H&IE (Question bank)

(1) Hydrostatics :-

(1.1) Properties of fluid :-

2 marks

(1) Define mass density and specific wt..

(2) Define specific gravity with an example.

(3) Define viscosity.

(4) What are the units of viscosity in CGS and MKS system.

(5) Define Newton's law of viscosity.

(6) Define Ideal and Newtonian fluid.

(7) Define surface tension. Write formula for surface tension on a hollow bubble.

(8) Define capillarity, write any expression for capillary fall.

(9) Differentiate between Real and Ideal fluid

(10) write the formula of surface tension on a liquid droplet. What is kinematic viscosity?

15 marks

(1) Calculate the density, specific wt., and weight of 1 litre of petrol of specific gravity = 0.7.

(2) Find the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9.

(3) A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2N per unit area i.e., $2 N/m^2$ to maintain this speed. Determine the fluid viscosity between the plates.

(4) What do you mean by surface tension? Derive an expression for surface tension on a hollow bubble.

(5) What is capillarity? Derive an expression for capillary rise.

(6) Calculate the capillary rise in a glass tube of 2.5mm dia. when immersed vertically in (a) water and (b) mercury. Take surface tension $\sigma = 0.0725 N/m$ for water and $\sigma = 0.52 N/m$ for mercury in contact with air. The sp. gravity for mercury is given as 13.6 and angle of contact = 130°.

(10 marks)

① State and explain Newton's law of viscosity. If the velocity distribution over a plate is given by $u = \frac{2}{3}y - y^2$ in which u is the velocity in m/s at a distance y m above the plate, determine the shear stress at $y = 0$ and $y = 0.15$ m. Take dynamic viscosity of fluid as 8.63 poises.

② Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5 m^2 between the two large plane surfaces at a speed of 0.6 m/s, if:

(i) The thin plate is in the middle of the two plane surfaces,

(ii) The thin plate is at a distance of 0.8 cm from one of the plane surfaces? Take the dynamic viscosity of glycerine = 8.1×10^{-1} kg/m-s.

③ Write short notes on the following :-
(a) specific volume, (b) Ideal and real fluid.
(c) Kinematic viscosity (d) Capillary fall.

(1.2) Pressure and its measurement :-

2 marks

(1) what is the unit of fluid pressure? Define Pascal's law.

(2) Define Hydrostatic law. what do you mean by pressure head?

(3) what is the difference between absolute and gauge pressure?

(4) what is the working principle of a piezometer?

(5) what do you mean by a vaccum pressure?

5 marks

(1) An oil of specific gravity 0.9 is contained in a vessel. At a point the height of oil is 40m. Find the corresponding height of water at the point.

(2) An open tank contains water upto a depth of 2m and above it an oil of sp. gr. 0.9 for a depth of 1m.

Find the pressure intensity
(i) at the interface of two liquids and (ii) at the bottom of the tank.

(3) with a schematic diagram, show various types of pressures and ~~show~~ the relation b/w them.

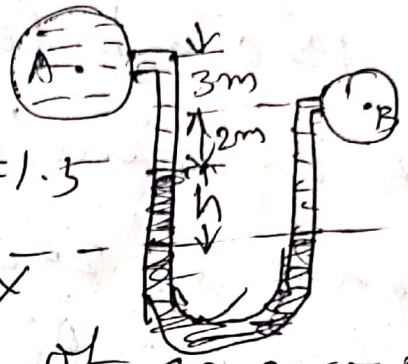
(4) Write an expression of pressure in an U-tube manometer connected ~~d~~ at a point in a pipe.

(5) An oil of sp. gr. 0.8 under a pressure of 137.2 kN/m^2,
(i) what is the pr. head expressed in m of water?
(ii) what is the pr. head expressed in m of oil?

(6) A pipe contains an oil of sp. gr. 0.8. A differential manometer connected at the two points A & B of the pipe shows a difference in mercury level as 20 cm. Find the difference of pr. at the 2 points.

