B.E. (Civil Engineering) Eighth Semester (C.B.S.)

Irrigation Engineering

P. Pages : 2 **NIR/KW/18/3612**

Time : Three Hours Max. Marks : 80

* 1 3 3 8 *

Notes :
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9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Discuss various factors which determine the soil water -plant relationship. **6**

b) A water course has a CCA of 1000 hectares. The intensity of irrigation for wheat crop is 45% & for rice crop is 30%. Wheat has a Kor period of 28 days & rice has a 20 days calculate the outlet discharge Kor depths for both are respectively 12 cm & 20 cm. **7**

OR

2. a) What do you understand by flow irrigation. **6**

b) Distinguish between : **Any two** **7**
   i) Base period and Kor period
   ii) Alkaline soil and saline soils
   iii) Border Irrigation and Furrow Irrigation

3. a) Define Mass curve. Explain the method to determine storage capacity of a reservoir using mass curve. **7**

b) Write short notes on **any two**. **6**
   i) Modes of failure of gravity dam.
   ii) Reservoir storage zones
   iii) Inspection Galleries.

OR

4. a) Distinguish between gravity dam and earthen dam. **6**

b) Explain the criterion for site selection for a reservoir. **7**

5. a) What are the different methods for reducing seepage in earth dam? **7**

b) Solve **any two** **7**
   i) Drainage Gallery & its effect on uplift pressure.
   ii) Explain elementary profile of a Gravity dam.
   iii) Explain various modes of failure in Gravity dam.

OR

6.	a)	Discuss the main principles of design of a gravity dam. Explain how the design profile is evolved.	**7**
	b)	A Masonry dam (specific gravity = 2.25) with vertical face has top width 4m, bottom width 20m and height 24m. FRL is 3m below top. Determine the factor of safety against overturning and stresses developed at the toe and heel of the dam.	**7**
7.	a)	Explain the design criteria for Ogee spillway?	**5**
	b)	Design an earthen Canal section to carry 50 cumecs discharge at a slope of 0.25, given that N = 0.0225 and m = 1.0, where the symbols have their usual meanings. Comment on the designed channel section.	**8**

OR

8.	a)	Write a short note on spillway gates.	**6**
	b)	Explain Bligh's creep theory for design of weirs on permeable foundations.	**7**
9.	a)	A canal has bed width 6m and depth 1.2m, discharge 4.60 m^3 and slope 1 in 5000, manning's N = 0.0225 and CVR = 0.95. Check whether the chosen section satisfies Kennedy's theory.	**7**
	b)	Using Lacey's theory, design a channel section for the following data, Discharge $40 m^3/sec$, silt factor = 1, side slopes 1V : 0.5 H.	**6**

OR

10.	a)	Design a concrete - lined channel to carry a discharge of 100 cumec with a velocity not exceeding 2m/sec. Bed slope $= \frac{1}{2500}$, side slopes = 5/4 horizontal : 1 vertical, $\eta = 0.014$.	**7**
	b)	Discuss the causes and preventive measures of water logging.	**6**
11.	a)	What is meant by Canal falls? Why are falls constructed in modern Canal systems?	**7**
	b)	Explain economics of canal lining.	**7**

OR

12. Write explanatory notes on **any three:** **14**

i) Spillway gates
ii) Head regulators
iii) Tile drain
iv) Land redamation

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B.E. (Civil Engineering) Eighth Semester (C.B.S.)

Irrigation Engineering

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11. Use of non programmable calculator is permitted.

1. a) Define irrigation? Explain its necessity & scope in India. **6**

b) Describe the different types of irrigation scheme. Explain each briefly. **7**

OR

2. a) Define Duty, Delta, & establish a relation between them. **6**

b) Determine the depth of irrigation & duration in days after which you will supply water to irrigation plot from the following data :- **7**

i) Specific Gravity of Soil = 2.65. ii) Root zone depth = 750mm.
iii) Field capacity = 30%. iv) Wilting point = 15%.
v) Rate of consumptive use = 10 mm/day.
vi) Maximum permissible depletion of moisture = 75% of available moisture.

