



Subject Name: WATER RESOURCES ENGINEERING

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Year and Sem, Department: III and I SEM

DEPARTMENT OF CIVIL ENGINEERING

Unit-I: (Title)

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

1. **Hydrology:** The branch of science concerned with the properties of the earth's water, and especially its movement in relation to land.
2. **Hydrologic cycle:** Describes the constant movement of water above, on, and below the earth's surface. Processes such as precipitation, evaporation, condensation, infiltration, and runoff comprise the cycle
3. **Abrasion:** Removal of stream-bank soil as a result of sediment-laden water, ice, or debris rubbing against the bank.
4. **Absolute Humidity:** The actual weight of water vapor contained in a unit volume of the atmosphere, usually expressed in grams of water per kilogram of air.
5. **precipitation mean:** Precipitation is rain, snow, sleet, or hail — any kind of weather condition where something's falling from the sky. Precipitation has to do with things falling down, and not just from the sky. It's also what happens in chemical reactions when a solid settles to the bottom of a solution
6. **Absorption Loss:** The loss of water by Infiltration or Seepage into the soil during the process of priming, i.e., during the initial irrigation of a field; generally expressed as flow volume per unit of time.
7. **6 types of precipitation:** There are many types of precipitation. Rain and drizzle are the only liquid types; the freezing types are snow, sleet, freezing rain, and hail. Hail is unique because it is frozen precipitation that generally only falls from thunderstorms in the summer
8. **Acclimatization:** The physiological adjustment or adaptation by an organism to new physical and/or environmental conditions. With respect to water, it is frequently used
9. **Accretion:** The slow addition to land by deposition of water-borne sediment. An increase in land along the shores of a body of water, as by Alluvial deposit
10. **What is Acre:** A measure of area equal to 43,560 square feet (4,046.87 square meters). One square mile equals 640 acres, and is also referred to as a Section
11. **Adiabatic Process:** A change involving no gain or loss of heat
12. **Aggressive Water:** Water which is soft and acidic and can corrode plumbing, piping, and appliances
13. **Define Stream.:** A general term for a body of flowing water; natural water course containing water at least part of the year.
14. **Infiltration:** The downward entry of water through the soil surface
15. **Groundwater hydrology:** Groundwater, water that occurs below the surface of Earth, where it occupies all or part of the void spaces in soils or geologic strata. Both surface and subsurface water are related through the hydrologic cycle (the continuous circulation of water in the Earth-atmosphere system).

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Draw the hydrological cycle. And label the different components.
2. What are the reasons for error in measurement of precipitation?
3. Define Readily available soil moisture in view of hydrology



4. How can we reduce the water usage? Give one example
5. What do mean by term 'Hydrology' in civil engineering
6. Write the applications of Hydrology and its importance.
7. Name the types of rain-gauges? How it works
8. How will you select the site for rain gauge?
9. What do mean by catchment area? List different units.
10. Define permanent wilting point with neat sketch

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Explain the methods of estimating missing rainfall data at a station in a basin. (May-2016)
2. Explain step by step procedure you would adopt to prepare the depth- area duration curves for a particular storm for a basin having a number of rain- gauges, most of which are recording Explain the following in brief.
3. (a) Probable maximum precipitation (December-2016)
(b) Rain gauge density
4. Discuss the analysis of rainfall data with respect to time, space, frequency and . (May-2016)
5. intensity.
6. Explain the balanced equation for precipitation (December-2016)
7. Describe the terms and explain it
 - i Interception and
 - ii. Depression storage.
8. Describe with the help of sketch various forms of soil moisture. Which of these soil moistures is mainly available for utilization by the plants?
9. Evaporation is indirectly a cooling process. Justify the statement. Discuss the factors affecting evaporation.
10. A basin has the area in the form of a pentagon with each side of length 20Km. The . (May-2016)
11. five rain gauges located at the corners A, B, C, D and E have recorded 60, 81, 73, 59 and 45 mm of rainfall respectively. Compute average depth of rainfall over the basin using arithmetic mean and Thiessen polygon methods.
12. The annual rainfalls at 7 rain gauge stations in a basin are 58, 94, 60, 45, 20, 88 and 68cm respectively. What is the percentage accuracy of the existing network in the estimation of average depth of rainfall over the basin? How many additional gauges are required, if it is desired to limit the error to only 10%.

