MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC-270001 – 2005 certified)

WINTER-14 EXAMINATION

Subject code: 17502 **Model Answer**

Important Instructions to examiners:

1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language error such as grammatical, spelling errors should not be given more importance.(Not applicable for subject English and communication skill).
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.

Q.1 A) Attempt any THREE of the following. **12**

a) Classify irrigation scheme on the basis of purpose and administration.

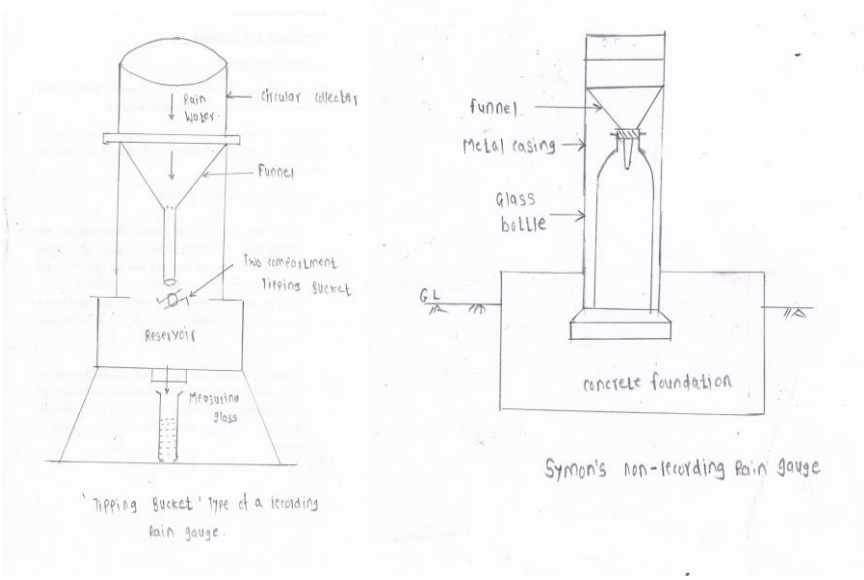
Ans:-a) Classification based on purpose:-

1) Single purpose irrigation project :-this type of project mainly constructed and founded under one head or purpose like irrigation, power generation etc. For example –Mula dam is constructed for irrigation purpose and koyana dam which is mainly use for power generation. — 01

2) Multipurpose irrigation Project**: -** It is a project which is constructed for two or more purpose such as irrigation, flood control, power generation, and navigation, domestic and industrial water supply. For example:Bhakra nangal project is used for irrigation and hydropower generation. — 01

b) Classification based on Administration :- — 02

Class of project	Command.Area (ha)	Description of works
Major project	Over 10,000	Multi purposed river valley projects barrages ,weirs etc.
Medium project	10,000 -2000	Low earthen dams and canal irrigation schemes
Minor Project	Less then 2,000	Extension of irrigation ,tube well irrigation ,lift irrigation

b) Define Irrigation, Hydrology, Rainfall intensity and Runoff.	
Ans:- **1) Irrigation:** The process of artificially supplying water to soil for raising the crops is called as irrigation. **2) Hydrology:-** It is the science which deals with occurrence distribution and circulation of water on earth on and below the earth surface. **3) Rainfall intensity**:- it is the maximum rainfall during a short period measured in mm /hr. is called rainfall intensity. **4) Runoff:-**The amount of water which flows over the surface of earth after all losses have taken place is called as runoff. OR The part of rainfall which flows over the surface of water after all losses have taken place is called as runoff **Runoff = Rainfall - Losses**	01 01 01 01
c) Calculate MFD for a catchment having area 1200km2 .Use Ingli's formula and Dickens' formula .Take Dicken Constant C=28.	
Solution :- Given- A = 1200 km^2, C = 28 **i)By Ingli's formula -** $Q = \frac{123A}{\sqrt{(A+10.24)}} = \frac{123*1200}{\sqrt{(1200+10.24)}}$ **=4242.781 m^3/sec** **ii)By Dicken's formula-** $Q = C.A^{3/4}$ $=28 \times 1200^{3/4}$ **=5708.78 m^3 /sec**	02 02
d) Draw the neat sketch of Symon's rain gauge and tipping bucket type rain gauge.	
	02 02

B)Attempt any one of the following: **06**

a) Compute the average rainfall by Thiessen's polygon method and arithmetic average method for a C.A at the dam site.

Rain gauge st. Rainfall in mm	1400	1500	1100	1200	1300
C.A.in sq.km.	20	30	24	26	25

Also calculate maximum yield in Mm3 by using Ingli's formula.

Ans. :- **i) Average rainfall by thiessen's polygon method –**

$$P = \frac{A1P1+A2P2+A3P+---An\ Pn}{A} = \frac{\sum A \times P}{\sum A}$$

$$= \frac{(20 \times 1400)+(30 \times 1500)+(24 \times 1100)+(26 \times 1200)+(25 \times 1300)}{(20+30+24+26+25)}$$

$$= \frac{28000+45000+26400+31200+32500}{125}$$

$$P\ average = \frac{163100}{125} = 1304.8\ mm = 1.308\ m$$

02

ii) **Arithmetic average method :-**

$$P = \frac{P1+P2+P3+--------+Pn}{N} = \frac{\sum P}{N}$$

$$P = \frac{1400+1500+1100+1200+1300}{5} = \frac{6500}{5}$$

P average=1300 mm 02

iii) **Runoff :-**

Average annual rainfall = p = (1304.8+1300) / 2mm

=1302.4mm = 130.24 cm & p is < 200 cm

For non of hot region ,Inglis formula is $R(cm) = \frac{P(P-17.74)}{254}$

$$R = \frac{130.24\ (130.24 - 17.74)}{254} = 57.68cm$$ 01

R=57.68cm =0.5768m

iv) Yield = Runoff X CA

$=0.5768 \times 125 \times 10^6$

$=72.1062 \times 10^6$

Yield $= 72.113 Mm^3$ 01

b)Attempt **any one** of the following:

a) Fix control levels DSL, FRL,HFL& TBL from given data.

1)Effective storage required for crops 3800 Ha.m

2)Carry over allowance—15 per cent of effective storage

3)Tank losses -10 per cent of effective storage

4) Dead Storage -10 per of gross storage.

