

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE – APRIL -2020.

IRRIGATION ENGINEERING

(Maximum Marks :75)

[Time : 2.15 hours]

PART–A

Marks

I. Answer **any three** questions in one or two sentences. Each question carries 2 marks.

1. What are the two main crop seasons followed in India.
2. What is meant by scouring sluice.
3. Define saturation gradient.
4. What is meant by drainage gallery.
5. Define the term balancing depth of cutting.

(3x2=6)

PART - B

II Answer **any four** of the following questions . Each question carries 6 marks.

1. State the different methods of expressing duty.
2. What are the different methods of Irrigation.
3. What are the component parts of a diversion work.
4. Write down the classification of head works and the suitability of each headwork.
5. Explain the situation suitable for Earth dams.
6. How the canals are classified based on carrying capacity.
7. What is a berm. What are the advantages of providing berms.

[4x6 =24]

PART - C

(Answer **any of the three units** from the following. Each full question carries 15 marks)

UNIT I

- III** (a) What are the characteristics of Good, bad and Average catchment. (6)
- (b) What is run-off. What are the factors affecting run-off of water. (9)

OR

- IV** (a) A tank has a capacity of 50 million cubic meters. If the duty is 115 hectares/million cu.m. How many hectares of land can be irrigated under the tank with two fillings. (6)
- (b) Explain the method of measurement of velocity by velocity roads. (9)

UNIT- II

- V** (a) List the factors to be considered for selection of site for diversion works. (6)
- (b) Describe with sketch the component parts of a weir. (9)

OR

- VI** (a) What is meant by marginal Embankment. What are the advantages of providing embankments. (6)
- (b) What is meant by Spurs or Groynes. How are they classified. (9)

UNIT- III

- VII** (a) List the forces acting on a gravity dam. (6)
- (b) Sketch the practical profile of a gravity dam and mark the important parts. (9)

OR

- VIII** (a) What is meant by a spillway. What are the component parts of a spillway. (6)
- (b) Explain how the drainage arrangements are provided in an earth dam. (9)

UNIT – IV

- IX** (a) Sketch the typical cross section of a canal in cutting, partial cutting and embankment. (6)
- (b) What is meant by lining of canals. What are the temporary and permanent linings provided in canals. (9)

OR

- X** (a) Draw the cross section of a canal drop and mark the important parts. (6)
- (b) What is soil erosion. What are the methods of prevention of soil erosion. (9)

MALABAR POLYTECHNIC CAMPUS CHERPULASSERY**DEPT. OF CIVIL ENGINEERING**

Course Name: Irrigation Engineering		Course Code: 4012
Class : S4		Department: CIVIL
QUES. NO	Test No: 1	Month & Year: APRIL 2020
	ANSWER	MARKS
I.1	The two main cropping seasons are Rabi and Kharif: i Rabi crops are sown in winter from October to December and harvested in summer from April to June. ii Kharif crops are sown with the onset of monsoon in different parts of the country and harvested in September-October	2
2.	The under sluices are the openings provided at the base of the weir or barrage These openings are provided with adjustable gates. Normally, the gates are kept closed. When the silt deposition becomes appreciable the gates are opened and the deposited silt is loosened with an agitator mounting on a boat	2
3.	It is also called saturation line or Hydraulic gradient line. It is defined as the line within a dam section below which there are positive hydrostatic pressures in the dam. ... Above the saturation line there will be a zone of saturation in which the hydrostatic pressure is negative	2
4.	A drainage gallery is an opening provided in the body wall of the gravity dam in the longitudinal direction to the dam. This serves as a longitudinal inspection chamber as well as an outlet for seepage of water	2
5.	Balancing canal depth comes when the canal is in partially embankment and partially in cutting. It is the depth of the canal (H) which gives equal amount of filling	2

Remarks:

PART B

II

1

Duty:- The relation between the area of crop irrigated and the quantity of irrigation water required to supply is called Duty of water