Fill in the Blanks / Choose the Best: (Minimum 10 to 15 with Answers)

1. Water contains
 - A. one hydrogen atom and one oxygen atom
 - B. two hydrogen atoms and one oxygen atom
 - C. one hydrogen atom and two oxygen atoms
 - D. three hydrogen atoms and two oxygen atoms
 - E. two hydrogen atoms and three oxygen atoms.



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2. Unit Hydrograph theory was enunciated by
- A. Merril Bernard
 - B. W.W. Horner
 - C. **Le-Roy K. Sherman**
 - D. Robert E. Horten.
-
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- A. Merrill Bernard
 - B. W.W. Horner
 - C. Le-Roy K. Sherman
 - D. **Robert E. Horten.**
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4. Hydrology helps in
- A. predicting maximum flows
 - B. deciding the minimum reservoir capacity
 - C. forecasting the availability of quantity of water at reservoir site
 - D. predicting the effects on the river water level on completion of dams
 - E. **all the above.**
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5. Pick up the correct statement from the following :
- A. Rivers, lakes, oceans and springs get water from the rains
 - B. Rain water is obtained by evaporation from rivers, lakes and oceans
 - C. Water remains in atmosphere as vapours
 - D. Hydrologic cycle is a continuous process of evaporation and precipitation of water in atmosphere
 - E. **all the above.**



Unit-II:

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

1. **Hyetograph:** A hyetograph is a graphical representation of the relationship between the rainfall intensity and time. → It is the plot of the rainfall intensity drawn on the ordinate axis against time on the abscissa axis.
2. **Unit Hydrograph:** It can be defined as the direct runoff hydrograph (DRH) resulting from one unit (e.g., one cm or one inch) of effective rainfall occurring uniformly over that watershed at a uniform rate over a unit period of time.
3. **Runoff Hydrograph:** It can be defined as the direct runoff hydrograph (DRH) resulting from one unit (e.g., one cm or one inch) of effective rainfall occurring uniformly over that watershed at a uniform rate over a unit period of time.
4. **Base flow:** Some part of stream flow derived from groundwater flowing into a stream or river.
5. **Brook :** A natural stream of water, smaller than a river or creek; especially a small stream that breaks directly out of the ground, as from a spring or seep.
6. **flood :** When water inundates land that is normally dry, this is called a flood. Floods are a natural process, but mankind's activities affect flooding. Floods occur at irregular intervals and vary in size, area of extent, and duration.
7. **hydrograph measure :** A hydrograph is a graph showing the rate of flow (discharge) versus time past a specific point in a river, channel, or conduit carrying flow. The rate of flow is typically expressed in cubic meters or cubic feet per second (cms or cfs).
8. **river discharge calculated:** In general, river discharge is computed by multiplying the area of water in a channel cross section by the average velocity of the water in that cross section:
discharge = area velocity
9. **lag time in a hydrograph:** The lag time is the delay between the maximum rainfall amount and the peak discharge. The shape of a hydrograph varies in each river basin and each individual storm event. The hydrographs below show two contrasting environments.
10. **Direct runoff hydrograph:** It can be defined as the direct runoff hydrograph (DRH) resulting from one unit (e.g., one cm or one inch) of effective rainfall occurring uniformly over that watershed at a uniform rate over a unit period of time.
11. **Concentration:** The amount of a given chemical or pollutant in a particular volume or weight of air, water, soil, or other medium – often expressed as milligrams per liter (mg/l) or parts per million (ppm).

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. What is hydrograph analysis? List its uses
2. What do you mean by base flow? How it is different from surface flow?
3. What do you understand about flood hydrograph, draw neat sketch
4. Define return period and exceedence probability? Give expressions
5. Define Unit hydrograph, Why it is called as unit hydrograph?
6. Define S- hydrograph, how it different from unit hydrograph
7. Define Maximum probable flood, give its importance
8. What is Design flood? How it useful in design calculations
9. What do you mean by Annual series in hydrology?
10. What does it mean Partial series in hydrology?



Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Define unit hydrograph. What are the assumptions underlying the unit Hydrograph theory (December-2016)
2. What does the word unit refer to in the unit hydrograph? Explain with sketches what do you understand by the principle of linearity and principle of time invariance in the unit hydrograph theory?
3. Describe how recession constants of direct runoff and base flow curves are obtained from a semi log arithmetic plot. . (May-2016)
4. Describe with the help of neat sketches any three methods of separation of base flow from the hydrograph of runoff (i.e. stream flow hydrograph) indicating the situation under which you advocate them
5. How is runoff estimated using Strange's tables and Barlow's tables
6. What is Hydrograph? Draw a single peaked hydrograph and explain its components
7. What do you understand by the principle of linearity and time invariance in unit hydrograph (December-2016)
8. A drainage basin has the following characteristics. Basin area = 2500 sq. km. Length of the main stream $L = 110\text{km}$ Distance from the centroid of the basin to outlet = 70 k m. Constructs the 4 hour synthetic unit hydrograph for the basin if $C_t = 1.50$ and $C_p = 0.6$
9. A 4h hydrograph for a project site in Mahanadi Basin is given below. Calculate 2 -h UH by S-hydrograph approach. Time (h) 0 2 4 6 8 10 12 14 16 18 20 22 24 26 UH ordinates 0 30 10 17 21 18 12 80 40 35 68 20 15 50 (m^3 / sec)
10. For a river reach K is 28 h and X is 0.25. Route the following inflow hydrograph. Take $O_1 = I_1$ for the beginning step. Determine the values of attenuation and translation of the peak. (May-2016)

Unit-III:

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

1. **Define Aquifer:** A geologic formation that holds and yields usable amounts of water. The water in an aquifer is called groundwater. Aquifers may be categorized into confined aquifers and unconfined aquifers.
2. **Define Confined Aquifer. :** An aquifer whose upper and lower, boundary is defined by a layer of natural material that does not transmit water readily. Water is "confined" under pressure similar to water in a pipeline. Drilling a well into this type of aquifer is analogous to puncturing a pressurized pipeline. In some areas confined aquifers produce water without pumps (flowing artesian well).
3. **Define Unconfined Aquifer:** An aquifer whose upper boundary consists of a relatively porous material that transmits water readily from the ground surface. The water level in an unconfined aquifer is the water table.
4. **What is Discharge:** The volume of water that passes a given point during a given period. It is an all-inclusive outflow term, describing a variety of flows such as from a pipe to a stream, or from a stream or river to a lake or ocean.
5. **What is Drawdown:** The distance between the static water level in well and the surface of the cone of depression.
6. **Elaborate the drainage condition:** (1) The natural movement of surface water over a land area to a river, lake or ocean (surface drainage), (2) removal of water from a soil using buried pipelines that are spaced regularly and perforated (subsurface drainage).



7. **Define Ephemeral stream :** A stream that flows in response to runoff producing precipitation events and thus discontinuing its flow during dry seasons. Such flow is usually of short duration.
8. **What are Estuarine waters :** Deep-water tidal habitats and tidal wetlands that are usually enclosed by land but have access to the ocean and are at least occasionally diluted by freshwater runoff from the land (such as bays, mouths of rivers, salt marshes).
9. **What is Erosion:** The detachment and transport of soil particles by water and wind. Sediment resulting from soil erosion represents the single largest source of nonpoint source pollution in the United States.
10. **Define Eutrophication :** The process of nutrient enrichment causing a water body to fill with aquatic plants and algae. Eutrophic lakes often are undesirable for recreation and may not support normal fish populations
11. **What is specific retention:** Definition of specific retention. The ratio of the volume of water that a given body of rock or soil will hold against the pull of gravity to the volume of the body itself. It is usually expressed as a percentage.
12. **What is the specific yield :** Specific yield is defined as the volume of water released from storage by an unconfined aquifer per unit surface area of aquifer per unit decline of the water table. ... Thus, specific yield, which is sometimes called effective porosity, is less than the total porosity of an unconfined aquifer

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Define aquifer, How aquifers are formed?
2. What are the different types of aquifers? Draw a neat sketch of the same.
3. Define porosity. Give the mathematical expression of the porosity.
4. Define Specific yield. Explain the term the equation
5. What is specific retention. How it is different from Specific yield?
6. Define Permeability. Give its dimensional formula
7. What do you mean by transmissibility? How it is different from permeability?
8. What is Storage coefficient. Write its mathematical expression
9. What are the types of wells? Draw Sectional view of the well
10. Ground water and surface water, Which water is more pure?

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Define well development, Draw a neat sketch. (December-2016)
2. What do mean by well construction? List the stepwise construction process.
3. Distinguish between Groundwater and Perched groundwater (May-2016)
4. Distinguish between Open wells and tube wells.
5. Derive a formula for discharge of a well in a homogeneous unconfined aquifer assuming equilibrium flow condition. State the assumptions on which the formula is based
6. Distinguish between: Vadose zone and phreatic zone Explain them with the help of neat sketch
7. Define the terms: Transmissivity, storability and write their mathematical expressions and also explain the terms in it.
8. A Flood of 1000 cumec exceeded 60 times during a period of 30years. A flood of 3500 cumes exceeded twice. Determine the annual probability and average recurrence interval for both the floods
9. A well with a radius of 0.5m penetrates completely a confined aquifer of thickness 40 m and permeability 30m /day. The well is pumped so that the water level in the well



- remains at 7.5m below the original piezometric surface. Assuming that the radius of influence is 500m compute the steady state discharge from the well (December-2016)
10. A 20 cm well penetrates 30 m below static water level. After a long period of pumping at a rate of 1800 lpm, the drawdowns in the observation wells at 12 m and 36 m from the pumped well are 1.2 m and 0.5 m respectively. Determine the (May-2016)
- Transmissibility of the aquifer
 - Drawdown in the pumped well assuming radius of influence as 300m
 - Specific capacity of the well.

Unit-IV:

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

- Define Hydraulic conductivity:** A term used to describe the ease with which water moves through soil or a saturated geologic material.
- What is Irrigation** The controlled application of water to arable lands to supply crop water requirements not satisfied by rainfall
- Which is the major source of irrigation in Telangana state** The economy of Telangana is mainly supported by agriculture. Two important rivers of India, the Godavari and Krishna, flow through the state, providing irrigation. Farmers in Telangana mainly depend on rain-fed water sources for irrigation. Rice is the major food crop.
- What are traditional methods of irrigation:** Sprinkler irrigation method is an easy and simple method of irrigation in present times. The whole land becomes available for cultivation of crops, whereas in traditional irrigation methods, 15 to 20 per cent land remains vacant in depressions and boundaries
- What is irrigation and why is it important :** Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops. Irrigation is a basic determinant of agriculture because its inadequacies are the most powerful constraints on the increase of agricultural production.
- Discuss Leaching process :** The removal of dissolved chemicals from soil caused by the movement of a liquid (like water) through the soil.
- What is Losing stream:** A stream or portion of a stream that discharges water into the groundwater, resulting in a smaller flow volume within the stream
- What is Part per million (ppm):** A measure of concentration of a dissolved material in terms of a mass ratio (milligrams per kilogram, $\mu\text{g}/\text{kg}$). For water analysis, part per million often is presented as a mass per unit volume (milligrams per liter, $\mu\text{g}/\text{l}$), $1 \text{ ppm} = 1 \text{ mg}/\text{l}$.
- What is Perched water table:** Water that occurs underground when a low permeability material, located above the water table, blocks or intercepts the downward flow of water from the land surface. Water accumulates above the impermeable material, creating a saturated zone.
- What is Percolation :** The movement of water through saturated soil layers, often continuing downward to groundwater
- What is Permeability :** A measure of the ease with which liquids or gases will move through soil or other porous material. Permeability is a characteristic of the soil media and does not depend on the type of fluid being transmitted.
- What is Porosity :** The ratio of the volume of open spaces or voids to the total volume of a material. For example, a sand and gravel deposit may have 20 % porosity. Porosity determines the amount of water that can be stored in a saturated formation. A saturated formation 100 feet thick with porosity of 20 % could store an equivalent water depth of approximately 20 feet.
- What is Potable water supply:** A source of water that is of adequate quality to be used for human consumption.



- 14. What is Precipitate :** A solid that has been deposited from an aqueous solution. For example, iron precipitates from groundwater to form a rust colored solid when exposed to air.

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Define Irrigation, Give the importance of Irrigation in India.
2. What are the different types of soils in Indian and their suitability?
3. What do you understand about full supply coefficient?
4. What are the ill effects of irrigation?
5. What standards required for Irrigation water?
6. Define Duty and Delta. State the relation between them.
7. What do you know about the water conveyance efficiency?
8. What do you understand about vertical distribution of soil moisture?
9. Define water logging? What are problems associated with this?
10. Define field capacity, discuss briefly its importance.