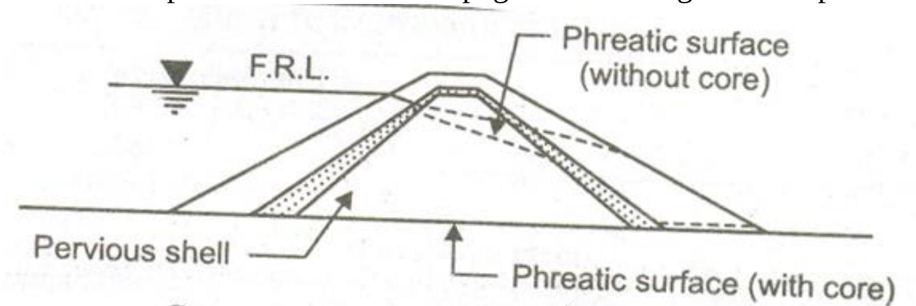
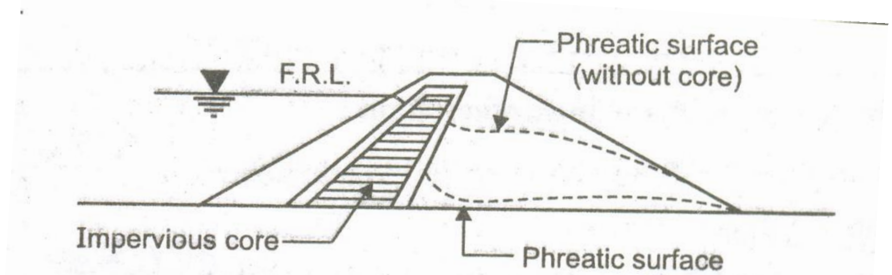
Contour

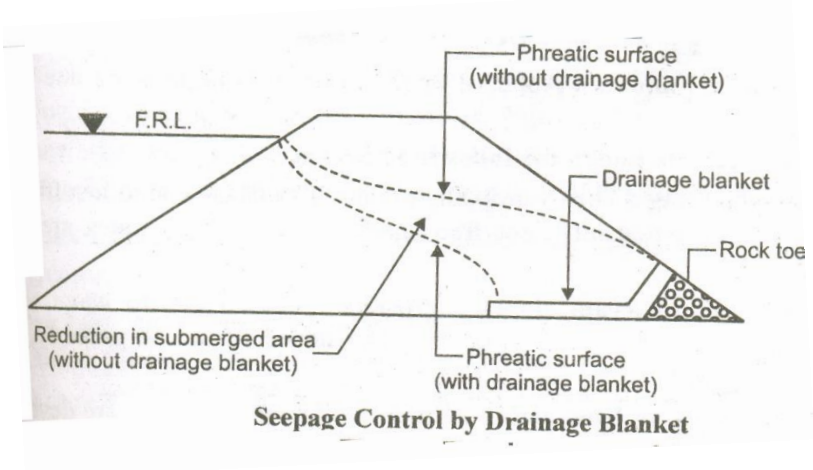
RL (m)	81	84	87	105	108	111	114
Storage Mm3	3.5	5.0	6.0	45.0	50.0	61	68

Assume flood lift as 1.5 m & free board as 2.0m

Solution:- Gross Storage =Dead storage + Live storage Live storage = Effective storage for crops + Tank losses + carry over allowance . = 3800+10/100 X 3800+15/100 X 3800 = 4750ha. =47.50Mm^2 Gross Storage=10/100 of gross storage +47.50 0.9 gross storage =47.50 Gross storage =47.50/0.9=52.77Mm^3 From capacity table by interpolating RL corresponding to capacity 52.77 Mm^3 will be =108+(111-108) / (61-50.0)*(52.77-50.0) =108.76 **FRL=108.76 m** Dead storage =10/100*52.77=5.277Mm^3 RL corresponding to the capacity of 5.277Mm^3 =84+(87-84) / (6.00-5.00)*(5.277-5.00) **DSL=84.831m** Assuming ,flood lift =1.5m Free board =2.0m HFL=FRL + flood lift =108.76+1.5=110.26 **HFL=110.26 m** TBL=HFL + FB =110.26 + 2=112.26 **TBL=112.26m**	02 01 01 01 01
Q2. Attempt any four of the following.	16
a) List the data collected in engineering survey and hydrological survey for an irrigation project.	
The following data is collected in Engineering Surveys & Hydrological Surveys. 1) **Engineering surveys**: These surveys include i.e plane table survey, traverse survey, aerial survey, and photographic survey etc. The main purpose of this survey is to prepare contour map and topographic map. In this survey information such as. a) Water spread. b) Arrangement of lines of communication. c) Capacity of the reservoir. d) Suitable dam site.	02

e) Site for waste weir and out lets. Is collected. 2) **Hydrological surveys**:-this survey is conducted to calculate or estimate the amt of water from the catchment area. This survey includes study of runoff pattern of the proposed site it also include determination of hydrograph of the worst flood to determine spillway capacity and its design. .	02
b) What is silting of reservoir? What are the factors affecting rate of silting?	
Silting of Reservoirs: - During rainy season silt from the catchment area carried or flows along with water into the drainage basins of catchments and then carried forward into the storage areas of reservoir. If the velocity of water is more ,it can carry more silt quantity and larger silt particles. "The collection of silt into the reservoir is known as silting of reservoir". **Factor affecting silting in a reservoir are as follows:** i) Catchment area:- if catchment area is more ,silting will be more. If catchment area is less, silting will be less. ii) Shape of catchment:- if catchment area is fan shaped, silting will be more. If catchment area is fern shaped, silting will be less. iii) Slope of country: - if slope is steep, more particle will be erodes because of high velocity of runoff & will be deposited in reservoir basin and vice versa. . iv) Climatic condition: - dry & rainy climate helps in production of more silt material. . v) Nature of surface soil: - if soil is weathered or loose it can be easily flow with runoff and deposited in reservoir. (Note:- *Consider credit for the factors of **any three** as above)*	1 3
c) Explain hydraulic failures and seepage failures of earthen dam.	
Hydraulic failures:-It includes Overtopping of dam surface, failure of u/s slope due to wave erosion, toe erosion, gullying etc. These failures can be avoided by taking following remedial measures. Overtopping: - Proper design of spillway capacity ,by providing min free board maintenance of spillway gates Failure of u/s slope: - Protection by providing stone pitching or riprap. Toe erosion: -By providing stone pitching or riprap Gullying: -By providing turfing or hariyali on d/s slope **Seepage failures:-** It includes Piping, Sloughing. These failures can be avoided by taking following remedial measures. 1) Proper compaction & bonding between layers. 2) Careful investigations of foundation soil 3) Proper design Sloughing: Causes due to -Full reservoir condition, highly permeable soil strata are present in foundation of dam permits seepage of water through it causing erosion of soil, which result in piping.	02 02

