

GUJARAT TECHNOLOGICAL UNIVERSITY

DI -3 SEMESTER – OLD PAPER – W22 TO S25 – QUESTION BANK(English)

Subject Name & Code:

Hydraulics- 4330604

Unit 1- Pressure measurement and Hydrostatic pressure

Repeated Questions:

1. **Explain U-tube differential manometer with a neat sketch.**
 - Appeared in: W23 (Q5a, 03 marks), S23 (OR Q1c, part of 07 marks), S24 (Q5a, 03 marks)
2. **Derive the equation for total pressure and center of pressure on a vertically immersed surface.**
 - Appeared in: W22 (OR Q2c, 07 marks), W23 (OR Q1c, 07 marks), S23 (Q1c, 07 marks)
3. **Derive the equation for total pressure and center of pressure on an inclined plane immersed in liquid.**
 - Appeared in: W23 (Q1c, 07 marks)
4. **State Pascal's Law.**
 - Appeared in: W23 (Q5a, 03 marks), S24 (Q5a, 03 marks)

Other Important Questions:

5. **Write a short note on U-tube manometer with a neat sketch. (S25 - Q1a, 03 marks)**
6. **Define: (i) Surface Tension, (ii) Ideal fluid. (S25 - Q1b, 04 marks)**
7. **Define term (1) Specific Weight (2) Surface Tension (3) Hydro kinematics. (W22 - Q1a, 03 marks)**
8. **Define: Adhesion and Cohesion. (W23 - Q1a, 03 marks)**
9. **List various types of pressure and state relation between them. (W24 - Q1b, 04 marks)**
10. **Define hydrokinematics. Explain various types of flow. (W24 - Q1c, 07 marks)**
11. **Write S.I. units of Kinematic viscosity, specific volume, and pressure. (S23 - Q1a, 03 marks)**
12. **What is "Pressure" state units in which it is measured. State equipments to measure pressure. Explain any one in details. (S24 - Q1b, 04 marks)**
13. **Write short note on Bourdon Pressure gauge. (S24 - OR Q2a, 03 marks)**

14. A tank 0.5m X 0.5m X 1.5 m height contains liquid of sp. Gr. 0.9 upto 0.5 m depth. Water is added to this tank till becomes full. Determine total pressure and its point of application on one side of tank. Also calculate total pressure acting on the bottom of tank. (S24 - Q1c, 07 marks)
15. An equilateral triangular plate having sides 1.20 m is submerged in liquid having specific weight 1.08. Find the centre of pressure and total pressure acting on the plate if one side of plate is parallel to the free surface and at a depth of 0.6m. (S24 - OR Q1c, 07 marks)
16. A triangular plate of 1.2m base and 1.5m. height is immersed in water vertically with its apex above the base. The base is parallel to and at a depth of 1.5m. below the free water surface. Calculate : (1) Total water pressure (2) Depth of centre of pressure (W22 - Q2c, 07 marks)
17. Convert the followings: (i) Pressure head of 2.5 m oil of sp. gravity 0.8 to pressure intensity in kN/m^2 . (ii) 108.62 kN/m^2 to pressure head in m of liquid of sp. gravity 1.4 (iii) Pressure head of 1.8 m of water to pressure head of mercury. (S25 - Q1c, 07 marks)
18. Convert following: (i) 65 kN/m^2 in pressure head in liquid of Specific Gravity 1.5 (ii) 330 cm. of oil (Specific Gravity 0.9) head in head of water. (W22 - Q1b, 04 marks)
19. Convert 60 cm. of water-head into head of mercury. (W23 - Q1b, 04 marks)
20. Convert (a) 0.6 meter mercury head into kN/m^3 (b) 10.33 meter of water head into mercury head. (S24 - Q2a, 03 marks)
21. Convert the following: • 120 KN/m^2 in pressure head of liquid having sp.gr. 1.2. • 5 m head of oil sp.gr. 0.9 in N/cm^2 (S23 - Q1b, 04 marks)