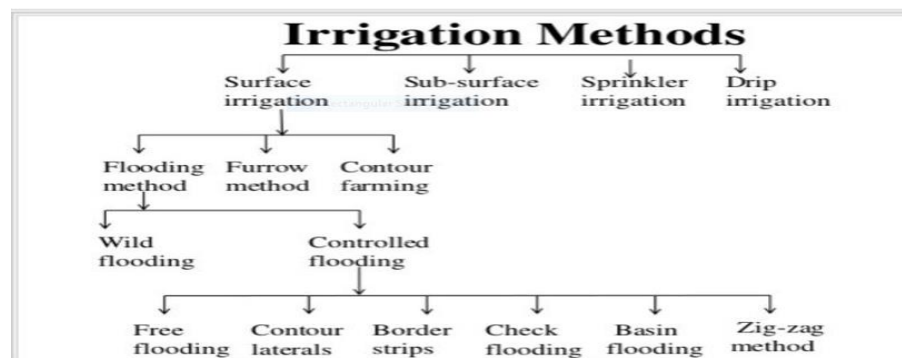
3

Different methods of expressing the Duty of Water:-

- Duty can be expressed as hectares/cumecs
- Duty can be expressed as hectares/million cub.meter
- duty can be expressed as hectares/meter

3

2.



1.Surface irrigation:- In all the surface methods of irrigation, water is either ponded on the soil or allowed to flow continuously over the soil surface for the duration of irrigation

2.Subsurface irrigation (or simply sub irrigation) :-is the practice of applying water to soils directly under the surface. Moisture reaches the plant roots through capillary action.

3.Sprinkling :-is the method of applying water to the soil surface in the form of a spray which is somewhat similar to rain.

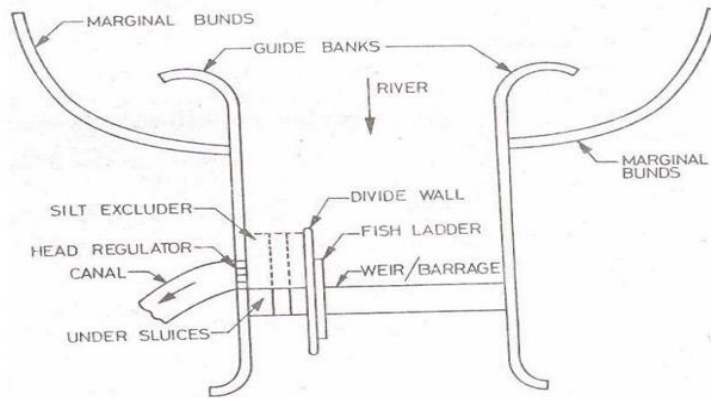
4. Drip irrigation:-Trickle irrigation system comprises main line, sub mains, laterals,

valves (to control the flow), drippers or emitters , pressure gauges, water meters, filters , pumps, fertilizer tanks, vacuum breakers, and pressure regulators

6

Remarks:

3



3

- Weir or barrage:- Normally the water level of any perennial river is such that it cannot be diverted to the irrigation canal. The bed level of the canal may be higher than the existing water level of the river. In such cases weir is constructed across the river to raise the water level
- Undersluices :- The under sluices are the openings provided at the base of the weir or barrage
- Divide wall:- The divide wall is a long wall constructed at right angles in the weir or barrage, it may be constructed with stone masonry or cement concrete
- Fish ladder:- The fish ladder is provided just by the side of the divide wall for the free movement of fishes
- Canal head regulator:- A structure which is constructed at the head of the canal to regulate flow of water is known as canal head regulator.
- Silt excluders/ Silt prevention devices
- Marginal bunds

3

4.

Any hydraulic structure which supplies water to the off-taking canal is called a headwork.