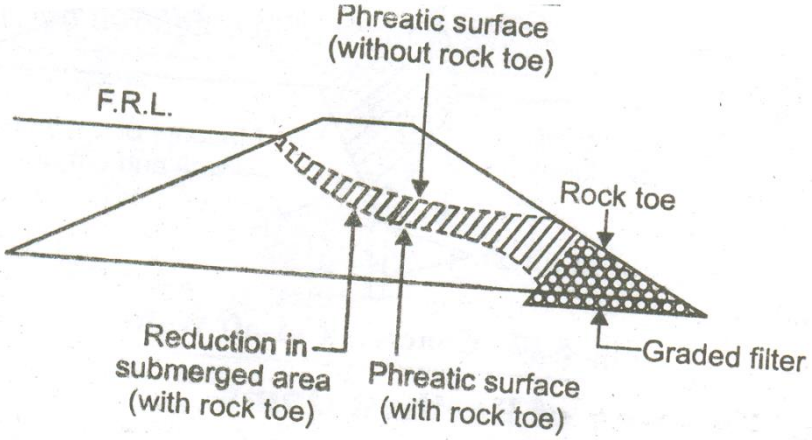
d)What is seepage? Explain any three methods to control seepage through embankment .	
Ans:-**Seepage :-** The water that flows through the pores i. e. voids of the soil is called seepage. **Methods to control seepage through body of earthen dam:-** i. Provision of Impervious core: The effective method of seepage control is zoned type section with impervious core . The seepage line is changed due to provision of core.  **: Seepage Control by Provision of Central Core** In case scarcity of impervious soil, an inclined core may be provided as shown below  **Seepage Control by Providing Inclined Core** **ii. By providing horizontal blanket:** Seepage can be controlled by providing horizontal blanket.The horizontal filter extends from the toe (d/s end) of the dam inwards up to a distance varying from 25 to 100% of the distance of the toe from the centre line of the dam .Generally length equal to three times the height of the dam is sufficient. The blanket should be properly designed as per the filter criteria and should be sufficiently previous to drain off effectively	01 *



Seepage Control by Drainage Blanket

iii)Rock Toe or Toe filter :

The 'rock toe' consist of stones of usually varying from 15 to 20 cm. A toe filter (graded inlayers) is provided as a transition zone, between the homogeneous embankment fill and rock toe. It generally consists of three layers of fine sand, coarse sand and gravel, as per filter criteria requirement. The height of the rock toe is generally kept between 25 to 35% of reservoir head. The top of the rock toe must be sufficiently higher than the tail water depth so as to prevent the wave action of the tail water.



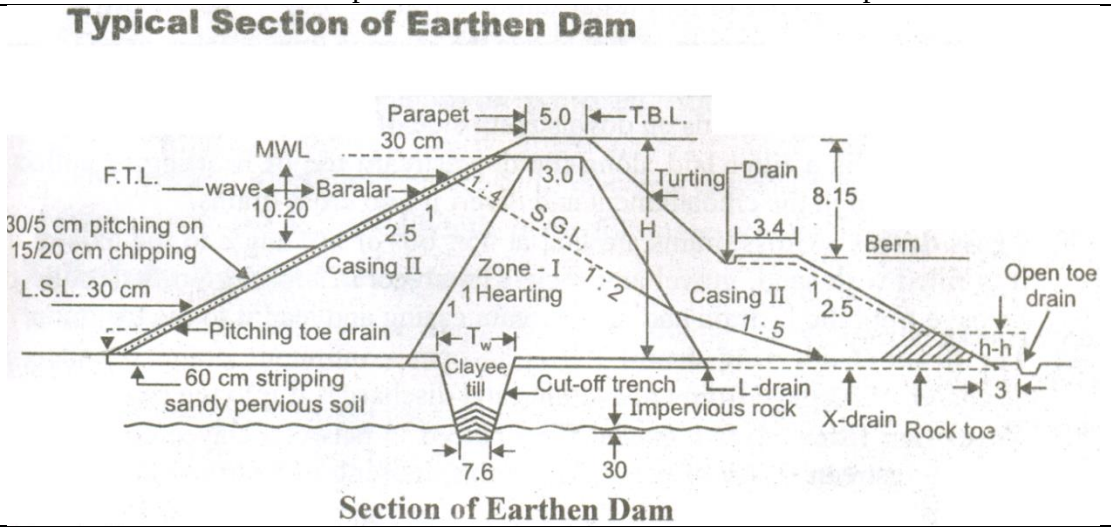
Seepage Control by Rock Toe

Contol of seepage by provision of rock toe: Rock toe is provided to change the path of seepage line & prevent sloughing of d/s toe..

iv) **Chimney Drain** : The horizontal filter not only helps in bringing the phreatic line down in the body of the dam but also provides drainage of the foundation and helps in rapid consolidation. But the horizontal filter tries to make the soil more pervious in horizontal direction and thus causes stratification. When large scale stratification occurs such a filter becomes inefficient in such case a vertical filter (or inclined v/s or d/s) is placed along with the horizontal filter so as to intercept the seeping water effectively such arrangement is termed as chimney drain.

(any three 01 mark each)

e) Draw a typical cross section of earthen dam suitable at a site where clayey soil and murum are available and pervious strata available of moderate depth



02 Sketch

02 labels

f) Enlist the forces acting on gravity dam. Show them with a neat sketch .

