

# WATER RESOURCES MANAGEMENT

## Question Bank

1. What is the main objective of water resources management?
2. What are the main sources of water?
3. List out the practical applications of hydrology
4. Differentiate clearly a retarding basin and a storage reservoir,
5. Explain the statement “Water and not land” would be a limiting factor in future economic growth of the country.
6. What are the different forms of precipitation? How rainfall does is measured in India?  
Explain
7. What do you mean by consumptive use of water?
8. Explain in detail the necessity for conservation and development of country’s water resources.
9. Discuss briefly the three important methods, which are used for determining the mean rainfall over a drainage basin.
10. Mention any five components of water management.
11. Mention the essence of national water policy
12. Differentiate convective and orographic precipitation.
13. What is meant by raingauge density?
14. What are the objectives of multipurpose water resources projects?
15. Differentiate flood control reservoir and multipurpose reservoir.
16. Interlinking of Indian rivers – Discuss critically the merits and demerits of such project.
17. Differentiate between a recording and non-recording types of rain-gauges.
18. Describe with a neat the construction of any one type of recording rain gauge.
19. How will you select the site for rain gauge?
20. What are the reasons for error in measurement of precipitation?
21. How will you calculate optimum number of rain gauge?
22. List out the methods for computation of average rainfall data.
23. Define Intensity frequency curve.
24. Draw Discharge – Area – Depth (DAD) Curves.
25. Define Double Mass curve.
26. Differentiate b/w arithmetic and Isohyetal Method.
27. What do you mean by rain gauge density?
28. Write down the advantages and disadvantages of recording type rain gauges.
29. List out the recording and non – recording type rain gauges.
30. How will you classify rainfall based on intensity?
31. What do you mean by orographic precipitation?
32. How will you measure flow in stream and rainfall?
33. List out any 4 data required for hydro meteorological studies?
34. Define Hydrological cycle.
35. State the water budget equation.
36. What are the essential requirements of data?
37. List out any 4 hydrological data.
38. List out the types of precipitation.

39. What are the different forms of precipitation?
40. Differentiate b/w snow and hail.
41. What are the different types of rain gauge?
42. What are significance features of global water balance studies?
43. Describe briefly the sources of hydrological data in India.
44. What are the difficulties in the measurement of precipitation?
45. Explain a procedure for checking a rainfall data for consistency.
46. Explain a procedure for supplementing the missing rainfall data.
47. Explain briefly the following relationship the precipitation p relating to precipitation over a basin
  - a) Depth Area relationship
  - b) Maximum Depth Area duration Curve
  - c) Intensity duration frequency relationship
48. What is meant by Probable Maximum Precipitation (PMP ) over a basin.
49. Describe briefly the sources of hydrological data in India.
50. Describe briefly the various abstractions from precipitation.
51. Explain briefly the evaporation process.
52. Explain the factor that affects the evaporation from a water body.
53. Explain a commonly used evaporimeter.
54. Explain the energy budget equation
55. Explain the factor affecting evapotranspiration process.
56. Describe briefly 1) Actual evapo transpiration 2) References Evapo transpiration.
57. Explain the infiltration process and resulting soil moisture zone.
58. Explain the factor affecting the infiltration capacity of an area.
59. Explain infiltration indices in detail.
60. Distinguish between
61. a) Infiltration rate and Infiltration capacity                      b) Actual and Potential Evapo transpiration
62. c) Field capacity and permanent wilting point      d) Dispersion storage and interception
63. A storm with 10 cm of precipitation produced a direct runoff of 5.8 cm. The duration of rainfall was 16 hours and its time duration given below .Estimate the  $\phi$  index

Time from start h	0	2	4	6	8	10	12	14	16
Cummulative rainfall	0	.4	1.3	2.8	5.1	6.9	8.5	9.5	10

67 .The infiltration capacity of a catchment is represented by Horton’s equation as

$$f_p = 0.5 + 1.2 e^{-0.5 t}$$

Where  $f_p$  is in cm/h .Assuming the infiltration to take place at a capacity rate in a storm of 4 hr duration, estimate the average rate of infiltration for the duration of storm.

68. The mass curve of rainfall of duration 100 min is given below .The catchment had an initial loss of 0.6 cm and a  $\phi$  index of 0.6 cm/h .Calculate the total surface from the catchment .

