06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary figures are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Describe in brief stages of planning of irrigation projects. [4]
2. After how many days will you irrigate your field in order to ensure healthy growth of crops if [8]

   Field capacity of soil = 29%
   Density of soil = 1.3 gm/cc
   Daily consumptive use = 12 mm
   Permanent Wilting Point = 11%
   Effective root zone depth = 65 cm

   For healthy growth moisture content must not fall below 25%. How much irrigation water required at outlet of the field, if the application efficiency is 75%
3. Describe economic analysis of canal lining during design of irrigation canal. [5]
4. Design concrete lined canal to carry a discharge of 45 cumec. The bed slope of canal is assumed to be 1 in 7000. Take side slope of canal as 45° and manning coefficient is 0.015. [8]
5. Why Kholsa's theory is appropriate than other methods? Write down limitation of mutual interference correction while applying Khosla's seepage theory. [3+2]
6. Design crest elements, cistern elements and draw HGL line of a designed glacis fall on a canal waterway with the following data: [15]

   Full supply discharge = 118 cumec
   Full supply level of canal (U/S) = 209.7 m
   Full supply level of canal (D/S) = 208.2 m
   Safe exit gradient of canal material = 1/6
   Canal bed level (U/S) = 207.5 m
   Canal bed level (D/S) = 206.0 m
   Canal bed width (U/S & D/S) = 62 m
   Fluming ratio = 75 %
7. Write down essential requirement of outlet. Derive the relationship between Flexibility and Sensitivity. [2+3]
8. Neatly sketch a guide bund and design the following components of guide bund for river discharge of 4000 cumec of flood height 5.0 m and silt factor 1.1. [8]

   Length of guide bund
   Thickness of pitching
   Width of launching apron
   Depth of launching apron

9. A distributary channel having bed with 5.0 m full supply depth of 1.20 m carries 3.0 cumec of water. A semi modular pipe outlet in this channel has a command area of 15 ha growing rice with a kor depth 20 cm and kor period of 3 weeks. Determine the size of the outlet and set it for sub proportionality with a flexibility of 0.9. Assume length of pipe as 3.0 m and friction factor as 0.03. [8]

10. Design a siphon for the data given below: [8]

	Canal	Drainage
Discharge (m^3/s)	18.0	60
Bed level (m)	100.0	101.5
Side slope (V:H)	1:1.5	
Bed width (m)	6.0	
FSL/high flood level (m)	103.0	103.5

Lacey's silt factor = 1.0, Rugosing coeffient N = 0.016
Normal ground level = 102.0 m

11. Explain causes and remedial measures of water logging in the agriculture land and write the method as well as assumption adapted to design the surface drainage in terai region of Nepal. [3+3]