3. a) Define trap efficiency. What are the factors affecting it? Give significance. **6**

b) Explain the various 'Storage zones' & 'Control levels' of a reservoir. Draw a neat sketch. **7**

OR

4. a) Define Dam classify various types of dam. **6**

b) An impounding reservoir had original storage capacity for 738ha.m. the drainage area of the reservoir is 80sq. km, from which annual sediment discharges into the reservoir at the rate of 0.1153 ha.m per sq. km of the drainage area. Assume the trap efficiency as 80%. Find the annual loss of the reservoir in % per year. **7**

5. a) Explain hydraulic failure in Earthen dam. **7**

b) Find maximum shear & compressive stress on D/S face of a 200m high gravity dam having D/S slope of 0.7H : 1v throughout. The top width of dam is 10m. Weight of masonry may be taken as 24kN/sq. m & eccentricity of resultant as 20m. U/s face is vertical. Neglect uplift & tail water depth. **7**

OR

6. a) Explain the elementary profile of Gravity Dam. **7**

b) Derive expression for determining base width of dam based on **7**
i) Stress criteria ii) Sliding criteria

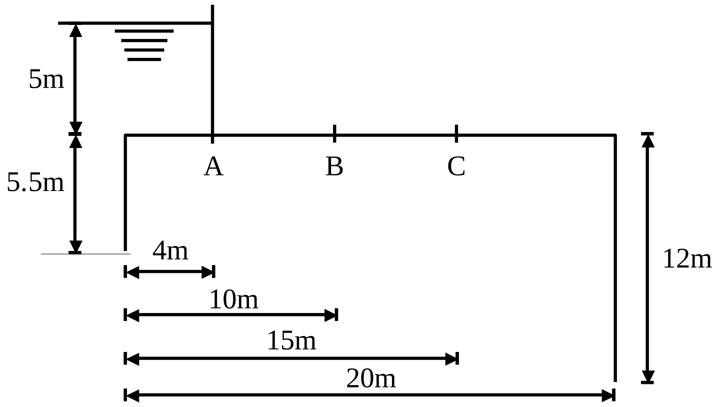
7. a) What is diversion head work? Draw neat layout & Explain its parts. **7**

b) Define energy dissipation. Discuss various methods used for Energy dissipation downstream of spillway. **7**

OR

8. a) Explain Khosla's correction theory for independent variable. **7**

b) Figure shows a section of a barrage built on fine sand. Using Bligh's creep theory find out **7**
i) Average hydraulic gradient
ii) Uplift pressures at points A,B,C.
iii) Thickness of floor at A,B,C.
Assume specific Gravity of concrete = 2.4.



9. a) Discuss the advantages and disadvantages of lining of an irrigation canal. **6**

b) Design a lined canal of trapezoidal section for a discharge of $150m^3$/sec. laid in a bed scope of 1in 10000. The side slopes are 1v: 1.5H manning's 'N' = 0.016. Assume $^B/_D$ = 1.5. **7**

OR

10. a) Write short note on Balancing depth. **4**

b) Design an irrigation channel in alluvial soil by using Lacey's silt theory for given data :- **9**
i) Full supply discharge = 18 cumecs.
ii) Side slope = 1v : 0.5H.
iii) Mean particle size = 3mm.

11. a) State the function of a head regulator, cross regulator, canal escape & irrigation outlet. **6**

b) What is water logging? Explain its causes & remeidal measures to control the same. **7**

OR

12. a) Write short notes on **any three.**
i) Cross drainage work. **5**
ii) Groynes. **4**
iii) Launching apron. **4**
iv) River training work. **4**

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B.E. (Civil Engineering) Eighth Semester (C.B.S.)