Ans:- Following are the forces acting on a gravity dam as shown in above fig.

1)Water pressure(P)
2)Weight of dam(W)
3)Uplift pressure (V)
4)Pressure due to earth quick (Pe)
5)Ice pressure
6)Wave pressure (Pw)
7) Silt Pressure(Ps)

List 02 marks

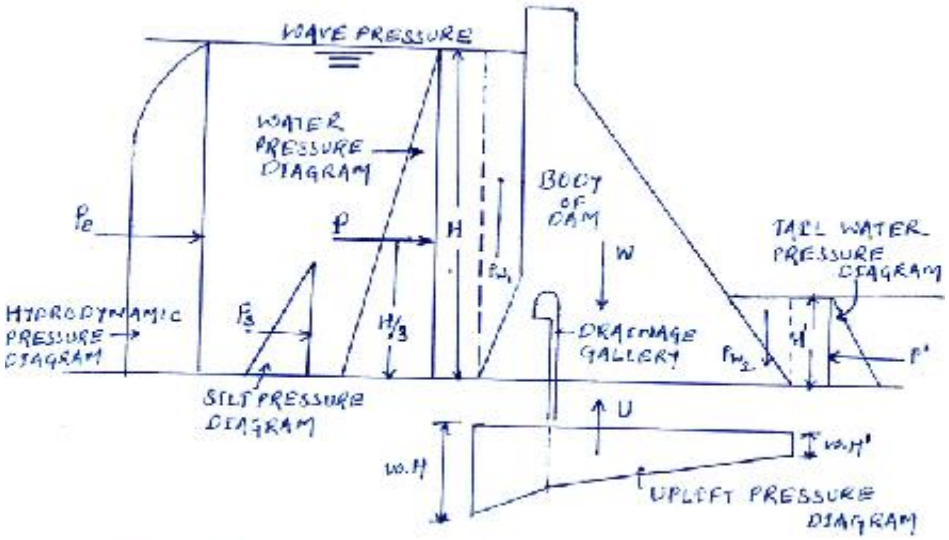


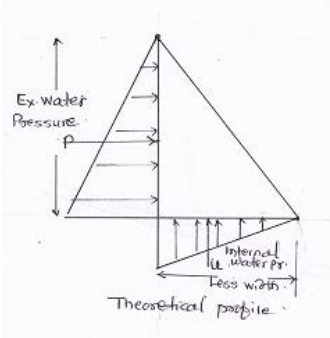
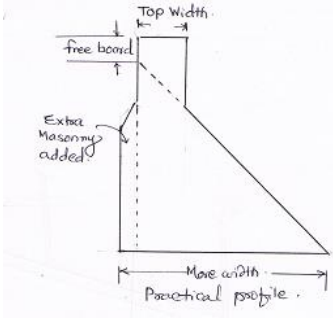
Fig.- Forces acting on a Gravity Dam

Sketch 02 marks

Q.3 Attempt **any four**: 16

a) Differentiate between theoretical and practical profile of gravity dam.

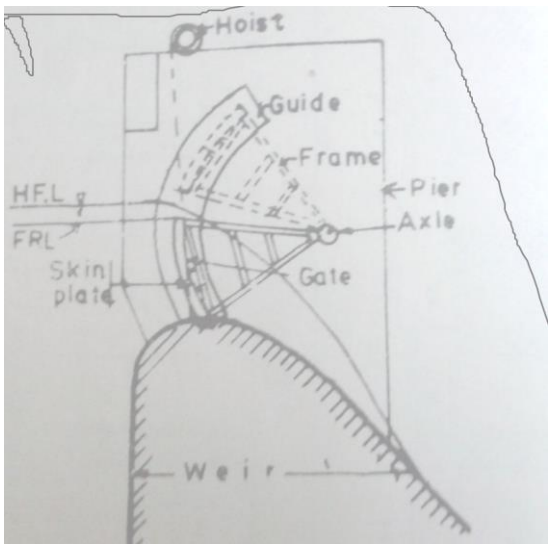
Ans:-

Theoretical Profile	Practical Profile.	
i)It is a right angled triangular section	i)It is trapezoidal section.	01
ii) Only water pressure on the upstream side is considered.	ii)All types of forces are considered.	01
iii) It has zero width at the top.	iii) It has top width at the top and height of dam is increased due to provision of free board.	01
		01

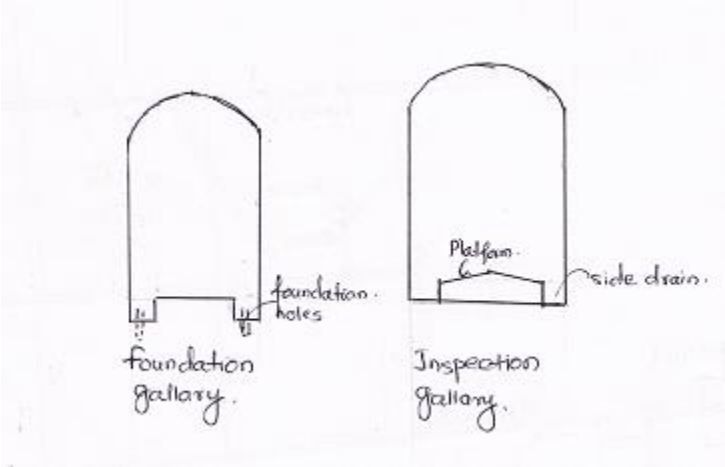
b) Explain working of Tainter gate with the help of neat sketch.

