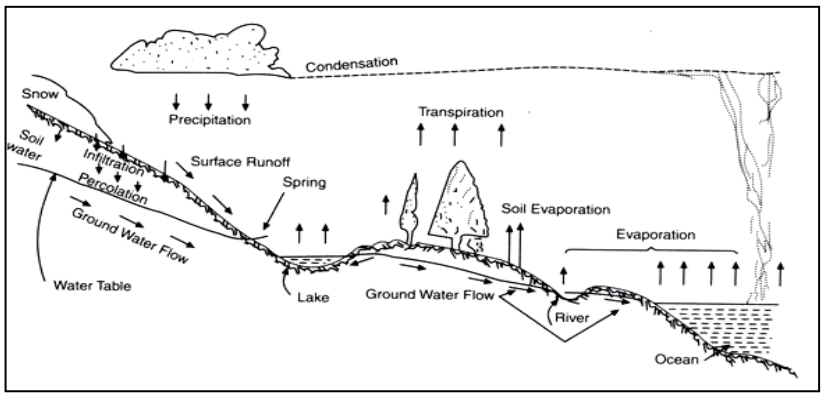
Model Answer: Summer-2019

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 Answer	Marks	Total Marks
Q.1	**a)**	**Attempt any THREE of the following:**		**(12)**
	(i)	**Define irrigation and state any four ill effects of irrigation.**		
	Ans.	Irrigation: The process of artificially supplying water to soil for raising the crops is called as irrigation. **OR** 'This artificial application of water to the land in accordance with the crop requirement is called as Irrigation.'	**2**	**4**
		Ill effects of irrigation are as follows: 1. Rising of water table /water logging 2. Formation of marshy land 3. Dampness in weather 4. Loss of valuable land 5. Tendency towards over irrigation.	**½ each (any four)**	
	(ii)	**State the factors affecting runoff.**		
	Ans.	**Factors affecting runoff:** **1. Rainfall characteristics:** a. More the rainfall, runoff will be more. b. More the intensity of rainfall more will be the runoff. **2. Topography:** a. It depends upon smoothness and roughness of the surface b. Steep slopes – Heavy runoff will reach the valley quickly, reducing losses gives more runoff. c. Catchment is mountainous, more will be runoff d. Catchment is in windward direction, more will be runoff **3. Shape and size of catchment:** a. Catchment area – Larger the area, more runoff. b. Fan shaped catchment gives greater runoff.	**1 each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	a) (ii) Ans.	**4. Characteristics of catchment :** a. Rocky strata – heavy runoff b. Compactive strata - heavy runoff c. Sandy strata – reduced runoff d. If more area of catchment is cultivated, surface runoff will be less. e. Presence of vegetation covers reduces the runoff during smaller storm. **5. Meteorological characteristics :** a. Low temperature – greater runoff b. High temperature– less runoff **6. Geological characteristics :** a. Pervious soil – reduces runoff b. Porous and fissure rock – very low surface runoff		
	(iii) Ans.	**Describe in brief hydrological cycle with neat sketch.**  **Fig. Hydrological Cycle**	**2**	**4**
		Hydrological cycle: a. It is a cycle followed by the water in three phase i.e. evaporation, precipitation and run-off. b. The hydrologic cycle begins with the evaporation of water from the surface of the ocean. As moist air is lifted, it cools and water vapor condenses to form clouds. c. Moisture is transported around the globe until it returns to the surface as precipitation. d. Once the water reaches the ground, one of two processes may occur; 1) Some of the water may evaporate back into the atmosphere or 2) Water may penetrate the surface and become groundwater. e. Groundwater either seeps its way to into the oceans, rivers, and streams, or is released back into the atmosphere through transpiration. f. The balance water that remains on the earth's surface is runoff, which empties into lakes, rivers and streams and is carried back to the oceans, where the cycle begins again.	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	(iv)	**Define: 1) Crop Period 2) Base Period 3) Duty 4) Delta.**		
	Ans.	**1. Crop period:** It is the period in number of days that crop takes from the instant of its sowing to that of its harvesting. **2. Base period:** It is the period in days from first watering at the time of sowing to the last watering before harvesting. **3. 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 **4. Delta:** Delta is total depth of water required by a crop during the entire period of the crop from first to last watering for complete maturity of the crop.	**1 each**	**4**
	b)	**Attempt any <u>ONE</u> of the following:**		**(06)**
	(i)	**A proposed tank has 950 km^2 of good catchment area. Assuming that dependable rainfall is 75 % of average annual rainfall of 110 cm, calculate yield in ha-m using Inglis formula for Non ghat area.**		
	Ans.	Data: Catchment area = 950 km^2, R = 75 %, Rainfall =110 cm Catchment area = 950 km^2 = (950 X 10^6) / 10^4 = 950 X 10^2 Ha Rainfall = 75% of average annual rainfall P = 75 /100 X 110 = 82.5 cm Runoff by Inglis formula for non ghat area R = [P(P – 17.74)] / 254 = [82.5 (82.5 – 17.74)] /254 = 21.03 cm = 0.21 m Yield = 950 X 10^2 X 0.21 = 19950 Ha-m	**1** **1** **1** **1** **2**	**6**
	(ii)	**Fix the control level i.e. dead storage level (DSL) and full reservoir level (FRL) from the following data:** **Effective storage for crops = 3200 ha-m** **Tank Losses = 20% of effective storage** **Carry over allowance = 10% of effective storage** **Dead storage = 10% of gross storage.**		