Headwork may be divided into two

1. Storage headwork.
2. Diversion headwork

2

Diversion head works:-Weir or barrage is constructed across a perennial river to raise water level and to divert the water to canal, is known as diversion head work

2X2=4

Storage head works:- Solid Impervious (or fairly impervious) barrier constructed at a suitable location across a natural stream (river), to store

Remarks:

<p>5</p> <p>6.</p>	<p>water in its upstream side</p> <ol style="list-style-type: none"> 1. Where the valley to be covered is wide with a gentle slope. 2. Where there is not much depth of water to be impounded. 3. Where there is no prominence given for water tightness. 4. Where there is ample space for forming the section as the earth dam needs a wide space. 5. Where the spill ways need not be provided in the section. 6. Where the durability is not a prime factor. 7. Where the materials like stone, silt, clay and sand are available in plenty <p>1. Main canal The main canal takes off directly from a river or reservoir. It carries water in large amounts to feed the branch and distributary canals. Due to conveying of very high discharge through the main canal it is not recommended to do direct irrigation from it.</p> <p>2. Branch Canal The branch canal takes off from main canals at regular intervals. These canals supply water to major and minor distributary canals. The discharge of the branch canal is generally over 5 m³/sec. In the case of branch canals also, direct irrigation is not recommended unless their water carrying capacity is very low.</p> <p>3. Major Distributary Canal Major distributary canal takes off from the branch canal or in some cases from the main canal. They supply water to minor distributaries and field channels. A canal is said to be major distributary when its discharge lies between 0.25 to 5 m³/sec.</p> <p>4. Minor Distributary Canal Minor distributary canal takes off from major distributaries and sometimes directly from branch canals depending upon the discharge of canals Their discharge is generally below 0.25 m³/sec. These canals supply water to the field channels.</p> <p>5. Field Channels Field channels also known as watercourses are small channels excavated by cultivators in the irrigation field. These channels are fed by the distributary canals and branch canals through canal outlets.</p>	<p>1X6=6</p> <p>6</p>
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Remarks:

7.	<p>Berms: A berm is a horizontal spacing given in between cutting and embankments (as in between two cuttings)</p> <ol style="list-style-type: none"> 1.They give additional strength to the banks and provide protection against erosion and breaches. 2.They protect the banks from erosion due to wave action. 3.They provide a scope for future widening of the canal. 	3 3
<p>PART C</p>		
<p>UNIT I</p>		
III a	<ol style="list-style-type: none"> 1.Good Catchment: If the characteristics of a catchment area contributes to more yield It is called a good catchment. Fan shaped area is a high rain fall zone with light soil and less vegetation with no ponds contributes good catchment. A good catchment has high run-off coefficient. 2.Bad Catchment: If the characteristics of catchment area contributes to less yield it is called a bad catchment. Fern shaped catchment in a low rain fall zone with high porosity. large vegetation, more number of ponds forms bad catchment. A poor catchment has low run off coefficient. 3. Average Catchment: If the characteristics of a catchment area contributes average runoff it is called average catchment area. An area with average rain fall, medium vegetation. medium porosity forms average catchment 	(3X2=6)
b.	<p>Run off:- When rainfall on the surface of the earth a part of it infiltrates on the soil, a part of it is intercepted by vegetation, a part gets evaporated into atmosphere and the remaining part flows on the surface of the earth to form small streams which ultimately joins</p>	4

Remarks:

	<p>the river and seas The part which flows on the surface of the earth and which runs away to join streams and rivers is termed as “ Run off “ on the catchment area</p> <p>Factors effecting run off:-</p> <ul style="list-style-type: none"> ▶ Pattern of rainfall ▶ Character of catchment surface ▶ Topography ▶ Shape and size of catchment area ▶ Vegetation in catchment area ▶ Geological features of the area ▶ Meteorological conditions <p style="text-align: center;">OR</p> <p>▶ $D = 8.64 \frac{B \text{ (in days)}}{\Delta \text{ (in metres)}}$</p> <p>where, D = duty in hectares/cumec. Δ = total depth of water supplied in metres. B = Base period in days.</p>	5
IV a		6
	<p>b Velocity rod is made up of hollow metal or wood. Its diameter is about 2.5 to 5 cm. Weight provided at the bottom of the rod to keep it vertical. Length of the rod is adjustable. Rod is generally submerged to the extent of 0.6D.</p>	4

Remarks:

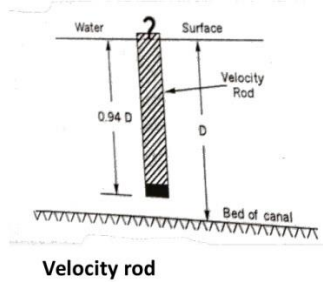


Fig- 5

UNIT II

V
a

- The river section at the site should be narrow and well-defined.
- The river should have high, well-defined, in erodible and non-submersible banks so that the cost of river training works is minimum.
- The canals taking off from the diversion head works should be quite economical and Should have a large commanded area.
- The required materials of construction should be available near the site.
- The site should be easily accessible by road or rail.
- The overall cost of the project should be a minimum.