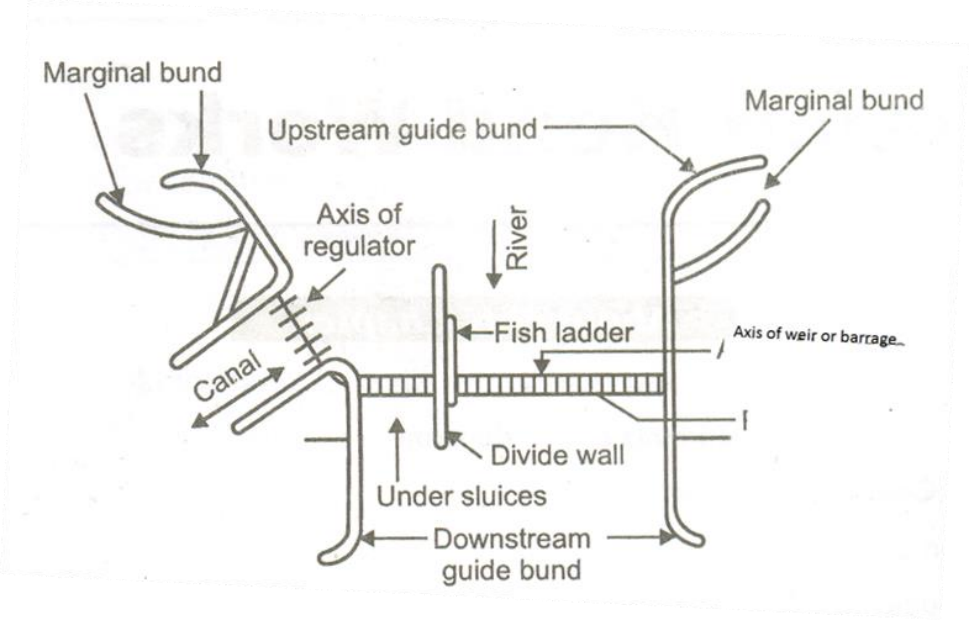
Ans:-

A radial gate, also known as a Tainter gate has its water supporting face, made of steel plates, in the shape of sector of circle, properly braced and hinged at the pivot. The gate can thus be made to rotate about fixed horizontal axis. The load of the gate and water, etc. is carried on bearings, mounted on piers. The gate can be lifted by means of ropes and chains acting simultaneously at both ends or with the help of power driven winches. 02



Tainter gate 02

c)What are the various types of galleries in gravity dam ?state the function of each type with neat sketch.	
Ans:- i) **Foundation gallery or Drainage gallery.** **ii) Inspection gallery.** **Functions:** i) Foundation gallery: It is provided near the rock foundations serve to drawn off the water which percolates through the foundations. It is also helpful for drilling and grounding of the foundations. ii) Inspection Gallery: These galleries are provided at various elevations and meter connected by vertical shafts. a) These galleries besides draining of seepage water serve inspection purpose. b) They provide access to dam interior for observing and controlling the dam. c) They provide access for carrying pipes, etc. d) They provide access for grouting the contraction joints. e) They provide access to all outlets, spillway gates, valves. They provide space for drilling and grouting of the foundations  	01 01 01 01
d) State any four essential requirements of site for construction of bandhara.	
Ans:- Essential requirements of site for construction of bandhara. 1) The site should be near (within 5 km) of the area to be irrigated. 2) The site should be located on straight reach of the stream, so that canals can take off from both sides & irrigation can be provided on both banks. 3) Good foundation should be available for construction of bandhara. 4) The banks of the stream at the site should be stable & steep.	 01 01 01 01
e) Draw a layout of diversion head works and name important components.	



02

Component Parts

i. Weir or Barrage
ii. Divide wall
iii. Fish ladder
iv. Stilling pocket / pond
v. Canal head regulator
vi. Silt excluder
vii. Scouring sluices
viii. Silt ejector
ix. Marginal & guide bund

½ each (any four)

Q.4 A) Attempt **any three :** 12

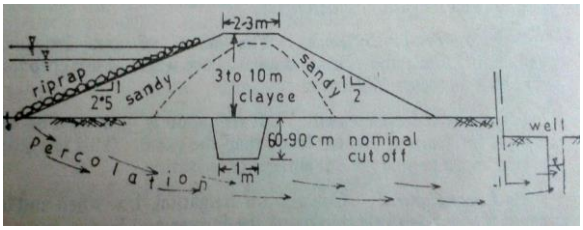
a) Explain need and construction of percolation tank with help of neat cross section

Percolation Tank:-

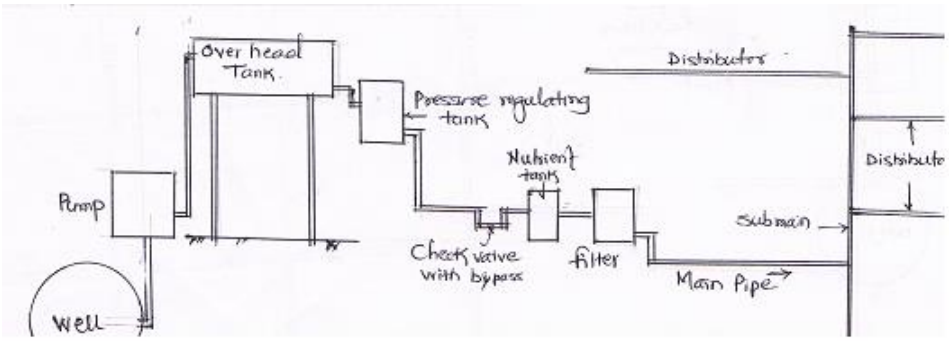
Percolation tanks are needed to raise the ground water table in the command area. This increase in water table leads to raising of water levels in wells which helps in increasing lift irrigation. For reducing evaporation loss of water & reducing cost of irrigation, percolation tanks are necessary. 01

