Model Answer: Summer 2018

Subject: Irrigation Engineering | **Sub. Code: 17502**

Important Instructions to examiners:

1) The answers should be examined by key words 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 errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills.)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by the candidate and those in the 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 some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and the model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1	**(a)**	**Attempt any THREE of the following :**		**12**
	(i)	**State necessity of irrigation in India.**		
	Ans.	1. India is basically an agricultural country and all its resources depend on the agricultural output. India being a tropical country, there is a vast diversity of climate, topography and vegetation. 2. The amount and frequency of rainfall varies from place to place. 3. Crops required certain quantity of water after certain fixed interval throughout its period of growth. 4. Indian government is spending lot of amount to ensure irrigation facilities for the maximum cultivable area. 5. Hence, necessity of irrigation can be summarized as – Less rainfall, Non-uniform rainfall, Cultivation of cash crops with additional water supply and controlled water supply.	**1 each (any four)**	**4**
	(ii)	**Define:** **(1) Hydrology** **(2) Rainfall Intensity** **(3) Runoff** **4) Yield**		
	Ans.	**(1) Hydrology –** It is a science which deals with the distribution and circulation of water on earth.	**1**	
		(2) Rainfall Intensity – It is the maximum rainfall during a short period measured in mm/hr is called rainfall intensity.	**1**	
		(3) Runoff – The amount of water which flows over the surface of earth after all losses have taken place is called as runoff.	**1**	
		(4) Yield – It is the total quantity of water available from a catchment area at the outlet in period of one year.	**1**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1	(iii)	**The following table provides the data for the influence area and rainfall.**		

Influence area in sq.km	360	275	420	650
Rainfall in cm	60.5	75.8	100.20	83.80

From above data compute the average annual rainfall by Theissen's Polygon method.

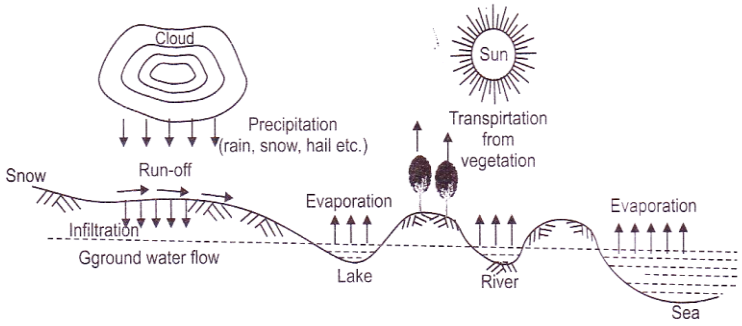
Ans.

Rain gauge station	Area of Thiessen's Polygon (A)	Rainfall (P)	A x P
1	360 sq.km	60.5 cm	21780
2	275 sq.km	75.8 cm	20845
3	420 sq.km	100.20 cm	42084
4	650 sq.km	83.80 cm	54470
Total	1705 sq.km	-	139179

		2	
		2	**4**

$P_{av} = \sum A \times P / \sum A = 139179 / 1705 = 81.63$ cm
Average annual rainfall by Theissen's Polygon method is 81.63 cm

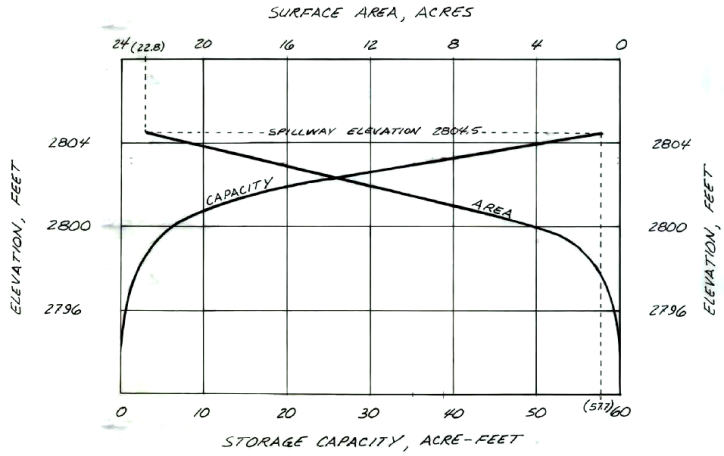
(iv)	**Define :** **(1) Duty** **(2) Delta** **(3) Base Period** **(4) Crop Period**		
Ans.	**(1) Duty –** Duty is the area in hectares (ha) irrigated by one cubic per meter per second of water flowing continuously for the base period for a particular crop.	**1**	
	(2) Delta – Delta is total depth of water required by a crop during the entire period of crop for complete maturity of the crop.	**1**	**4**
	(3) Base Period – Base period is period in days from first watering before sowing to the last watering before harvesting.	**1**	
	(4) Crop Period – Crop period is that period in number of days that crop takes from the instant of its sowing to that of its harvest.	**1**	
(b)	**Attempt any <u>ONE</u> of the following :**		**6**
(i)	**Describe in brief Hydrologic cycle with neat sketch.**		
Ans.	Hydrological cycle – 1. In general it means a term to show the circulation of water from ocean to atmosphere to the ground and back to ocean again. 2. Water from ocean is evaporated into atmosphere. The vapor is condensed and fall onto earth as rain fall. Some of water is evaporated back to atmosphere, some portion fall in direction of the ocean and some falls on land surface. 3. A portion falling on land is retained by soil, depression and vegetation and some portion runs as runoff and ultimately joins to ocean. The portion retained by soil infiltrate through soil and joins ground water which joins streams and ultimately ocean.		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1		4. The portion retained by vegetation returned to atmosphere by evaporation and transpiration. Thus the hydrologic cycle includes evaporation, precipitation and run off.	4	6
			2	
		Fig. Hydrological Cycle		
	(ii)	**Fix up the F.S.L, H.F.L, T.B.L. from the following data:** **1) Dead storage level = 200 m** **2) Effective live storage = 7.0 Ha.m** **3) Evaporation losses = 0.7 Ha.m** **4) Carry over = 0.5 Ha.m** **5) Max. flood discharge = 400 cumec** **6) Length of the waste weir (clear water way) = 120.00 m** **7) Franci's formula $Q = 1.9\ LH^{3/2}$ cumec** **8) Free board = 1.5 m**		
	Ans.	Effective live storage = 7.0 ha-m = 0.07 Mm^3 Evaporation losses = 0.7 ha-m = 0.007 Mm^3 Carry over = 0.5 ha-m = 0.005 Mm^3 Gross storage = Dead storage + Live storage Live storage =Effective live storage + evaporation losses + Carry over Live storage = 0.07 +0.007 + 0.005 = 0.082 Mm^3 Gross storage = Dead storage + 0.0082 Mm^3	1	
		Dead storage =? Gross storage =? F.S.L =? ***(Note No. 1: For above problem additional data is assumed.)***		

Contour (RL in M)	200	203	206	208
Storage (Mm^3)	1.2	2.3	3.8	4.5

Dead storage = 1.2 Mm^3
Gross storage = 1.2 + 0.082 = 1.282 Mm^3

1

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 1		From the above assumed storage capacity table, by interpolating RL corresponding to the storage capacity 1.282 Mm^3 will be, = 200 + [(203-200)/(2.3-1.2)] x (1.282-1.2) = 200.223 m	1	
		F.S.L = 200.223 M $Q = 1.9\ LH^{3/2}$ $400 = 1.9 \times 120 \times H^{3/2}$ H = 1.45 m	1	6
		H.F.L = H + F.S.L **= 1.45 + 200.223 = 201.673m**	1	
		T.B.L = FB + H.F.L **= 1.5 + 201.673 = 203.173m**	1	
		(Note No.2: If students assume the additional data and try to attempt the question, accordingly give appropriate marks.)		
Q. 2		**Attempt any FOUR of the following :**		16
	(a) Ans.	**Draw area capacity curve for a reservoir. State its use.**		
			2	4
		Fig. Area Capacity Curve		
		The area capacity curve is useful in: 1) Deciding capacity of reservoir. 2) Water spread of reservoir. 3) Elevation of water at any point can be calculated. 4) Determining control levels of dam.	**1 each (any two)**	
	(b) Ans.	**Define silting of reservoir. State factors affecting reservoir.** **Silting of reservoir**: Silting of reservoir means the deposition of silt and clay i.e. fine particles of soil in reservoir.	1	
		Factor affecting silting in a reservoir are as follows: 1) **Catchment area:** If catchment area is more, silting will be more. If catchment area is less, silting will be less. 2) **Shape of catchment:** If catchment area is fan shaped, silting will be more. If catchment area is fern shaped, silting will be less.	**1 each (any three)**	4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 2		3) **Slope of country:** If slope is steep, more particles will be erodes because of high velocity of runoff & will be deposited in reservoir basin and vice versa. 4) **Climatic condition:** Dry and rainy climate helps in production of more silt material. 5) **Nature of surface soil:** If soil is weathered or loose it can be easily flow with runoff and deposited in reservoir.		
	(c) Ans.	**Compare Earthen and Gravity dam with respect to foundation, seepage, construction and maintenance.**	1 each	4

Criteria	Earthen dam	Gravity dam
Foundation	They can be founded on any type of soil.	They cannot be founded on any on any soil without proper foundation.
Seepages	Seepage is more.	Seepage is less.
Construction	Locally available soil stone silt clay and sand can be used. Also Construction is easy.	Stone brick and concrete only can be used. Also Construction is not easy.
Maintenance	Maintenance cost is more.	Maintenance cost is less.

	(d) Ans.	**Draw a typical cross-section of earthen dam; show the all component parts.**	4	4

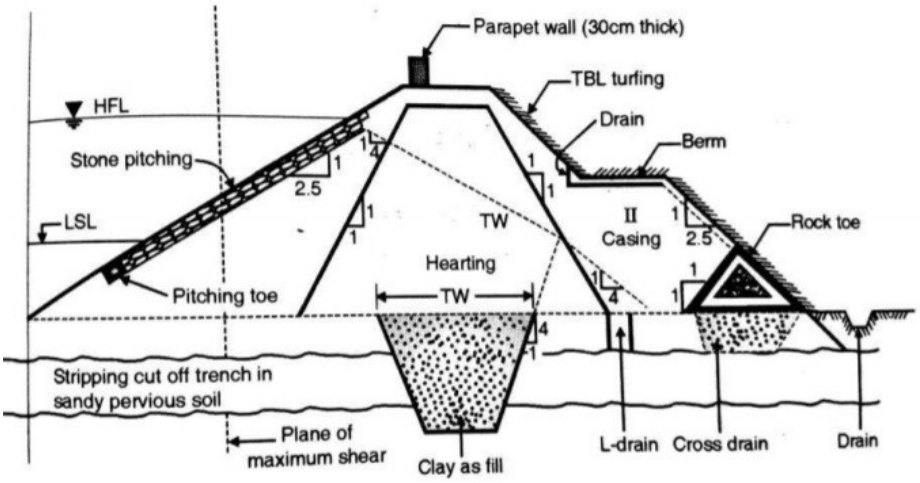
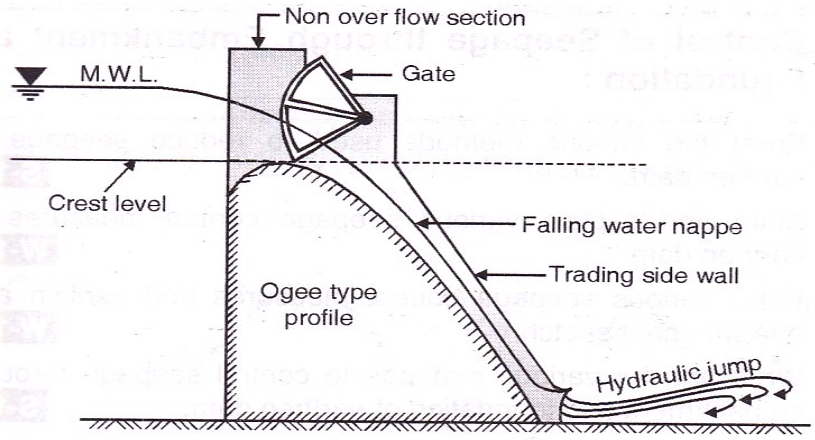


Fig. Cross-section of Earthen Dam

(Note: 3 marks for sketch and 1 mark for labeling.)

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 2	(e)	**Define Seepage. Enlist the various methods used to reduce seepage in earthen dam.**		
	Ans.	**Seepage**: The flowing of water through the pores of the soil is called seepage.	1	
		Various methods used to reduce seepage in earthen dam:		
		A] Control of seepage through Embankment 1] Provision of impervious core 2] Provision of rock toe 3] Provision of drainage blanket	1½	
		B] Control of seepage through Foundation 1] Cut off trench 2] Concrete cut off walls	1½	4
	(f)	**Define spillway and explain in brief ogee type spillway with neat sketch.**		
	Ans.	**Spillway**: Spillway is an arrangement provided at the crest of dam to expel the excess water rises above the full reservoir.	1	
			1½	
		Fig. Ogee spillway		
		Ogee spillway: The shape of spillway is Ogee or 'S' shaped. The main difference between free over fall spillway and ogee spillway is that in case of free over fall spillway water flowing over the crest of spillway drops vertically as free set where in ogee shaped spillway water is guided smoothly over the crest and is made to guide over the downstream face of the spillway. It is ideal spillway as water flowing over the crest of spillway always remains in contact with the surface spillway.	1½	4

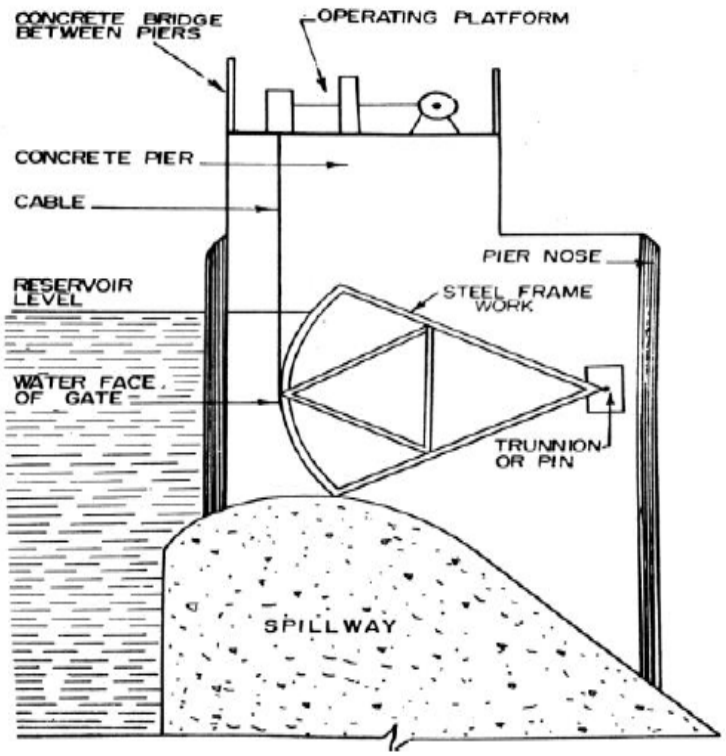
Q. 3 — **Attempt any FOUR of the following:** — **16**

(a) Ans. — **Distinguish between Low dam and High dam.** — **1 each (any four)** — **4**

High Dam	Low Dam
1) A gravity dam is said to be high when it's height in meters is more than the expression – $H = \frac{\lambda}{w(1+s)}$ Where, H = Height of dam in meters λ = Safe allowable compressive stress for dam masonry in tones /m^2 w = Specific weight of water in tonnes/m^3 s = Specific Gravity of dam material	1) A gravity dam is said to be low when it's height in meters is less than the expression – $H = \frac{\lambda}{w(1+s)}$ Where, H = Height of dam in meters λ = Safe allowable compressive stress for dam masonry in tonnes /m^2 w = Specific weight of water in tonnes/m^3 s = Specific Gravity of dam material
2) In general, if λ = 300 tonnes /m^2, w = 1 tonnes/m^3, s = 2.4 H = 88 m. If height of dam is more than 88 m, it is called high dam.	2) If height of dam is less than 88 m, it is called low dam.
3) The resultant may go outside the middle third point.	3) The resultant passes through the lower middle third point.
4) Maximum compressive stresses may exceed the permissible limit.	4) Maximum compressive stresses does not exceed the permissible limit.
5) Upstream face of dam given a slope for lower portion of dam height to maintain resultant in middle third portion.	5) Upstream face of dam is vertical.

(b) Ans. — **Explain in brief emergency spillway** — **4** — **4**

Emergency spillway is also called as breaching section and is provided in earthen dams and rock-fill dams. In such spillway part of the length of earthen dam is kept weak. It is constructed to dispose-off the excess floodwater more than the designed flood. The top of emergency spillway is kept below the top of main dam, but slightly above the H.F.L.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3		When abnormal high intensity flood occurs the weaker portion gets washed and flood water flows through that portion which acts as additional spillway and thus avoids possibility of failure of the dam. It can be reconstructed afterwards. Thus emergency spillway helps main spillway in emergency.		
	(c) Ans.	**Describe and sketch Radial gate.** **Radial gate can be described with the help of following points :** 1) The gate in cross – section is seen as a sector of a circle. 2) A radial gate has a curved water supporting face made of steel. 3) It is properly braced by a steel framework which is pivoted on horizontal shafts. 4) The gate can rotate about fixed horizontal axis. 5) Hoisting cables are attached to the gate and lead to winches on hoisting platform. 6) The gate is pulled up by using cables and water is released through the gate. 7) It is used for big spans varying from 4 m to 15 m height 3 m to 10 m	**2**	
		 **Fig. Radial Gate**	**2**	**4**

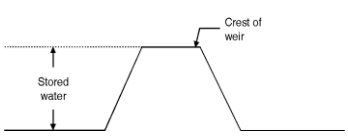
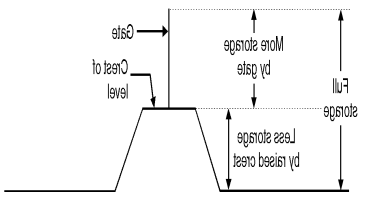
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3	(d) Ans.	**State the advantages and disadvantages of bandhara irrigation.** **Advantages of Bandhara Irrigation :** 1) The system of irrigation is economical. 2) The irrigated area is compact and hence irrigation is intensive, length of canal is less, transit losses are also less, all these factors lead to high duty of water. 3) The water of small catchments which would otherwise have gone waste is fully utilized. **Disadvantages of Bandhara Irrigation :** 1) As irrigable area is fixed if more water is available for irrigation it cannot be used. 2) There might be uncertainty of supply of water in case of non-Perennial River. 3) If number of bandhara is constructed on a stream downstream people may be adversely affected.	**1 each (any two)** **1 each (any two)**	**4**
	(e) Ans.	**State the points to be kept in mind while selecting site for percolation tank.** The following points need to be kept in mind while selecting the site for percolation tank, (1) The bed of tank should be pervious. So that water will percolate and join ground water. (2) There should be sufficient number of wells in the command area. If wells are not there then it will have to dig. (3) The site at which bunds are constructed should have sufficient discharge. (4) The side of stream should be steep. If the side are not steep it should be made by rising both sides. (5) For construction the material and labours should available near by the site.	**1 each (any four)**	**4**
Q. 4	(a)	**Attempt any <u>THREE</u> of the following:**		**12**
	(i) Ans.	**List the components of Lift Irrigation and state use of each.** 1) **<u>Intake well:</u>** A channel is constructed for diverting the flow of water to inlet chamber. 2) **<u>Inlet chamber:</u>** It avoids silts and debris to enter into jack well. 3) **<u>Jack well:</u>** It is provided to facilitate location of an engine house above high flood level and allows pumping during floods. 4) **<u>Inlet pipe:</u>** To convey water from inlet chamber to jack well and inlet pipe is provided with proper gradient. 5)**<u>Engine House</u>**: It is small storage room which accommodates the engine and pumps to be installed. 6**<u>) Rising main:</u>** It is a delivery pipe which transmits water from well to delivery chamber. 7) **<u>Delivery chamber:</u>** The water from rising main is collected in delivery chamber and then it is allowed to flow in field ditches. 8) **<u>Water distribution system:</u>** It is the system which distributes water from delivery chamber to field channel.	**½ each**	**4**

Q. 4 (ii) Ans. **Differentiate between sprinkler and drip irrigation on any four points**.

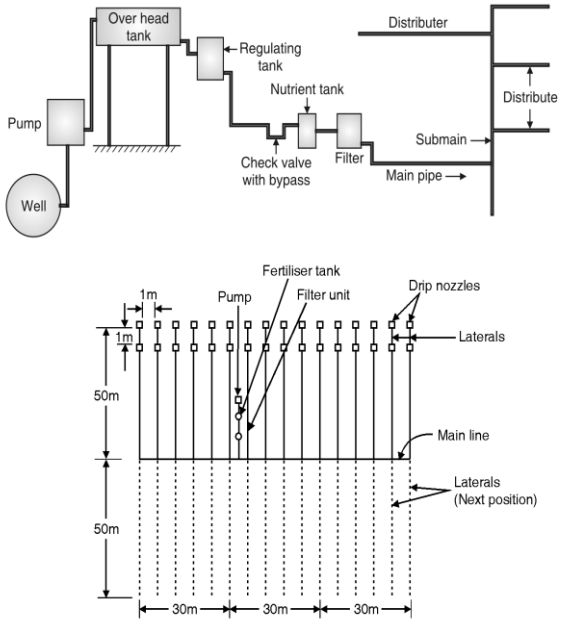
Sr. No.	Drip irrigation	Sprinkler irrigation
1.	Initial investment is more.	Initial investment is less.
2.	Dripping valves are present in drip system	Spray guns and nozzles are used in sprinkler system.
3.	Only the root area is wetted by drip irrigation	Sprinkler wets an area of a circle, which covers a number of plants. more area is wetted by this system
4.	Drip irrigation prevents the spreading of diseases	Sprinkler system does not prevent the spreading of diseases
5.	Run off and evaporation is less in sprinkler method.	Run off and evaporation is higher in sprinkler method.
6.	The effectiveness and efficiency is higher in drip irrigation	The effectiveness and efficiency is lesser in sprinkler irrigation

Marks: 1 each (any four) — Total Marks: 4

(iii) Ans. **Differentiate between weir and barrage**.

Sr. No.	Weir	Barrage
01	Initial cost is low	Initial cost of barrage is high.
02	Area of submergence is more	Area of submergence is less
03	The raising and lowering of shutter is not convenient	The raising and lowering of shutter is convenient
04	The control over flood is not possible	There is good control over flood
05	It is difficult to inspect and repair	These provides better facilities for inspection and repair
06	Roadway is not possible across river	Roadway can be provided across the river
07	Storage of water is done by crest and very little by gate	In barrage most of water storage is done by shutter and very less by crest
08	Due to crest there is problem of silting.	There is good control over silt entry into canal.
09		

Marks: 1 each (any four) — Total Marks: 4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 4	(iv) Ans.	**State function of fish ladder and silt excluder.** **Function of fish ladder:** It is passage provided adjacent to divide wall for the movement of fish from upstream to downstream and vice versa. It allows free access to fish so that they can travel from colder water to hot water	2	
		Function of silt excluder: It is a device by which silt is excluded from water entering the canal. It is constructed in the bed in front of head regulator.	2	4
	(b)	**Attempt any ONE of the following :**		6
	(i)	**Give a field layout or arrangement for drip irrigation system; stating the components parts and their functions.**		
	Ans.		2	
		Fig. Field Layout		
		1. Pump unit : It conveys the water from the source and provides the pressure for delivery into the pipe system.	1	
		2. Control head or control valves : Control head is made of valves. These valves control the discharge and pressure of water in the complete system. It also consists of filters which clear the water.	1	
		3. Mainlines, submains and laterals : Water is pumped from source and conveyed to the fields from the control head through mainlines, submains and laterals. Mainlines, submains and laterals are generally made in PVC or polythylene hose which buried below ground.	1	
		4. Emitters or Drippers: It is a device by which the discharge of water from lateral to the plants can be controlled. Emitters are generally spaced more than 1m apart with one or more emitters.	1	6

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 4	(ii)	**Design the economical section of a canal suitable in the following case:** (1) Discharge = 1.3 cumecs (2) Coefficient of Rugosity = 0.025 (3) Canal is in full cutting with side slopes. = 3/2 :1 (4) Longitudinal bed slope = 1:2000		
	Ans.	$Q=1.3\ m^3/s,\ N = 0.025,\ S = 1:2000,\ Z = 1.5:1$ For economical trapezoidal section $\frac{(b + 2zd)}{2} = d\sqrt{(1 + z^2)}$	**1**	
		$\Rightarrow \frac{\left(b + 2 \times \frac{3}{2} \times d\right)}{2} = d\sqrt{1 + 1.5^2}$ $\therefore\ b = 0.605\ d$	**1**	
		By manning formula $V = \frac{1}{N} R^{2/3} s^{1/2} = \frac{1}{0.025} \times \left(\frac{d}{2}\right)^{2/3} \left(\frac{1}{2000}\right)^{1/2}$	**1**	
		$V = 0.563\ d^{2/3}$ …(1)		
		$V = \frac{Q}{A} = \frac{1.3}{(b + zd) \times d} = \frac{1.3}{(0.605d + 1.5d)\ d}$	**1**	
		$\therefore\ V = \frac{1.3}{2.10\ d^2}$ …(2)		
		Equation (1) and (2) $0.563d^{2/3} = \frac{1.3}{2.10\ d^2}$ $\quad d^{\left(\frac{2}{3}+2\right)} = 1.0995$		
		$d = 1.03m$	**1**	
		putting value of d in $b = 0.605\ d$	**1**	**6**
		$b = 0.62m$		

Q. 5 — **Attempt any TWO of the following:** — **16**

(a) **A main canal taking off from a storage reservoir irrigates the following crops as shown below** — **8**

Sr. No.	Name of crop	Crop period in Days	Area to be irrigate in (Ha)	Duty at the head of main canal in Ha/cumecs
1.	Sugarcane	280	360	650
2.	Overlap of sugar cane (HW)	100	80	650
3.	Jawar (Rabi)	120	4850	1700
4.	Bajri (Monsoon)	121	6490	2860
5.	Vegetables (HW)	120	360	700

Find discharge required at the head of the main canal taking time factor as 6/10. Assume 15% transit losses.

Ans.

Sr. No.	Name of crop	Crop period in Days	Area to be irrigate in (Ha)	Duty at the head of main canal in Ha/cumecs	Discharge Q=Area/ Duty cumec
1.	Sugarcane	280	360	650	0.553
2.	Overlap of sugar cane (HW)	100	80	650	0.1230
3.	Jawar (Rabi)	120	4850	1700	2.852
4.	Bajri (Monsoon)	121	6490	2860	2.269
5.	Vegetable (HW)	120	360	700	0.514

4

Discharge required for (HW) = 0.553+0.1230+0.514 = 1.19 cumec
Discharge required for (Rabi) = 0.553+2.852 = 3.405 cumec

2

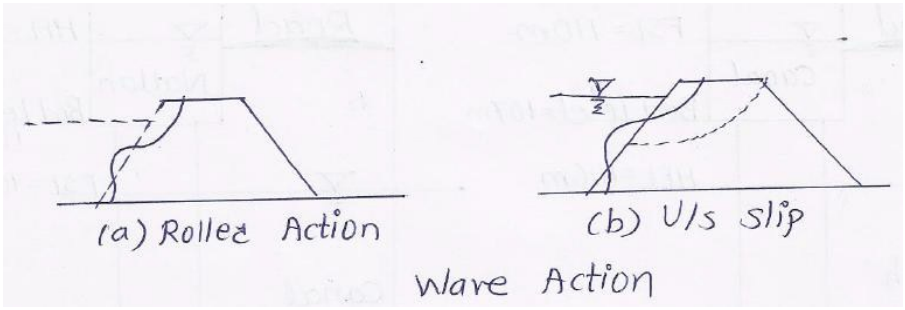
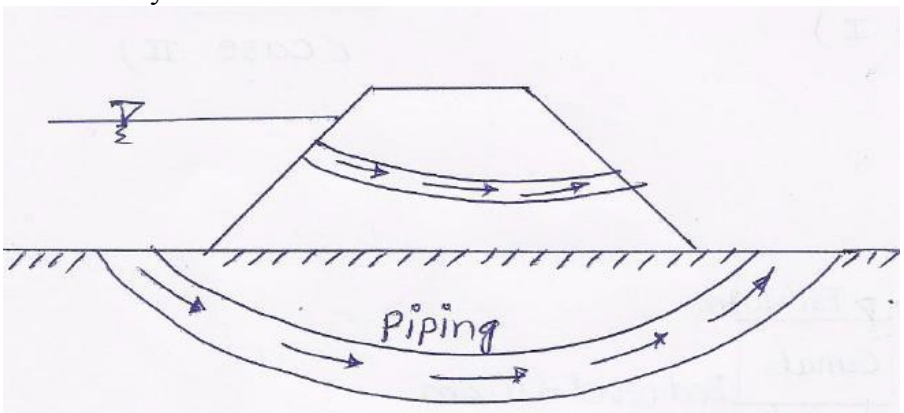
Discharge required for (Monsoon) = 0.553+2.269 = 2.822 cumec
Hence Q Max= 3.405 Cumec

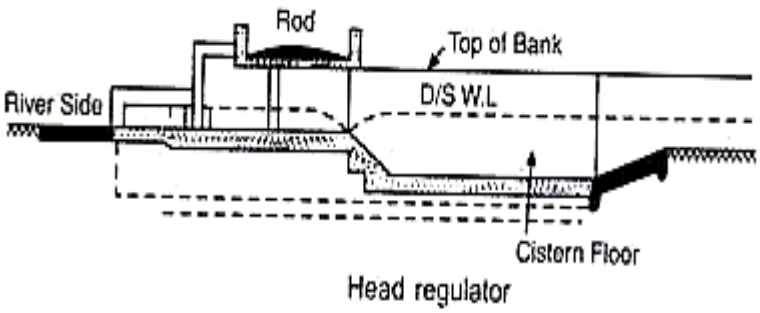
$$\text{Design discharge} = \frac{\text{Q Max}}{\text{Transit Losses} \times \text{Time factor}}$$

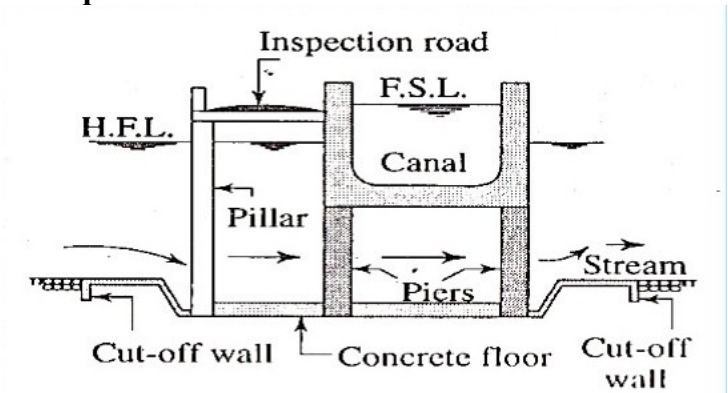
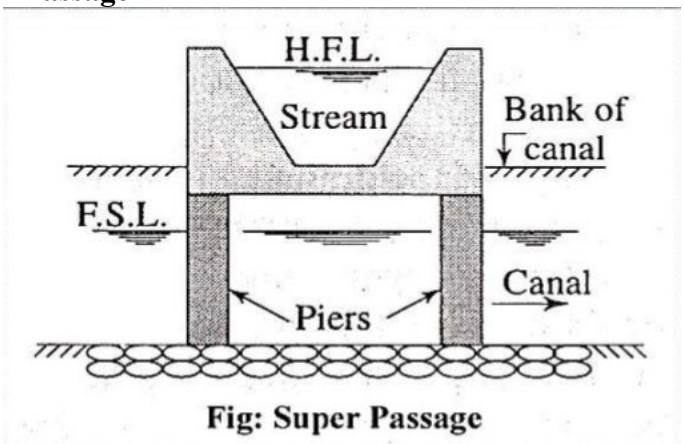
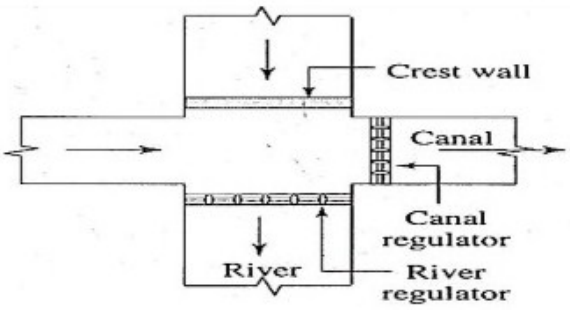
$$\text{Design discharge} = \frac{3.405}{(100\text{-}15)/100 \times (6/10)}$$

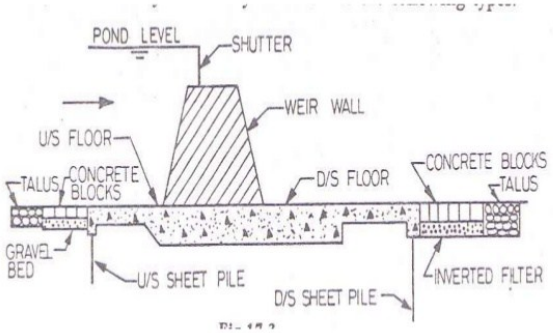
$$\textbf{Design discharge} = \frac{3.405}{0.85 \times 0.6} = \textbf{6.68 cumec}$$

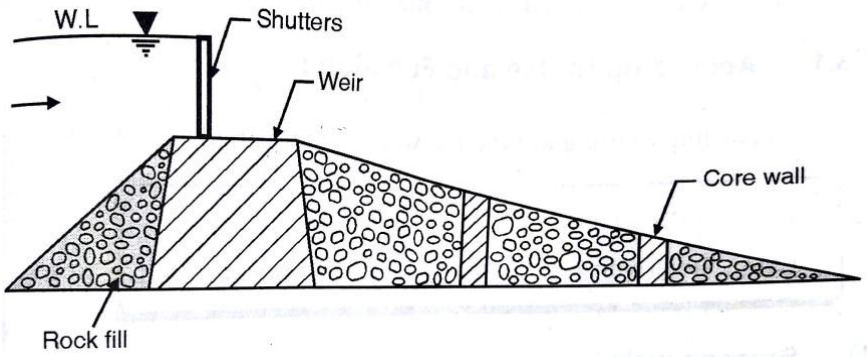
2 — **8**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5	(b) Ans.	**Describe in brief types of failure of earthen dam with neat sketch and state the remedial measure for the same.** **(1) Hydraulic Failure :** It may be caused by – **a) Overtopping:** If the actual flood discharge is much more than the estimated flood discharge or the free board is kept insufficient or there is settlement of the dam or capacity of spillway is insufficient, then it results in the overtopping of the dam. During over-topping the crest of the dam may be washed out & the dam may collapse.	1	
		b) Erosion: If the stone protection on u/s side is insufficient, then the u/s face may be damaged by erosion due to wave action. The d/s side also may be damaged by tail water, rain water etc. The toe of the dam may also get damaged by water flowing through spillways.	1	
				
		(2) Seepage Failure : It may be caused by – **a) Piping:** Due to continuous seepage, flow through the body of the dam & through the sub-soil below the dam. The d/s side gets eroded or washed out & a hollow pipe like groove is formed which extends gradually towards the u/s through the base of the dam. This phenomenon is known as piping or undermining. It weakens the dam & ultimately causes the failure of the dam.	1	
				
		b) Sloughing: The crumbling of the toe of the dam is known as sloughing. When the reservoir runs full, for the longer time, the d/s base of the dam remains saturated. Due to the force of seepage water the toe of the dam goes on crumbling gradually. Ultimately the base of dam collapses.		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5		**(3) Structural Failure :** **a) Sliding of side slopes**: Sometimes it is found that the side slope of the dam slides down to form some steeper slope. Then the dam goes on depressing gradually & then overtopping occurs which leads to the failure of the dam. **b) Damage by Earthquake:** The earthquake cracks may develop on the body of the dam. It may eventually collapse. c) Damage by burrowing animals: Some burrowing animals like craw, fish, snake, squirrel etc. causes damage to the dam by digging holes through the foundation & body of the dam. **Remedial measures to avoid failure of earthen dam :** 1) Control of seepage through embankment a) Provide Hearting in the central portion of dam. b) Provide casing over the hearting. c) Provision of horizontal drainage blanket 2) Control of seepage through foundation a) Provide cutoff trench under hearting zone. b) Provide concrete cut-off wall 3) Control of seepage in general a) Provide rock toe on d/s face at toe. b) Provide pitching on u/s slope. c) Provide turfing on d/s slope. d) Provide berms at 8 to 10 m vertical interval on d/s.	**1** **1 each (any four)**	**8**
	(c)	**Draw a neat sketch of following structures and state their suitability favoring:** **i) Head Regulator** **ii) Siphon Aqueduct** **iii) Super Passage** **iv) Level Crossing**		
	Ans.	**i) Head Regulator**  Head regulator **Head regulator**: It 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 downstream.	**1** **1**	

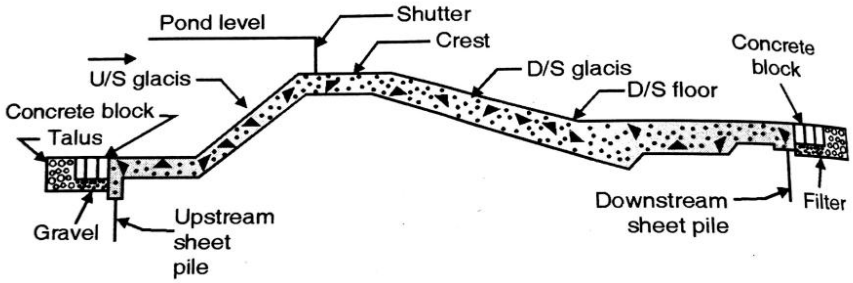
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5		**ii) Siphon Aqueduct**  **Fig: Siphon Aqueduct** This structure is suitable when the bed level of canal is below the highest flood level of drainage. **iii) Super Passage**  **Fig: Super Passage** This structure suitable at point of crossing where drainage water is taken over the canal. **iv) Level Crossing**  Level crossing is constructed where RL of canal bed and RL of natural drain are practically the same. Also when the discharge of drain and that of the canal is approximately of the same magnitude, duration of the flood in drain is short and no other structure is economically feasible.	1 1 1 1 1 1	8

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6		**Attempt any FOUR of the following:**		16
	(a) Ans.	**Describe in brief types of weir.** Weirs are mainly classified as follows 1) Gravity weir. Depending on material and design features, gravity weirs are subdivided into following types- (i)Vertical drop weir. (ii) Sloping weir - a. Rock fill weirs. b. Concrete weirs. (2) Non gravity weir. OR Weirs are also classified as follows : (1) According to use and function. (1) Storage weir. (2) Pick up weir. (3) Diversion weir. (4) Waste weir. (2) According to control of surface flow. (3) According to the design of floors. (4) According to constructional material. **i) Vertical Drop Weir:** Vertical Drop weir  This type of weir consists of horizontal floor and masonry crest with vertical or nearby vertical downstream face and the shutters are provided at the crest. Most of the storage is done by raised crest and some storage by shutters provided over the crest. **ii) Rock Fill Weir** It is also called as dry stone slope weir. It is suitable for fine sandy foundation stone are mainly used for construction of such type of weir and hence requires large quantities of stone	**1 each (any four)**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6				

iii) Concrete Weir:

These are suitable for permeable foundations. In such weirs sheet piles are provided on both upstream and downstream floors in order to destroy the energy of water.

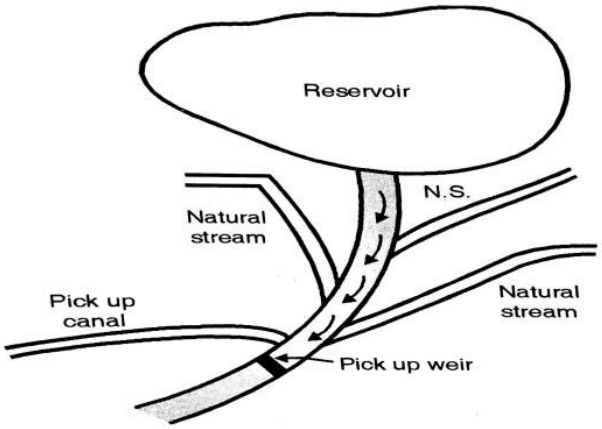


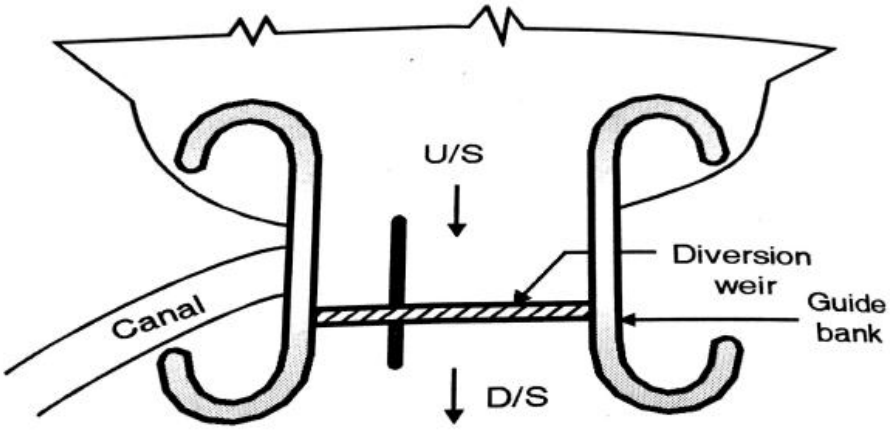
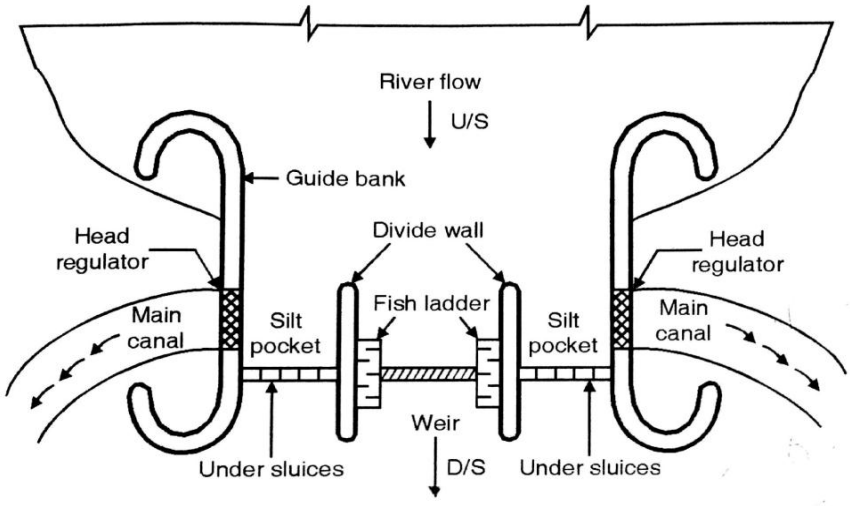
iv) Storage Weir :

It is high weir constructed for storing water. It is also called as diversion weir. In such weirs shutters may or may not be provided.

v) Pick Up Weir :

These are constructed when command area is far away from reservoir either due to rolling topography or because the land is not cultivable and if there is broken or rolling topography on one or both banks of parent river in which construction of canal may be costly.



Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6		**vi) Diversion Weir:** A weir which is constructed for diverting the river water into the canal is called as diversion weir. Generally it is constructed at 900 to the flow of river.  		
	(b) Ans.	**Draw the layout of diversion head work with its all components.**  **Fig. Diversion Head Work** ***(Note : 3 marks for sketch and 1 mark for labeling)***	**4**	**4**
	(c) Ans.	**Define canal lining. Enlist common material used for canal lining .** Lining of canal means providing impervious thin layer of 2.5 to 15 cm thickness to protect the bed and sides of canal. **Materials used in canal lining.** 1) Cement Mortar, lime Mortar 2) Concrete 3) Stone masonry 4) Brick 5) Sodium carbonate 6) Asphalt 7) Precast concrete block	**1** **½ each (any six)**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 6	(d)	**Sate the important points to be considered while fixing the alignment of canal.**		
	Ans.	Following points should be considered while fixing the alignment of canal:- 1. Along the alignment of canal, the cross – drainage works should be minimum. 2. The alignment of canal should be such that, water should flow under gravity. 3. The canal alignment should be such that, the quantity of earthwork in cutting should be equal to the quantity of earthwork in filling. 4. The alignment of canal should be such that, it can cover maximum command area. 5. The length of main canal should be minimum. 6. The number of curves should be minimum. 7. The alignment should not made in a rocky cracked strata.	**1 each (any four)**	**4**
	(e)	**State the causes and remedial measures of water logging.**		
	Ans.	**Causes:** 1. Seepage from the nearly channel. 2. Over irrigation of the fields. 3. Inadequate surface drainage system. 4. Obstruction of man-made constructions in the natural drainage **5.** Obstruction of sub-soil drainage.	**½ each (any four)**	
		Remedial measures: 1. Lining of canal 2. By providing intercepting drains 3. By providing proper drainage system 4. Awareness: by making the people aware about the proper use of water, over watering may cause water logging.	**½ each (any four)**	**4**