

* Soil and water conservation Engineering -

Q-1 Define watershed. Enlist causes of watershed deterioration. (2017-18)

→ Watershed -

It is a natural unit draining runoff water to the common point of outlet.

causes of Watershed deterioration -

- 1) Faulty agriculture, forestry and pasture.
- 2) Unscientific mining and quarrying.
- 3) Faulty road alignment and construction.
- 4) Industrialization.
- 5) Fire
- 6) Apathy of the people.

Q-2 Enlist the agronomical and Engineering measures of Soil and Water conservation. (2017-18)

→ A) Agronomical Measure -

1) Contour cultivation -

2) Strip cropping -

a) Contour strip cropping

b) Field strip cropping

c) Buffer strip cropping

d) Wind strip cropping

3) Tillage practices -

a) Mulch Tillage

b) Vertical Tillage

c) Minimum Tillage

d) Conventional Tillage

e) Listening

- 4) Soil Management practices -
- 5) Supporting practices - (Interplanting, fertilizer, application)
- 6) Vetiver grass planting -

8) Engineering Measures (practices) -

1) Terracing -

a) Diversion terrace -

- i) Magnum type
- ii) Nichols type
- iii) Broad based type
- iv) Narrow based type

b) Retention terrace -

c) Bench terrace -

2) Bunding -

a) contour bunding -

i) Narrow based

ii) Broad based

b) Graded bunding -

i) Narrow based

ii) Broad based

c) Side bunds -

d) Lateral bunds -

e) Supplemental bunds -

f) Marginal bunds -

g) Shoulder bunds -

C2017-18

Q-3 Define Surveying and state its objectives.

→ Surveying-

It is the art of making such measurement to determine the relative positions of points on the surface of earth, in a horizontal plane.

Objectives of surveying -

- 1) preparation of plan or map
- 2) To draw the results of survey on paper
- 3) To know the relative positions of point on ground.
- 4) To collect different information.
- 5) To collect data for analysis.

C2017-18, 2015-17,

Q-4 Define runoff. Enlist various climatic factors affecting runoff and physiographic factors affecting runoffs.

→ Runoff-

Runoff may be defined as that portion of rainfall as well as any other flow, which makes its way towards the river, stream or oceans etc.

Climatic factors affecting runoff -

- 1) Type of precipitation
- 2) Rainfall intensity
- 3) Forms of precipitation
- 4) Duration of rainfall
- 5) Rainfall distribution
- 6) Direction of prevailing wind and
- 7) other climatic factors.

* Physiographic factors affecting runoff -

- 1) Size of Watershed
- 2) Shape of Watershed
- 3) Slope of Watershed
- 4) Orientation of Watershed
- 5) Land use
- 6) Soil Moisture
- 7) Soil type
- 8) Topographic characteristics and
- 9) Drainage Density.

Q - 5 Define runoff. Explain types of runoff.

→ Runoff -

Runoff may be defined as that portion of rainfall as well as any other flow, which makes its way towards the river, stream or oceans etc.

Types of Runoff -

- 1) Surface runoff,
- 2) Sub-surface runoff, and
- 3) Base flow.

1) Surface Runoff -

- i) It is that portion of rainfall, which enters the stream immediately after the rainfall.
- ii) It occurs, when all losses are satisfied and if rain is still continued, with the rate greater than infiltration rate, at this stage the excess water makes a head over the ground surface.
- iii) (Surface detention), which leads to move from

one place to another, known as overland flow.

iii) As soon as the overland flow joins to the streams, channels or oceans, teams as surface runoff.

2) Sub-surface Runoff-

i) That part of rainfall, which first leaches into the soil and moves laterally without joining the water-table to the streams, rivers or oceans, is known as sub-surface runoff.

ii) Sometimes sub-surface runoff is also treated under surface runoff due to reason, that it takes very little time to reach the river or channel in comparison to ground water.

iii) The sub-surface runoff is usually referred as interflow.