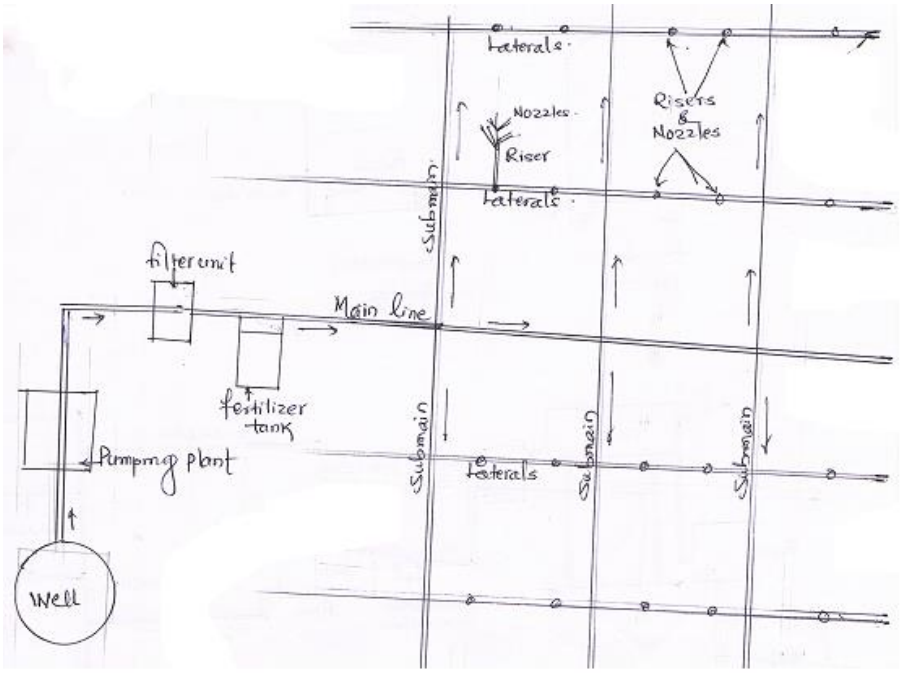
Construction:-It consists of earthen bund consisting of sandy casing & clayee hearting for retaining water on u/s side. Riprap is provided to protect the u/s slope of bund. Cut off trench is provided at the centre of hearting in foundation of tank. 01

Percolation tanks are constructed on pervious soils so that percolation of water takes place through foundation soil & will be available on d/s in wells for lift irrigation when required. The typical c/s with dimensions is shown as below.



Percolation tanks 02

b)Explain importance of drip irrigation .Also draw layout and show component parts	
Ans : <u>Importance of drip irrigation</u>:-Drip irrigation is the application of water at a slow rate drop by drop through ,perforations in pipe to irrigate limited area around the plant. A precise amount of water which is required by the plant is given .in drip drip irrigation deep percolation losses and evaporation losses are reduce .This method very useful in arid regions where water is scarce .It enables application of fertilizers along with importance of irrigation water.it ensure s optimum growth ,better fruiting and more growth of crops with optimum quantity of water .it is more applicable to variety of row crops from widely spaced fruit crops to closely spaced vegetable crops	02
	02
c) State two advantages and two disadvantages of Barrage	
Ans:- Advantages of Barrage:- 1) Area under submergence of water is less. 2) Cost of rehabilitation is less 3) It is economical as cost of protective and energy dissipation work is less 4) All the stored water can be utilised for irrigation & other purposes. 5) Collected silt in the barrage can be regularly removed hence used with full capacity throughout its life. ***(any two 01 mark each)** **Disadvantages of barrage:-** 1) Storage capacity is less as compared to dams. 2) Maintenance cost is more	* 2
d)Write function of the following : i)Divide wall ii)Fish ladder iii)Scouring sluices iv)Head regulator	
Ans: i)Divided wall :- Function -1)It Separate the under sluices from weir. 2)It is also helps in reducing velocity of flow near the head regulator due to which silt is deposited and Clearwater passes into canal . **ii)Fish ladder :-** Function:-It is provided for the movement of fish from U/S to D/S and vice versa. **iii)Scouring sluices:-** Function:- It is provided in need reaches of main canal to scour out the deposited bed silt is called scouring sluices . **iv)Head regulator:-** Function:-i)It regulates the discharge . 2)It divert proportionate quantity of silt to off taking cand . 3)It helps to measure discharge	 01 01 01 01

B) Attempt **any one :**	06
a)Describe sprinkler irrigation system with the help of neat layout and also mention situation on w.r.t crop, soil ,topography ,maintenance and operation	
Ans:-<u>sprinkler irrigation:-</u> sprinkler irrigation refer to application of water to crops in form of spray from above the crop like rain it is also called as overhead irrigation .In this method water under pressure is carried and sprayed into the air above the crop through a system of overhead perforated pipes ,nozzle lines or through nozzle fitted to riser pipes attached to a system of pipe laid on the ground .Nozzles may be fixed type or rotating under the water pressure. **Situation :** Sprinkler irrigation may be used for many crops and on all type of soil on lands of different topography and slopes. It is best useful to sandy soil and soil with high infiltration rates It is applicable for are with steep slopes having erosion hazards. The operating and maintenance cost is high. It is suitable for growing high priced **Layout:-**  	02 02 02
b) Design an economical trapezoidal section of a canal for carrying discharge 5.0 m3/s,bed slope1:1000,N=0.013,and side slope IV:2 H.	
Given Q=5.0 m3/s Bed slope =1:100 N=0.013 Side slope =IV :2H i. e n=2 For economic trapezoidal section = b +2nd =$^{2d}\sqrt{n2+1}$ b+2 X 2d =$^{2d}\sqrt{(2)2+1}$ b+4d=4.472d b=0.47211 d	02

Area =(b + nd) = (0.4721d+2d)d Area=2.4721 d^2 But Q=A X V (Assuming R=d/2) =5.0=2.4721d^2 X 1/0.013 X $(d/2)^{3/2}$ X $(1/1000)^{1/2}$ =5.0=2.4721d^2 X 76.923 X d^3/2/2.828 X 0.013162 $=d^{7/2}$=2.3516	02
d= 1.276 m , b = 0.6024 m	02
Q.5 Answer **any two**	16

a)Calculate the storage required in Ha.m for irrigation following crops. Consider reservoir loss as 12% and canal losses 15%.