1x6=6

b

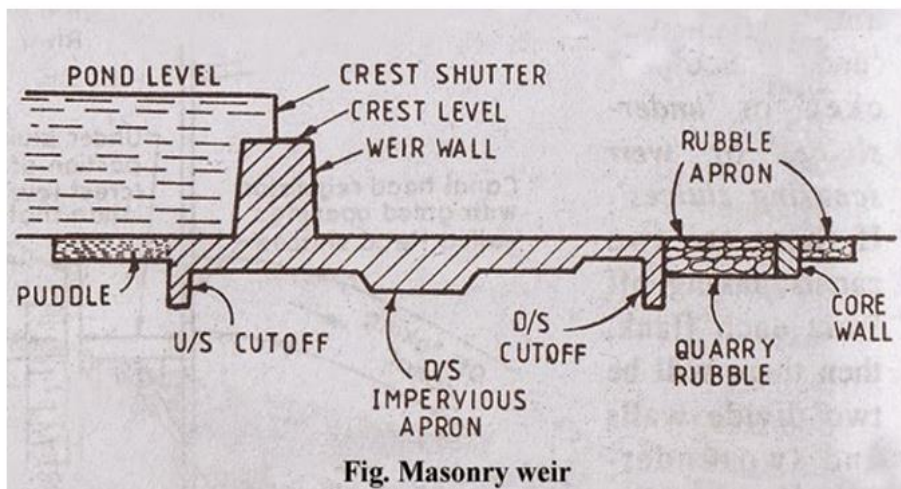


Fig-4

- Body wall of weir :- It is a wall which is constructed To raise water level on u/s Strong enough to resist water and uplift pressure
- Upstream aprons :- Protect weir from erosive forces during floods Length of apron depends upon discharge in river and length of weir
- Downstream aprons :- To reduce the kinetic energy of water Length depends upon height of fall of water nature of soil discharge in river

5

Remarks:

<p>VI a</p> <p>b</p>	<ul style="list-style-type: none"> ■ Upstream curtain Wall ■ Downstream curtain wall ■ Shutter <p style="text-align: center;">OR</p> <p>Marginal Embankments: The floods may be prevented from submerging the country by constructing earth embankments. They are generally constructed up to a height of 12 m. They are designed and constructed in the same way as an earth dam. The embankments are generally constructed parallel to the river channel</p> <p>Advantages :-</p> <p>(i) They are very widely used river training work.</p> <p>(ii) It is cheaper and quick as well as simple in construction. They can be constructed with locally available material.</p> <p>(iii) Maintenance of embankments is similar to canal bank maintenance and does not involve intricate methods.</p> <p>(iv) Embankment can be constructed reach by reach to extend extent of protection.</p> <p>(v) They protect large areas by comparatively small investment</p> <p>Spurs or Groynes: They are the structures constructed transverse to the river flow. They extend from the bank into the river.</p> <p>Classification according to the functions served.</p> <p>(a) Attracting type,</p> <p>(b) Deflecting type,</p> <p>(c) Repelling type</p> <p>Repelling type:-When a groyne points upstream then it is called a repelling groyne. The reason being, this type has a property of repelling the river flow away from the bank .This is accomplished by creation of a still pond on the upstream.</p>	<p>3</p> <p>3</p> <p>3</p>
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Remarks:

Attracting type:-when a groyne points downstream it is called an attracting groyne as. It attracts the river flow towards the bank from which it takes off

3x2=6

Deflecting type:-In this case the groyne actually provides a body against which the river current keeps hugging. The river flow thus remains along the bank permanently. When a groyne of short length is taken perpendicular to the bank, it only deflects the flow locally. Hence, it is called deflecting groyne

