H&HM

UNIT I SHORT ANSWER QUESTIONS

1. What is the purpose of providing bed slope in open channels
2. What is a specific energy curve?
3. What is Bazin's formula and how is it used
4. What is meant by Prismatic channel? How it is classified
5. Differentiate between the Uniform and Non-Uniform flow
6. Find the velocity of flow and rate of flow of water through a rectangular channel of 5 m wide and 2 m deep, when it is running full. The channel is having bed slope of 1 in 3000. Take Chezy's constant C = 50
7. What do you understand by Flow in open channel?
8. Define the term most economical section of a channel. What are the conditions for the rectangular channel to be the best section?
9. Derive the condition for the best side slope of the most economical trapezoidal channel.
10. Find the side slope in a trapezoidal section of maximum efficiency which will carry the same flow as a half square section of the same area.
11. Prove that for a channel of circular section, the depth of flow, d = 0.81 D for maximum velocity & d = 0.95 D for maximum discharge where D = Diameter of circular channel, d = depth of flow.
12. Explain Specific energy of a flowing liquid, minimum specific energy, critical depth, critical velocity and alternate depths as applied to non-uniform flow.
13. What do you know about critical depth in an open channel flow.
14. Distinguish between Prismatic and Non-prismatic channels.
15. Write a short note on velocity distribution in open channel flow.
16. Find the specific energy of flowing water through a rectangular channel of width 5m when the discharge is 10 m3/s and depth of water is 3m.
17. What is momentum correction factor. Also derive the expression for the same.
18. Differentiate between Critical, sub-critical and super –critical flow in a open channel.
19. Differentiate between Steady and unsteady flow.
20. Derive the condition for depth of flow of a most economical circular channel Section subject to the condition for maximum velocity.

H&HM

UNIT I ESSAY QUESTIONS

1. A canal of trapezoidal section has bed width of 7 m and bed slope of 1 in 3500 .If the depth of flow is 2.7 m and side slopes of the channel are 1 horizontal to 3 vertical, determine the average flow velocity and the discharge carried by the channel. Also compute the average shear stress at the channel boundary.
Take value of Chezy's constant = 50

2. A wide channel laid to a slope of 1 in 900 carries a discharge of 3 m3/s per meter width at a depth of 1.8 m. Find out the value of Chezy's constant C. Consider the flow to be uniform.
If the actual depth varies from 1.5 m at an upstream location to 1.7 m at a location 300 m downstream or in other words the flow is gradually varied, what will be the value of Chezy's coefficient C

3. A rectangular channel 5 m wide has depth of water 2 m. The slope of the bed of the channel is 1 in 900 and value of Chezy's constant C=50.It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross-section, slope of the bed and roughness of the channel. Find the new dimensions of the channel and increase in discharge

4. The normal depth of flow of water, in a rectangular channel 1.5 m wide, is one meter. The bed slope of the channel is 0.0006 and Manning's rugosity coefficient N 0.012.Find the critical depth.
At a certain section of the same channel the depth is 0.92 m while at a second section the depth is 0.86 m. Find the distance between the two sections. Also, find whether the section is located downstream or upstream with respect to the first section

5. A trapezoidal channel having the side slope equal to 600 with the horizontal and laid on a slope of 1 in 750,carries a discharge of 10 m3/s. Find the width at the base and depth of flow for most economical section. Take the value of Chezy's resistance coefficient C= 60

6. Calculate the specific energy of 12 m3/s of water flowing with a velocity of 1.5 m/s in a rectangular channel 7.5 m wide. Find the depth of water in the channel when the specific energy would be minimum. What would be the value of critical velocity as well as minimum specific energy?

7. An open channel of most economical section, having the form of a half hexagon with horizontal bottom is required to give a maximum discharge of 20.7 m3/s of water. The slope of the channel bottom is 1 in 3000.Taking Chezy's constant=50 in Chezy's equation, determine the dimensions of the cross section.

8. Water flows at a velocity of 1 m/s and a depth of 2m in an open channel of rectangular cross section, 3 m wide. At a certain section the width is reduced to 1.8 m and the bed is raised by 0.65 m. Will the upstream depth be affected? If so, to what extent?

9. Prove that for the trapezoidal channel of most economical section:
Half of top width = Length of one of the sloping sides.
Hydraulic mean depth = ½ depth of flow.

10. A rectangular channel has a convex curvature in a vertical plane on its bed. At a section the bad has an inclination of 300 to the horizontal and the depth measured normal to the flow is 0.75 m. A certain flow produces a normal acceleration of 0.4 g which can be assumed to be constant throughout depth. Determine the pressure distribution and compare with hydrostatic distribution. Also determine the pressure distribution if the boundary has a concave curvature to the flow and rest of the data remain same?

11. 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 takes the value of N in Manning's formula as 0.012.

12. A trapezoidal channel with side slopes of 3 horizontal to 2 vertical has to be designed to convey 10 m3/s at a velocity of 1.5 m/s so that the amount of concrete lining for the bed and sides is minimum. Find the wetted perimeter and slope of the bed if Manning's N=0.014 in the formula C=m1/6(1/N).

13. A power canal of trapezoidal section has to be excavated through hard clay at the least cost. Determine the dimensions of the channel if it has to carry a discharge of 14 m3/s with bed slope of 1:2500 and Maning's N=0.020.

14. Determine the economical cross-section for an open channel of trapezoidal section with side slopes of 1 vertical to 2 horizontal, to carry 10 m3/s, the bed slope being 1/2000. Assume Manning coefficient as 0.022.