Contour RL(m)	250	253	256	278	281	284
Storage (mm^3)	3.3	4.1	5.25	42.65	47.3	55.12

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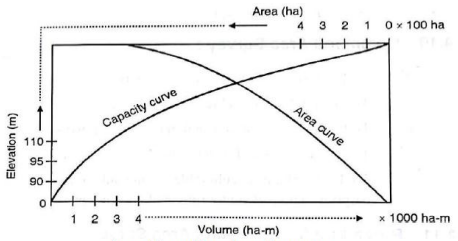
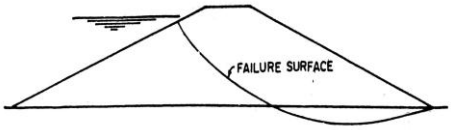
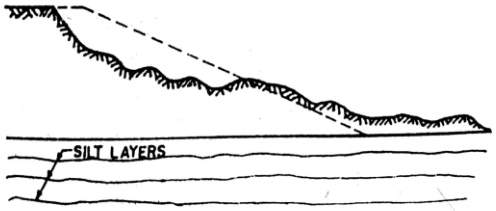
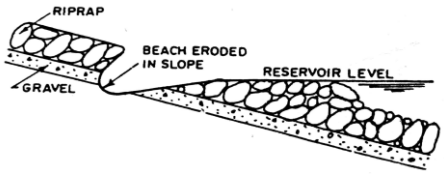
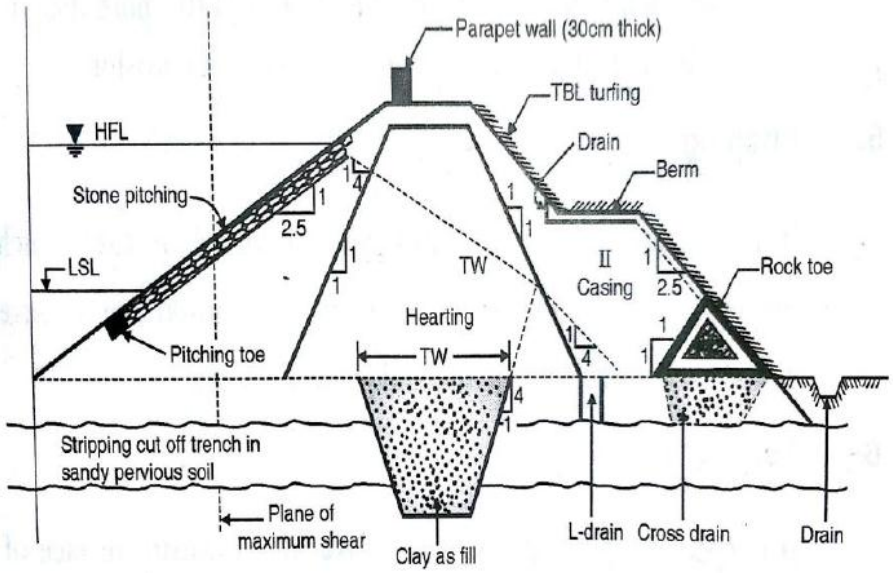
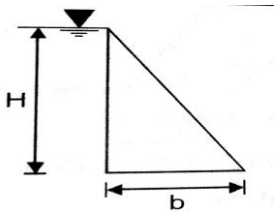
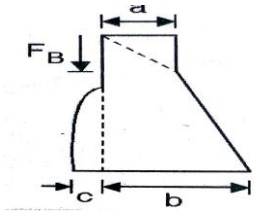
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	b) (ii) Ans.	Effective storage required for crops = 3200 ha-m = 32 Mm^3 Gross storage = Dead storage + Live storage……..(1) **Live storage =** Effective crop water requirement + Tank losses + Carry over allowance Effective storage required for crops = 3200 ha-m =(32 Mm^3) Live storage = 32 + (20/100) (32) + (10/100) (32)= 32+6.4+3.2 = 41.6 Mm^3 **Live storage = 41.60 Mm^3** From Equation (1), Gross storage =10/100 of gross storage + 41.6 0.9 Gross storage = 41.6 Gross storage = 46.22 Mm^3 From capacity table, by interpolating R.L. corresponding to the capacity 46.22 Mm^3 will be, = 278 + [(281 – 278) / (47.3 – 42.65)] X (46.22 – 42.65) = 280.30 m F.R.L.= 280.30 m Assuming flood lift and free board = 3 m HFL = FRL + Flood lift = 280.30 + 3 HFL = 283.3 M TBL = HFL + Free board = 283.3 + 3 = 286.3 M Dead storage = 10/100 of gross storage = 10/100 X 46.22 = 4.622 Mm^3 R.L. corresponding to the capacity of 4.622 Mm^3 = D.S.L. = 253 + [(256 – 253) / (5.25 – 4.1)] X (4.62 – 4.1) = 254.35 M D.S.L = 254.35 M	1 1 1 1 1 1 1	6
Q.2		**Attempt any FOUR of the following:**		(16)
	a) Ans.	**Describe in brief factors affecting silting.** **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. 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.	**1 each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	b) Ans.	**Draw area capacity curve and state its significance.**  Area-Capacity elevation curve **The significance of area capacity curve:** 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.	2 2	4
