deformation when constant shear force is applied?
15. Compare specific weight and specific volume
16. Distinct b/w statics and kinematics.
17. Give the difference between liquid and gas.
18. Find the kinematic viscosity of oil having density 981 kg/m3 . The shear stress at a pointin oil is 0.2452N/m2 and velocity gradient at that point is 0.2m/sec.
19. Differentiate fluid and solid. 1. BT-2 Understand 20. State Archimedes principle.
20. Write the value of specific gravity and density of water and mercury.
21. State pascal‟s law? What is manometric liquid and where it is used?
22. Two horizontal plates are placed 1.25 cm apart. The space between them is being filled with oil of viscosity 14 poises. Examine the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s
23. Temperature rise, decreases viscosity in liquids but increases in gases, why?

5 MARKS

1. a. Calculate the specific weight, density and specific gravity of one litre of a liquid, which weighs 7N. b. Calculate the density, specific weight and weight of one litre of petrol of specific gravity = 0.7
2. The space between two parallel horizontal plates is kept 5 mm apart. This is filled with crude oil of dynamic viscosity 2.5 kgs/m2 . If the lower plate is stationary and the upper plate is pulled with velocity of 1.75 m/s, determine the shear stress on the lower plate.
3. The space between two parallel plates 4 mm apart is filled with an oil of specific gravity 0.85. The upper plate of area 600 cm2 is dragged with constant velocity of 0.75 m/s by applying a force of 0.2 kgf to it. Assume straight line velocity distribution and calculate velocity gradient, dynamic viscosity of oil in poise and kinematic viscosity of oil in stokes.
4. What do you mean by viscosity?. Velocity distribution of a fluid of dynamic viscosity 8.63 poise is u =2/3y – y 2 in which u is the velocity in m/sec at a distance meter above the plate. Determine the shear stress at y = 0 and y = 1.5m
5. A plate with surface area of 0.4 m 2 and weight of 500 N slides down on an inclined plane at 300 to the horizontal at a constant speed of 4 m/s. If the inclined plane is lubricated with an oil of dynamic viscosity 2 poises, find the thickness of lubricant film.
6. A vertical gap 23.5 mm wide of infinite extent contains oil of specific gravity 0.9 and viscosity 2.5 N-s/m2 . A metal plate 1.5m * 1.5m * 1.5mm weighing 50N is to be lifted through the gap at a constant speed of 0.1 m/sec. Estimate the force required to lift the plate.
7. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5m and it rotates at 200 r.p.m. Calculate the power lost in oil for a sleeve length of 100mm. The thickness of oil film is 1.0mm
8. Explain the three conditions of equilibrium developed when a floating body is given a sight angular displacement. BT-2 Understand 9. Derive an expression for the pressure inside a droplet, hollow bubble and a free jet.
9. Explain about different types of manometer in detail

10 MARKS

1. a. A circular plate of 3.0m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4m and 1.5m respectively. Determine the total pressure on one face of the plate and position of centre of pressure b. A metallic cube 30cm side and weighing 45 N is lowered into a tank containing a two fluid layer of water and mercury. Top edge of the cube is at water surface. Determine the position of block at water-mercury interface when it has reached equilibrium.
2. A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if its size is 2 m * 1 m * 0.8 m.
3. a. A rigid steel container is partially filled with a liquid at 15 atm. The volume of the liquid is 1.232 L. At a pressure of 30 atm, the volume of the liquid is 1.231 L. (Atmosphere pressure = 101.3 kPa). What is the bulk modulus of elasticity (K) of the liquid over the given range of pressure? And what is the coefficient of compressibility? b. The velocity distribution in m/s near the solid wall at a section is a laminar flow is given by u = 5 sin (πy). If μ = 5 poise. Find the shear stress at y = 0.05m in N/m2 .
4. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid.
5. Explain different pressure measuring devices.
6. Explain the characteristics of Newtonian and nonNewtonian fluids in detail.
7. Through a very narrow gap of height h, a thin plate of large extent is pulled at a velocity V. On one side of the plate is oil of viscosity μ1 and on theother side of oil of viscosity μ2. Calculate the position of the plate so that (i) the shear force on the two sides of the plate is equal; (ii) the pull required to drag the plate is minimum.