Sr.No	Crop	Base period days	Duty of filed Ha/cumec	Area under crop Ha
1	Wheat	150	2,000	12000
2	Rice	120	900	4500
3	Sugarcane	320	700	4200
4	Cotton	210	1600	8000
5	Vegetable	120	600	2400

Ans:- i) Water requirement for Wheat:

Discharge required $= \frac{\text{Area under crop Ha}}{\text{Duty of field Ha/cumec}} = \frac{12000}{2000}$= 6 cumecs

$\therefore$ Volume of water required = discharge x days = 6 x 150 = 900 cumec- days

ii) Water requirement for Rice:

Discharge required$= \frac{\text{Area under crop Ha}}{\text{Duty of field Ha/cumec}} = \frac{4500}{900}$=5 cumecs

$\therefore$ Volume of water required = discharge x days = 5 x 120 = 600 cumec- days

iii) Water requirement for Sugarcane:

Discharge required$= \frac{\text{Area under crop Ha}}{\text{Duty of field Ha/cumec}} = \frac{4200}{700}$= 6 cumecs

$\therefore$ Volume of water required = discharge x days = 6 x 320 = 1920cumec- days

iv) Water requirement for Cotton:

Discharge required$= \frac{\text{Area under crop Ha}}{\text{Duty of field Ha/cumec}} = \frac{8000}{1600}$=5 cumecs

$\therefore$ Volume of water required = discharge x days = 5 x 210 = 1050 cumec- days

v) Water requirement for Vegetable:

Discharge required$= \frac{\text{Area under crop Ha}}{\text{Duty of field Ha/cumec}} = \frac{2400}{600}$= 4 cumecs

$\therefore$ Volume of water required = discharge x days = 4x 120 = 480 cumec- days

Total volume of water required on the field for all crops = 900 + 600 + 1920 +1050 + 480 = 4950 Cumec-day

∴ Total volume of water required on the field = 4950x 24 x 60 x 60 Cum.

= 427680000 Cum.

$\therefore \frac{427680000}{10000}$ = 42768 Ha.m.

Since the losses in the canal system are 15% , the volume of water required at the head of canal = x 42768 $\frac{100}{85}$ = 50315.29415 Ha-m

Allowing 12 % reservoir losses , the storage capacity of the reservoir

= 50315.29415 x $\frac{100}{88}$ = 57176.47059 Ha-m

Say **57176.5 Ha-m**

OR

Alternative solution

Sr.No.	Crop	Base period days	Duty of field Ha/cumec	Area under crop Ha	Δ in m $=\frac{8.64\,B}{D}$	Volume =(Δ x A) Ha-m
1	2	3	4	5	6	7= 5 x 6
1	Wheat	150	2000	12000	0.648	7776
2	Rice	120	900	4500	1.152	5184
3	Sugarcane	320	700	4200	3.9497	16588.74
4	Cotton	210	1600	8000	1.134	9072
5	Vegetable	120	600	2400	1.728	4147.2
Cumulative volume 42767.94 ha-m Say 42768 Ha-m						
Considering reservoir loss as 12 %and canal losses 15% ∴Storage capacity of reservoir = $\frac{42768}{0.85x0.88}$ = 57176.47Ha-m say 57176.5 Ha-m						

(02 mark each crop water requirement ,02 canal losess 02 mark reservoir losses 02 mark reservoir storage capacity)

b)Explain any eight selection criteria for suitable type of class

Ans:- *

***Note (consider the print mistake – instead of type of class as type of dam)**

Selection Criteria:

1. **Topography:** It decides the choice of a particular type of dam.
   U- narrow Shaped valley - concrete overflow dam
   Rolling Plane country – Earth fill dam with spillway separate site
   Narrow V-Shaped valley – An Arch Dam.
2. **Geology and foundation Condition:** Foundation of dam requires carrying

weight of dam therefore it is important.

On solid rock foundation – All types of dam can be constructed

Gravel foundation – Only earth dam

Silt and fine sand foundation – Earthen dam or low gravity dam.

Clay foundation – Earthen dam

3. **Availability of material-** Construction material must be locally available as their quantity required is very large

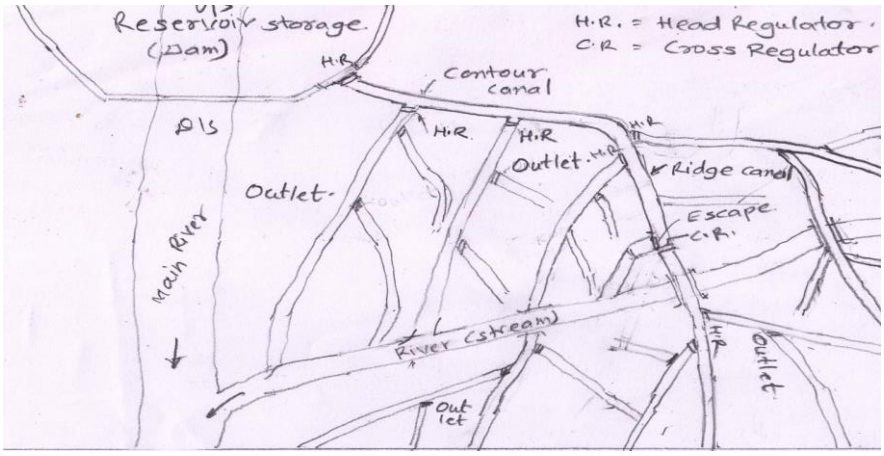
   If good soil available easily - Earthen dam are suitable

   If sand, cement, And stone easily available - concrete gravity dam are constructed

   If Above material are to be transported from large distances – Hollow concrete dam available
4. **Spillway site and location :** In masonry dam construction spillway can be constructed in continuation with the embankment but in earthen dam separate site for spillway is required
5. **Earthquake zone:** Concrete or masonry dam cannot sustained earthquake whereas earthen dam are suitable in earthquake zone areas which can absorb small shocks
6. **Height of dam:** Earthen dam are suitable for heights up to 30 m. for greater height gravity dams are generally preferred
7. **Man power/ skilled labour:** If skilled labour are available then masonry dam can be constructed otherwise earthen dam can be constructed.
8. **Life of dam:** Concrete or masonry dam has more life as compare to earthen dam. Depending upon the requirement or planning type of dam can be considered.
9. **Roadway width:** width of Road way on masonry dam is less as compare to earthen dam. If access is to be provided than earthen dams are constructed.
10. **Funds available:** Earthen dam can be constructed with less cost as compare to masonry or concrete dam

***(Any eight one mark each)**

c) Draw neat sketch of canal network show the location mention situation favouring following structure. I) Head regulator ii) Cross regulator iii) Escape iv) Outlets.