Unit 2- Hydro kinematics & Hydrodynamics

Repeated Questions:

1. **State and explain the continuity equation.**
 - Appeared in: W22 (Q2a, 03 marks), S23 (Q2b, 04 marks), S25 (OR Q2b, 04 marks)
2. **State and explain Bernoulli's theorem/equation. Also give its assumptions and limitations.**
 - Appeared in: W23 (Q2c, 07 marks), S23 (Q2a & OR Q2a, 03 marks each), S24 (Q3a, 03 marks), W24 (OR Q1c, 07 marks)
3. **Differentiate between Steady flow and Unsteady flow.**
 - Appeared in: W23 (Q2a, 03 marks), S24 (Q2b, part of 04 marks), S25 (Q2a, 03 marks)
4. **Differentiate between Laminar flow and Turbulent flow.**
 - Appeared in: W23 (OR Q2a, 03 marks), S24 (Q2b, part of 04 marks)
5. **Explain Hydraulic Gradient Line (H.G.L.) and Total Energy Line (T.E.L.).**
 - Appeared in: W23 (Q3b, 04 marks), S23 (Q4b, 04 marks), S25 (Q3b, 04 marks)

Other Important Questions:

6. **Give assumptions and limitations of Bernoulli's theorem. (S25 - Q2b, 04 marks)**
7. **Differentiate between Uniform flow and Non-Uniform Flow. (W23 - Q2a, part of 03 marks), S25 (OR Q2a, 03 marks)**
8. **Explain potential energy, pressure energy and kinetic energy. (W22 - OR Q2a, 03 marks)**
9. **Define Reynold's number. Water is flowing through a pipe having diameter 25 cm with rate of $3.2 \text{ m}^3/\text{s}$. Considering kinematic viscosity 0.01 stoke, decide the type of flow. (W24 - OR Q2c, 07 marks)**
10. **Explain the working of a venturimeter with a neat sketch. (W24 - OR Q1c, 07 marks)**
11. **Derive the equation to calculate discharge of liquid by Venturimeter. (S24 - OR Q2b, 04 marks)**
12. **Explain various components of Venturimeter with sketch. (S24 - OR Q3a, 03 marks)**
13. **A $30 \text{ cm} \times 15 \text{ cm}$ venturimeter is inserted in a vertical pipe carrying water flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 10 cm . Find the discharge. Take $C_d = 0.90$. (S25 - OR Q2c, 07 marks)**
14. **A $30 \text{ cm} \times 15 \text{ cm}$ venturimeter is used to measure the flow of water. Mercury is used in differential manometer which shows a gauge difference of 4.2 cm . Assuming coefficient of the Venturimeter as 0.975 ; calculate the discharge. (W24 - Q2c, 07 marks)**
15. **A $20\text{cm} \times 10\text{cm}$ venturimeter is used to measure the flow of oil with sp.gravity 0.8 . if the differential mercury manometer shows a deflection of 20 cm , find out the discharge of oil through pipe. Take $C = 0.92$. (S23 - Q2c, 07 marks)**