FLUID FLOW ANALYSIS

2MARKS

1. Classify the types of Motion
2. What do you understand from Continuity Equation?
3. List the properties of potential function
4. Write the integral form of momentum equation
5. What do you infer from vorticity?
6. Define flow net.
7. Define Stream function.
8. Define velocity potential function.
9. Define “Vortex flow”
10. State Principles of conservation of mass
11. the equation velocity of fluid flow
12. Compare Laminar flow and turbulent flow
13. What are flow pattern obtained in fluid flow?
14. Define rate of flow.
15. Define Principles of conservation of energy.
16. Write the properties of stream function
17. Derive the continuity equation.
18. Distinguish between stream line and streak line.
19. Outline the expression for Circulation.
20. Distinguish between uniform and non-uniform flow
21. What is stream tube path line?
22. Write and infer the equations of motion
23. Define circulation and write its expressions
24. Illustrate the equation for acceleration of flow of fluid.
25. Write Euler‟sequation.
26. Define Reynolds number
27. Name the characteristics of laminar flow
28. Analyze pipe in series
29. equation of head loss due to friction.
30. Write the advantages of venture meter over orifice meter.
31. What are the minor losses?

32. Compare hydraulic gradient line with total energy line.

33. Differentiate orifice meter and orifice

34. Relate an expression for co efficient of friction in terms of shear stress.

35. Write the application of Bernoullis equation.

36. Differentiate laminar and turbulent flow

37. Outline major loss in pipe.

38. Write about pipes in parallel.

39. Illustrate the disadvantages of orificemeter.

40. Illustrate the expression for drop of pressure for a given length of a pipe

41. Outline about water hammer in pipes.

42. Derive an expression for Chezys formula.

43. Classify flow based on Reynolds number.

44. Write about HazensWillams equation.

45. Illustrate about time for empty of tank

46.1 Enumerate an expression for mannings formula

47. Give the relation between friction and chezys constant.

48. Formulate Hagen Poisuille‟s equation.

49. What are the effect observed due to sudden closure of value in pipe flow?

50.velocity and shear stress distribution over length of pipe

5 MARKS

1. Two velocity components are given in the following cases, find the third component such that they satisfy the continuity equation a) u = x 3 + y2 + 2z2 ; v = -x 2 y – yz–xy b) u = log (y2 + z2) ; v = log(x2 + z2)
2. The velocity components in a two-dimensional field for an incompressible fluid are expressed as u = (y3 /3) + 2x – x 2 y; v = xy 2 – 2y – (x3 /3) a) obtain the expression for stream function b) obtain the expression for velocity potential
3. For a three dimensional flow field described by V = (y 2 + z2) i + (x2 + z2)j + (x2 + y2)k. Find at (1,2,3) a) the components of acceleration b) the components of rotation.
4. For a two dimensional flow Φ = 3xy and Ψ = (y 2 - x 2) 3/2. Determine the velocity components at the points (1,3) and (3,3). Also find the discharge passing between the streamlines passing through the points given above.
5. The stream function Ψ = 4xy in which y is in cm2 /sec and x and y are in meters describe the incompressible flow between the boundary shown below. Calculate a) Velocity at B. b) Convective acceleration at B. c) Flow per unit width across AB.
6. The velocity components of the two dimensional plane motion of a fluid are u = y 2−x 2 (x2 + y2) 2 and v = −2xy (x2 + y2) 2 .Show that the fluid is incompressible and flow is iirotational

7. a) A stream function is given by $\Psi = 3x2 – y 3$. Determine the magnitude of velocity components at the point (2, 1). b) A stream function in a two dimensional flow is $\Psi = 2xy$. Show that the flow is irrotational and determine the corresponding velocity potential Φ.
8. A ripple 200 m long slop down at 1 in 100 and taper from 600 mm diameter at the higher end to 300 mm diameter at the lower end, and carries 100 litres/ sec of oil having specified gravity 0.8. If the pressure gauge at the higher end reads 60 kN/m2, determine the velocities at the two ends and also the pressure at the lower end
9. Explain about principle of conservation of mass and momentum BT-3 Application 10. In a three dimensional flow, the components of velocity are u = xy, v = 4yz3 and w = - (yz + z4). Test whether the continuity equation for incompressible fluid flow is satisfied. Determine the acceleration vector at point (1, 1, 1).
10. For a two dimensional irrotational flow, the velocity potential is defined as $\Phi = \log_e(x2 + y 2)$. Find the possible stream function(Ψ) for this flow.
11. The velocity of an incompressible fluid flow is given by U = (Px – Q)i + Ryj + Stk m/s where P = 3 s-1 , Q = 4 m/s, R = 3 s-1 and S = 5 m/s2. Find the local and convective acceleration components at x =1m, y = 2m and t = 5s.
12. a) The velocity in m/s at appoint in a two dimensional flow is given as V = 3i + 5j. Find the equation of the stream line passing through the point (x, y). b) In a 2m long tapered duct, the area is function of x and decreases as Ax = (0.4 – 0.1x) where x is distance in meters measured from the lef end of the duct. It was found to increase discharge at the rate of increase discharge at the rate of 0.12 m 3 /s/s. Find the local acceleration in m/s2 at x = 2m.
13. In a certain 2 – D potential flow the streamline passing through a point A = (1, 1) has the following equation xy =1. Find the equation of the equipotential line passing through A pipe.
14. a) A 0.25m diameter pipe carries oil of specific gravity 0.8 at the rate of 120 litres per second and the pressure at a point A is 19.62 kN/m2 (gage). If the point A is 3.5m above the datum line, calculate the total energy at point A in meters of oil. b) Water ($\gamma w = 9.879$ kN/m3) flows with flow rate of 0.3 m 3 /sec through a pipe AB of 10 m length and of uniform cross section. The end B is above end A and the pipe makes an angle of 300 to the horizontal. For a pressure of 12 kN/m2 at the end B, Find the corresponding pressure at the end A.
15. A 0.3 m pipe carries water at a velocity of 24.4 m/s. At points A and B measurements of pressure and elevation were respectively 361 kN/m2 and 288 361 kN/m2 and 30.5 m and 33.5 m. For steady flow , find the loss of head between A and B.
16. A straight pipe AB of length 10m, tapers from a diameter of 40 cm at A to 20 cm at B. . The centre line of the pipe is so located that the end B is 2m above the level of A. Liquid of specific gravity 0.9 flows through the pipe at 150 litres/sec. Pressure gauges connected at A and B show the reading of 60 kPa and 40 kPa, respectively. Determine the direction of flow