Time from	0	20	40	60	80	100
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start h						
Cumulative rainfall	0	.25	1.2	2.6	3.3	3.5

64. Explain the step by step procedure involved to adjust the rainfall record at a suspicious station through the double mass curve technique.
65. What are the factors should be considered in selecting a site for a stream gauging station? Explain the dilution method of flow measurement.
66. State the Horton's equation for infiltration capacity curve and sketch with salient components of the curve
67. Explain briefly about the O - Index and W - Index.
68. Explain with neat sketch the various methods of estimation of Evaporation
69. Differentiate the reservoir evaporation from the agricultural field Evaporation
70. Define infiltration. Describe how infiltration capacity rate can be measured using double ring infiltro metre. How is better than a tube infiltrometre.
71. Explain with neat sketches how to evaporation is measured using evaporation pan
72. Elaborate on the factor affecting infiltration and different methods of infiltration
73. Write short notes on the various methods of reducing evaporation losses from reservoirs

## Unit – 2

1. List the factor affecting the seasonal and annual runoff (yield) of a catchment.
2. With the help of typical hydrograph describe the salient features of a) Perennial b) Intermittent c) ephemeral stream
3. Explain briefly a) Water year b) Natural (Virgin flow)
4. Describe briefly SCS-CN method of estimation yield of a catchment through use of daily rainfall record.
5. What is flow duration curve?
6. Sketch a typical flow mass curve.
7. What is residual mass curve
8. List the factor affecting a flood hydrograph. Discuss the role of these factors.
9. Describe the analysis of the recession limb of a flood hydrograph.
10. Explain the term Rainfall Excess. How is ERH of a storm obtained?
11. Why is base flow separated from the flood hydrograph in the processing of developing a unit hydrograph?
12. What is unit hydrograph? List the assumption involved in the unit hydrograph theory.
13. Describe the procedure of preparing a D hour unit hydrograph for a catchment.
14. Describe the S curve method of developing a 6-h UH using 12-h UH.

15. What is IUH? What are its characteristics?

16. Distinguish between a) Hyetograph and hydrograph b) D-h UH and IUH

17. Obtain a Unit Hydrograph for a basin of 315 km<sup>2</sup> of area using the rainfall and stream flow data tabulated below.

Stream flow data

Time (hr)	Observed hydrograph(m <sup>3</sup> /s)
0	100
1	100
2	300
3	700
4	1000
5	800
6	600
7	400
8	300
9	200
10	100
11	100

Rainfall data

Time (hr)	Gross PPT (GRH) (cm/h)
0-1	0.5
1-2	2.5
2-3	2.5
3-4	0.5

18. Find the half-hour unit hydrograph using the excess rainfall hyetograph and direct runoff hydrograph

<b>Time (1/2 h)</b>	<b>Excess rainfall (in)</b>	<b>Direct runoff (cfs)</b>
1	1.06	428
2	1.93	1923
3	1.81	5297
4		9131
5		10625
6		7834
7		3921
8		1846
9		1402
10		830
11		313

19. Given below are the ordinate of a 6-h unit hydrograph for a catchment. Calculate the ordinate of the DRH due to a rainfall excess of 3.5 cm occurring in 6hr.

Time (h)	0	3	6	12	15	18	21	24	30	36	42	48	54	60	69
UH ordinate (m <sup>3</sup> /s)	0	25	50	85	125	160	185	160	110	60	36	25	16	8	0

20. What is a synthetic unit hydrograph?
21. The recession curve of a hydrograph is sometimes called the depletion curve
22. Define time of concentration
23. What is meant by base flow in a stream Explain the following terms: Kor period, C.C.A., Temporary Wilting Point, Base period, Crop period.
24. Explain the advantage and disadvantage of sprinkler irrigation system.
25. What is "Assessment of irrigation water"? In which situation volumetric method is adopted? What are its shortcomings?
26. Discuss briefly the benefits as well as the ill effects of irrigation system.
27. How would you proceed to determine phreatic line through homogenous earth dam provided with a horizontal filter?
28. Explain the working of sprinkler irrigation system with a neat sketch.
29. 10. List any four factors which affect the hydrograph
30. 11. List out the uses of unit hydrograph
31. 12. Compare the hydrographs obtain from a watershed and rural watershed.
32. Give the comparisons of 'Bandhara Irrigation' and 'Lift Irrigation'.
33. Give the difference between "Sprinkler Irrigation System" and "Drip Irrigation System".
34. Describe the various considerations made in alignment of an irrigation canal.
35. What are the physiographic factors affecting the flood hydrograph. Discuss the role of these factors.
36. Explain a procedure of deriving a synthetic unit hydrograph for a catchment by using Snyder's method.
37. The effective rainfall hyetograph of a complex storm has duration of 12 hours, with rainfall intensities of 1.5, 0.5 and 5 cm/hr respectively in successive 4-hour periods. The ordinates of the corresponding direct runoff hydrograph read at 4-hour intervals are 150, 250, 520, 313, 394, 212, 102 and 45 m<sup>3</sup>/sec respectively. Determine the ordinates of the 4-hour unit hydrograph.

## Unit – 3

1. Give the short note on “Bligh creep theory”.
2. Briefly describe drawbacks of Kennedy’s theory for design of canal in alluvial soil.
3. Give the short note on “Classification of irrigation canal”.
4. Explain the term “Water logging”? How to control water logging?
5. Explain in brief Canal Lining and its advantages and disadvantages.
6. What are the factors which effect the selection of site for dam site?
7. Give difference between Silt Excluder and Silt ejector in brief.
8. What are the initial and final regime conditions of an alluvial channel according to Lacey’s?
9. Explain various methods of reducing seepage through earthen dams.
10. Write short note on “Relationship between Duty, Delta and Base period”.
11. Enlist different types of irrigation efficiencies. Explain them in brief
12. After how many days will you supply water to soil in order to ensure efficient irrigation of the given crop, it
  - a. Field capacity of soil = 35%
  - b. Permanent wilting point = 15%
  - c. Density of soil = 1.5 g/cm<sup>3</sup>
  - d. Daily consumption use of water for the given crop = 12 mm.
  - e. Effective depth of root zone = 80 cm.
13. 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, Co- efficient of permeability  $K = 0.008$  cm/sec. Calculate seepage per meter length of dam.
14. Design an irrigation canal using Lacey’s theory for the following data: Discharge = 55 cumecs Silt factor = 1.6, Side slope = 0.5: 1.
15. The base period, Duty of water and area under irrigation for various crops under a canal system are given in table. The total culturable command area is 50,000 ha. It the losses in the reservoir and canal are respectively 16 % and 25 %. Determine the reservoir capacity.

## Unit – 4

16. Give difference between Weir and Barrage in brief.
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. Write short note on “Head Regulator” and “Canal Regulator”.
20. Explain the following terms: Syphon, Aqueducts, Irrigation efficiency, Irrigation frequency, Sluice way.
21. Draw a neat sketch of Diversion Head work and explain functions of each component.
22. Describe with the help of sketches, the various types of cross-drainage works
23. Which considerations are taken when design earthen dam in earthquake region?
24. Discuss various factors affecting while design spillway.
25. Explain in brief various forces acting on Gravity dam with suitable sketches.

26. Discuss the various modes of failure of Gravity dam.
27. Define the term "Exit Gradient". What is the importance of exit gradient? How would you check the exit gradient?
28. Discuss the various causes of failure of Earth dam
29. 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.
30. Discuss briefly the causes of failure of hydraulic structures founded on pervious foundation.

## Unit – 5

### Part –A

1. Define Aquifer parameters
2. What is a perched aquifer?
3. List out Dupit's Assumptions
4. Define the term transmissibility co-efficient of aquifer
5. Draw a neat sketch to indicate the different types of aquifers
6. Distinguish between water table aquifer and pressure aquifer.
7. State Darcy's law and its limitations'
8. Explain the terms "storage coefficient" and "transmissibility".
9. Distinguish between confined aquifer and unconfined aquifer
10. What are the assumptions made in driving thiems equilibrium equation for steady radial flow?
11. State Dalton's law of evaporation and its applicability in the field.

### Part –B

1. Discuss the principle of recuperation test of an open well with a neat sketch
2. Describe the different types of aquifers with neat sketches.
3. At a certain point in an unconfined aquifer of 3km<sup>2</sup> area the water table was at an elevation of 102m. Due to natural recharge in a wet season its level raise to 103.2m. a volume of 1.5 Mm<sup>3</sup> of water was then pumped out of the aquifer caving the water table to reach a level of 101.2m.

Estimate specific yield and volume of recharge during wet season.

4. A 30cm diameter well completely penetrates an artesian aquifer. The thickness of strainer is 25m. Determine the discharge from the well when the draw down in the well is 4m and the coefficient of permeability is 45m/day. Assume radius of influence as 350m
5. Derive an expression for the steady state discharge of well fully percolated into a confined aquifer.

6. Write short notes on (i) pumping test (ii) recuperation test on yield of a well
7. Derive Darcy's equation from first principle
8. A stream flows in the approximate centre of a flat alluvial valley bounded by impermeable shale. The valley average 2000 m in width and contains an alluvial aquifer in hydraulic connection with the stream. The hydraulic conductivity of the aquifer is 0.054 cm/s. During irrigation season recharge can be assumed to be steady and uniform over the valley. Observation, wells indicate that during irrigation the water table at a distance of 150 m from the stream is 3.5 m above the impermeable shale and 1.5 m above the stream level. Make any suitable assumptions if necessary and calculate the discharge from the aquifer to the stream and find the maximum water table level.
9. Explain with neat sketches various types of aquifers.
10. State Dupuit-Forcheimer assumptions and its uses in groundwater hydrology?
11. List the various types of aquifers and explain with neat sketches about groundwater column and its characteristics.
12. In a certain area groundwater discharge into a canal. The soil has hydraulic conductivity  $K = 1.0$  cm/s and a porosity of 0.2. The groundwater flow is practically horizontal and the gradient of the head is 1 in 100 along flow direction, in plan view, that is at  $45^\circ$  to line of the canal. A conservative tracer is introduced into the ground at a point "A" perpendicular distance of 6 m from the canal. If dispersion and diffusion of the tracer are assured negligible estimate how long it will take for the tracer to appear in the canal
13. How is the pump test conducted for evaluation of, aquifer parameters?