	c) Ans.	**Describe in brief structural failure of earthen dam with neat sketch.** **Structural failure may be due to following reasons:** **1. Upstream and downstream slope failures due to construction pore pressure:** When dam is built of relatively impervious compressible soil, the drainage is extremely slow and excess pore pressure develops during and immediately after construction. When the permeability is low, there may be no substantial drop in pore pressure in central zone of the dam by the end of construction if this lies within usual range of 2-4 years. An initial pore pressure up to almost 140% of total weight of soil, above the point considered has been more critical from the point of stability. **2. Upstream slope failure due to sudden drawdown:** When upstream slide occurs due to sudden drawdown, the pore pressure along the surface of slide is dissipated to large extent.  U/S SLOPE FAILURE DURING SUDDEN DRAWDOWN. **3. Downstream slope failure during full reservoir condition:** Critical condition for downstream slope occurs when the reservoir is full and percolation is at its maximum rate. The direction of seepage tends to decrease stability.  DEEP D/S SLIDES DURING STEADY SEEPAGE.	1 each (any four)	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	c)	**4. Foundation slide:** Spontaneous liquefaction- If the foundation is laid on soft soil then dam will slide. It may also slides if strata consist of weathered rock, shales etc. i.e. if a soft and weak strata exits in foundation. The dam may slide over some expansion of clayee soil on saturation may cause lifting dam. **5. Failure by spreading:** Failures by spreading have been observed only on connection with fills located above stratified deposits that contain layers of soft clay.  FAILURE BY SPREADING. **6. Failure by earthquake:** it depends upon the intensity of earthquake. The most serious damages and failures may be due to the following effects due to earthquake: a. Cracks in the core of dam leading to leakage and piping failure b. Settlement of the crest due to compression of foundation and / or embankment c. Shaking of reservoir bottom causing slow waves d. Liquefaction of sand below foundation. **7. Slope protection failure:** Slopes are generally protected by riprap over a layer of gravel or filter blanket. During a heavy storm the waves on the surface of reservoir beat repeatedly against the slope just above the reservoir level which causes erosion.  TYPICAL FAILURE OF RIPRAP. **8. Damage caused by water soluble materials:** The leaching of natural deposits of water soluble materials such as gypsum may cause excessive settlement.		

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	d) Ans.	**Discuss seepage control in earthen dam.** **a. Methods to control seepage through body of earthen dam:** 1. **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. 2. **Provision of rock toe:** rock toe is provided to change the path of seepage line and prevent sloughing of downstream toe. It reduces the submerged area of the dam section. 3. **Horizontal drainage blanket:** the seepage can be controlled by providing a horizontal drainage blanket along with the rock toe. **b. Methods to control seepage through foundation of earthen dam:** 1. **Cut-off trench:** a trench is excavated below hearting zone, filled with impervious soil a properly compacted. 2. **Concrete cut-off walls:** vertical impervious cut-off made of concrete or sheet piles may be provided at upstream side of earthen dam. Such cut-off should generally be extended through the entire depth of pervious foundation so as to achieve effective seepage control.	**1 each (any two)** **1 each**	**4**
	e) Ans.	**Draw typical cross section of earthen dam. Show all components of its.**  **Fig. Cross Section of Earthen Dam** ***(Note: 2 marks for sketch and 2 marks for labeling.)***	**4**	**4**
	f) Ans.	**Define gravity dam and enlist forces acting on gravity dam.** **Gravity dam:** gravity dam is a solid structure made up of masonry or concrete designed in such a way that its own weight resist the external forces and are constructed across river to create reservoir on its upstream side.	**1**	

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Q.2</td><td>f)</td><td>Forces acting on gravity dam:
1. Water pressure on upstream side
2. Water pressure on downstream side
3. Weight of the dam
4. Upstream silt pressure
5. Seismic forces
6. Uplift forces
7. Ice pressure
8. Wind pressure.</td><td>½ each (any six)</td><td>4</td></tr>
<tr><td>Q.3</td><td>a)

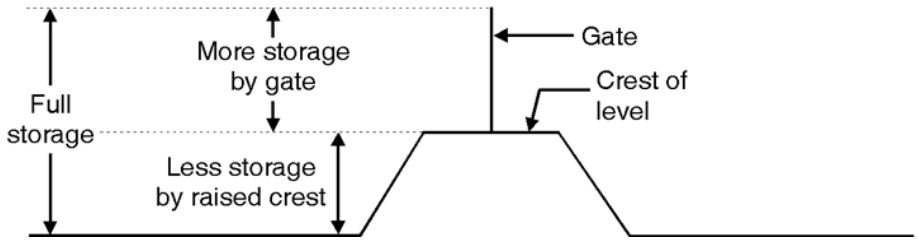
Ans.</td><td>Attempt any <u>FOUR</u> of the following:
Differentiate between theoretical and practical profile of gravity dam.
<table>
<tr><th>Sr. No.</th><th>Elementary Profile</th><th>Practical Profile</th></tr>
<tr><td>1</td><td>Provision of free board is not provided.</td><td>Provision of free board is provided.</td></tr>
<tr><td>2</td><td>Road way at top is not possible.</td><td>Road way at top is possible.</td></tr>
<tr><td>3</td><td>For reservoir empty condition it will provide maximum possible stability.</td><td>For reservoir empty condition tension is developed at toe and hence some masonry is provided on u/s side.</td></tr>
<tr><td>4</td><td> 
</td><td> 
</td></tr>
</table></td><td>1 each</td><td>(16)

