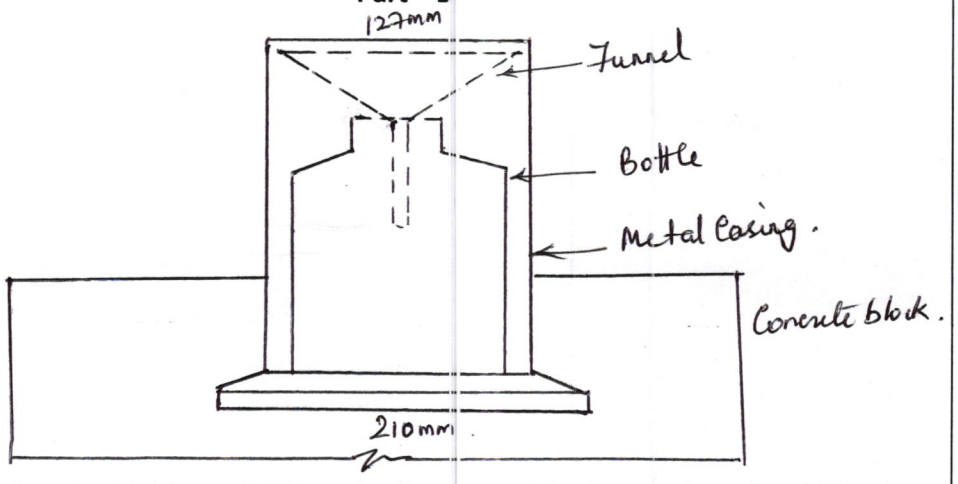
Scoring Indicators

I/A

Code :4012 **Version:2015**

Qn. No.	Scoring Indicators	Split score	Total score
I.	**Part – A** **1. When the top fertile soil layer is transported by natural forces like water and wind from one place to another, the phenomenon is called soil erosion.** **2. Works constructed at the head of a canal taking off from a river for the supply of water for irrigation purposes are known as head works.** **3. Food crops: - rice, maize, millet, pulses commercial crops: - ground nut, sesame, cotton.** **4. The total water supply of the earth except deep ground water is in circulation from the earth to the atmosphere and back to earth. This circular system of the earth's water is called Hydrologic Circle.** **5. Barrage: - if storage of water is done by gates and a smaller portion or no portion of water is stored by the raised crest, then the barrier is known as a barrage.**	5×2=10	
II.	**Part – B** **1.**  **It consists of a cylindrical vessel 127mm in diameter with a base enlarged to 210mm diameter. A bottle is placed in it with a funnel of internal diameter 127mm with a circular brass rim at its top. The capacity of the bottle is about 75mm to 100mm of rainfall. In case of heavy rainfall, it should be measured 3 or 4 times in a day. At the site where the rainfall is to be measured, the site should be free from obstructions such as trees , houses , walls etc.**	Fig-3 Exp:-3	6
	2.<u>Head regulator</u>:- it is a structure constructed at the head of the canal where it takes off from the river behind the weir or dam. A head regulator consists of a number of spans separated by piers and operated by gates. It regulates the supply of water into the canal. The head regulator is constructed with stone masonry. **The main functions are:-** **It controls the entry of silt into the canal.** **It regulates the water entering the canal.** **It can be used for measuring the discharge allowed into the canal.**	Exp: 3 Funct: 3	6
	3. <u>Selection of site for head works.</u> **Head works should not be located in a rocky or mountainous region because the river in this stage has steep bed slope and high velocity. Hence,** **More cross drainage works are required.** **A shingle excluding regulator is necessary which is very expensive.** **Suitable site for diversion works.** **The site should be so selected such that-**		

The number of cross drainage works should be less.
Losses due to percolation should be less.
Construction materials should be locally available.
The width of the river should be narrow inorder to reduce the cost of head works.
The demand of water should be large.
The site of head work should be safe for the disposal of water.
Transport facility and labour should be cheaply available

phs 6×1 — 6

4.The stage or gauge is the elevation of water surface of the stream measured relative to a datum. The river water levels are generally measured with reference to a fixed bench mark which is always connected to GTS bench mark. Stage or gauge is an important river flow parameter.
Gauge posts are installed at a convenient place , where water reading can be taken with accuracy. If depth of flow is more, a number of gauges in the same section will be necessary. Care should be taken to see that the last graduation of the first gauge and the starting graduation of the second gauge should be at the same level so that the readings can be consecutive. The posts should have good foundation to resists scouring action. The gauge is usually made of enamelled plate graduated in m and mm. The zero of the gauge is generally connected to an established bench mark.

Def: 3
Exp: 3 — 6

5.<u>Rotation of crops</u>
If the same crop is grown for a number of years on the same field, the soil becomes weak and less fertile and the yield of the crop gets reduced. Change of crops from year to year helps to restore the fertility of the soil.

Def: 3
Advr: 3 — 6

<u>Advantages of rotation:-</u>
-it checks multiplication of insects, pests and crop deseases.
-if a crop like gram is introduced in rotation nitrogen content of the soil is increased.

Pattern of rotation suggested by scientists are
Wheat- great millet- gram
Rice- gram
Cotton- wheat- gram
Cotton- wheat-sugarcane
Cotton- great millet-gram

6. <u>Classification of canals</u>
<u>Based on nature of source of supply</u>
Permanent canals:- when water flows through the canals throughout the year they are known as permanent canals or perennial canals. The source of these canals are perennial rivers. These canals are closed only for repair works.
Innundation canals:- the canals which run only for particular periods during which water level remins above the specified level are known as innundation canals or barsati canals. Water is drawn by providing open cuts in thee river bank. The flow in these canals can only be available when the water level in the river is above the bed level of the cut provided in the bank.
<u>Based upon the purpose of the canal</u>
Irrigation canals
Water supply channels
Navigation canals
Carrier canals
Power generation canals
Feeder canals
<u>Based on financial output</u>
Protective canal:- the main aim is to protect the areas prone of famine. Proper regulation works are constructed in these canals. During famine conditions these

Any two
3×2 — 6

canals carry water to the affected areas.
Productive canal:- these are normal irrigation canals. These are revenue earning canals.
Based upon the relative position in the network
Main canal:- this is the canal which is directly taken off from a river or reservoir. Usually large in size, no direct irrigation is done. It functions as a carrier or feed canal to branch or other canals.
Branch canal:- for supplying water to a larger area, the main canal is bifurcated into two or more canals known as branch canals.
Distributary:- these draw water from the branch canals. They carry small discharges of 0.5 to 7.0 cumecs.
Minor:- they draw water from the distributaries. They carry discharges from 0.25 to 0.50 cumecs. Outlets are provided in minors at various points for irrigation purposes.
Water course:- these are small channels which draw water from the minors through their and carry it direct to the fields for irrigation purposes.

7. Over topping- if the water level in the reservoir rises to such a height that it flows over the top of the earth dam failure due to erosion takes place. Sometimes if spillway capacity is insufficient or if the free board is insufficient or if the foundation settles it may lead to over topping.
Wave erosion:- if the upstream slope is not protected properly, waves, rain and wind may scoop out the earth and cause erosion on the upstream side. The slope becomes steep due to erosion and slipping of the upper layers occur.
Toe erosion:- occur due to -erosion due to tail water.
-erosion due to cross currents. If the spillway or surplus weir is too close to the earth dam the discharging water may erode toe of the dam.
Gullying:- due to heavy rainfall , gullies may be formed on the downstream slope which is normally unprotected.
Piping:- water percolates either through the bund or under its foundation. When the velocity of the seeping water is more, erosion takes place. Conduits may be formed inside the bunds. Soil erosion takes place through these cavities. This leads to the internal wash out of the dam and the bund sinks.
Leaks in the embankment may also lead to piping failure.
Poor compaction and poor quality of bonding between embankment and the foundation may also lead to piping failures.

Sloughing:- this is also closely related to piping. Under full reservoir condition the downstream toe remains saturated and slowly lead to erosion producing small slide or slump. This when saturated by seepage slumps again. This process continues till the remaining portion of the dam cannot withstand the water pressure. Complete failure occurs suddenly as the reservoir breaks through.

Any two
3x2

6.

Part –C
Unit - I

III. (a)

Flow irrigation:- an irrigation in which the water is conveyed to the land by gravity flow.

Perrennial irrigation:- water is supplied according to the crop requirements through out the crop period. For such systems constructions like dams or barrages are required to store the excess water during floods and to release it to the crops as and when required.

Inundation irrigation:- it is done by deep flooding and thorough saturation of the land to be cultivated which is then drained off prior to the planting of the crop.

Direct irrigation/ river, canal irrigation:-here water is directly diverted to the canal without storing. A low diversion barrage is constructed cross the river which raises the

Any 4
4x2

8

water level in the river.

Storage irrigation:- in this system a solid barrier such as a dam is constructed across the river and water is stored. This scheme is comparatively of a bigger magnitude and involves much more expenditure. A network of canal systems convey water to the agricultiral fields.

Combined system (storage cum diversion scheme):- here a combined scheme is adopted in which the water is first stored in the reservoir formed at the upstream side of the dam, and this water is used for water power generation. The discharge from the power house is fed back into the river, to the downstream side of the dam. Thus sufficient quantity of flow is again available in the river. At a suitable location in the downstream, a weir is constructed , which diverts water from the river to the canal.

(b)

Various methods to improve duty

Suitable method should be adopted for applying water.

The land should be properly ploughed and levelled before sowing the crop.

The land should be cultivated frequently , since it reduces the loss of moisture.

The canals should be lined.

Parallel canals should be constructed.

The idle length of the canal should be reduced.

Canal should not be aligned in sandy soil or fissured rock.

Good quality of water should be supplied.

Rotation of crops should be practised .

The canals should be so aligned that the areas to be cultivated are concentrated along it.

Any 7 pts

7.

IV. (a)

Duty:- represents the irrigating capacity of a unit of water. It is the relation between the area of a crop irrigated and the quantity of irrigation water required during the entire period of the growth of that crop.

Delta:- is the total depth of water required by a crop during the entire period the crop is in the field and is denoted by the symbol Δ.

Base period:- for a crop refers to the whole period of cultivation from the time when irrigation water is first issued for preparation of the ground for planting the crop, to its last watering before harvesting.

Crop period:- is the time in days that a crop takes from the instant of its sowing to that of its harvest.

4×2

8

(b)

Relation between Duty and Delta

D - duty in hectares/ cumec

Δ - total depth of water in 'm'

B - base period in days

If we take a field area D heatares, water supplied to the field corresponding to the water depth Δm will be

Δ X D hectare- metres

= D X Δ X 10^4Cu m .....(1)

For the same field of D hectares, one cumec of water is required to flow during the entire base period.

Hence water supplied to this field = 1 X (B X 24 X 60 X 60) m^3.....(2)

Equating (1) and (2)

D X Δ X 10^4 = B X 24 X 60 X 60

$$\Delta = \frac{B \times 24 \times 60 \times 60}{D \times 10^4}$$

Ie, Δ = 8.64 B/D metres

7. 7.

Unit -II

V. (a) Weir or anicut or barrage across the river:- a weir is a masonry structure constructed across a river to raise the water level so that water from the river can be diverted into the canal. Generally a weir is aligned at right angles to the direction of the flow of water in the river.

Simple weir:- a barrier is required to be constructed across the river to raise the level of water on the u/s side. If the major part of the entire amount of water is stored by a raised crest and a negligible part of water is stored by shutters then the barrier constructed across the river is called a simple weir.

4×2 8

Barrage:- if storage of water is done by gates and a smaller portion or no portion of

water is stored by the raised crest , then the barrier is known as a barrage.

(b) Divide wall or divide groyne:- it is a long solid masonry wall built between the scouring sluices and the weir at right angles to the axis of the weir. It divides the river channel into two compartments. In the smaller compartment which is near to the head regulator a still pond is created. It extends beyond the upstream vent of the head regulator and upto rough stone apron on the downstream side.

The divide wall retains water on both the faces . The river flow is on one side and the still water is on the other side.

The main functions are:-

Exp : 3
Facts : 4 — 7.

It protects the main weir wall from scouring.

It forms a still pond in front of the head sluice and prevent the silt from entering the canal.

It provides a straight approach to scouring sluices.

It divides the floor of the main weir and scouring sluices which are at different levels.

It serves as one of the side walls of the fish ladder.

Head regulator:- it is a structure constructed at the head of the canal where it takes off from the river behind the weir or dam. A head regulator consists of a number of spans separated by piers and operated by gates. It regulates the supply of water into the canal. The head regulator is constructed with stone masonry.

The main functions are:-

It controls the entry of silt into the canal.

It regulates the water entering the canal.

It can be used for measuring the discharge allowed into the canal.

VI. (a) Classification of head works.:- can be divided into two types

Diversion works :- diversion works are constructed to divert water into the canal from the river.

It regulates the intake of water into the canal.

It increases the water level so that the command area can be increased.

Entry of silt into the canal is controlled. — 4×2 — 8

Water can be stored for tiding over small periods of short supply.

It reduces fluctuations in the level of supply in the river.

Storage works:- storage works are constructed across streams and rivers to store water. Reservoirs and tanks come under this category. These are constructed where

storage in the form of a reservoir is possible. Generally the canals start from high levels and flow for some distance without irrigation. After entering into the plains the water is allowed to flow to the fields by gravity for irrigation purpose.

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It can be used for measuring the discharge allowed into the canal.

Unit -III

VII. (a) Conditions suitable for earth dams:-

Foundations which have low bearing capacity.

The foundation is permeable and earthy. Dny 4

Suitable soil for earth dam is available in the nearby area. Materials like stone, silt, clay and sand are available in plenty. 4×2 | 8

The impounding water depth is not much.

The spillway need not be provided in the section.

(b) Structural failures:-

Failure of upstream slope due to sudden draw down :- when the reservoir is suddenly emptied which is called sudden draw down, it causes the upstream slope to slip if it is cohesive soil.

Failure of downstream slope:- when the downstream slope is steep and the soil is not compacted well , the seepage water through the bund causes the downstream slope to slip and slowly failure occurs.

Foundation slide:- when the foundation of the earth dam consists of fine silt , soft soil the foundation is likely to slide due to water pressure.

Failure due to spreading:- this occurs when stratified deposits contain layers of silt and soft clay.

Any 5 pts - 3 pres - 4

7.

Slope protection failure:- slopes are generally protected by rough stone revetment over a layer of gravel. When the reservoir is full during heavy storm , the waves beat repeatedly against the slope. Due to this the stones are washed away exposing the embankment to wave erosion.

Failure due to damage caused by burrowing animals:- animals like rats burrow into the embankment to dig passage from one point to another to make homes. This will make the bund weak.

Failure due to earthquakes:- due to earthquakes , the dam foundation settles due to compression, thereby reducing the free board and increasing the chances of overtopping.

Precautions to be taken

Both upstream and downstream slopes should be made very flat to avoid stress on foundation.

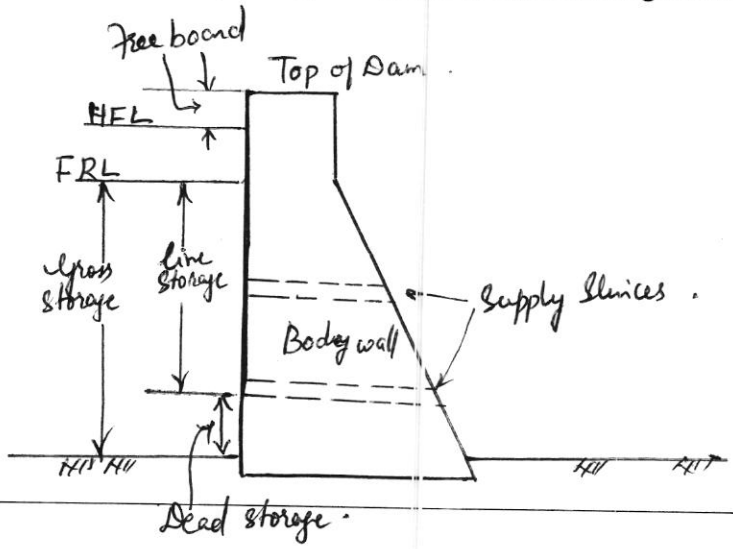
Providing key trenches to bond the dam section to the ground.

Providing cut of trench for sufficient depth.

Good materials should be used for dam construction.

Compaction should be done by rolling the surface at different stages with heavy rollers.

VIII. (a)



figs 5 parts 3

8.

with revetment 0.3m thick.

(b)

Tank sluice with tower head:-

It has the following component parts

1.Lead chamber:- it is placed on the upstream side and it is a stone masonry chamber. This chamber leads the water from the tank into the barrel of the sluice.

2. Tower head with regulating arrangements:- It is placed on the upstream side of the earthen bund. A circular well of masonry with internal diameter 1.25m is built. A wooden shutter is placed in the circular chamber to regulate the flow of water into the barrel.

3. Barrel of the sluice:- the main function is to convey water from upstream side of the tank to the field channel through the cistern. The size of the barrel depends upon the quantity of discharge it has to convey.

4. Cistern:- this is a square chamber built in masonry at the downstream side. The water from the barrel enters the cistern and is released to the different field channels through the vents provided at different levels.

7.

Unit – IV

IX. (a) Natural causes:-

1. Water erosion:- this is due to beating of rain water flowing with high velocity on the land.

Two types:-

Sheet erosion:- here a thin sheet of soil is washed away, which is undetected for a long time.

Gully erosion:- when sheet erosion is allowed for a long time, it leads to gully erosion. As water flows fast, gullies are formed.

Causes - 4
Preventive measures - 4

8.

2. Wind erosion:- occurs due to high velocity of wind. Coarse sand particles are lifted and carried away to other places and deposited.

Artificial causes:-

- Faulty method of cultivation like improper rotation of crops.
- Deforestation and over grazing.

Preventive measures:-

- Contour bunding, contour tilling, contour sowing
- By growing trees which obstruct wind velocity.

(b) Drainage of earth dams

The methods adopted are:-

Internal drainage system:- horizontal filters and vertical filters are provided at the base from the end of the hearting zone to the downstream end. The seepage water is collected from vertical filters which in turn are collected from the body of the dam and caries the seepage water to the toe drain.

rock toe and toe drain: rock toe keeps the phreatic line within the section and also facilitates drainage. The toe drain and rock toe are to be provided at the downstream end (toe) of the earth dam to collect the seepage flow from the horizontal filters. The seepage flow is drained out by a network of cross and longitudinal drains provided on the downstream side in the body of the dam.

- Surface drainage:- it is required to protect the downstream face of the earth dam from erosion by rain water. Open drains are laid along the sloping face to drain rain water. These drains are generally formed with dry stone pitching or concrete blocks. Sometimes perforated pipes are laid horizontally. Along the length of the dam one main pipe is laid and at right angles to this , small drains are laid. The collected seepage water is taken to an outfall.

Types -4
Exp-3

7.

Tank sluices:- a sluice is an arrangement to convey water from the tank to a distribution channel by means of a masonry barrel or RCC pipe running under the tank bund.

Two types:-

Tank sluice with head wall

Tank sluice with tower head.

Tank sluice with head wall:- the head wall type tank sluice is generally adopted by minor irrigation department. It discharges water with a head of 5.5m above tank sluice sill.

This type of tank sluice consists of the following parts-

Head wall (abutment) on the upstream side with arrangement for regulating water:- constructed with rubble masonry in CM 1:6. Suitable wing walls are provided at the head and tail end of the sluice.

Culvert or barrel of the sluice:- the size of the culvert should not be less than 0.7m wide and 0.75m high. It should be such that a person should be able to enter it for carrying repairs and cleaning operations.

Stilling basin:- provided to reduce the velocity of water flowing through the barrel. In the middle of the stilling basin, a precast RCC block of 0.40m thick is provided to reduce the velocity of water to a safe level.

Approach embankment for operating the regulating arrangement:- an approach embankment with 1:1 side slopes is provided for access to the head wall. It is provided

IX (a) - Crops should be selected such that they cover the soil and prevent beating of rain.

- Rotation of crops and mixed crops prevent soil erosion.
- Providing outlets to reduce the velocity of water.
- Afforestation of catchment area.

4x2 — 8

(b) Canal lining:- can be defined as providing an impervious layer either of concrete or asphalt to the bed and sides of the canal to control the seepage losses.

Advantages:-

- Water can be allowed to flow at higher velocities.
- Maintenance cost of the canal is reduced.
- The erosion of bed and sides is reduced.
- It checks growth of weeds in the canals.
- It helps to prevent canal breaches.

Def: 3
Exp: 4 — 7.

X. (a) Berm:- is the horizontal distance left at ground level between top edge of the cutting and inner toe of the embankment. A berm is one which remains at FSL or slightly above it.

Regime channel:- a channel is said to be regime when there is neither silting nor scouring happens.

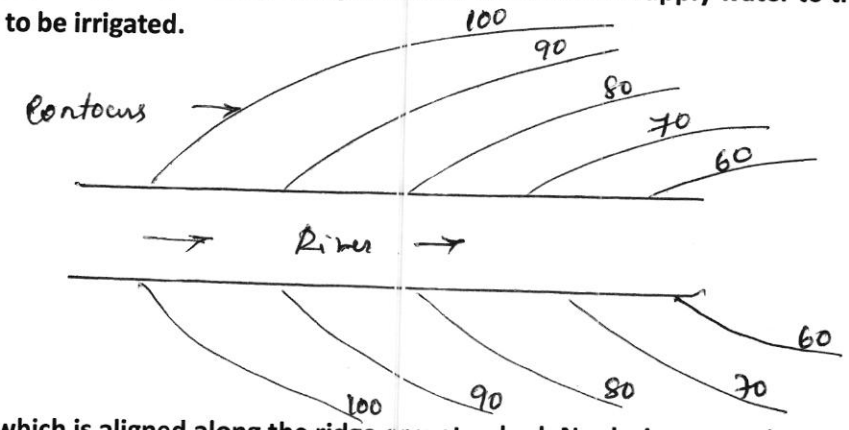
Land reclamation:- is defined as a process of converting barren, unproductive, waste land which are unfit for cultivation into productive and crop growing land.

Aqueduct:- when the canal bed level is higher than the bed level of the river, the cross drainage work constructed is known as an aqueduct.

Def: 4
Exp: 4 — 8

(b) A canal is aligned according to the topography of the land. It is to be aligned in such a way that it covers the entire proposed area to be irrigated with shortest possible length and with minimum cost.

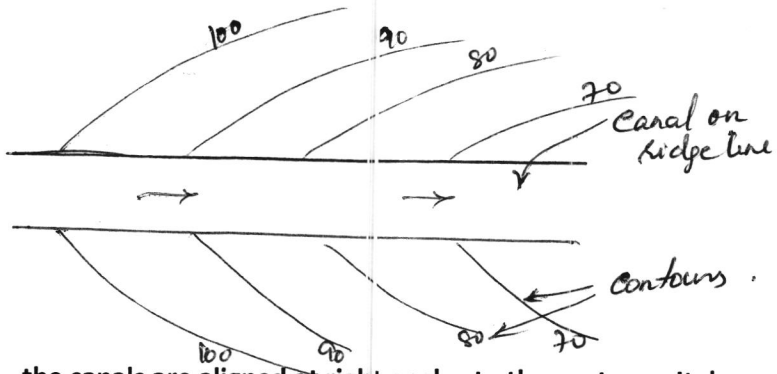
Contour canal :- is aligned generally along a contour sufficient to supply water to the adjacent land to be irrigated.



Def: 3
fig: 4 — 7

Ridge canal:- which is aligned along the ridge or watershed. No drainage can intersect

a ridge canal.



Side slope canal:- the canals are aligned at right angles to the contours. It does not run