(1)- A differential manometer is connected at the two points A & B of 2 pipes as in figure.

The pipe A contain liquid of sp-gr=1.5 while pipe B contains liquid of sp gr=0.9.



The pr. at A & B are 1 kgf/cm² and 1.80 kgf/cm² respectively. Find the difference in mercury level in the differential manometer.

(2) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of sp-gr-0.8 and having vacuum pr. is flowing. The other end of the manometer is open to atmosphere. Find

The vacuum pr. in pipe if the difference of mercury level in the two limbs is 40 cm and ht. of fluid in the left from centre of pipe is 15 cm below.

(5) A hydraulic press has a ram of 20 cm dia. and a plunger of 3 cm dia. It is used for lifting a weight of 30 kN. Find the force req. at plunger.

12

(6) Define absolute zero pr. and absolute pr.

(7) Write the expression for U-tube manometer measuring vacuum pr.

(8) If the pr. intensity at a pt. in a fluid is @ 3.924 N/cm² Find corresponding ht. of fluid when the fluid is water.

(9) write the type of simple manometer.

(10) what do you mean by single colum manometer.

(1.3) Pr. exerted on an immersed surface

12

(1) Define total pressure.
(2) Define centre of pressure.
(3) what are the forces acting on a fluid particle in static fluid.
(4) write the formula for Total pr. and explain briefly.
(5) Write the formula for centre of Pr. and explain briefly.
(6) what is the ~~CG~~ M.I. of a Δ at its CG and vertex
(7) State parallel axis theorem.
(8) Define hydrostatic paradox
(9) Between C.G and centre of Pr. which lies above in immersed body and why?
(10) In horizontal plane surface

submerged in liquid, CG and centre of pr. lie at which pt. & why?

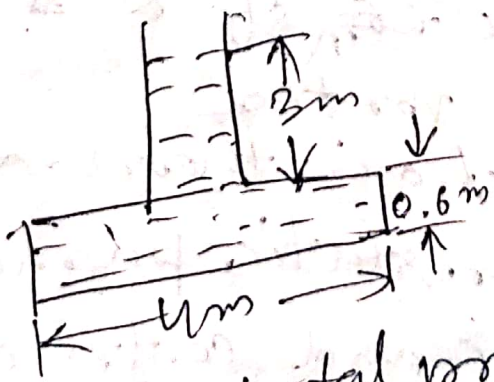
Ls

(1) Derive an expression for Centre of pressure in vertical plane surface submerged in liquid.

(2) Derive an expression for ~~Centre of~~ Total pressure in vertical submerged surface.

(3) Derive an expression for total and centre of pr. in a horizontal plane surface submerged in liquid.

(4)



In this figure, a tank is full of water. find total pr. at bottom of tank, wt. of water in tank.

(5) A rectangular plane surface is 2m wide and 3m deep. It lies in vertical plane in water. Determine total pr. and position of centre of pr on plane surface when its upper edge is horizontal.

(6) Determine the total pr. and centre of pr. on an isosceles ~~Δ plate~~ of base 4m and altitude 4m when it is immersed vertically in an oil of S.G 0.9. The base of the plate coincides with the free surface of oil.

L10

(1) A caisson for closing the entrance to a dry dock is of trapezoidal form 16m wide at the top and 10m wide at bottom and 6m deep. Find the total pr. and centre of pr. on the caisson if the water on the outside is just level with top and dock is empty.

(2) A circular opening 3m dia in a vertical side of a tank is closed by a disc of 3m dia which can rotate about horizontal dia. Calculate:

(i) the force on disc.

(ii) torque required to maintain the disc in equilibrium in the vertical position when the head of water above the horizontal dia is 4m.

(3) A cubical tank has sides of 1.5m. It consists water for the lower 0.6m depth. The upper remaining part is filled with oil of S.G 0.9. Calculate for the vertical side of tank:

(i) Total pr.

(ii) position of centre of Pr.

(2) Kinematics of fluid flow

(2.1) basic eqⁿ of flow & applⁿ & (2.2) flow over notches and weirs

L2

(1) What do you mean by steady flow and non-uniform flow?

(2) Define Laminar and turbulent flow.

(3) Define Reynold's number for pipe flow and write its significance in it.

(4) Define discharge.

(5) ~~Conti~~ Define continuity eqⁿ. On what principle it is based upon?

(6) Define Bernoulli's eqⁿ for ~~motion~~ fluid flow. Write down its assumptions.

(7) What are the various practical applications of Bernoulli's eqⁿ.

(8) What is the principle behind a pitot tube?

(9) Define a notch. Write formula for discharge over a ~~notch~~ rectangular notch.

(10) Write the formula for discharge over a trapezoidal weir.

(11) For an error of 1% in measuring H what is the error in discharge over rectangular and Triangular notch.

15

(1) A 30 cm dia pipes conveying water, branches into two ~~halves~~ pipes of dia 20 cm & 15 cm respectively. If the average velocity in 30 cm dia pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15cm pipe if average velocity in 20cm dia pipe is 2m/s.

(2) State and explain Bernoulli's equⁿ with all its assumptions.

(3) A pipeline carrying oil of sp. gravity 0.87, changes in dia. from 200mm dia. at a position A to 500mm dia at position B which is 4m at a

higher level. If the pr. at A & B are 9.81 N/cm² and 5.886 N/cm² respectively and the discharge is 200 l/s. Determine the loss of head and direction of flow.

(4) Find the velocity of the flow of an oil through a pipe, when the difference of mercury level in a differential U-tube manometer connected to the two tappings of the pitot tube is 100 mm. Take coefficient of pitot tube 0.98 and sp. gr. of oil = 0.8

(5) A rectangular channel 2m wide has a discharge of 250 l/s, which is measured by a right angled V-notch weir. Find the position of apex of the notch from the bed of the channel if max^m depth of water is not to exceed 1.3m. Take $C_d = 0.62$.

(6) Water flows through a triangular right angled weir first and then over a rectangular weir of 1m width. The discharge coefficients of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the overall depth of water over the triangular weir is 360mm, find the depth of water over rectangular weir.

(7) An orifice meter with orifice dia. 15cm is inserted in a pipe of 30cm dia. The pr. difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50cm of mercury. Find the rate of flow of oil of sp. gr. 0.9 when the coefficient of discharge of the orifice meter = 0.64.

(1). Find the discharge of water flowing through a pipe 30 cm dia placed in an inclined position where a venturimeter is inserted, having a throat dia 15 cm. The difference of pr. b/w the main and throat is measured by a liquid of sp. gr. 0.6 in an inverted U-tube which gives a reading of 30cm. The loss of head b/w main and throat is 0.2 times the kinetic head of pipe.

(2)

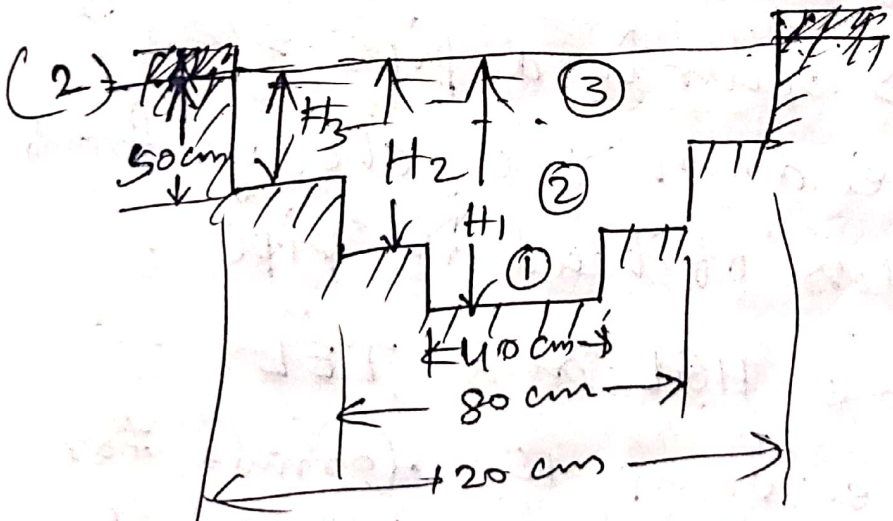


Figure shows a stepped notch. Find the discharge through the notch if Cd for all section = 0.62

(3) The water is flowing through a taper pipe of length 100m having dia. 600 mm at the upper end and 300 mm at lower end at the rate of 50 l/s. The pipe has slope of 1 in 30. Find the pr. at the lower end if the pr. at higher level is 19.62 N/cm²

(2.3). - flow through pipe,
(2.4). Loss in pipe.
(2.5). open channel

2

(1) = What are the various major losses occur in a pipe flow?

(2) Write down the chezys formula for loss of head in pipe.

(3) Define HGL and TEL.

(4) Write down the formula for loss of head due to sudden contraction and sudden enlargement.

(5) what is the difference b/w R.V.F. and G.V.F.

(6) Define Froude number. What is its significance in open channel flow?

(7) what do you mean by most economical section of channels?

(8) what conditions should be satisfied for a most economical trapezoidal channel?

(9) Define specific energy of a flowing fluid.

(10) what are the conditions of max^{m} discharge in a circular channel?

15

(1) An oil of sp. gr. 0.7 is flowing through a pipe of dia 300mm at the rate of 500 l/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take $\nu = 0.29$ stokes.

(2) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 l/s.

(3) Determine the rate of flow of water through a pipe of dia 20 cm and length 50 cm when one end of the pipe is connected to a tank and other end of the pipe is ~~connected to a tank~~ open to atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above centre of pipe. Consider minor losses and take $f = 0.009$ in the formula

$$h_f = \frac{4fLV^2}{d \times 2g}$$

(4)- Find the discharge through a trapezoidal channel of width 8m and side slope of 1 horizontal to 3 vertical. The depth of flow of water is 2.4m and value of Chezy's constant, C=50. The slope of bed of the channel is given 1 in 4000.

(5)- Find the discharge through a rectangular channel of width 2m, having a bed slope of 4 in 8000. The depth of flow is 1.5m and take the value of N in Manning's formula as 0.012.

(6)- A trapezoidal channel has its side slopes of 1 horizontal to 2 vertical and the slope of bed is 1 in 1500. The area of the section is $40m^2$. Find the dimensions of the section if it is most economical. Determine the discharge of the most economical section if C=50.

(1)- A concrete lined circular channel of dia 3m has a bed slope of 1 in 500. Work out the velocity and flow rate for the conditions of (i) maximum velocity and (ii) maximum discharge. Assume chezy's $C = 50$.

(2) Find the bed slope of trapezoidal channel of bed width 4m, depth of water 3m and side slope 2 horizontal to 3 vertical, when discharge through the channel is $20 m^3/s$. Take manning's $N = 0.03$ in Manning's formula $C = \frac{1}{N} m^{1/6}$

(3)- A horizontal pipe of dia 500mm is suddenly contracted to a diameter of 250 mm. The pr. intensity in the large and smaller pipe is given as

13.734 N/cm² and 11.772 N/cm² respectively. Find the loss of head due to contraction if $C_c = 0.62$. Also determine the rate of flow of water.

(4). Find the head lost due to friction in a pipe of dia 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 $C = 60$. Take ν for water = 0.01 stoke.

(5) Determine the rate of flow of water through a pipe of dia 20cm and length 50m when one end of the pipe is connected to a tank and other end of the pipe is open to atmosphere. The pipe is horizontal and ht. of water in tank is 4m above c/L of pipe. Consider minor losses and take $f = 0.009$ in formula, $h_f = \frac{4fLV^2}{d \times 2g}$

(3) Pumps

[2

(1) Define a pump. what are various types of pump?

(2) what is the principle behind a centrifugal pump?

(3) Define suction head and Manometric head in centrifugal pump.

(4) Define manometric efficiency of centrifugal pump.

(5) Write the expression for specific speed of a centrifugal pump.

(6) what do you mean by priming of a pump.

(7) what is the working principle of a reciprocating pump?

(8) what is the work done by a reciprocating pump.

(9) Define slip of a reciprocating pump.

(10) How will you classify the reciprocating pumps?

(1) Derive an expression for work done by centrifugal pump.

(2) Derive an expression for mechanical efficiency of centrifugal pump.

(3) The internal and external dia. of the impeller of a centrifugal pump are 200mm and 400mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit wt. of water.

(4) Find the number of pumps required to take water from a deep well under a total head of 89 m. All the pumps are identical and are running at 800 rpm. The specific speed of each pump is given as 25 while

the rated capacity of each pump is 0.16 m^3/s.

(5) Briefly explain the working of a reciprocating pump with diagram.

(6) Derive an expression for discharge in a double acting reciprocating pump.

[10

(1) Describe various parts of a centrifugal pump with diagram.

(2) A centrifugal pump having outer dia. equal to 2 times the inner dia, and runing at 1000 rpm works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer dia of the impeller is 500 mm and width at outlet is 50mm, determine:

(i) vane angle at inlet

(ii) work done by impeller on water per second

and (iii) Manometric efficiency.

(3) A single-acting reciprocating pump running at 50 rpm, delivers 0.01 m³/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine:

(i) The theoretical discharge of the pump.

(ii) Co-efficient of discharge,

(iii) Slip and the % age slip of the pump.

Part-B (Irrigation Engineering)

① Hydrology

12

(1) Define Hydrology. what is its importance?

(2) what is meant by a hydrograph?

(3) with a diagram explain a hyetograph?

(4) what is an orographic precipitation?

(5) Name various types of recording type Raingauge.

(6) Define evapotranspiration loss.

(7) Define ϕ-index and W-index.

(8) write Dicken and Ryve's formula for maximum flood discharge.

(9) write the rational formula to find run off.

(10) what do you mean by a catchment area? Draw various shapes of catchment area.

(15)

(1) With a neat hand sketch explain a hydrologic cycle.

(2) Describe various types of Non-Recording type raingauge with diagram.

(3) Describe various losses in precipitation.

(4) the following are the rates of rainfall for successive 30 minutes period for a storm duration of 210 minutes.

5.5, 6.0, 12.5, 8.0, 3.25, 3.25, 6.5 cm/hr.

Take ϕ-index as 4.5 cm/hr

Calculate, (a) the runoff in cm
(b) Total rainfall
(c) The value of ϕ-index

(5) Distinguish b/w hydrograph and hyetograph.

(6) Describe various factors affecting runoff.

LLO

(1) what are the different types of precipitation? Describe with neat sketches.

(2) Describe various methods to find average depth of precipitation.

(3) what are the different types of raingauges? Describe any two with neat sketch.

(4) what is unit hydrograph? What are the assumptions and ~~(b)~~ advantages of unit hydrograph. Explain with a diagram.

(2) Water requirement of crops

/2

(1) Define Irrigation. Briefly discuss necessity of Irrigation.

(2) Name various types of surface irrigation method.

(3) Define G.C.A. and C.C.A.

(4) Define Intensity of Irrigation with an example.

(5) Define crop ratio with an example

(6) what ~~are~~ is the ~~Base~~ water application efficiency?

(7) what do you mean by crop rotation

(8) what do you mean by Paleva and kor watering?

(9) Define Base and Duty.

(10) ~~Define~~ what is the base period of Rice, Sugarcane and Delta of Rice and wheat.

/5

(1) Enumerate various Benefits of Irrigation.

(2) Describe various crop seasons in Indian condition.

(3) Describe various factors affecting duty.

(4) Derive relation between Base, Duty and Delta.

(5) Describe factors affecting water requirement of crops.

(6) Describe various types of Irrigation Efficiency.

Q10

(1) The command area of a channel is 4000 hectares. The intensity of irrigation of a crop is 70%. The crop requires 60 cm of water in 15 days when the effective rainfall is recorded as 15 cm during that period.

Find, (a) The duty at the head of field.

(b) The duty at head of channel.

(c) The head discharge at the head of channel.

Assume total losses as 15%.

(2) Describe various surface and subsurface method of Irrigation with diagram.

(3) What do you mean by consumptive use of water? Describe various methods of determining consumptive use.

(3) Flow Irrigation & (4) Water logging and Drainage

12

(1) Define flow irrigation and write down names of various construction works related to it.

(2) What is the difference b/w Inundation and Perennial irrigation system?

(3) Draw a typical plans showing a contour and a side slope canal.

(4) Define Berm and show it in a diagram.

(5) What is the purpose of a Dowel and a free board?

(6) which type of lining of canal is widely accepted and why?

(7) Define water logging and what do you mean by capillary fringe?

(8) what do you mean by leaching and where this process is helpful in the context of Irrigation ?

(9) How a shotcrete lining is done in a canal ?

(10) what is the use of borrowpits in a canal ?

[5]

(1) Write down various points to be considered while selecting a Dam or Barrage site.

(2) what are the advantages and disadvantages of Inundation Irrigation ?

(3) what is the object of canal lining ?

(4) what are the causes of water logging ?

(5) Describe various anti water logging measures.

(6) what are the effects of water logging ?

L10

(1) Classify canals and describe various types of canals with diagrams.

(2) Draw a typical cross section of a canal and describe various components in it.

(3) Describe various types of canal lining along with their relative advantages and disadvantages.

(5) Diversion head works and regulatory structures.
(6) Cross drainage works

2

(1) what do you mean by a Diversion head works?
(2) what is the difference b/w a weir and a barrage?
(3) what is the purpose of under sluices?

(4) what is the purpose of a fish ladder?
(5) what is the purpose of silt excluder?
(6) where marginal embankment is constructed and why?
(7) what do you mean by a cross drainage work?
(8) Debine a siphon aqueduct.
(9) Debine super passage.
(10) what are the main object of diversion head works?

15

(1) what are the points to be considered while selecting site for diversion head works?
(2) Describe various component parts of a guide bank along with their diagrams.
(3) what is the necessity of cross-drainage works?
(4) Describe an Aqueduct with diagram.
(5) what are the criteria for

selection of cross-drainage works?

(6) What is a Level crossing in the content of Irrigation Engineering? Describe its various components.

L10

(1) Describe various types of cross drainage works with diagram.

(2) With a sketch describe various components of diversion headworks

(3) Write short notes on :-

(a) canal head regulator.

(b) Siphon aqueduct.

(c) Inlet and outlet

(7) Dams

L2

(1) Define a Dam. What are the purpose of constructing a dam?

(2) What is the difference b/w a rigid and a non-rigid dam?

(3) What is the purpose of a spillway?

(4) Why free board is provided in a dam?

(5) What is the purpose of a drainage gallery?

(6) What do you mean by an economic height of a dam?

(7) Why uplift pressure is dangerous for a dam?

(8) What do you mean by Energy dissipation in spillway?

(9) Where drop ~~spp~~ spillway is used?

(10) What is the working principle of a siphon spillway?

5

(1) Define a spillway. What are the necessities of providing it in a dam?

(2) By a neat hand sketch, explain an ogee spillway.

(3) What is the necessity of a storage reservoir?

(4) Write down various causes of failure of a gravity dam.

(5) What are the precautions taken to prevent failure of a dam?

(6) What are the causes of failure of an Earthen dam?

10

(1) Classify a Dam and describe various types of dam.

(2) Describe about various forces acting on gravity dam.

(3) Describe about various ~~various~~ types of spillways.

Prepared by- Chinmaya Maharana
PTGF(civil)
VGMIT, Rayagada