UNIT III

VII

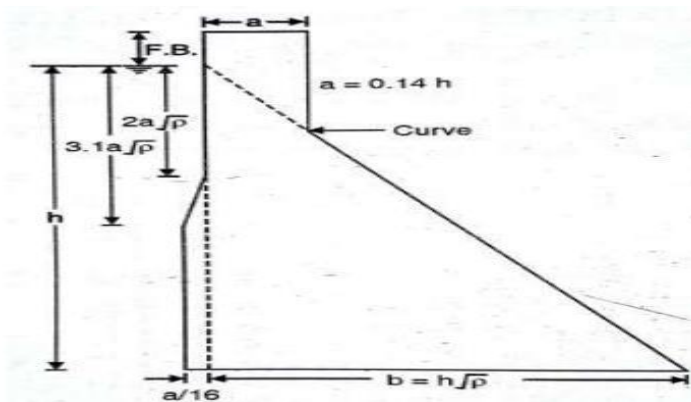
Water Pressure

a

- Self Weight
- Uplift Pressure
- Silt Pressure
- Earthquake Pressure
- Wave Load
- Snow Load
- Wind Load

1X6=6

b



9

OR

VIII

a

Spillway :- A passageway through which surplus water escapes from a reservoir, lake, or the like

Component parts of Spillway :

- Approach channel
- Control structure
- Discharge carrier
- Discharge channel
- Energy dissipators.

1x6=6

Remarks:

Approach channel:- Entrance structure or the path to draw water from reservoir and convey it to the control structure. It may be straight or curved in plan

Control structure:- Major component of spillway provided with bridge and gates. Regulates and controls the surplus water from the reservoir.

Discharge carrier:- It is the waterway provided to convey the flows released from the control structure to the downstream side of spillway.

Discharge channel:- Provided to convey the water from bottom of the discharge carrier to the downstream flowing river

b

A drainage gallery is an opening provided in the body wall of the gravity dam in the longitudinal direction to the dam. This serves as a longitudinal inspection chamber as well as an outlet for seepage of water. It runs through three fourth of the length of the dam. Suitable cross drains connecting the above with the downstream face of the dam serve also as entrance to the main gallery. It is also an inspection gallery or a foundation gallery. foundation gallery is provided near the foundation to drain off the water that percolates through foundations.

9

UNIT IV

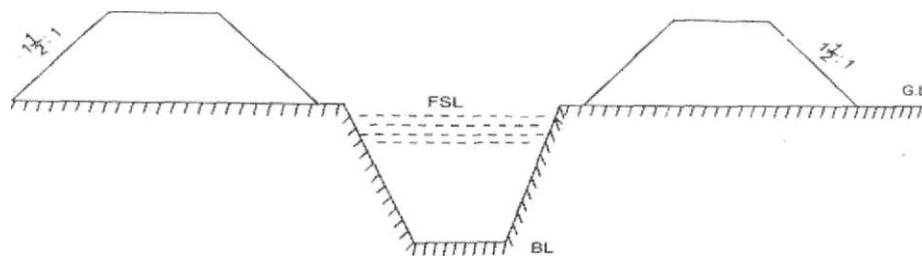
IX
a

1. Canal in full cutting: When the full supply level of the canal is below the natural ground level the section is said to be in full cutting.

2. Canal in full banking: When bed level of the canal is above the natural ground level the section is said to be in full banking.

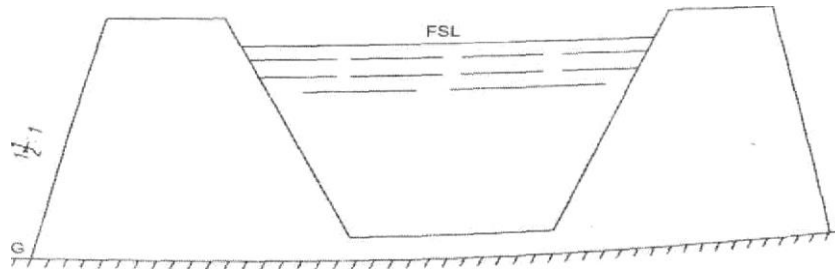
3. Canal in partial cutting: When the full supply level of the canal is above the natural Ground level and the bed level is below the natural ground level the section is said to be in partial cutting and partial banking