Irrigation Engineering

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10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Define the following. **6**

i) Wilting point.
ii) Gross commanded area.
iii) Crop rotation.
iv) Time factor.
v) Kor Period.
vi) Capacity factor.

b) The base period, intensity of irrigation & duty of water for various crops under the canal system are given. Determine the reservoir capacity if the culturable command area is 4000 hectares. canal losses are 25% and reservoir losses are 15%. **7**

Crop.	Base Period (days)	Duty at field (hec/cumec)	Intensity of Irrigation
Wheat	120	1800	20%
Sugarcane	360	1700	20%
Cotton	180	1400	10%
Rice	120	800	15%
Vegetables	120	700	15%

OR

2. a) Define Duty & Delta and derive the relationship between them. **6**

b) After how many days will you supply water to soil, in order to ensure efficient irrigation of the given crop if; **7**

i) Field capacity of soil = 27 %
ii) Permanent wilting point = 14 %
iii) Dry density of soil = 15 kN/m^3.
iv) Effective depth of root zone = 75cm.
v) Daily consumptive use of water for the given crop = 11mm.

3. a) Explain Brune's Method of estimation of useful life of a reservoir. **6**

b) Find the probable life of a reservoir from following data; **8**

i) Initial reservoir capacity = 30 Mm^3.
ii) Annual flood inflow = 60 Mm^3.
iii) Average annual sediment inflow = 36,00000kN
iv) Specific weight of sediment = 12 kN / m^3.
v) The useful life of reservoir will terminate when 80%. of initial capacity is filled with sediments.
vi)

Capacity Inflow	Trap efficiency (%)
0.1	87
0.2	93
0.3	95
0.4	95.5
0.5	96
0.6	96.5

OR

4. a) Explain the Reservoir storage Zones and mater levels with neat sketch. **7**

b) What is mean by mass curve? Explain the method of determining the reservoir capacity by mass curve. **7**

5. a) Explain the elementary Profile of a gravity dam. Derive $B = \frac{H}{\sqrt{\rho - c}}$ **6**

b) From the analysis of gravity dam, the following results were obtained; **7**

i) Summation of resisting moments = 1548000 kNM.
ii) Summation of overtraining moment = 1208050 kN-m.
iii) Summation of vertical forces = 32550 kN.
iv) Summation of Horizontal forces = 31340 kN.
v) Base width of dam = 55m
vi) Coefficient of friction of dam Material = 0.7
vii) Shear strength of joints = 1.4 N/mm^2.

Calculate Normal stresses at toc and Heel, factor of safety against overturning & shear friction factor.

OR

6. a) What are the Modes of failure of gravity dam? **6**

b) Define Phreatic line. explain the procedure for drawing phreatic line by Casagrande method. **7**

7. a) Explain salient features of Bligh's creep theory? **7**

b) Explain with neat sketch – **any two.** **6**

i) Still excluder.
ii) Divide wall.
iii) Energy dissipater.

8. a) Explain the corrections in Khosla's theory. **7**

b) Explain 'Ogee spillway' with labeled diagram. **6**

OR

9. a) Derive an expression for Balancing depth of a canal with neat sketch. **6**

b) Design a concrete lined canal to carry a discharge of 45 m^3/s with side slopes of 1.25 : 1 and Manning's N of 0.016, The Maximum permissible velocity is 1.8 m/s. & section is triangular. **8**

OR

10. a) Differentiate between Kennedy's & lacy's theory. **6**

b) Design an irrigation channel in alluvial soil. according to Lacey's silt theory for the following data. **8**

i) Full supply discharge = 12 cumec.
ii) Lacy's silt factor = 0.90
iii) Side slopes of channel = 1H: 2v

11. a) Explain cross drainage works with neat sketches. **7**

b) Write short notes on **any two.** **6**

i) Canal falls.
ii) Canal regulators.
iii) Components of head regulator.

OR

12. a) What is water logging? Write the causes, effects & remedial measures of water logging. **7**

b) Write short notes on **any two.** **6**

i) Land reclamation.
ii) Tile drain.
iii) Inlet and level crossing.

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B.E. Eighth Semester (Civil Engineering) (C.B.S.)

Irrigation Engineering

P. Pages : 3 — NKT/KS/17/7529

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9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Explain in brief the following : **6**

i) Storage irrigation.

ii) Drip Irrigation.

b) Determine the depth of application and duration in days after which the water is applied to the irrigation plot from the following data : **7**

i) Root zone depth : 1.5 m

ii) Soil density : 1500 gm/m^3

iii) Field capacity of soil : 25%

iv) Wilting coefficient : 13%

v) Rate of consumptive use : 15 mm/Day

vi) Permissible depletion of moisture : 60% of the available moisture.

OR

2. a) What is flooding method of irrigation ? In how many ways it can be accomplished ? **6**

b) Culturable command of a reservoir is 50,000 hectares. If canal losses are 5% and reservoir losses are 8%, find out the reservoir capacity based on the data given below : **7**

Crop	Base period in days	Duty in hectares / cumec	Intensity of irrigation as %
Wheat	120	2000	20
Rice	140	900	15
Cotton	180	1600	10
Sugarcane	360	2500	20

3. a) Write short note on **any one.** **6**

i) Storage capacity of a reservoir using mass curve.

ii) Sedimentation of reservoir.

b) A reservoir has been planned with useful life of 100 years. The storage capacity of the reservoir is 1000 millions cubic meters. The average annual yield from the basin is assessed to be 10,000 mm^3 and the average annual sediment flow to be 2 mm^3. In how many years the reservoir capacity will be depleted to 50% of its present capacity due to silting ? Trap efficiencies for various capacity inflow ratios are given as below : **7**

Capacity Inflow ratio	0.1	0.09	0.08	0.07	0.06	0.05
Trap efficiency (%)	86	85	84	82.5	80	78

OR

4. a) What is mass curve ? How will you determine storage capacity for the reservoir from the mass curve ? **6**

b) Explain with a neat sketch the storage levels and storage zones in a reservoir and also how these are fixed ? **7**

5. a) Explain with a neat sketch the elementary and Practical profile of gravity dam. **7**

b) A gravity dam is 10 m high. It has top width of 1 m and base width 9 m. The upstream face is vertical. The water is stored upto the top of the dam. The specific weight of concrete is 24 kN/m^3. Test the stability of this dam section against overturning. **7**

OR

6. a) Explain in brief the Hydraulic and seepage failures of earthen dam. **7**

b) A homogeneous earth dam has a section as follows : **7**

i) Top width = 6 m
ii) U/S slope = 2.5 H : 1V
iii) D/S slope = 2H : 1V
iv) Height of dam = 20 m
v) Free-board = 2 m
vi) Filter length = 20 m

The horizontal filter is provided on the downstream side. Draw the base parabola and the phreatic line. Also calculate the seepage per meter length of the dam if coefficient of permeability is 8×10^{-4} cm/sec.

7. a) Explain with a neat sketch : **6**

i) Divide wall

ii) Silt excluder

iii) Fish ladder

b) Explain in brief the design criteria of ogee spillway. **7**

OR

8. a) Explain in brief the design of a weir on permeable foundation using Bligh's creep theory. **6**

b) Explain with a neat sketch vertical and radial spillway gates. **7**

9. a) Explain in brief : **7**

i) Canal lining

ii) Kennedy's critical velocity ratio.

b) Using Lacey's theory, design a channel section carrying full supply discharge of 15 cumec. Mean diameter of silt particles is 0.33 mm and side slopes of the channel are 0.5:1. **7**

OR

10. a) Using Kennedy's theory, design a channel section carrying full supply discharge of 50 cumec. Kutter's N = 0.0225 and side slopes are 0.5 : 1. B/D ratio is 10.5. **7**

b) Design a trapezoidal shaped concrete lined channel to carry a discharge of 100 cumec at a slope of 1 in 4000. The side slopes of the channels are 1.5 : 1 and Manning's N may be taken as 0.016 Limiting velocity is 1.5 m/s. **7**

11. Write short notes on : **13**

i) Canal falls.

ii) Causes of Waterlogging and it's remedies.

iii) Superpassage and level crossing.

iv) Cross regulators.

OR

12. Write short notes on **any three.** **13**

i) Aqueducts and siphon aqueducts.

ii) Head regulators.

iii) Design of tile drains.

iv) Canal escapes.

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B.E. Eighth Semester (Civil Engineering) (C.B.S.)

Irrigation Engineering

P. Pages : 3 **KNT/KW/16/7529**

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9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Differentiate between : **any two.** **6**

i) Drip Irrigation and Sprinkler irrigation.

ii) Storage Irrigation and Flow Irrigation systems.

iii) Border Irrigation and Furrow Irrigation.

b) Following table indicates the data of a off-taking canal. **7**
Determine the discharge at the head of this canal by assuming 20% losses as conveyance losses.

S.N	Crop	Base Period (days)	Water requirement of crop (cm)	Area Irrigated (ha)
1	Sugarcane	300	400	1000
2	Overlap sugarcane in hot weather	100	150	200
3	Hot weather crop	120	150	300
4	Kharif crop	120	55	800
5	Rabi crop	120	70	900

OR

2. a) Define the following: **any four.** **6**

i) duty, ii) delta,
iii) capacity factor, iv) root zone depth,
v) field capacity vi) crop ratio.

b) After how many days will you do irrigation in order to ensure healthy growth of crops, if: **7**

i) Field capacity of soil = 30%
ii) Permanent wilting percentage = 13%
iii) Density of soil = $13 KN/m^3$
iv) Effective depth of root zone = 750 mm
v) Daily consumptive use of water for the given crop = 12 mm,

For healthy growth moisture content must not fall below 25% of the water holding capacity between the field capacity and the permanent wilting point.

3. a) Write Short Notes: **any two** **6**

i) Sedimentation of a reservoir
ii) Reservoir storage zones and water levels.
iii) Criterion for Selection of site for a reservoir.

b) The following table gives the mean monthly runoff of a river. **7**

Month	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Runoff Mm^3	3	5	8	13	16	18	12	8	5	2	2.2	2.5

Draw a mass curve and find the capacity of the reservoir for the combined demand for irrigation, power generation reclamation etc. is 5 million cu. m/ min.

OR

4. a) Explain how would you determine the area-elevation and capacity-elevation curves for reservoir and their utility? **6**

b) Fix FRL, LSL, HFL and TBL of a reservoir from the following data: **7**

i) Effective storage required for crops = 3200 ha-m
ii) Reservoir losses = 20% of effective storage.
iii) Carry over allowance = 10% of effective storage.
iv) Dead storage = 10% of gross storage.
v) Flood lift = 3.2 m
vi) Free board = 3.0 m

Contour RL (m)	81	84	105	108	111
Storage (Mm^3)	3.62	4.25	44.75	49.26	59.25

5. a) Solve **any two.** **7**

i) Explain elementary profile of a Gravity dam.
ii) Describe various modes of failure in Gravity Dam
iii) Drainage Gallery & its effect on uplift pressure.

b) A masonry dam (specific gravity = 2.25) with vertical face has top width 4 m, bottom width 20 m and height 24 m. FRL is 3 m below top. Determine the factor of safety against overturning and stresses developed at the toe and heel of the dam. **7**

OR

6. a) What are the methods of seepage control in an earthen dam? Explain with the help of neat sketches. **7**

b) Flow net was prepared for a 50 m high earth dam having 2.5 m free board, No. of potential drops = 20 and no. of flow channels = 5. If the dam is provided with 45 m horizontal filter at downstream side, determine the discharge per m length of the dam. Coefficient of permeability of the dam is 2.5×10^3 cm/sec. **7**

7. a) Explain the design criteria for Ogee Spillway? **6**

b) Explain Bligh's Creep theory for design of weirs on permeable foundations. **7**

OR

8.	a)	Explain with a neat sketch, the functions of **any two.** i) Divide wall ii) Silt excluder iii) Undersluices	**6**
	b)	Distinguish between a Chute spillway and a side channel spillway. Under what circumstances are they used?	**7**
9.	a)	Design an irrigation channel in fine alluvium to convey a discharge of 30 cumec with bed slope of 1 in 5000. CVR = 0.9 and Kutter's N = 0.0225. Assume side slopes of 0.5:1.	**7**
	b)	Using Lacey's theory, design a channel section for the following data: Discharage = $40m^3$/sec, Silt factor = 1, Side slopes = 1 V: 0.5H.	**7**

OR

10.	a)	Design a concrete-lined channel to carry a discharge of 100 cumec with a velocity not exceeding 2 m/s. Bed slope = 1/2500, side slopes = 5/4 horizontal: 1 vertical, n = 0.014.	**7**
	b)	Explain **any one** with neat sketch. i) Canal lining ii) Balanced depth of a lined canal	**7**
11	a)	Write Short notes on **any one.** i) Canal falls ii) Canal regulators	**6**
	b)	Write Short notes on **Any One.** i) Aqueduct and Super passage ii) Canal escapes	**7**

OR

12.	a)	What is waterlogging? Write the causes, effects and remedial measures of waterlogging.	**6**
	b)	Write short notes on **any two.** i) Groynes ii) River training work iii) Land reclamation	**7**

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Irrigation Engineering

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9. Assume suitable data whenever necessary.
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11. Use of non programmable calculator is permitted.

1. a) What do you understand by flow irrigation. **6**

b) Discuss various environmental effects of irrigation. **7**

OR

2. a) Distinguish between **any two.** **6**

i) Drip irrigation and sprinkler irrigation.

ii) Base period and Kor period.

iii) Alkaline soil and saline soils.

b) The CCA for a distributary is 15,000 ha. The intensity of irrigation is 40% for rabi and 10% for rice. If Kor period is 4 weeks for rabi and 2.5 weeks for rice, determine the outlet discharge. Outlet factor for rabi and rice may be assumed as 1,800 ha/m^3/sec and 775 ha/m^3/sec. What is design discharge at distributary head at 10% conveyance loss? **7**

3. a) Explain reservoir storage zones and water levels with a neat sketch. **6**

b) Explain the criterion for site selection for a reservoir. **7**

OR

4. a) Distinguish between gravity dam and earthen dam. **6**

b) Define mass curve. Explain the method to determine storage capacity of a reservoir using mass curve. **7**

5. a) Explain in brief forces acting on a gravity dam. **6**

b) Write short notes on **any two.** **7**

i) Elementary profile of a gravity dam.

ii) Inspection Galleries.

iii) Modes of failure of gravity dam.

OR

6. a) Define phreatic line. Explain the procedure for drawing phreatic line. **6**

b) Explain in brief seepage control measures in earthen dam. **7**

7. a) Discuss development utility & limitations of Khosla's theory. **6**

b) State the functions of the following in a head works with illustrative sketches. **7**
i) Silt excluder
ii) Divide wall
iii) Sheet piles.

OR

8. a) Write short notes on spillway gates. **6**

b) "Design criteria of ogee spillway" explain. **7**

9. a) Discuss the salient features of Kennedy's theory for the design of earthen channels based on the critical velocity concept. **6**

b) A canal has bed width 6m and depth 1.20 m, discharge 4.60 cumecs and slope 1 in 5,000- manning's N = 0.0225 and CVR = 0.95. Check whether the chosen section satisfies Kennedy's theory **8**

OR

10. a) Explain Lacey's regime theory. **6**

b) Design a channel section using Lacey's theory for discharge 15 cumecs, mean diameter of silt particles = 0.33 mm, and side slopes $\frac{1}{2}$:1, Also find the longitudinal slope. **8**

11. a) Distinguish between. **7**
i) Syphon and super passage. ii) Level crossing and inlet.

b) State under what circumstances you will recommend use of cross drainage works **7**
i) Syphon ii) Inlet along with neat sketch.

OR

12. Write explanatory notes on **any three.** **14**
i) land reclamation.
ii) Water logging.
iii) Tile drain
iv) Head regulators.

****