04

Fig.: Canal Network showing H.R.,C.R.,Escape, Outlet

Situation favouring the following structures

i) **Head regulator**: When the canals are branched or taking off from reservoir or main canals in the distribution system head regulator is provided at the head of canal, to divert necessary discharge from reservoir to canal or main canal to branch canal, to control, regulate or measure the discharge, to control the silt entry in the taking off canal ,to stop the supply of water when not needed (end of rotation) or for repair at down stream. — 01

(ii)**Cross regulator**: When it is required to raise the water level in main canal in order to regulate the flow in branch canal ,to stop the flow in case of repair on down stream. To divert silty overflow water in to the near by river or stream during flood control cross regulator is provided. — 01

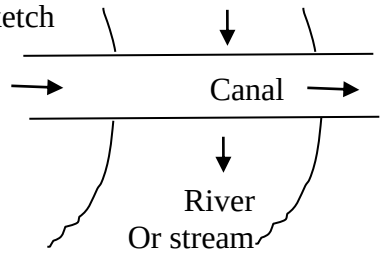
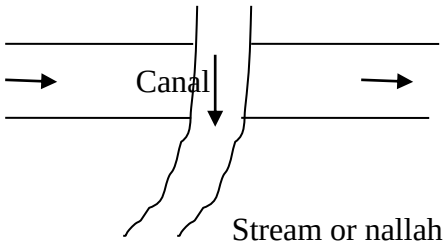
(iii) **Escap**e: At the end of main canal or to allow escape of the silty water into the waste channel and then to natural drain during rainy season escapes are provided. — 01

(iv)**Outlets:** To admit water into the, distributaries, minors, water courses, field channels etc. Out lets — 01

Q6. Attempt **any Four :** — 16

a) Compare between aqueduct and super passage **.**

Ans:-

Sr. No	Aqueduct	Superpassage
1	It is provided at the crossing of stream and canal where canal bed level is higher than HFL of stream.	It is provided at the crossing of stream and canal where stream bed level is higher than HFL of FSL of canal. — 01
2	Usually stream discharge is more than canal discharge at this site	Usually canal discharge is more than stream discharge at this site — 01
3	Object of aqueduct is to take the canal across large drainage	Object of superpassage is to take the sream flood discharge safely across canal. — 01
4	Sketch 	 — 01

b) What is meant by pick up weir? Explain the situation where, it is proposed.

Ans:-

Pickup weir: A solid weir usually with crest gates constructed in concrete or stone masonry located at some distance downstream of dam forming a large reservoir to raise the water level upto FSL of canal is known as pickup weir . — 02

Situations: It is proposed in the following situations-

i) In case of broken or rolling topography on one or both banks of the parent river where canal construction is costly. — *

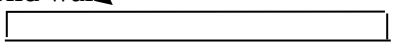
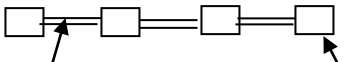
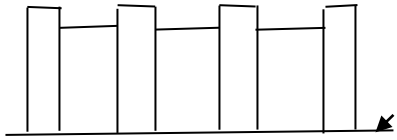
ii)In case of command area is too far away from the reservoir may be due to rolling topography.

iii) In case of land nearby the reservoir is not cultivable.

*(**any two one mark each**)

c) Differentiate between weir and barrage.

Ans:-

Sr. No	Weir	Barrage
1	A solid masonry or concrete wall constructed between the banks of the river is known as weir	A weir constructed with the top of the weir at (or very near) the river bed is known as barrage.
2	Gates may be provided on weir	Number of piers are constructed above barrage and gates are installed between them
3	Flood is obstructed by weir	Flood is not obstructed by barrage as gates are kept open during flood(or rainy) season.
4	It produce more afflux	It produce less afflux
5	It causes large submergence area during flood	It causes small submergence area during flood
6	Construction cost of weir is more	Construction cost of weir is more
7	Maintenance cost of weir is less	Maintenance cost of barrage is more
8	Less personals are required	More and skilled personals required for upkeep of gates
9	Sketch Solid wall  Plan  Elevation	Sketch  Gate Pillars  River Bed level

*

***(any four one mark each)**

d) Compare between counter canal and ridge canal**..**

Ans:-

Sr. No.	**Contour canal**	**Ridge canal**
1	It follows falling contour	It follows highest or predominant ridge in the command
2	Main canal is usually provided in its head reach near reservoir as contour canal	Main canal is usually provided in its lower reach and all other canal as ridge canal
3	It has large number of cross drainage works	It has less number of cross drainage works
4	It does not have falls	In this canal falls are more as canal bed gradient is flatter than natural grade
5	It irrigates on only one side	It irrigates on both side
6	It is 50% efficient	It is best and most efficient.
7	It leads to more seepage	It leads to less seepage
8	It has more length ,more loss of land	It leads to less loss of cultivable area as land at ridge is poor quality

*

***(any four one mark each)**

e) What are causes and remedial measures of water logging?

Ans.: **Causes of water logging are as follows**. *

i) Over irrigation by farmers under wrong impression that more water will fetch more crop yield.
ii) Bad tilling creating depressions and ponds in the field.
iii) Improper land grading.
iv) Seepage through vast network of unlined canals.
v) leakage through badly maintained structures and cracks.
vi)Irrigation of unsuitable soils (deep clayey soil)
vii)Inadequate surface drainage which leads to stagnation of water in the area
viii)Obstruction to natural drainage due to road, railway or canal embankment which leads to flooding of land and then water logging.
ix) Natural obstruction to the flow of ground water.
x) Seepage through reservoir leads to water logging on d/s and u/s side.

*(**any two one mark each**)

Remedial measures:

i)Provide an efficient drainage system to permit quick flow of rain and reduce the water logging.
ii)Reduce the percolation from canals –by Lining of irrigation channels to make canal surface impervious, Lowering of full supply level of irrigation channel to reduce seepage loss from embankment. Construct intercepting drains to collect the seepage water and carry it to nearby natural stream quickly in short period
iii)Restrict the irrigation by educating the people regarding water requirement of crop ,wastage of water , modern and efficient methods.
iv)Remove obstruction in natural drainage.v)Prevent seepage of water from reservoir.
vi)Reduce ground water storage by pumping out water from wells.
viii)Apply sprinkler and drip or any other micro irrigation system.

***(any two one mark each)**