3x2=6

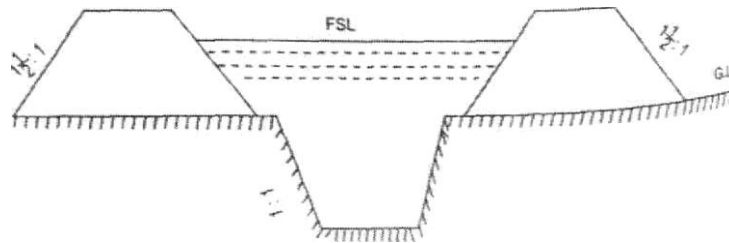


Canal in Full Cutting

Remarks:



Canal in Full Banking



Canal in partial cutting

b

Canal lining means providing impervious thin layer of 2.5 to 15 cm thickness to protect the bed and sides of canal.

Permanent types of canal lining:

1. Brick lining: If burnt bricks of good quality are used for protectinh the bed and sides of the channel the lining is called as Brick lining. The unburnt bricks should be rejected and the bricks should be thoroughly soaked in water before being laid.

2. Precast concrete block lining: In this type of lining precast concrete blocks are used. The blocks are laid on a prepared bed. The thickness of these blocks vary front 5 cms to 6.5 cms.

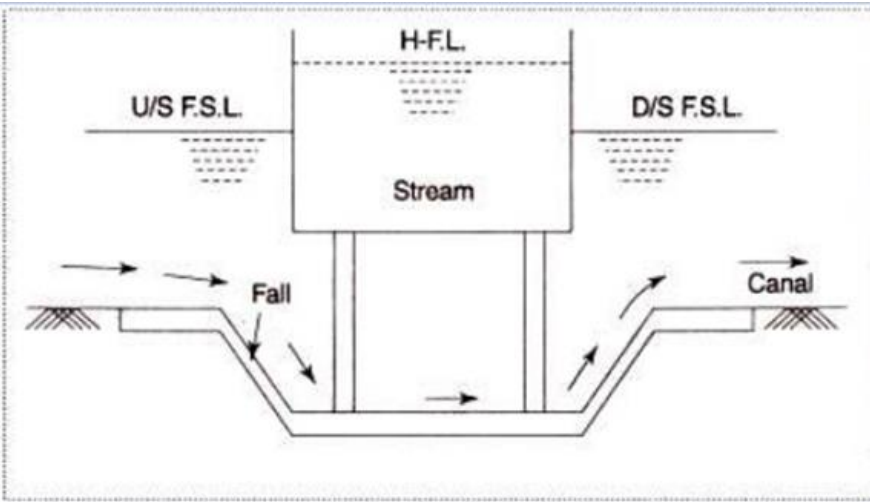
3. Cement mortar lining: Cement mortar mixed in a proportion 1:3 or 1:4 is used as a lining material. It is not durable unless properly protected. If the thickness is more seepage losses can be reduced

1

4x2=8

OR

Remarks:

<p>X a</p>	<p>a canal fall or drop is an irrigation structure constructed across a canal to lower down its bed level to maintain the designed slope when there is a change of ground level to maintain the designed slope when there is change of ground level.</p> 	<p>2</p> <p>4</p>
<p>b</p>	<p>Soil Erosion: When the top fertile layer of soil is transported from one place to another place by a natural agency like wind or water or glaciers, the phenomenon is called soil Erosion.</p> <p>Methods of prevention of soil erosion:</p> <ol style="list-style-type: none"> 1. Contour bunding, contour tilting and contour sowing. 2. outlets and spillways so that the velocity of water is arrested and excess run off is allowed to escape. 3. Crop varieties selected should be such that they cover the soil and check the beating of rain directly on soil. 4. Adopting mixed cropping and crop rotation. 5. Afforestation of catchment area is necessary. Areas not economical to grow crops should be converted to grass growing pastures. 6. Wind erosion can be prevented by growing trees which obstruct the wind velocity 	<p>2</p> <p>1x7=7</p>

Remarks:

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Remarks: