

Model Answer of AS-2996

B.Sc. (R.T.) V Semester - 2013.

RT-307 : Water and Land Management

Section - A

Objective Type Questions:

Q.1.

- (i) 2.7%
- (ii) Bipolar
- (iii) All
- (iv) Summer Tillage
- (v) Both
- (vi) All
- (vii) All
- (viii) Water
- (ix) Drip
- (x) Clogging of Nozzles

Section - B

Q.2. Write an account on Water Wealth / Global Water:

- Earth  $\rightarrow$  70.8%
- Oceans  $\rightarrow$  97.3%
- Fresh water  $\rightarrow$  2.7%  $\rightarrow$  Glaciers, Rivers, Lakes
- Available fresh water  $\rightarrow$  1.0%
- Fresh water lakes  $\rightarrow$  0.01% (1% in Baikal Lake of USSR and 20% in five Laurentian lakes of America)
- Tyagi et al. (1989) "Only one teaspoonful of sweet water is available per five liters of total water"

Q.3. What is water erosion? Describe the factors affecting the water erosion.

- Loss of soil from land surface by water, including run-off from melted snow and ice.

- Factors:

- ① Rainfall → Soil erosion is directly a function of rainfall. Amount, intensity, duration and distribution of rainfall influence run-off and erosion.
- ② Soil → Soil properties influencing soil erodability include primary particle size, distribution, organic matter, structure, initial moisture contents, etc.
- ③ Topography → Water flows slowly over a gentle slope and faster over a steeper one. If velocity of a stream is increased, its eroding power is increased to the square of its velocity. If the slope is long, there will be large accumulation of water at the base leading to problems.
- ④ Soil surface cover → Covers include plant canopy and mulching materials on soil surface reducing erosion. The canopy intercepts raindrops and reduces its impact on soil. Covers also reduce the velocity of run-off. Plant roots bind the soil particles and addition of organic matter improves soil aggregation to resist breakdown.
- ⑤ Biotic interference: Removal of vegetal cover for cultivation, disturbance of slopes, misuse of forest area by burning, overgrazing, etc. result in accelerated erosion whose extent depends on the degree and nature of human interference.

Q.4. Write a short note on Evaporation Control:

- Evaporation is the process of conversion of water from liquid state to gaseous state, due to solar radiation and it is transfer into atmosphere.

Factors affecting rate of evaporation:

- (a) Temperature of air and evaporating surface
- (b) Wind velocity
- (c) Atmospheric pressure
- (d) Topography of evaporating surface
- (e) Surface area.

Control measures to check evaporation from water:

- (a) Locating Reservoirs at high altitude → Due to reduction in surface-water temp. at higher altitudes
- (b) Keeping the lower surface area/volume ratio of water body → Lower exposed surface, lower is the evaporation.
- (c) Constructing artificial aquifers → These are emptied before the onset of monsoon, then charged from surface reservoirs and should not be exposed to atmosphere.
- (d) Application of monomolecular film/ Reducing energy available for evaporation: Chemicals in the form of solutions or powder are spread over the body which reflect away energy resulting in reduction in evaporation rate.
- (e) Installing wind breaks → to reduce wind velocity by planting a row of trees.

Methods to reduce evaporation from soil surface →

- (a) Spreading of plant residues on soil surface
- (b) Gravels, papers, plastics, straw, etc. are spread on the field to conserve the moisture.
- (c) Use of oil and chemicals to conserve the soil moisture

Evaporation Reduction Techniques:

- Success rate of technique is 10-60%
- Average cost is Rs. 0.40 to 0.60 per tonne of water
- 15% reduction by microfilm of paraffin oil on water
- Use of chemical retardants → Hexadecanol + Octadecanol, Cetyl alcohol + Cetyl Stearyl alcohol

Q.5. Describe objectives of Watershed Management →

- To control damaging run-off.
- To manage and utilize run-off for useful purposes.
- To control erosion and effect in the sediment production.
- To moderate floods in the down stream areas
- To enhance ground water storage wherever applicable.
- Appropriate use of land resources in the watershed and thus developing forest and fodder resources.
- Minimizing silting up of tanks, reservoirs and fertile lands.
- Ensuring sustainability of the ecosystem.
- Setting up of small scale agroindustries
- Improving socio-economic status of farmers.

Q.6. Write about Watershed problems →

- (a) Flood water damage →
- (b) Sediment damage →
- (c) Erosion damage →
- (d) Problems relating to water management →
- (e) Special Problems →
- (f) Socio-economic problems →
- (g) Others →

Q.7. Write about sub-surface method of irrigation →

- irrigation to crops by applying water from beneath the soil surface either by installing pipelines underground. pipes are perforated.
- Water is discharged and allowed to stand during the whole period of irrigation for lateral and upward movement

- Underground perforated pipes in which water is forced, water is trickled out through perforations in pipes.
- Water moves laterally and upward to moist the root zone soil under irrigation
- The upper layers of soil remain relatively drying owing to constant evaporation while the lower layers remain moist
- Loss of water through evaporation is least comparative to other methods of irrigation.
- It is moderately costly method of irrigation but labour and maintenance is minimum.

### Section - C

#### Long Answer type questions:

Q. 8. Write a detail account on wind erosion →

- Erosion of soil by the action of wind is called wind erosion
- Mechanism of wind erosion → Consists of three phases:

(i) Detachment → Lifting and abrasive action of wind resulting in detachment of tiny soil particles. These dislodged particles are ready for movement.

(ii) Transportation → Particles movement by wind takes place in three stages:

(1) saltation → Bouncing movement of soil particles

(ii) Suspension → movement of fine dust particles by floating in air

(iii) Surface creep → Rolling and sliding movement of particles

(c) Deposition → Suspended particles are deposited in the suitable places.

- Factors affecting wind erosion →

- 1) Soil clodiness
- 2) surface roughness
- 3) Water stable aggregates & surface crust
- 4) wind and soil moisture

- ⑤ Vegetative cover
- ⑥ organic matter
- ⑦ Topography

### - Wind erosion control:

- Greatest damage occurs during summer in dry regions where land is bare and wind velocity at its peak.

### - Basic principles of wind erosion control:

- ① Reducing wind velocity
- ② Increasing the size of soil aggregates
- ③ Trapping the saltating soil particles
- ④ Keeping the soil moist
- ⑤ Covering the soil with a non-erodable surface

### - Practices to control to wind erosion:

- ① Stubble mulching → Traps the saltating soil particles and decreases wind velocity
- ② Minimum tillage → Conserves soil residues, soil organic matter to resist the action of wind.
- ③ Cover crops → Crop plantation when regular crops are off
- ④ Strip cropping → Control soil erosion & conserve moisture.
- ⑤ Crop rotation → Legumes and grasses improve soil aggregate to minimise erosion. Close growing crops are more effective
- ⑥ Mulching → Crop residues on soil surface to conserve soil and moisture.
- ⑦ Windbreaks and Shelterbelts →
  - Windbreak is a barrier for protection from wind
  - Shelterbelt is a longer barrier consisting of combination of shrubs and trees
  - effectiveness of these depend on their density, height and length.

Q.9. Write short notes on:

① Soil water and plant relation →

- It deals with those physical properties of soils and plants that influence the movement, retention and use of water.
- They are mutually dependent
- Plant water uptake depends on the ability of root to absorb water from soil and on the ability of soil to supply and transmit water towards the roots at a rate sufficient to meet transpiration and growth requirements

- Factors affecting relationship →

(i) Plant characters → Rooting density, depth, extension and resistance offered by the plant for escape of water from leaf surface to atmosphere.

(ii) Soil properties → Texture, depth, structure of soil influencing water retention and conductivity.

(iii) Weather conditions → Precipitation, humidity and temperature

- Availability of soil moisture is not a property of soil alone, but indeed a combined function of the plant, soil and climate

② Water stress →

- It often caused by drought which can affect all plant growth and development resulting in reduced crop yields and possibly crop failure.
- Water stress varies from species to species
- The early symptoms can be corrected to maintain the growth of a crop
- The most common symptom of plant-water stress is wilt.
- As plant undergoes to water stress, the water pressure inside the leaves decreases and the plant wilts.

- Factors affecting water uptake :

① Metric potential and effect → The amount of force needed for plant to remove water from the soil.

- During high metric potential, high energy is required to remove water from soil.