3) Base flow-

i) It is delayed flow, defined as that part of rainfall, which after falling on the ground surface, infiltrated into the soil and meets to water-table and flow to the streams, oceans etc.

ii) The movement of water in this type of runoff, is very slow, that is why it is also referred as delayed runoff.

iii) It takes a long time to join the rivers or oceans

iv) Some times base flow is also known as ground water flow.

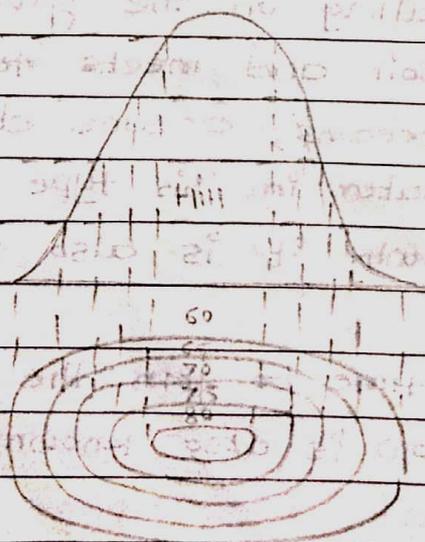
Q - 6 Define contour line. Explain characteristics of contour line 2017-18

→ Contour line -

The line joining the points on the contour map is called contour line or a contour.

Characteristics of contour lines -

- 1) All points on a contour have the same elevation
- 2) Contour lines close to each other represent very steep ground.
- 3) Contour lines are widely separated represent flat ground.
- 4) A uniform slope is indicated when the contour lines are uniformly spaced and a plane surface when they are straight, parallel and equally spaced.
- 5) A series of closed contour lines on the map represent a hill if the higher values are inside



- 6) A series of closed contours on the map indicate depression if the higher values are outside.

80
 75
 70
 65
 60

DEPRESSION



7 Define Soil erosion. Enlist different types of erosion and explain them in detail.

→ Soil Erosion-

It is the detachment and transportation of soil material from one place to another through the action of wind, water in motion.

Types of Erosion-

- 1) Geological erosion
- 2) Accelerated erosion.

Explanation-

1) Geological erosion-

- i) It sometimes referred to as natural or normal erosion, represents erosion under the cover of vegetation.
- ii) It takes place as result of the action of water, wind, gravity and glaciers.
- iii) Geological erosion is due to geologic processes on land in natural environment.
- iv) Geological erosion may be considered as a part of the natural soil forming processes.
- v) It results formation and distribution of soils over the surface of the earth.

2) Accelerated erosion-

i) The removal of surface soil takes place at a much faster rate than it can be built up by the soil forming processes.

ii) This erosion is due to artificial causes or acts of man.

iii) Erosion on cultivated land is of accelerated type.

iv) The term Soil erosion or simply erosion means accelerated erosion.

Q-8) Define strip cropping and Explain types of strip cropping.

→ Strip cropping.

It is the practice of growing alternate strips of close growing and intertilled crops in the same field.

Types of Strip cropping -

- a) Contour strip cropping -
- b) Field strip cropping -
- c) Wind strip cropping -
- d) Buffer strip cropping -

Explanation -

a) Contour strip cropping -

- ① The crops are arranged in strips or bands on the contours at right angles to the natural slope of land.
- ② Usually the strips are cropped in definite rotational sequence.

b) Field strip cropping -

- ① It consists of strips of uniform width running perpendicular to the direction of erosive force.
- ② For the control of erosion by water the strips run across the slope.
- ③ This practice is recommended only in areas where topography is too irregular or undulating.

c) Wind strip cropping -

- ① It is a field strip cropping for wind erosion control consist of parallel strips of crops placed cross-wise to the direction of prevailing wind.

d) Buffer Strip cropping.

- ① It consists of strips of some grass or legume crop laid out between contour strips of crops in regular rotation.
- ② They may also be used as correction strips where slope is irregular.
- ③ The buffer strips may be wide or narrow.
- ④ They may be placed only on the steep slope.

3-9

Explain the characteristics of watershed which affecting the function of watershed.

→ The various characteristics which affects the function of watershed are as follows.

① Size of watershed -

- i) The size of watershed has significant effect on its function.
- ii) In small watershed overland flow is main contributor.
- iii) While in large watershed channel flow is main.

② Shape of watershed -

- a) Square b) Rectangular c) Triangular etc.

Watershed shape can be described by shape index

$$S = \frac{L}{W}$$

Length of watershed, km
average width of watershed km.

③ Topography -

- a) Slope of watershed
- b) Drainage and
- c) Vegetation.

④ Time of concentration - Defn.

- i) The time taken by water

to travel from the most distant point of the watershed to the outlet.

⑤ Geology rock and soil-

- i) Geological formation and rock types affects the deposition of water erosion.
- ii) This factor determines sediment production.

⑥ Climate-

- i) Rain provides incoming precipitation along with its intensity, frequency and amount.
- ii) parameters like rainfall, temperature, humidity, wind velocity also affects the functioning.

⑦ Land use-

- i) Type of land use, its extent and management affects the watershed behavior.
- ii) land use is essentially under the control of land users.

9-10 What is watershed Management? write it's objectives.

→ Watershed Management.

The Watershed management implies, the judicious use of all the resources, i.e. land vegetation's and water of the watershed to achieve maximum production with minimum hazard to the natural resources and for the well being of people.

objectives of watershed management-

- 1) To control damaging runoff and degradation and conservation of soil and water.
- 2) To manage and utilize the runoff for useful

purposes.

- 3) To protect, conserve and improve the land of watershed for more efficient and sustained production.
- 4) To protect and enhance the water resources originating in the watershed.
- 5) To check the soil erosion and reduce the effect of sediment yield on the watershed.
- 6) To rehabilitate the deteriorating lands.
- 7) To moderate the flood peaks at down stream areas.
- 8) To establish watershed management practices and measures.
- 9) To enhance the ground water recharge resources.
- 10) To improve and increase the production of timber and wild life resources.
- 11) To expand electricity programme.
- 12) To intensify agricultural extension activities.

Q-11) Enlist different steps in watershed management.

→ Steps of watershed management-

- a) {
 - 1) Recognition of problem
 - 2) Analysis to determine the causes of watershed problem.
 - 3) Development of alternative solutions for the objectives formulated to solve the problem.
- b) {
 - 4) Selection of best solution
 - 5) Application of selected solution.
- c) 6) Protection and improvement works, which have
- d) already been implemented.

The above steps can further be grouped in the following four phases.

- a) Recognition phase
- b) Restoration phase
- c) protection phase
- d) Improvement phase.

Q-12 Explain land use capability classification based on Slope.

→ Land use capability classes.

A) Land suited for agriculture-

Class-I -

- 1) Slope 0-1% , good land which can be cultivated by following farming practices.
- 2) Level land which does not easily erode by water or wind.
- 3) Soil moderately deep to deep.
- 4) It has good water holding capacity , well drained and can be cropped intensively with proper crop rotation.

Class-II -

- 1) Slope 1-3% , good soil , susceptible to slight erosion , moderate depth (22.5-45m) , moderate wetness and slow drainage.
- 2) water holding capacity fair , requires contour bunding , terracing , contour cultivation , strip cropping and crop rotation to make it productive.

Class-III -

- 1) Slope 3-5% , moderately good for cultivation with some limitations.
- 2) High susceptibility to erosion.
- 3) Shallow depth (7.5 - 22.5 m) , low water holding capacity , slow-very slow permeability , susceptible to water logging.
- 4) Requires intensive soil conservation measures.

Class-IV -

- 1) Slope 5-10% , serious limitation of cropping.

2) Need careful and efficient management.

3) Cultivated only periodically.

4) Severe susceptibility to erosion.

5) Steeps, slopes, shallow soils with low water holding capacity.

6) Water logging and salt accumulation are limitations.

B) Land suited for permanent vegetation.

Class - V -

1) Slope upto 3%, cultivation not feasible due to stoniness, wetness, soils moderately deep with gentle slope.

2) Not susceptible to water or wind erosion, suitable for pasture and forestry, susceptible to slight water erosion.

Class - VI -

1) Slope 12-18%.

2) These soils are subject to moderate permanent limitations, having shallow depth and steep slopes.

3) can be used for grazing and forestry.

Class - VII -

1) Slope 18-25%.

2) The soils are steep, rough, eroded, shallow, draughty or swampy.

3) Limitations for grazing or forestry.

4) Controlled grazing.

5) If rainfall is sufficient used for forestry.

Class - VIII -

1) Slope greater than 25%.

2) These lands are unfit even for grazing or

forestry.

3) They can be used for natural vegetative cover, wild life.

4) These lands includes marshes, deserts, deep gullies, high mountains and stony barren areas.

Q-13 Define Surveying? Differentiate between the geodetic and plane surveying.

→ Surveying - It is the part of determining relative position of different object on the surface of the earth by measuring the horizontal distance between them and by preparing a map to any suitable scale.

plan surveying

Geodetic surveying.

1) Curvature of the earth is not taken into consideration.

1) In this curvature of earth considered.

2) This survey is done on smaller area less than 250 km^2

2) This survey is done on large area greater than 250 km^2

3) Required accuracy is comparatively low.

3) High accuracy is required.

4) Simple method and instrument can be used as the required accuracy is low

4) Very defined defined method and instrument are used

14. Give details classification of Surveying.

→ classification of surveying -

A) classification based upon the nature of field Survey as:

- 1) Astronomical surveys
- 2) Marine or Navigation surveys
- 3) Land surveys -
 - a) Topographical survey
 - b) cadastral survey
 - c) city survey
 - d) Engineering survey -
 - i) Reconnaissance Survey
 - ii) preliminary survey
 - iii) Location Survey

B) classification based upon the object of survey -

- 1) Archaeological Survey
- 2) Mine Survey
- 3) Military survey
- 4) Geological Survey

C) classification based upon the instrument used -

- 1) Compass Survey
- 2) plane table survey
- 3) chain Survey
- 4) photographic survey
- 5) Aerial survey
- 6) cross - staff survey
- 7) Theodolite survey
- 8) Tacheometric survey

D) classification - based upon the methods employed in survey -

- 1) Triangulation Survey
- 2) Traverse Survey -
 - a) Open Traverse Survey
 - b) Closed Traverse Survey

Q-15 Enlist different types of temporary and permanent gully control structures.

→ Gully control structures -

- A) Temporary check dams -
 - 1) Open wire dams
 - 2) Brush dams
 - 3) Loose rock dams
 - 4) plank or slab dams.
 - 5) Long and pole dams

B) permanent gully control structures -

- 1) permanent check dam
- 2) drop spillways
- 3) chute spillways
- 4) drop inlet spillways.

Q-16 What are Gully development and write down stages of gully development.

→ Gully development -

Gullies are developed by following processes -

- 1) Scouring of soil particles from the bottom and sides, by flowing water.
- 2) Water fall erosion at the gully head resulted the cutting of the gully bank.
- 3) Sliding or mass movement of the soil from the gully banks.

Stages of gully development -

Stage - I - Channel erosion and deepening of the gully bed take place. There is the initiation stage and slow.

Stage - II - Development stage in which due to run-off water width and depth is increased.

Stage - III - This is the healing stage in which vegetations are started to grow in the channel.

Stage - IV - In this stage the gully has been fully stabilized. No further change to develop the gully. The channel attain a stable gradient and gully walls gain a stable slope.

17 How can the evaluation of watershed management be done?

Evaluation -

The process to see the assesment of input of watershed development programme.

Main objective of watershed development projects.

- 1) control soil erosion
- 2) Reduce siltation of dams
- 3) Flood control
- 4) control runoff and harvest it for use
- 5) Increase inductivity per unit area.