16. A horizontal venturimeter 16 cm X 8 cm is used to measure the flow of an oil of Sp Gr. 0.8. Determine the deflection of the oil-mercury manometer, the discharge of the oil is 50 lit./second. Take. $C = 1.0$ (S24 - OR Q2c, 07 marks)
17. The diameters of a pipe at the sections 1 and 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s. Determine also the velocity at section 2. (S25 - Q2c, 07 marks)
18. A pipe AB branches into two pipes BC and BD at point B. The pipe has diameter of 0.45 m at A, 0.3 m at B, 0.2 m at C and 0.15 m at D. Find the discharge at A, if the velocity of water at A is 2 m/s Also find the velocities at B and D, If the velocity at point C is 4 m/s. (S24 - Q2c, 07 marks)
19. Water flows over a 30 cm wide rectangular notch with constant head of 16 cm. Again this water flows over 90° V notch. Find head of water over V notch. Assume that C_d for rectangular and V notch is equal. (S24 - Q3c, 07 marks)
20. A right angle V notch is used to measure the discharge of water. The depth of water above notch is 35 cm. Calculate the discharge in lit/sec. $C_d = 0.60$. (S25 - OR Q4c, 07 marks)
21. A 100mm diameter Orifice under a head of 6m discharge at the rate of 60 lit/s. A point on the jet measured from the vena contracta has co-ordinates $X = 3\text{m}$ & $Y = 0.5\text{m}$. Calculate the coefficient, C_c , C_v & C_d of orifice. (S23 - OR Q2c, 07 marks)
22. A jet of water is issued from 1.5cm diameter Orifice under a constant head of 2.5m. Horizontal and Vertical coordinate of a point on jet are 60cm and 4cm take $C_c = 0.62$ Find (i) coefficient of discharge C_d . (ii) Actual velocity at venacontracta (S23 - OR Q3c, 07 marks)
23. Write short note on Pitot tube. (W24 - Q2c, part of 07 marks)
24. Explain simple U-tube manometer with neat sketch. (W24 - OR Q2b, 04 marks)

Unit 3- Flow through pipes

Repeated Questions:

1. **Derive Darcy's formula for loss of head in pipe.**
 - Appeared in: W22 (Q1c, 07 marks), W23 (Q3c, 07 marks), S23 (Q4a, 03 marks)
2. **List/Explain various (major & minor) head losses in flow through pipe.**
 - Appeared in: W22 (OR Q2b, 04 marks), S23 (Q4c, 07 marks), S24 (OR Q4a, 03 marks), S25 (Q3a, 03 marks)
3. **Explain H.G.L. and T.E.L. with figure.**
 - Appeared in: S23 (Q4b, 04 marks), S24 (OR Q4b, 04 marks), S25 (Q3b, 04 marks)
4. **Find the diameter of a uniform pipe to replace a compound pipeline. / Find the equivalent pipe diameter.**
 - Appeared in: S23 (OR Q3c, 07 marks), S25 (OR Q3c, 07 marks), W24 (OR Q2c, 07 marks)

Other Important Questions:

5. **A horizontal pipe 0.9 meter diameter and 1200 meter long is discharging water at a velocity of 1 m/sec. Find the head loss due to friction as per Darcy's and Chezy's Equation. Assume, Darcy's friction $f=0.005$ and Chezy's constant $C=64$ (W22 - Q3c, 07 marks)**
6. **Water is flowing through a pipe 800m long and 30cm diameter with a velocity of 1.15m/s. Calculate head loss due to friction, if $f=0.005$. (S23 - Q3a, 03 marks)**
7. **Two reservoirs are connected by a 3500M long pipe having 200mm diameter. The difference in reservoir surface is 12m. Find discharge in pipe if $f=0.008$ (S23 - Q4c, 07 marks)**
8. **A pipe 60 m long and having 15 cm diameter is connected to a water tank at one end and flows freely into atmosphere at other end. The height of water level in the tank is 2.6 m above the center of pipe. The pipe is horizontal and $f=0.01$. Determine the discharge through the pipe in liter/ second.if all minor losses are to considered. (S24 - OR Q4c, 07 marks)**
9. **A town has a population of 100000 people. Water is supplied to it from a pond 5 km away. It is estimated that 50% of daily supply of 150 liter/head should be supplied within 8 hours. What should be the size of pipe to provide supply. If available head is 12 meter. Take $C= 45$. (S24 - Q4c, 07 marks)**
10. **Define HGL and TEL. Compute head loss due to entry, if velocity at entry is 6.265 m/s. (W24 - Q2a, 03 marks)**
11. **Explain various head losses in pipe flow with formulas to calculate them. (W24 - OR Q2b, 04 marks)**
12. **List various types of minor head losses. Calculate hydraulic mean depth (m) if area of channel (A) is 1.57 m² and wetted perimeter (P) is 3.14 m. (W24 - Q2a, 03 marks)**
13. **What is nomogram? Give its uses. (S25 - OR Q3a, 03 marks)**

14. Explain Nomogram with sketch. (S23 - Q3b, 04 marks)
15. Write Chezy's formula and Manning's formula for velocity of flow in pipe. (S25 - OR Q5b, 04 marks)
16. Explain hydraulic coefficients. (S25 - OR Q3b, 04 marks)
17. Enlist and define all the hydraulic co-efficient. (W23 - Q3a, 03 marks)
18. Explain various hydraulic co-efficients and derive relationship between them. (W24 - OR Q2c, 07 marks)
19. A jet of water issued from a 2 cm diameter sharp edged orifice under a constant head of 300 cm. Vertical and horizontal co-ordinates of a point on the jet measured from vena contracta are 40 cm and 200 cm respectively. If $C_c = 0.64$, calculate: (i) Co-efficient of discharge, (ii) Diameter of jet at vena contracta and (iii) Actual velocity at vena contracta. (W22 - Q3c, 07 marks)
20. A jet from of water issued from 2cm diameter sharp edged orifice under a constant head of 300cm. vertical and horizontal Co-ordinate of a point on the jet measured from vena contracta are 40cm. and 200cm. respectively of $C_c=0.64$ Calculate: (1) Co-efficient of discharge (2) Diameter of jet at Vena contracta (3) Actual Velocity at vena contracta (W23 - Q3c, 07 marks)
21. A jet of water issued from a 2 cm diameter sharp edged orifice and a constant head of 300 cm. Vertical and horizontal co-ordinates of a point on the jet measured from vena contracta are 40 cm and 200 cm respectively. If $C_c = 0.64$, calculate: (i) Co-efficient of discharge, (ii) Diameter of jet at vena contracta and (iii) Actual velocity of vena contracta. (S25 - Q3c, 07 marks)
22. 2 cm with sharp edges.300 cm from the diameter orifice.Water emerges from the fixed top. The veins contract vertically and horizontally parallel to 40 cm respectively and 200cm. is $C_c=0.64$ 1) Export coefficient 2) Diameter of the cross (water jet) at vena contracta. 3) True velocity of the edge at the vena contracta. (W23 - Q5c, 07 marks)
23. Water passes through a right angled triangular notch at a depth of 40cm. The same quantity is flowing over rectangular notch of 80 cm. Find depth over rectangular notch. Take $C_d = 0.59$ and 0.62 for triangular and rectangular notches respectively. (W22 - OR Q5c, 07 marks)

Unit 4- Flow through Open Channel

Repeated Questions:

1. **Derive the equation for the most economical rectangular channel section. / Write the most economical condition for a rectangular channel section.**
 - Appeared in: W23 (Q4a, 03 marks), S23 (Q5a & OR Q5a, 03 marks each), S25 (OR Q5c, 07 marks)
2. **Derive the formula for discharge over a rectangular notch/weir.**
 - Appeared in: W22 (Q4a, 03 marks), W23 (OR Q4b, 04 marks), S23 (Q2b, 04 marks), S24 (Q3b, 04 marks), S25 (Q5c, 07 marks)
3. **Differentiate between flow through pipe and flow through (open) channel.**
 - Appeared in: W23 (Q5b, 04 marks), S23 (Q4b, 04 marks), S24 (Q4a, 03 marks), S25 (Q5b, 04 marks)
4. **Differentiate between a notch and a weir.**
 - Appeared in: S24 (Q4a, 03 marks), S25 (Q4a, 03 marks)
5. **Explain the specific energy curve/diagram.**
 - Appeared in: S23 (Q5b, 04 marks), S24 (Q4b, 04 marks), S25 (Q4b, 04 marks)

Other Important Questions:

6. **Write the Most economical condition for a Trapezoidal channel section.**
 - Appeared in: W23 (Q4b, 04 marks), S23 (Q5a, 03 marks)
7. **Derive the conditions for the most economical rectangular channel section. (S25 - OR Q5b, 04 marks)**
8. **Derive the formula for discharge over a triangular notch. (S25 - OR Q5a, 03 marks)**
9. **Derive formula for Discharge over V notch. (S23 - OR Q3a, 03 marks)**
10. **Write the difference between Triangular Notch and Rectangular Notch. (W23 - OR Q4a, 03 marks)**
11. **Differentiate between Triangular Notch and Rectangular Notch write formula also. (S23 - OR Q3b, part of 04 marks)**
12. **Give classification of weir. Differentiate between Rectangular notch and Triangular Notch. (S24 - OR Q3b, 04 marks)**
13. **Explain 'Hydraulic jump'. (S25 - OR Q4a, 03 marks)**
14. **Write short note on Hydraulic Jump. (S24 - OR Q5a, 03 marks)**
15. **Explain hydraulic jump with sketch. (W22 - Q3b, 04 marks)**
16. **Explain hydraulic jump and explain its uses. (W24 - OR Q2d, 04 marks)**
17. **Write short note on Specific Energy Diagram in open channel. (S24 - Q5a, 03 marks)**
18. **What is importance of river gauging? How river gauging is done. (S24 - Q5b, 04 marks)**
19. **List method of measuring velocity of water in river and explain any one in detail. (S23 - OR Q4b, 04 marks)**
20. **Give classification of open channel. (S23 - OR Q4a, 03 marks)**
21. **The lateral slopes of a trapezoidal channel are 3:2 (H: V). In which a stream of 20 cumec flows over a slope of 1:2000. Use the design manning formula of good cross-section of channel. Take $N=0.01$ (W23 - Q4c, 07 marks)**
22. **Slope of sides of a canal with perpendicular cross section is 1:2 (H:V). longitudinal bed slope is 1:1500. The area of cross section is 40m. Find export and canal dimensions for 'MOST ECONOMIC SECTION' $C=50$ (W23 - OR Q4c, 07 marks)**
23. **A trapezoidal channel has side slope 1 : 1 is flowing with depth 2 m and bed width 3 m. If bed slope is 1 in 2000, find discharge of the flow. Take Manning constant $N = 0.01$. (S25 - Q4c, 07 marks)**
24. **A trapezoidal channel with a base width 3 m and side slope 1:1 carries water with a depth of 1 m. The bed slope is 1:1000. Estimate the discharge (Take $N= 0.04$) (S25 - Q5c, 07 marks)**

25. A rectangular channel has cross section area of 30 m² and bed slope of 1 in 1200. Find the dimension and discharge of most economical section, take Chezy's constant $C = 60$. (W24 - Q5c, 07 marks)
26. A rectangular channel is having cross sectional area of 30 m² and bed slope 1 in 1200. Determine the dimensions and discharge for most economical section. (S24 - Q5c, 07 marks)
27. Calculate discharge of flowing water through a rectangular channel 3.5m wide and 1.5m deep, assuming bed slope of channel 1:900 and Chezy's constant $C = 55$. (S23 - Q5c, 07 marks)
28. In trapezoidal open channel having the base width 3.00 mt and side slope 1:1. Depth of water is 1.00 mt. Find out the discharge if bed slope is 1:1000 and value of $N=0.04$ (S23 - OR Q5c, 07 marks)
29. An earthen channel with a base 3 m wide and side slope 1:1 carries water with a depth of 1 m. The bed slope is 1:1600. Estimate the discharge. Take value of N in Manning's formula $N = 0.04$. (S24 - OR Q5c, 07 marks)
30. Find the discharge and best economic section for a rectangular channel having a cross section of 4.5 m². The bed slope is 1 in 900. Take $N=0.03$ (W22 - Q5c, 07 marks)
31. A 24 meter long weir is divided into 8 equal parts by vertical posts. Calculate discharge over weir under effective head of 1.2 meter using Francis formula. Take width of vertical post 30 cm. Take $C_d = 0.6$ (S24 - OR Q3c, 07 marks)
32. Explain how hydraulic coefficients are determined in laboratory? (S24 - Q4b, 04 marks)