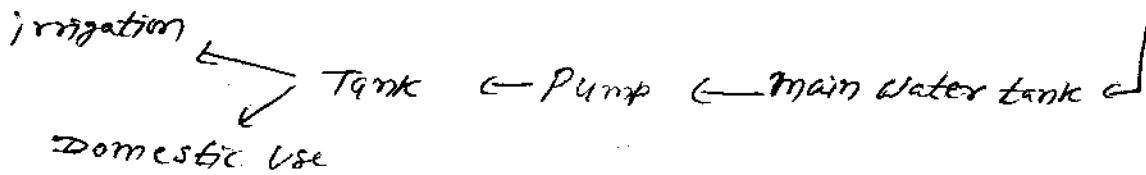
⑥ Osmotic effect: If soil solution is more saline than the plant, then more energy is required to uptake the water

⑦ Root density and distribution → 40% or more of plant water comes from the top 12 inches of soil so adequate root development, density, distribution and condition also affects the water uptake.

| <u>Crop Type</u>     | <u>Water stress limitations</u>                       | <u>Management types</u>   |
|----------------------|---|---|
| ① Determinate type   | Resistant to water stress during vegetation stages    | Avoid water stress during reproductive stage                              |
| ② Indeterminate type | No specific critical periods                          | Sugar beets are more stress tolerant than potato, Carrots and onion       |
| ③ Forager            | Perennial foragers are least affected by water stress | Concentrate irrigation effort early in season to increase the production. |

Q.10. Write a brief account on the Rain water harvesting

- First done by H.J. Geddes in Australia
- It is collection and storage of rain water for irrigation & domestic use



- Need of water harvesting:

- Method of Rain water harvesting:

① Roof top harvesting → Harvesting of rain water from a roof into storage tank by the arrangement of gutter and pipes.

- Precautions during roof harvesting →

- Steps in roof top harvesting →

- ① Collection of rain water
- ② Separation of first rain flush
- ③ Filtration
- ④ Storage
- ⑤ Distribution



- Structure of system -

② Run-off water harvesting -

- In low rain fall areas, run-off is induced by compacting the soil surface of catchment areas

④ Short term run-off harvesting - By

- Contour bunds - Graded bunds - Rock catchment - mulching  
- Vegetative covers - Bench terracing, etc.

⑤ Long term run-off harvesting - By

- Farm ponds - Irrigation dam - silt detention dam  
- Percolation tank - Injection well, etc.

③ Flood water harvesting - By

① Arreicut dams

② check dams -> Barrier constructed across river, stream or Gully.

- Classification of check dams -

① Temporary structures - eg. Brush wood dams

② Semipermanent structures -> eg. Loose rock fill dam, Netting dam, Log check dam.

③ Permanent structures -> eg. spillways, Rubble masonry, Gabions, Concrete dam, silt trap dam.

Q.11. Describe surface method of irrigation and also write advantages and disadvantages -

- Water flows by gravity through furrows or borders  
- Most ancient method (95% irrigation)

Types ->

① Wild flooding -> Primitive and least controlled method.

- Water is distributed in accordance with natural topography  
- Distribution of water is highly uneven.

② Controlled flooding -> Water is guided into sub-division.

① Basin flooding -> Small plots with low earth dikes, for one tree or few trees in an orchard.

- (ii) Check basin flooding: Water is supplied in excess of intake rate of the soil to rapidly cover the area.
- (iii) Border strip: strips with parallel ridges, each strip is irrigated separately.
- (iv) Furrow irrigation method: Water is applied in furrows while crop is grown on ridges.
  - Alternate furrow irrigation
  - Alternate ridges irrigation
- (v) Surge irrigation → Large sized furrows, water is switched alternately from one set of furrows to the other by a valve and automatic time controller.
- (vi) Cablegation → Modified furrow method, consists of gated pipe and water is controlled by a plug.
- (vii) Pitcher irrigation → Porous cup irrigation method.
  - No evaporation, no percolation and ample saving of water.

Advantages: (1) Less investment (2) Low energy requirements (3) Mechanical simplicity (4) Can avoid wind drift and canopy interception losses (5) Easy adaptation to small land holdings

Disadvantages → (1) Low application efficiency (2) Waste of water (3) Water table raise (4) Water logging taking place (5) Salinization takes place