17. A venturimeter having a diameter of 75mm at the throat and 150mm diameter at the enlarged end is installed in a horizontal pipeline 150mm in diameter carrying an oil of specific gravity 0.9. The difference of pressure head between the enlarged end and the throat recorded by U-tube is 175mm of mercury. Determine the discharge through pipe. Assume the coefficient of discharge of the meter as 0.97.

18. A venturimeter has its axis vertical, the inlet and throat diameters being 150mm and 75mm respectively. The throat is 225mm above inlet and K = 0.96. Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029m3 /s. Find the pressure difference between the inlet and the throat.

19. Water flows at the rate of 0.147m3 /s through a 150mm BT-2 Understand diameter orifice inserted in a 300mm diameter pipe. If the pressure gages fitted upstream and downstream of the orifice plate have shown readings of 176.58 kN/m2 and 88.29 kN/m2 respectively. Find the coefficient of discharge C of the orifice meter.

20. Water discharges at the rate of 98 litres per second through a 0.12 m diameter vertical sharp edged orifice placed under a constant head of 18m. A point on the jet measured from the vena-contracta of the jet has coordinates 4.5m horizontal and 0.54 m vertical. Find a) the coefficients Cc, Cv, Cd and Cr for the orifice and b) the power lost at the orifice.

21. A rectangular orifice 1.5m wide and 1.0m deep is discharging water from a tank . If the water level in the tank is 3.0m above the top edge of the orifice. Find the discharge through the orifice. Take the coefficient of discharging for the orifice = 0.6. BT-3 Application

22. a) Find the discharge through a fully sub merged orifice of width 2m if the difference of water levels on both sides of the orifice be 50cm. The height of water from top and bottom of the orifice are 2.5m and 2.75m respectively. Take Cd = 0.6 b) Find the discharge through a totally droened orifice 2.0m wide and 1m deep, if the difference of water levels on both the sides of the orifice be 3m. Take Cd = 0.62

23. Derive Darcy Equation for the loss of head due to friction in pipes.

24. A horizontal pipe of diameter 60mm is subjected to an oil flow at the rate of 6.36 liter/sec. The mass density and viscosity of oil 900 kg/m3 and 0.9 Pa-sec respectively. The length of the pipe is 100m.

25. Determine the following, a) Pressure drop b) Shear stress at the boundary of the pipe c) Power required to maintain the oil flow d) Velocity at 8mm from the pipe wall surface

26. Water discharged from a tank maintained at a constant head Analyse at 5m above the exit of a straight pipe 100m long 150mm diameter. Estimate the rate at flow if the friction factor for the pipe is given as 0.01. Minor losses are accounted.

27. Describe an orifice meter and find an expression for measuring discharge through a pipe with this device.

28. A pipe of 0.7 m diameter has a length of 6km and connects two reservoirs A and B. The water level in reservoir A is at an elevation 30 m above the water level in reservoir B. Halfway along the pipeline, there is a branch through which water can be supplied to a third reservoir C. The friction factor of the pipe is 0.024. The quantity of water discharged into reservoir C is 0.15m3 /s. Considering the acceleration due to gravity as 9.81 m/s2 and neglecting minor losses, Find the discharge (in m3 /s) into the reservoir?

10 MARKS

1. 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.
2. Describe about flow measuring devices.
3. The inlet and throat diameter of a horizontal venturimeter are 30cm and 10 cm respectively. The Liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm2. While the vacuum pressure head at the throat is 37cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the venture meter.
4. The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, At the rate of 50 lit/sec. The pipe has a slope of 1 in 30. Find the pressure at the pressure at the lower end BT-6 Create if the pressure at the higher level is 19.62 N/m2
5. Derive Euler equation of motion.
6. Derive 3D continuity equation in differential form.
7. The velocity component for a two dimensional incompressible flow are given by u =3x – 2y and v = - 3y – 2x. Show that the velocity potential exists. Determine the velocity potential function and stream.
8. (i) If for a two – diamantine potential flow, the velocity potential is given by $\phi = x(2y - 1)$ determine the velocity at the point P(4,5). Determine also the value of stream function Ψat the point P. (ii) Briefly describe about velocity potential function and stream function

10 MARKS QUESTION

1. Explain the following terms: Kor period, C.C.A., Temporary Wilting Point, Base period, Crop period.
2. Explain the advantage and disadvantage of sprinkler irrigation system.
3. What is "Assessment of irrigation water"? In which situation volumetric method is adopted? What are its shortcomings?
4. Discuss briefly the benefits as well as the ill effects of irrigation system.
5. How would you proceed to determine phreatic line through homogenous earth dam provided with a horizontal filter?
6. Explain the working of sprinkler irrigation system with a neat sketch.
7. Give the short note on "Bligh creep theory".
8. Briefly describe drawbacks of Kennedy's theory for design of canal in alluvial soil.
9. Give the short note on "Classification of irrigation canal".
10. Explain the term "Water logging"? How to control water logging?
11. Explain in brief Canal Lining and its advantages and disadvantages.
12. What are the factors which effect the selection of site for dam site?
13. Give difference between Silt Excluder and Silt ejector in brief.
14. Give difference between Weir and Barrage in brief.
15. What is the initial and final regime conditions of an alluvial channel according to Lacey's?
16. Describe the various considerations made in alignment of an irrigation canal.
17. Discuss various methods used for energy dissipation below spillway.
18. What do you understand by a fall in canal? How do you select its location?
19. Give short note on "Irrigation Development in India"
20. Write short note on "Head Regulator" and "Canal Regulator".
21. Give the comparisons of 'Bandhara Irrigation' and 'Lift Irrigation'.
22. Give the difference between "Sprinkler Irrigation System" and "Drip Irrigation System".
23. Explain the following terms: Syphon, Aqueducts, Irrigation efficiency, Irrigation frequency, Sluice way. Q.24 Explain various methods of reducing seepage through earthen dams.
24. Write short note on "Relationship between Duty, Delta and Base period".
25. Draw a neat sketch of Diversion Head work and explain functions of each component.
26. Describe with the help of sketches, the various types of cross-drainage works
27. Which considerations are taken when design earthen dam in earthquake region?
28. Discuss various factors affecting while design spillway.

29. Explain in brief various forces acting on Gravity dam with suitable sketches.

30. Discuss the various modes of failure of Gravity dam.

31. Define the term "Exit Gradient". What is the importance of exit gradient? How would you check the exit gradient?

32. Discuss the various causes of failure of Earth dam

33. What do you understand by the elementary profile of the gravity dam? Derive the expression for determining the base width of such a dam based on (i) Stress criteria, (ii) Sliding criteria.

34. Discuss briefly the causes of failure of hydraulic structures founded on pervious foundation.

35. Enlist different types of irrigation efficiencies. Explain them in brief

36. After how many days will you supply water to soil in order to ensure efficient irrigation of the given crop, it (i) Field capacity of soil = 35% (ii) Permanent wilting point = 15% (iii) Density of soil = 1.5 g/cm3 (iv) Daily consumption use of water for the given crop = 12 mm. (v) Effective depth of root zone = 80 cm.

37. Following data refers to homogeneous earth dam: Top width = 4.5m, Head of water u/s = 15 m. u/s and d/s slope = 2.5 H : 1 V and 2H : 1V respectively, Free board = 2.5 m. Horizontal filter 35 m from d/s toe, Coefficient of permeability K = 0.008 cm/sec. Calculate seepage per meter length of dam.

38. Design an irrigation canal using Lacey's theory for the following data: Discharge = 55 cumecs Silt factor = 1.6 Side slope = 0.5: 1.