UNIT II

SHORT ANSWER QUESTIONS

1. What do you understand by critical depth of an open channel when the flow is non uniform

2. What is meant by Rapidly varied flow? In which cases the rapidly varied flow takes place?

3. What is meant by gradually varied flow? In which cases the gradual varied flow takes place?

4. Explain how the hydraulic jump forms.

5. Derive dynamic equation for GVF.

6. Explain direct step method.

7. Obtain an expression for the depth after the hydraulic jump and the loss of head due to the jump. Write the assumptions made.

UNIT II

ESSAY QUESTIONS

1. The depth of flow of water at a certain section of a rectangular channel of 2m wide is 0.3m. The discharge through the channel is 1.5 m3/s. Find whether a hydraulic jump will occur and if so find its height and loss of energy per kg of water.

2. Water is discharged at a velocity of 8 m/s with a depth of 0.7 m in a horizontal rectangular open channel of constant width when the sluice gate is opened upwards. Determine the height of the hydraulic jump and the loss of energy

3. A rectangular channel of 5 m width discharges water at the rate of 1.5 m3/s into a 5 m wide apron with 1/3000 slope at a velocity of 5 m/s. Determine the height of the hydraulic jump and energy loss.

4. A Wide channel of uniform rectangular section with a slope of 1/95 has a flow rate of 3.75 m3/s/m. The Manning constant is 0.013. Suddenly the slope changes to 1/1420. Determine the normal depths for each case. Show that a hydraulic jump has to occur and calculate the downstream flow height.

UNIT III

SHORT ANSWER QUESTIONS

1. What are limitations of hydraulic similitude

2. How are hydraulic models classified?

3. What are the advantages of model testing

4. What is model analysis and dimensional homogeneity?

5. What do you mean by fundamental units?. Give examples.

6. What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable? If not why?

7. Define the following non-dimensional numbers: Reynold's number, Froude's number and Mach's number. What are their significances for fluid flow problems?

8. What do you mean by derived units? Give examples.

9. What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable?

10. Explain the term dimensionally homogeneous equation.

11. What are the different laws on which models are designed for dynamic similarity? Where are they used?

12. Explain the terms: Distorted models and undistorted models. What is the use of distorted models?

13. Differentiate between Geometric similarity and Kinematic similarity.

14. What are similarities between model and prototype. Mention the applications of model testing.

15. Explain the statement of Buckingham pi theorem .

16. Give the advantages of Dimensional analysis.

17. What is a model and when do you call it as a distorted model and undistorted model.

18. Explain Rayleigh's method.

19. What is Euler's model law?

20. Give the uses of dimensional analysis. Also explain different methods with respect to their application.

21. Give the dimensions of force, viscosity and power.

22. When can you apply the results of a model to prototype? Explain in detail.

23. Water at 15^0C flows at 4 m/s in a 150 mm pipe. At what velocity must oil at 30^0C flow in a 75 mm pipe for the two flows to be dynamically similar. Take Water at 15^0 C as $1.145x10^{-6}m^2/s$ and that for oil at 30^0c as $3.0x10^{-6}m^2/s$.

24. Explain any four dimensionless numbers.

25. If the capillary rise h depends on specific weight w, surface tension 'σ' of the fluid and the radius of the tube r show that $h/r = \phi\ (\sigma/wr^2)$.

26. What do you mean by dimensional numbers? Name any four dimensional numbers. Define and explain Reynolds's number, Froude's number and Mach number. Derive expressions for any above two numbers.

27. State Buckingham's π theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis.

28. Explain different types of hydraulic similarities that must exist between a prototype and its model.

29. Define the term dimensional analysis and model analysis

30. What do you mean by repeating variable?

UNIT III

ESSAY QUESTIONS

1. A 120 m long surface vessel is to be tested by a 3 m long model. If the vessel travels at 10 m/s, at what speed must model be towed for dynamic similarity between the model and prototype? If the drag of the model is 9.37 N, What prototype drag is to be expected?

2. In 1:30 model of a spill way, the velocity and discharge are 1.5 m/s and 2 m/s. Find the corresponding velocity and discharge in the prototype

3. An air duct is to be modeled to a scale odf1:20 and tested with water which is 50 times viscous and 800 times denser than air. When tested under dynamically similar conditions, the pressure drop between the two sections in the model is 235kPa.What is the corresponding pressure drop in the prototype?

4. In an aeroplane model of size 1/50 of its prototype the pressure drop is 4 bar. The model is tested in water. Find the corresponding pressure drop in the prototype. Take specific height of air=0.0124 kN/m^2.The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise

5. A spillway model is constructed on a scale of 1:25. Calculate (i) the prototype discharge corresponding to model discharge of 0.12 m^3/sec (ii) the velocity in model corresponding to prototype velocity of 3.5 m/s.

6. A spillway model is constructed on a scale of 1:25. Calculate
(i) the prototype discharge Corresponding to model discharge of 0.12 m^3/sec
(ii) the velocity in model corresponding to Prototype velocity of 3.5 m/s.

7. A 1:10 scale model of a submarine moving far below the surface of water is tested in a water tunnel. If the speed of the prototype is 8 m/s, determine the corresponding velocity of water in the tunnel. Also determine the ratio of the drag for the model and the prototype. γ**sea water** =1.121x 10^{-6} m^2/s, γ **water** =1.00x 10^{-6} m^2/s, ρ**sea water** =1027 Kg/m^3, ρ**water**=1000kg/m^3.