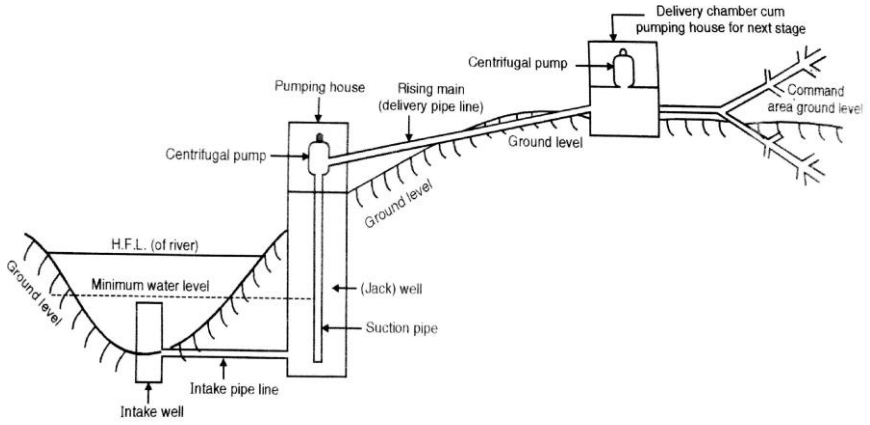
4</td></tr>
<tr><td></td><td>b)
Ans.</td><td>Define spillway. State the necessity and location of emergency spillway.
Spillway: It is a masonry or concrete overflow portion provided for every dam. It is also called as overflow portion of dam. It is very important component of a dam.
OR
It is an arrangement provided at the crest of dam to expel the excess water rises above the full reservoir level.
Necessity and location of emergency spillway:
Emergency spillway is provided to dispose-off the excess flood water 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. 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.</td><td>1

3</td><td>4</td></tr>
</table>

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	c) Ans.	**State the necessity of energy dissipators in spillway and enlist types of energy dissipators.** **Necessity of Energy Dissipators:** Energy dissipator in spillway is necessary to reduce or dissipate the kinetic energy of flow, before it enters in the tail channel. **Types of energy dissipaters:** 1. Hydraulic jump type 2. Bucket type 3. Jet diffusion type.	**2** **1 each (any two)**	**4**
	d) Ans.	**State the factors affecting on selection of site for percolation tank.** **Factors affecting on selection of site for percolation tank:** 1. The tank bed should be pervious. 2. The nalla or stream should have sufficient discharge in monsoon. 3. There should be number of wells on downstream side of the tank. 4. A good agricultural land should be available near each well. 5. The flanks on both the sides of the nalla should be rising with steep slopes. 6. The materials of construction, labour, machinery , approach road should available nearby.	**1 each (any four)**	**4**
	e) Ans.	**Define bandhara irrigation and state three advantages of bandhara.** **Bandhara Irrigation:** Bandhara irrigation scheme is a minor irrigation scheme in which direct irrigation is practiced. The bandhara is a masonry diversion weir of small height and the object is to raise water level in the stream. **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	**1** **1 each**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	a)	**Attempt any <u>THREE</u> of the following** :		(12)
	i)	**State the two advantages and two limitations of sprinkler irrigation .**		
	Ans.	**Advantages of Sprinkler irrigation system:** 1. Erosion of land can be controlled. 2. Uniform application of water can be possible. 3. Leveling of land is not required. 4. Elimination of seepage and percolation losses and prevents water logging. 5. Fertilizers can be applied ion solution form along with irrigation water. 6. More land is available for irrigation. 7. Small streams of irrigation water can be used effectively. 8. It is stand –by pumping set. **Limitations of Sprinkler irrigation system:** 1. Uniformity of irrigation is not achieved when wind velocity is more than 16 km/hour. 2. Initial cost of sprinkler set is high 3. Not suitable for crops requiring frequent large depth of irrigation water. 4. A constant supply is needed for economical use of equipment. 5. Water must be clean and free from sand. 6. The power requirement is high.	**1 each (any two)** **1 each (any two)**	**4**
	ii)	**Enlist component parts of drip irrigation and state function of each.**		
	Ans.	**The main components of drip irrigation:** 1. Pump unit 2. Control heads or control valves 3. Mainlines, sub-mains and laterals 4. Emitters or drippers **Functions of unit:** **1. Pump unit:** It conveys water from source and provides pressure for delivery into pipe system. **2. Control heads or control valves:** These valves control discharge and pressure of water in complete system. **3. Mainlines, sub-mains and laterals:** Water is pumped from source and conveyed to the fields from the control head through mainlines, sub-mains and laterals. **4. Emitters or drippers:** It is a device by which the discharge of water from lateral to the plants can be controlled.	**½ each** **½ each**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	iii) Ans.	**Define weir and state classification of weir.** **Weir:** It is an impervious barrier constructed across a river to raise its water level on its upstream side and divert the water into the canal taking off from its upstream side. **Classification of Weir:** **a) According to constructional material:** i) Masonry weir ii) Rockfill weir iii) Concrete weir **b) According to use and function:** i) Storage weir ii) Pick-up weir iii) Diversion weir iv) Waste weir **c) According to design:** i) Gravity weir ii) Non Gravity weir	**1** **1 each**	**4**
	iv) Ans.	**Define barrage and draw typical sketch of barrage. Write names to component parts of it.** **Barrage:** If storage of water is done by gates and very small portion or nil portion of water is stored by raised crest then the barrier is called as barrage. Barrage is a gate controlled weir. The heading up of water is effected by the gates alone.  **Fig. Typical Sketch of Barrage**	**1** **3**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	b)	**Attempt any ONE of the following:**		(06)
	i)	**Draw a neat labeled layout of lift irrigation scheme and state function of major component parts.**		
	Ans.		2	
		Fig. Layout of Lift Irrigation Scheme		6
		1) Intake well: A channel is constructed for diverting the flow of water to inlet chamber. **2) Inlet chamber:** It avoids silts and debris to enter into jack well. **3) Jack well:** It is provided to facilitate location of an engine house above high flood level and allows pumping during floods. **4) Inlet pipe:** To convey water from inlet chamber to jack well and inlet pipe is provided with proper gradient. **5) Engine House**: It is small storage room which accommodates the engine and pumps to be installed. **6) Rising main:** It is a delivery pipe which transmits water from well to delivery chamber. **7) Delivery chamber:** The water from rising main is collected in delivery chamber and then it is allowed to flow in field ditches. **8) Water distribution system:** It is the system which distributes water from delivery chamber to field channel.	**1 each (any four)**	
	ii)	**Design a trapezoidal channel for carrying 25 m^3/sec discharge of water. The bed slope of canal is 1:1800 side slope is 1.5 :1. Assume C= 50.**		
	Ans.	**Design the economical section of a canal suitable in the following case:** 1. Discharge = 25 cumecs 2. C = 50 3. Canal is with side slopes. (z) = 1.5 :1 4. Longitudinal bed slope (s) = 1:1800		

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	ii)	n= H/V = 1.50 For most economical channel, Half of the top width=length of sloping side. $R=\frac{d}{2}$ $\frac{b+2nd}{2}=d\sqrt{n^2+1}$ $b+2\times1.5\times d = 2d\sqrt{1.5^2+1}$ $b+3d = 3.605d$ $b = 0.605d$ Area = (b+ nd) d = (0.605d + 1.5d) d = 2.105 d^2 $Q = A\times C\times\sqrt{R\,S}$ $25 = 50\,(0.5d)^{1/2}\times(1/1800)^{1/2}\times 2.105\,d^2$ $14.25 = d^{5/2}$ d = 2.894 m b = 0.605d b = 0.605× 2.894 b =1.75m	1 1 1 1 1 1	6

Q.5 a) Attempt any TWO of the following: — **Marks: (16)**

Find the design discharge of canal for irrigating the crops as per detail given below:

(i) Transit Loss = 10%
(ii) Time Factor = 0.6
(iii) Capacity Factor = 0.7

Sr. No.	Name of Crop	Area under irrigation in Ha	Duty (Ha/cumec)
1	Sugarcane	300	650
2	Rice (Kharif)	200	600
3	Wheat (Rabbi)	1100	1700

Ans.

(1) Discharge for crops calculated as follows:

Sr. No.	Name of Crop	Area Irrigated (A in ha)	Duty (D in ha/Cumec)
1	Sugarcane	300	650
2	Rice (Kharif)	200	600
3	Wheat (Rabbi)	1100	1700

For Sugar cane
Q = Area / Duty = 300 / 650 = 0.46 cumec — **1**

For Rice (Kharif)
Q = Area / Duty = 200 / 600 = 0.33 cumec — **1**

For Wheat (Rabbi)
Q = Area / Duty = 1100 / 1700 = 0.65 cumec — **1**

Discharge required for Kharif season = 0.46 + 0.33 = 0.79 cumec — **1**
Discharge required for Rabbi season = 0.46 + 0.65 = 1.11 cumec
Max. Discharge = Discharge required for Rabbi season = 1.11 cumec — **1**

$$\text{Design Discharge} = \frac{Q_{max}}{\text{Time Factor} \times \text{Capacity Factor} \times \text{Transit Losses}}$$ — **1**

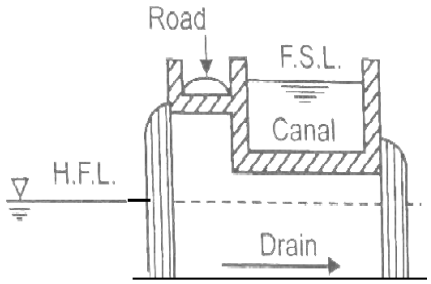
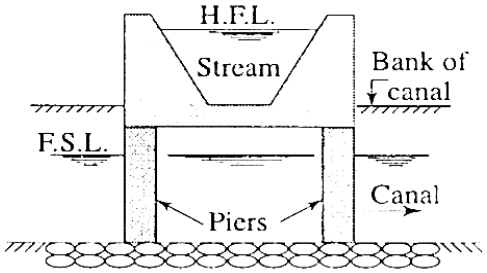
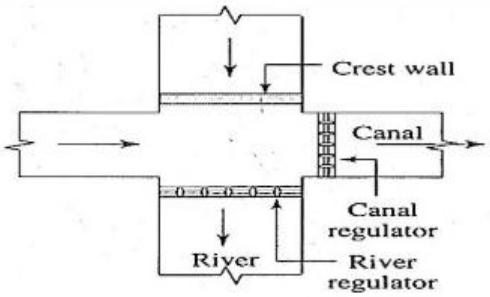
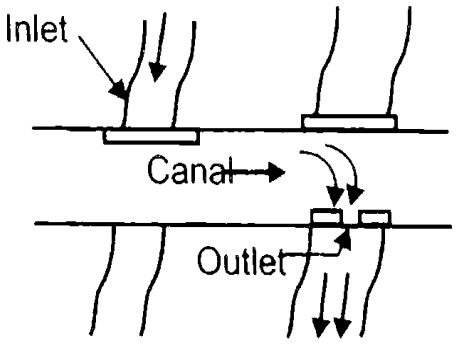
Design Discharge = 1.11 / [0.6 x 0.7 x {(100-10)/100}] = 1.11 / 0.378
= 2.936 cumec — **1**

Design Discharge = 2.936 cumec — **1**

8

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	b) Ans.	**Differentiate between gravity dam and earthen dam (eight points).**	1 each (any eight)	8

Sr. No.	Earthen Dam	Gravity Dam
1.	These are less durable.	These are more durable.
2.	It cannot withstand very high pressure.	It can withstand high pressure.
3.	It cannot be 100 % water tight.	It can be 100 % water tight.
4.	It cannot be made thinner.	It can be made thinner.
5.	Failure is sudden.	Failure if any is not sudden.
6.	Locally available soil stone silt clay and sand can be used.	Stone, brick and concrete only can be used.
7.	Skilled labour is not required for construction.	Skilled labour is required for construction.
8.	Spillway should be provided separately.	Spillways can be provided in the body of dam.
9.	Maintainance cost of earthen dam is more.	Maintainance cost of gravity dam is less.
10.	Initial cost is less.	Initial cost is more.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q. 5	c)	**Draw neat sketch of following.** **(i) Aqueduct** **(ii) Super Passage** **(iii) Level Crossing** **(iv) Inlet and Outlet**		
	Ans.	**Aqueduct:**  	2	
		Super Passage:  	2	
		Level Crossing:  	2	8
		Inlet and Outlet:  	2	

Q.6 **Attempt any FOUR of the following:** **(16)**

a) Ans. **Differentiate between weir and barrage.**

Sr. No.	Weir	Barrage
1.	Initial cost of weir is low	Initial cost of barrage is high.
2.	Area of submergence is more due to large afflux.	Area of submergence less due to less afflux.
3.	Due to crest there is problem of silting.	There is good control over silt entry into canal.
4.	The raising and lowering of shutter is not convenient it requires more time and labour as it is done manually.	The raising and lowering of gate is convenient as it can be operated mechanically.
5.	The control over flood is not possible.	There is good control over flood situation.
6.	It is difficult to inspect and repair.	These provides better facilities for inspection and repair of various structure.
7.	Roadway is not possible across river.	Road way can be provided across the river.
8.	Storage of water is done by crest and very little by or nil portion of water is by gate.	In barrage most of water storage is done by shutter and very less or nil portion of water is by crest.

Marks: 1 each (any four) **4**

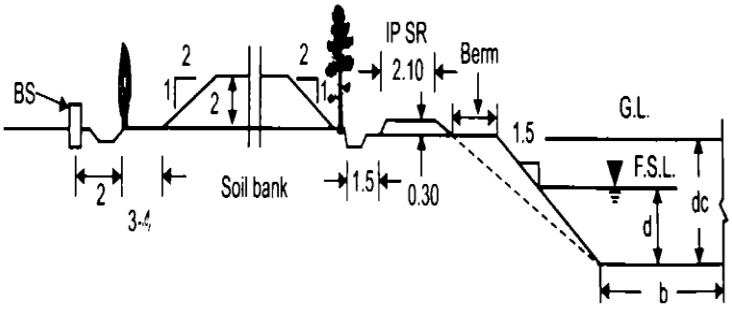
b) Ans. **State the function of following components of diversion head works: i) Fish ladder ii) Silt excluder iii) Divide wall iv) Guide bank**

i) Fish Ladder:
1. To provide free movement of fishes.
2. To help the survival of the fishes.

ii) Silt Excluder:
1. It prevents entry of silt particles into canal.

iii) Divide Wall:
1. To separate flow from the scouring weir which is at lower level than proper weir.
2. To separate the silting packet from scouring sluices

Marks: 1 each **4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	b)	3. To prevent formation of cross currents to avoid domain effects 4. To cut off the main portion of the river and provide a comparatively quite packet in front of the canal head regulator resulting in deposition of silt in the pocket and enter clear water in canal **iv) Guide Bank:** 1. It protects regulator from river attack. 2. It prevent out flanking of structure. 3. It create reasonable water way for a weir. 4. It prevent oblique approach to the head regulator. ***(Note: Only one function of each should be considered.)***		
	c) Ans.	**State eight advantages of canal lining.** **Advantages of canal lining:** 1. It reduces the loss of water due to seepage and hence the duty is enhanced. 2. It controls the water logging. 3. It provides smooth surface and hence the velocity of flow can be increased. 4. Due to the increased velocity the discharge capacity of canal is also increased. 5. Due to the increased velocity the evaporation also is reduced. 6. It eliminates the effect of scouring in the canal bed. 7. The increased velocity eliminates the possibility of silting in the canal bed. 8. It controls the growth of weeds along the canal sides and bed. 9. It provides the stable section of the canal. 10. It prevents the sub soil salt to come in contact with the canal water. 11. It reduces the maintenance cost of canal.	½ each (any eight)	4
	d) Ans.	**Draw labeled diagram of canal cross section in cutting.**  **Fig. Canal Cross Section In Cutting** ***(Note: 3 marks for diagram and 1 mark for labeling.)***	4	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	e) Ans.	**State the necessity of providing:** **(i) Canal Escape** **(ii) Canal Falls and Rapids** **(iii) Cross Regulator** **(iv) Canal Outlets** **(i) Canal escape:** 1. To remove surplus water from canal into some natural drain or nallah. 2. To avoid damage to the channel by surplus water. 3. To provide safety valves of canal 4. To save downstream section of canal from overflow of banks. **(ii) Canal Falls and Rapids:** 1. To lower the canal bed level according to the slope of ground 2. To maintain the designed bed slope of the canal. 3. To avoid heavy banking. 4. It gives the consideration of economy in cost of excavation of channel. **(iii) Cross Regulator:** 1. To control flow of water in the canal system. 2. To feed the off taking canals. 3. To enable closing of canal the canal branches on the downstream side. 4. To provide roadway for vehicular traffic. **(iv) Canal Outlets:** 1. To admit water from the distributor or parent channel to field channel. 2. To draw proportionate quantity of silt. 3. To measure the discharge released in the field channel. ***(Note: Only one necessity should be considered for each.)***	**1 each**	**4**