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Discuss various methods of irrigation and state the advantages of each method. (December-2016)
2. Describe the step by step procedure for preparation of land for irrigation
3. Discuss in brief, various methods of surface irrigation
4. Explain in detail about the ill-effects of irrigation and brief about assessment of irrigation. (May-2016)
5. What is meant by 'Border flooding' How does it differ from 'Check flooding' and 'free flooding'?
6. What is meant by Check flooding and also give a brief note of crop rotation.
7. What is meant by flow duty and quantity duty? Explain the factors affecting the duty
8. Define the terms Duty, Delta and base period and also derive the relation between them.
9. Define irrigation efficiency. List out different types of irrigation efficiencies. Explain any two of them.
10. Determine the storage capacity of soil from the following data: Field Capacity = 30% (May-2016)
Wilting point = 14%
Depth of Root zone = 1.20 m
Dry Unit weight of soil = 1.7 g/cc
Also determine the depth of water required in the field if irrigation water is supplied when the moisture content falls to 20% and the field application efficiency is 80%. If the conveyance losses in the water courses and field channels are 16% of the outlet discharge, calculate the depth of water needed at the canal outlet

Unit-V:

Important points / Definitions: (Minimum 15 to 20 points covering complete topics in that unit)

1. **What is Pumping water level** The water level in a well when the pump is operating and water is being withdrawn.
2. **What is Recharge area:** The area where water predominantly flows downward through the unsaturated formation (zone) to become groundwater
3. **What is Reservoir :** A pond, lake, tank, or basin (natural or human made) where water is collected and stored. Large bodies of groundwater are called groundwater reservoirs; water behind a dam is also called a reservoir.
4. **What is Return period :** The average elapsed time between occurrences of a hydrologic event with a specified magnitude or greater. For example, a 100-year discharge measured on a given river is equaled or exceeded, on average, once every 100 years. This does not mean that the 100-year discharge occurs once every 100 years, but that the average time between events



of that magnitude or greater is 100 years. Stated another way, there is a 1% chance of a discharge equal to or greater than the 100-year flood event occurring in any given year.

5. **Define River :** A natural stream of water of considerable volume, larger than a brook or creek.
6. **What is River basin:** The area drained by a river and its tributaries.
7. **What is Runoff :** That part of rainfall or snowmelt that does not infiltrate the soil but flows over the land surface toward a surface drain, eventually making its way to a stream, river, lake or an ocean. It can carry pollutants into receiving waters.
8. **What is Saturated formation :** The portion of a soil profile or geologic formation where all voids, spaces or cracks are filled with water. No air is present
9. **What is Saturated thickness :** The total thickness of a saturated formation
10. **What is Surge irrigation :** A method of irrigation using computerized valves to turn the water supply on and off to move water more uniformly down the field.
11. **What is Transpiration :** The physiological process by which water vapor escapes from a living plant, principally through the leaves, and enters the atmosphere.
12. **What is Transmissivity :** The capacity of an aquifer to transmit water. It is dependent on the water-transmitting characteristics of the saturated formation (hydraulic conductivity) and the saturated thickness. For example, sand and gravel formations typically have greater hydraulic conductivities than sandstone
13. **What is Unsaturated zone :** That part of the soil profile in which the voids are not completely filled with water, some air is present.

Short Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. What is the difference between the lake and a canal? Give examples (December-2016)
2. Name the two different types of silt theories? List their applications in hydrology.
3. What do you mean by initial and final regime of channels?
4. What are the merits of Lacey's theory? And how they are useful?
5. Why do we need to provide side slopes for canals? Justify your answer. (December-2016)
6. What do you understand about SCS curve? Give its application.
7. What is meant by depression storage? Draw a neat figure
8. What do you know about Gumbel's method of flood frequency analysis? (December-2016)
9. What is the difference between the silt and scour?
10. Which rational formula gives the best results for flood frequency analysis?

Long Questions (minimum 10 previous JNTUH Questions – Year to be mentioned)

1. Write down the classification of canals. Explain canal alignment
2. Why Lacey's conception is superior to that of Kennedy's?
3. What do you understand by Initial and final regime of channels?
4. When do you classify the channel as having attained regime condition? (May-2016)
5. Describe briefly the observations of Lacey on the regime of river.
6. Discuss critically the statement "The bank's of an unlined channel are more Susceptible to erosion than its bed, and hence the stability of the bank s and not of its bed is the governing factor in unlined canal designs".
7. What is the necessity of drainage below the lining? Discuss the various drainage and pressure release arrangements.
8. Using Lacey's basic regime equations derive an expression for Lacey's scour depth



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9. What is meant by scour? What precautions do you take against it during the design of weirs?
10. Explain the mid-section method of computing the discharge in a stream. (May-2016)