***

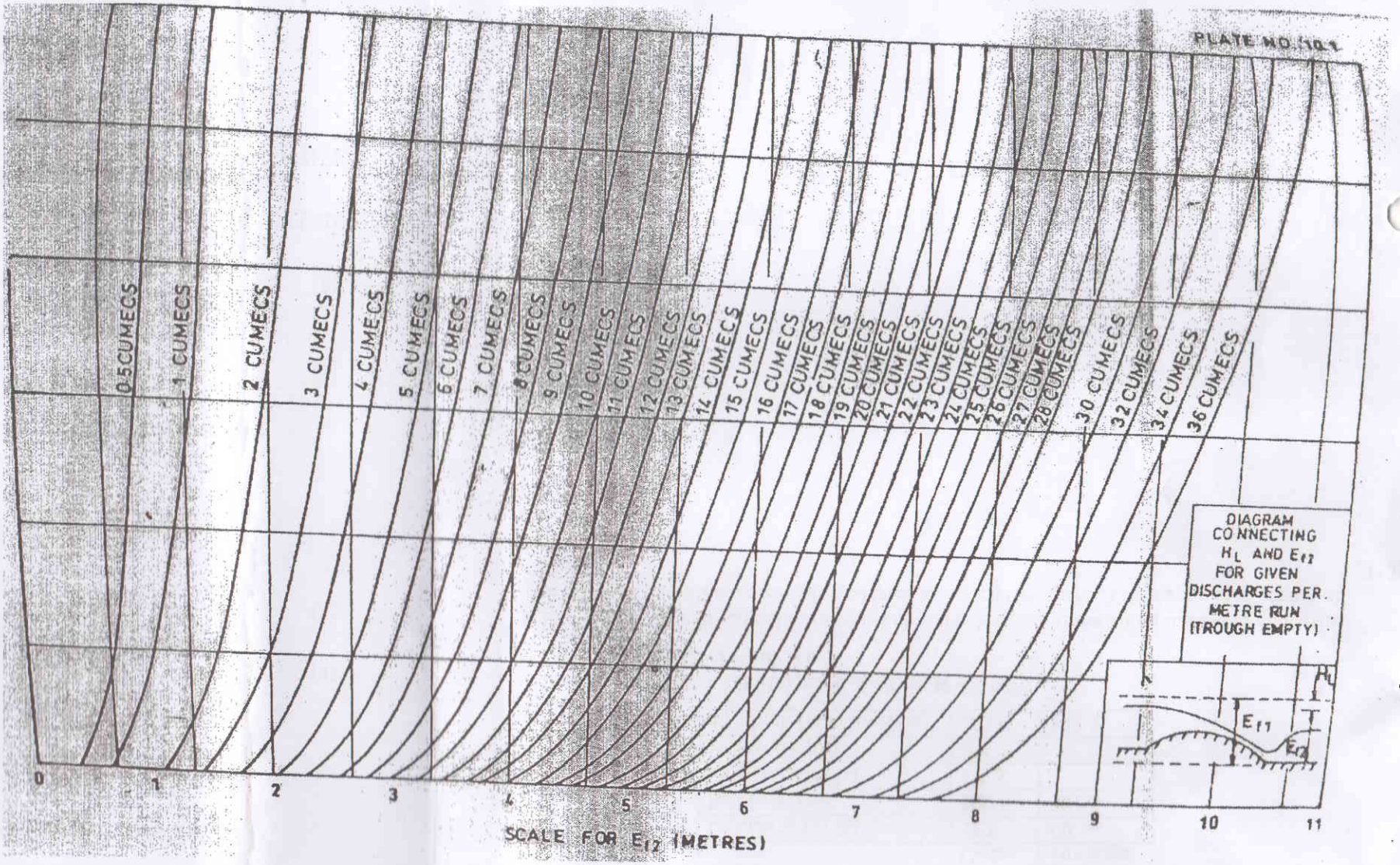


PLATE NO. 10.1
0.5 CUMECS
1 CUMECS
2 CUMECS
3 CUMECS
4 CUMECS
5 CUMECS
6 CUMECS
7 CUMECS
8 CUMECS
9 CUMECS
10 CUMECS
11 CUMECS
12 CUMECS
13 CUMECS
14 CUMECS
15 CUMECS
16 CUMECS
17 CUMECS
18 CUMECS
19 CUMECS
20 CUMECS
21 CUMECS
22 CUMECS
23 CUMECS
24 CUMECS
25 CUMECS
26 CUMECS
27 CUMECS
28 CUMECS
30 CUMECS
32 CUMECS
34 CUMECS
36 CUMECS
DIAGRAM CONNECTING H_L AND E_{12} FOR GIVEN DISCHARGES PER METRE RUN (TROUGH EMPTY)
E_{11}
E_{12}
H_L
0
1
2
3
4
5
6
7
8
9
10
11
SCALE FOR E_{12} (METRES)

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain GCA, CCA, NCA, Cropping Intensity and Cropping Pattern. [5]
   b) Write down the steps for calculating irrigation requirement for Rice crop. [4]
   c) The field capacity of soil is 40%, Permanent wilting point is 20%, Density of soil is 1.2gm/cc, effective root depth is 90cm, ET crop is 10mm/day. Calculate the irrigation interval (IR) if the readily available moisture (RAM) is 75% of available soil moisture capacity and show AMC, RAM and irrigation interval on graph of Available moisture and time. [5+2]
2. a) Write down the concept of Kennedy and Lacey's Silt Theory. [8]
   b) Proof using Lacey's Theory that $P = 4.75\ (Q)^{0.5}$ [4]
   c) Design a canal using Lacey's Theory carrying a discharge of 20 cumec, silt factor = 1.5 and side slope is 0.5:1(H:V) [4]
3. a) Write down the cause and effects of water logging. Also explain method of reclamation of water logged area. [6]
   b) Derive the expression for subsurface drainage spacing. [5]
   c) Explain different types of outlets used in irrigation projects. [5]
4. a) Neatly sketch a guide bund and design the following components of a guide bund for a river discharge of 4000 m^3/s and silt factor 1.1. [8]
      (i) length of guide bund
      (ii) thickness of pitching
      (iii)width of launching apron
      (iv)depth of launching apron
   b) Explain different level of planning in irrigation projects, also explain different types of maintenance in irrigation projects. [8]
5. Write short notes: [4×4]
   a) Irrigation Development in Nepal
   b) Types of Irrigation Method
   c) Different types of cross Drainage works
   d) Different types of Fall structures

***

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1) Describe about the different method of surface and sub-surface irrigation and their suitability. (5)

2) How do you calculate the frequency of irrigation on the basis of soil moisture? Water is released at the rate of 16 cumecs at the head sluice.If the duty at the field is 80 ha/cumecs and loss of water in transit 20%.Find the area of the land that can be irrigated. (8)

3) Describe with sketch about possible alignment of irrigation canal. (5)

4) Describe about alluvial and non-alluvial canal. Design a canal using Kennedy's formula with the following data:Q=40 m^3/s, manning's roughness coefficient (n) =0.018, bed slope(s) =0.00020, m=1.0 and side slope=0.5:1(H:V) (2+8)

5) Explain the design method to find the suitable size, length and thickness of floor of barrage Using Khosla's seepage theory. Also draw the typical section of barrage showing the different component. (6+6)

6) what is river training works. Explain with sketch three methods of training works normally adopted in Nepalese rivers. (8)

7) (a) what are the functions of head regulator and cross regulator. Sketch the section of cross regulator (2+2)

(b) Design a vertical drop structure for the data given below.

Full supply discharge u/s and d/s =1.8 cumecs

Drop height=0.75m

FSL u/s and d/s =106.997 and 106.247

Full Supply depth u/s and d/s =0.929m

Bed levels u/s and d/s =106.068 and 105.318

Bed width u/s and d/s =1.2m

Top width of crest =0.5m for initial assumption C_d=0.415 for rectangular crest. The drop structure is of masonry with specific gravity 2.0 Side slope of the canal is 1:1.The Bligh's coefficient as 6.0 for sandy loam soil at foundation. (8)

8) Design the following components of a suitable C/D work for the following data.

Discharge of canal=50 m^3/s , Bed width of canal=30m,Depth of water in canal=1.5m,Bed level of canal=100.0m,High flood discharge of drain=450 m^3/s, High flood level of drainage=100.50m,Bed level of drainage=98.8m,General ground level=100.0m (i)Design of drainage water- way(ii)Design of canal water way (iii) Design of transition and (iv)Uplift pressure on the roof. (10)

9) Explain about internal and external drainage system. Also explain the causes and remedial measures of water logging in the agriculture land and write the method as well as assumptions adapted to design the surface drainage in terai region. (3+3+4)

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary figures are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Justify the need of irrigation development in Nepal. Define cropping intensity and irrigation intensity. [3+2]

2. The base period, intensity of irrigation and duty of various crops under a canal irrigation system are given in the table below. Find the reservoir capacity if the canal losses are 18% and reservoir losses are 14%. [8]

Crop	Base periods (days)	Duty at the field (Ha/Cumecs)	Area under the crop (hectares)
Rice	120	850	3000
Wheat	120	1700	4500
Sugarcane	360	750	5400
Vegetables	120	650	1200
Cotton	200	1300	2200

3. Draw a typical cross section of a canal in partial cutting and partial filling and label at least five different canal elements on it. [5]

4. a) Sides of an irrigation canal with the following design parameters are well protected. What will be the stable depth and bed width of such a canal?

   $Q = 5\ m^3/s$, $d_{50} = 3$ cm, $i = 1$ in 500

   b) The slope of a channel in alluvium in 1/6000. Find the channel section and the maximum discharge which can be allowed to flow in it. Take $f = 1.0$. [5]

5. A diversion weir with a vertical drop to be designed for an irrigation system has the following data: Design flood = 4000 m^3/s; Natural width of the source river = 300 m; Bed material = Coarse sand, Bligh's C = 12; Lacey's f = 1.2; Height of weir above low water = 3.0 m; Top width of the crest = 2.0 m. Fix the length of the floor according to Bligh's principle and design the length of floor and depth of cutoffs using Khosla's seepage theory. Compute the thickness of the floor at key points. Make suitable assumptions if necessary. Draw a neat sketch of the designed weir.

6. What is meant by river training works and what are the different objectives served by it. What are the underlying principles behind the determination of spur spacing. Draw L and X - section of a typical spur. [1+2+2]

7. Describe the functions of different regulating structures used in an irrigation system. Design the crest and cistern of a drop structure (Sarda type) for a discharge of 9 cumecs and a drop height of 1.2 m: FSL u/s and d/s = 105.7 m and 104.5 m; Bed Level u/s and d/s = 104.2 m and 103.0 m; Bed Width u/s and d/s = 8 m; Side Slope of Channel = 1:1. [5+

8. Determine bed and water levels at four critical locations of the canal water way at transition of Syphonic Aqueduct designed with the following data.

Canal

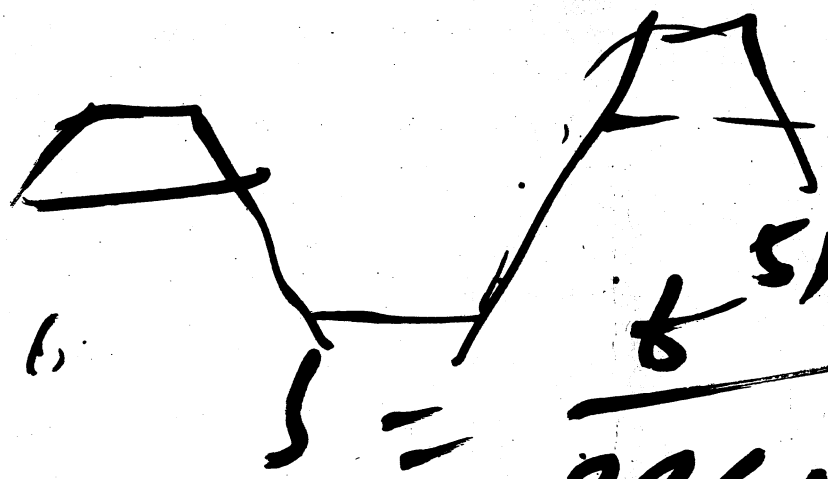
Full supply discharge = 40 m^3/s
Full supply level = 151.8 m
Side slope = 1.5:1
Depth of water = 1.5 m
Bed level = 150.00 m
Bed width = 32 m

Drainage

Maximum flood discharge = 520 m^3/s
High flood level = 150.6 m
Bed level = 148.2 m
Normal ground level = 150.00 m

9. List out the main effects and preventive measures of water logging. Estimate the rate of internal drainage discharge in lps/ha from bunded rice fields of Terai area. The 3-day design rainfall of 10 years frequency in that area has been estimated as 400 mm. Make suitable assumptions for removing excess water from the field of Terai. [4+6]

***



$$S = \frac{t^{5/3}}{3340\, P^{1/6}}$$

M = 28

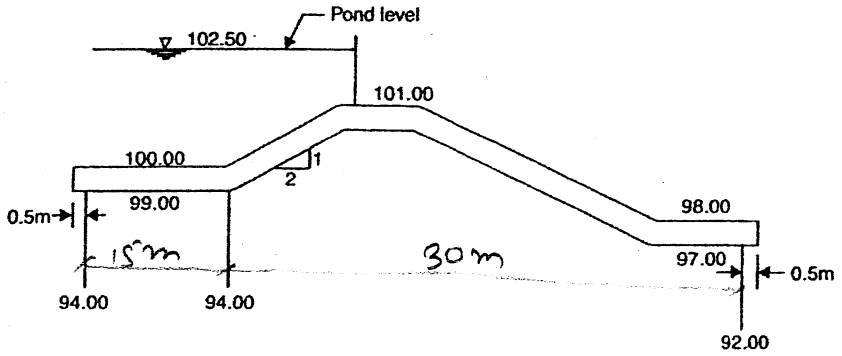
07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Exam.	**Regular**		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	III / II	**Time**	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Writing various methods of surface irrigation, discuss the suitability of drip and sprinkler irrigation. [5]
2. A minor commands 400 ha of irrigable area. It is proposed to consider wheat crop in the whole command area. The kor period for the wheat is considered 3 weeks. The kor depth has been assessed to be 10 cm. In this period 2.75 cm of rainfall is normally expected with such an intensity that 50% of this could be taken as superfluous (surface runoff). Considering 10% conveyance loss find out (a) duty of the canal water at the field head and (b) discharge of the minor at upstream head. [8]
3. Explain the components of a canal irrigation system. [5]
4. A stable channel is to be designed for a discharge of 40 m^3/s and the silt factor of unity. Calculate the dimensions of the channel using Lacey's regime equations. What would be the bed-width of this channel if it were to be designed on the basis of Kennedy's method with critical velocity ratio equal to unity and the ratio of bed-width to depth of flow the same as obtained from Lacey's method. [4+6]
5. Sketch the hydraulic gradient line for the weir profile, shown below, considering the case of no flow at pond level. Slope correlation for the slope (2:1) is 6.5 percent. Also compute the value of the exit gradient. [12]



6. The launching apron of a guide bank is laid in a width equal to 1.8 times the depth of scour below original bed. If a scour slope of 3:1 is to be maintained with thickness 1.5 t, find the thickness of apron before it get launched. Draw neat sketch of designed structure. [8]
7. a) Write down the functions of head-regulator and cross-regulator. [4]
   b) Why is the provision of drop structures required in an canal irrigation system. Explain with appropriate sketches. [4]
   c) Mention various types of canal outlet and describe in brief. What is flexibility of outlet? [4]

8. a) Following data are obtained at the crossing of a canal and a drainage. [6]

Canal data:

$Q = 20\ m^3/s$, depth of water = 1.5 m and FSL = 151.50 m, Bed width = 12 m, side slope (H:V) = (1.5:1)

Drainage data:

$Q = 200\ m^3/s$, HFL = 150.7 m, Bed level = 148.5 m and Ground level = 150.0 m

Design the following components of siphon aqueduct.

i) Drainage waterway
ii) Canal waterway
iii) Transition
iv) Uplift

b) Explain different types of cross-drainage structure with necessary sketch. [4]

9. Determine the drainage rate in l/s/ha required to meet the following conditions for healthy growth of rice paddies in bonded filed in Terai of Nepal. [10]

Initial water level in field = 50 mm
Maximum water level is 400 mm which may persist for up to one day.
Depth in excess of 250 mm may persist for up to 2 days.
No rain follows the design rainfall for several days.
Neglect ET and deep percolation losses.
Design 3 day rainfall is 400 mm.

***

03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chitra

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering *(EG724CE)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1.a. Explain following terms *(8)*
   a. GCA
   b. NCA
   c. Cropping Intensity
   d. Cropping Pattern

   b. Write down the steps for calculating irrigation requirement for Rice crop (4)

   c. The field capacity of soil is 40%, Permanent wilting point is 20%. Density of soil is 1.2gm/cc. effective root depth is 90cm, ETcrop is 10mm/day. Calculate the irrigation interval if the readily available moisture is 75% of available soil moisture capacity. (4)

2. a. Using Lacey's basic equation, establish a relationship between R, Q and f *(6)*

   b. Design a canal using Kennedy formulation with following data
   Q = 10 cumec, Manning roughness coefficient = 0.0245, slope of bed = 0.0002, m = 1 and side slope of canal 0.5:1 (H:V) *(6)*

   c. Write down the importance of canal living. *(4)*

3. a. Define groynes and explain different types of groynes *(8)*

   b. Explain different types of flood control measures *(4)*

   c. Explain different stages of rivers *(4)*

4. Calculate the uplift pressure at key points of piles in Fig 1. Also check the thickness of the floor at A, B location and exit gradient. The safe exit gradient is 0.2 (16)

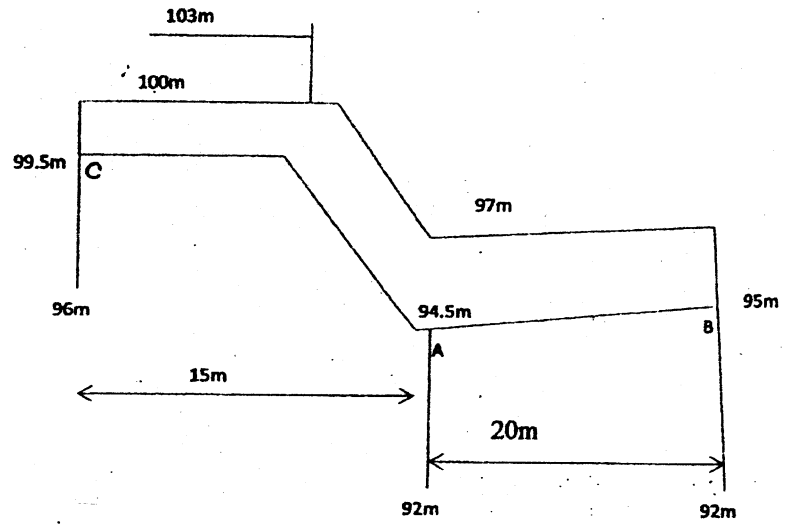


Fig. 1

5. a) Write down the cause and effects of water logging. Also explain method of reclamation of water logged area. *(6)*

b) Derive the expression for subsurface drainage spacing *(5)*

c) Write down the design criteria of surface drainages *(5)*

6. Write short notes *(4x4)*

a. Types of Irrigation Method

b. operation and Maintenance of Irrigation system

c. Modular and non modular outlets

d. Different types of Cross Drainage works

***

07 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Irrigation and Drainage Engineering *(CE654)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Write down sowing time, harvesting time and average delta of five principal crops of hills of Nepal. [5]
2. a) Write down the steps for calculating irrigation requirement for Rice crop. [5]

   b) The field capacity of soil is 60%, permanent wilting point is 25%, Density of soil is 1.2gm/cc, effective root depth is 120cm, ET crop is 9mm/day. Calculate the irrigation interval if the readily available moisture is 85% of available soil moisture capacity. [3]
3. Neatly draw the component of canal and explain it. [5]
4. Explain sediment transport and tractive force approach in canal design. [10]
5. Draw a neat sketch of the general layout of a diversion head works and cross sections of under sluices, canal head regulator and weir with all details. [3+3+3+3]
6. Following hydraulic data near a proposed bridge site are obtained.

   Maximum discharge = $4000m^3/s$
   Higest flood level = 205.0m
   River bed level = 200.00m
   Average diameter of river bed meterial = 0.1mm

   Design the following components of a guide bund and neatly sketch it. (i) Length of guide bund (ii) Thickness of pitching of the slope (iii) Length of launching apron (iv) thickness of launching apron. [8]
7. a) Design crest, length and thickness of impervious floor of a vertical drop structure for the data given below:

   Discharge = $1.8m^3/s$; Bed level U/S = 205.05m
   Side slope of channel = 1:1; Bed level D/S = 204.35m
   FSL U/S = 205.95m; Bed width U/S and D/S = 1.5m

   Top width of crest = 0.5m (for initial assumption); Cd = 0.415 sp.gr. of masonary drop structure = 2.2; Bligh's coeff = 6.0. [8]

   b) Describe with neat sketches the functions of distributory head regulator and cross regulator in a canal project. [4]
8. Design a syphon aqueduct (Drainage water way, Canal water way, Bed levels and Transitions) if the following data at the crossing of canal and drainage are given. [10]
   - Discharge of canal = 50 cumecs
   - Bed width of canal = 32m

- Full supply depth of canal = 1.80m
- Canal bed level = 200.0m
- Side slopes of canal = (1.5H:1V)
- High flood discharge of drainage = 400 cumecs
- High flood level of drainage = 200.60m
- Bed level of drainage = 198.0m
- General ground level = 200.20m

9. Design a surface drainage for a field of 40ha area in Terai with following data. Design maximum yearly precipitation for three consecutive days = 50mm, longitudinal slope of channel 1:400, Manning roughness coefficient 0.025, Maximum water level is 300mm which may persist for up to one day and depends in excess of 200mm may persist for up to 3 days. Assume other suitable values if necessary. [10]

***

03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) "Irrigation shall be given top priority for the overall development of our country". Justify this statement. [5]

   b) What do you mean by crop water requirement? Explain the factors affecting the crop water requirement. [5]

   c) After how many days will you supply water to soil (clay loam of 1.5 g/cc dry density, Field capacity = 25% and PWP = 13%) in order to ensure efficient irrigation of the crop for which daily consumption use of water is 10 mm. Take 75cm of root zone depth. [6]

2. a) Discuss, with suitable sketch, various methods of surface irrigation system. [5]

   b) A field channel has a culturable command area of 2000 hectares. The intensity of irrigation for gram is 30% and for wheat is 50%. Gram has a kor period of 18 days and kor depth of 12cm, while wheat has a kor period of 15 days and a kor depth of 15 cm. Calculate the discharge of the field channel. [6]

   c) Showing the position of a fish ladder, write its necessary in headworks. [5]

3. a) Prove that the wetted perimeter is directly proportional to square root of the design discharge. [4]

   b) Design an irrigation channel with side slope 0.5H: 1V to carry a discharge of 50 m^3/s at a slope of 1 in 5000. Take kutter's n = 0.0225 and C.V.R (m) = 0.9. [8]

   c) Draw cross section of an irrigation canal in cutting and filling showing major elements. [4]

4. a) Discussing sediment problems in an irrigation headworks, write any two methods of controlling sediment entry to the irrigation canal. [4]

   b) Design a 1.5 Sarda type fall for a canal having a discharge of 12 cumecs with the following data. [12]

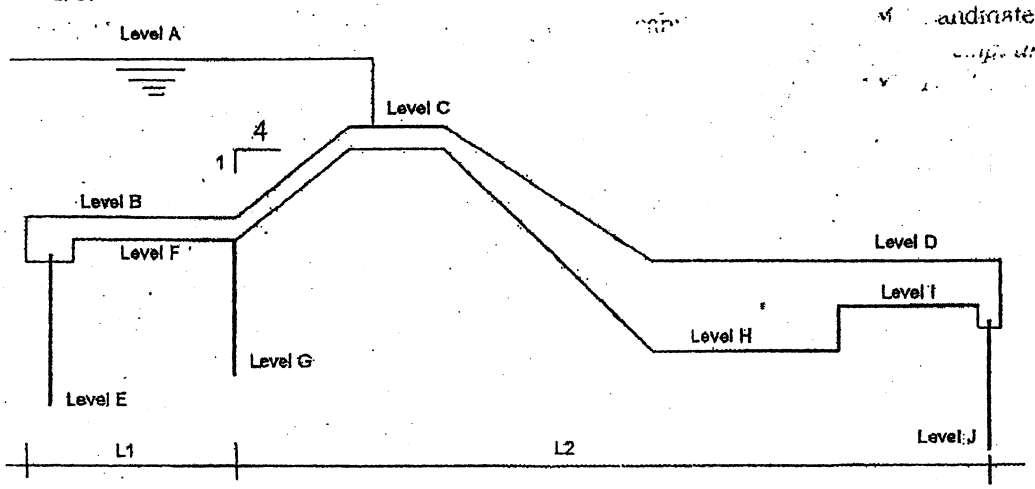
   Bed level u/s = 103.0m
   Side slopes of canal = 1:1
   Bed level d/s = 101.5m
   Full supply level u/s = 104.5 m
   Bed width u/s and d/s = 10m
   Soil = Good loam
   Bligh's Coefficient = 6

5. a) For the following irrigation headworks and respective data, [7+3]

Compute the pressure at the intermediate pile section

- Floor and pile interface
- Bottom end of pile

Check the exit gradient of the hydraulic structure. The safe exit gradient of the soil is 1/6.



Reference Point	Level, masl	Reference Point	Level, masl
A	160	F	142
B	143	G	139
C	146	H	140
D	142	I	141
E	138	J	135

L_1 and L_2 are 30m and 60m respectively. Correction factor for slope is 3.3. Use analytical method. Make suitable assumption if necessary.

b) What is outlet? Write down the requirements that an outlet should fulfill. Distinguish clearly between non modular and semi-modular outlet. [1+2+3]

6. a) What is water logging? Write down causes, effects and preventive measures of water loggings. [1+2+2+3]

b) With neat sketch (plan and section), show the river training works for a bridge. What is a launching apron? How is it designed? [4+4]

***

03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary chart is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. a) Calculate the design discharge of canal at 0, 1, 2 and 3 km from headworks. The GCA at the head of the canal is 40000 ha and after each km it is reduced by 6000 ha. Of this command, the CCA is only 70%. The intensity of irrigation for Wheat and Rice is 40% and 25% respectively. Assume total loss below 3km = 0.4 m^3/s; channel losses per km = 4% of discharge at beginning of each km; Kor period for wheat and Rice is 4 and 3 weeks respectively. Kor depth for wheat and rice is 14 and 20cm respectively. [9]

   b) What are the factors to be considered in fixing canal alignment? Discuss the types of canals and their suitability in planning of irrigation system. [7]

2. a) Find the spacing of the tile drains for an area having average annual rainfall of 1400mm, if 1% is to be drained in 24 hours. From ground level, depth of impervious stratum = 9m; depth of drains = 2m and depth of highest position of the water table = 1m. Coefficient of permeability may be taken as 0.001 cm/sec. [8]

   b) An irrigation canal passing through the alluvium soil (d_{mean} = 0.50mm) carries a discharge of 64 m^3/s. What major principle you apply while designing such a canal? Find out the principal dimension and bed slope of the canal and draw a sketch of the designed section. [1+6+1]

3. a) The cross drainage structure across an irrigation channel has following data: [12]

Parameters	Canal	Drainage
Discharge (m^3/s)	125.0	64.0
FSL/HFL (downstream) m	298.00	304.0
Bed Level (downstream) m	294.00	300.00
Bed width (m)	40.0	80.0
Side slope (H:V)	1:1	0:1

   Fix the waterway of the canal and drainage designing a suitable type of cross drainage structure and find out the bed level of the drainage structure at the upstream end.

   b) Write with explanation of three major functions of undersluice constructed in an irrigation headworks and mention its design criteria. [2+2]

4. a) Calculate the thickness of a 7m long launching apron of loosed stones for a shank portion of guide bund at a bridge site of a river having design flood of 8000 m^3/s and flood depth of 5m. Assume that average diameter of river bed material at flood time is 0.3mm. [9]

   b) Define river training works. Enumerate three major objectives of river training works. Write down two basic purposes of spur installation. [2+3+2]

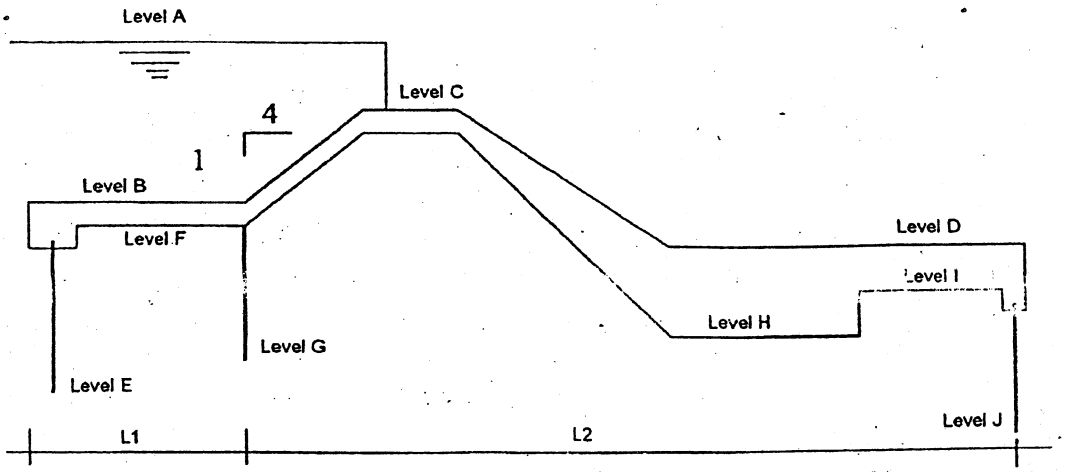
5. a) Discuss the advantages and disadvantages of sprinkler and drip irrigation. [6]

b) For the following irrigation headworks and respective data, [6+2+2]

i) Compute the pressure at the end pile section.
- floor and pile interface
- bottom end of pile

ii) Check whether the floor thickness provided at the end is sufficient or not?

iii) Check the exit gradient of the hydraulic structure. The safe exit gradient of the soil is 1/6.



Reference Point	Level, masl	Reference Point	Level, masl
A	160	F	142
B	143	G	139
C	146	H	140
D	142	I	141
E	138	J	135

L_1 and L_2 are 20m and 60m respectively. Use analytical method or Khosla's curve (attached herewith). Make suitable assumption if necessary.

6. a) Explain the working of a non-modular outlet. What are the advantages and disadvantages of this type of outlet? [3+3]

b) Explain soil moisture tension, osmotic pressure, field capacity, wilting point and available moisture. [3]

c) Describe the status of irrigation development in Nepal. [4]

d) Write a short note on institutional aspects of irrigation system management. [3]

***

PLATE NO 1

Sheet pile not at end

$$\phi E = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-1}{\lambda}\right)$$

$$\phi C = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda+1}{\lambda}\right)$$

$$\phi D = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda}{\lambda}\right)$$

$\alpha = \frac{b}{d}$

To find ϕE for any value of α and base ratio $\frac{b_1}{b}$ read ϕC for base ratio $(1-\frac{b_1}{b})$ for that value of α and subtract from 100

Thus ϕE for $\frac{b_1}{b}=0.4$ and $\alpha=4$, $= 100-\phi C$ for $\frac{b_1}{b}=0.6$ and $\alpha=4 = 100-29.1 = 70.9\,\%$

To get ϕD for values of $\frac{b_1}{b}$ less than 0.5 read ϕD for base ratio $1-\frac{b_1}{b}$ and subtract from 100

Thus ϕD for $\frac{b_1}{b}=0.4$ and $\alpha=4$

$= 100-\phi D$ for $\frac{b_1}{b}=0.6$ and $\alpha=4$

$= 100-44.8 = 55.2$

Values of $\frac{1}{\alpha}=\frac{d}{b}$

Sheet pile at end

Depressed floor

Scale for $\phi=\frac{p}{H}\times 100$

Depressed floor

$\phi E = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-2}{\lambda}\right)$

$\phi D = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-1}{\lambda}\right)$

$\phi C_1 = 100-\phi E$

$\phi D_1 = 100-\phi D$

$\phi D' = 100-\phi D_1'$ (Depressed floor)

$\phi D' = \phi D - \frac{2}{\pi}(\phi E-\phi D)+\frac{3}{\pi^2}$ (Depressed floor)

$\lambda = \frac{1+\sqrt{1+\alpha^2}}{\alpha}$

Values of $\phi C = \frac{p_c}{H}\times 100$

Values of $\phi D = \frac{p_D}{H}\times 100$

Ratio $\frac{b}{x}$

Khosla's Pressure Curves

'01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2066 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) With the help of a neat sketch, describe the components of a canal system used in irrigation project. [4]
   b) Explain the terms duty, delta and their relationship. [4]
   c) Draw the crop coefficient curve for rice crop. An irrigation project has 6000 ha of CCA and ETo is 150 mm/day, effective rainfall is 30mm/month and the overall efficiency of the project is 30%. Calculate the irrigation demand in cumec. [3+5]
2. a) From the data given below, design a stable irrigation canal, ensuring the stability of particles at bed as well as sides. [10]

   Discharge = 20 m^3/s
   Bed slope = 0.001
   Particle size = 4cm
   Side slope = 30°
   Angle of repose of soil = 38°

   b) With the help of neat sketches, explain how silt excluders and silt ejectors control the bed load in an irrigation system. [6]
3. a) Write with definition sketch, how do you determine the pressure along the foundation of the structure and ensure safety against uplift pressure using Bligh's creep theory. [6]
   b) Draw four (4) simple Khosla's profiles for a weir of complex profiles. What corrections Khosla suggested to accommodate such simplifications? [3+3]
   c) Write down the advantages and disadvantages of sprinkler and drip irrigation. [4]
4. a) Design the following components of a guide bund for a river discharge of 6000 m^3/s and silt factor as 1.1. Take HFL = 150m, Bed level = 145m. [5+3]

      i) Length of guide bund
      ii) Thickness of pitching
      iii) Width of launching apron
      iv) Depth of launching apron

      Using the design data, draw the followings:

      A) Plan of guide bank
      B) Section at shank and
      C) Section at u/s curved head

   b) Write down the five objectives of river training works. [4]
   c) Write down different types of canal maintenance. [4]

5. a) The annual rainfall in Biratnagar is 2000mm. Find the spacing of sub-surface drains if 2% of average annual rainfall is to be drained in 2 days. [6]

Given:

Depth of impervious stratum from the top of soil surface = 12m

Position of drain is 2m below the top soil surface and the depth of highest position of water table below the top soil surface = 1.5m

Permeability, $K = 1 \times 10^{-4}$ m/s

b) Explain different types of outlets used in irrigation projects. Define proportionality and flexibility of such outlets. [4+2]

c) Draw a neat longitudinal section through a head regulator of an irrigation head works showing all components. [4]

6. a) Find out the waterway, bed level and FSL of a suitable cross drainage structure for the following data given below. The structure should be flumed to achieve economy. [10]

Parameters	Canal	Drainage
Q_{max} (m^3/s)	30	200
B (m)	20	80
Bed level at d/s	200	198
FSL / HFL	202	201

Assume Manning's rugosity coefficient as 0.014 for concrete.

b) Explain with plans and sections of any two types of fall structures used in irrigation canals. [3+3]

***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Shrawan

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

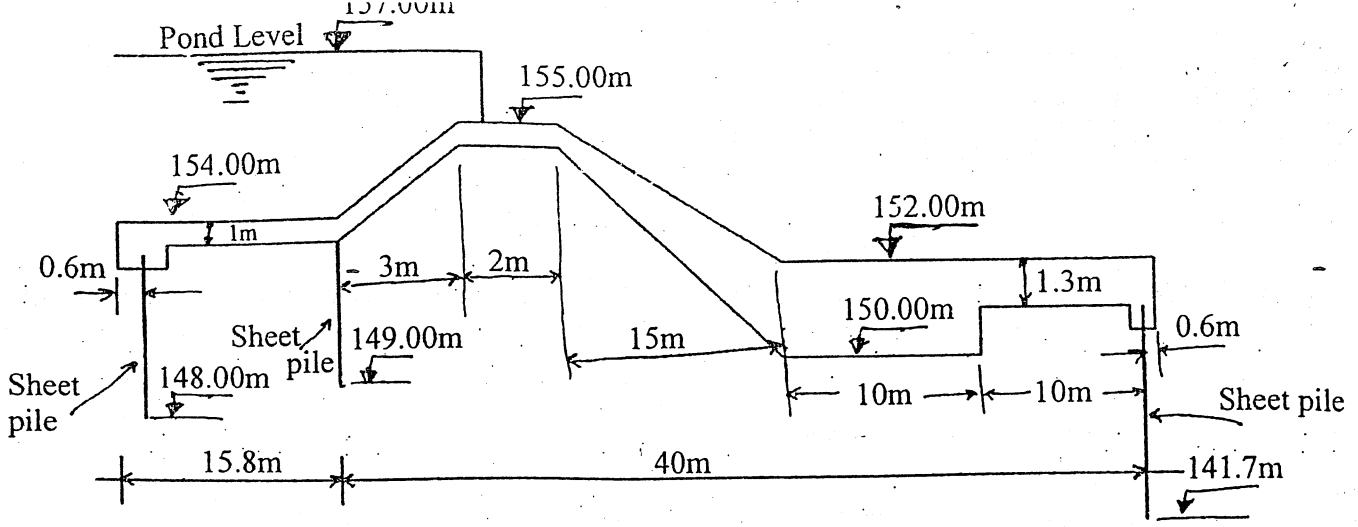
Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary figure is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. a) Explain different types of irrigation methods. [8]
   b) Write the definition of potential evapotranspiration and write down the steps for calculation potential evapotranspiration by Penman methods with all associated formula. [8]
2. a) Explain different types of canal alignments. [5]
   b) What is water logging? Write down its causes, effects and preventive measures of water loggings. [6]
   c) Explain different types of irrigation efficiencies. [5]
3. a) Enumerate different methods of flood control measures. Explain the functions of spur and their types with the help of sketches. [3+3]
   b) Design a guide bund for a flood discharge of 7000 cumecs, the high flood depth is 5m and the silt factor is 1.1. [6]
   c) Explain different methods of irrigation system maintenance. [4]
4. a) An irrigation canal carrying a discharge of 40 m^3/s has to be constructed in alluvial soil. If the mean diameter of the soil is 0.5 mm, design a suitable section and bed slope of such a canal. [8]
   b) Draw a neat sketch of cross-sections of a canal in cutting, filling and balanced mode, showing all features. [8]
5. a) Design a canal drop structure for the data given below: [8]

Q	= 5 m3/s
FSL, upstream	= 110.5 m
FSL, downstream	= 109.5 m
Normal Depth, u/s and d/s	= 1.5 m
Bed width	= 3.0 m
Bligh's coefficient, C	= 7

   b) Drawing neat sketches, explain how silt excludes and silt ejectors control the bed load in an irrigation system. [8]
6. Find out the corrected pressure at upstream, downstream and intermediate key points of a hydraulic structure founded on permeable foundation as given below. Use factor for slope correction as 4%. Assume suitable data if necessary. Also calculate the exit gradient and plot the hydraulic gradient line. [16]



***

PLATE NO 1

Sheet pile not at end

$\phi E = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-1}{\lambda}\right)$

$\phi C = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda+1}{\lambda}\right)$

$\phi D = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda}{\lambda}\right)$

$\alpha = \frac{b}{d}$

To find ϕE for any value of α and base ratio $\frac{b_1}{b}$ read ϕC for base ratio $(1-\frac{b_1}{b})$ for that value of α and subtract from 100

Thus ϕE for $\frac{b_1}{b}=0.4$ and $\alpha=4$, $=100-\phi C$ for $\frac{b_1}{b}=0.6$ and $\alpha=4$, $=100-29.1=70.9\%$

To get ϕD for values of $\frac{b_1}{b}$ less than 0.5 read ϕD for base ratio $1-\frac{b_1}{b}$ and subtract from 100

Thus ϕD for $\frac{b_1}{b}=0.4$ and $\alpha=4$

$=100-\phi D$ for $\frac{b_1}{b}=0.6$ and $\alpha=4$

$=100-44.8=55.2$

Values of $\frac{1}{\alpha}=\frac{d}{b}$

Sheet pile at end

Depressed floor

$\phi D'$

ϕD

ϕE

Scale for $\phi=\frac{P}{H}\times 100$

Depressed floor

$\phi E = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-2}{\lambda}\right)$

$\phi D = \frac{1}{\pi}\cos^{-1}\left(\frac{\lambda-1}{\lambda}\right)$

$\phi C_1 = 100-\phi E$

$\phi D_1 = 100-\phi D$

$\phi D' = 100-\phi D_1$ (Depressed floor)

$\phi D' = \phi D - \frac{2}{\alpha^2}(\phi E-\phi D) + \frac{3}{\alpha^2}$ (Depressed floor)

$\lambda = \frac{1+\sqrt{1+\alpha^2}}{2}$

α = Infinity

$\alpha=0$

Curves of ϕD

Curves of ϕC

Values of $\phi D = \frac{P_D}{H}\times 100$

Ratio $\frac{b_1}{b}$

Khosla's Pressure Curves

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2064 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Describe the various types of fall structures and their components with neat sketches. [8]

   b) A sandy loam soil holds water at 140 mm/m depth between FC and PWP. The crop has a root depth of 30cm and CWR (Crop Water Requirement) equal to 5 mm/day. The cropping area is equal to 60 ha in which allowable depletion of water is 35% and irrigation application efficiency equal to 40%. Determine: (i) Allowable depletion depth between irrigations (ii) Frequency of irrigation (iii) Net application depth of water (iv) Volume of water required. [8]

2. a) Following corrected ϕ values were computed from Khosla's curves in a barrage placed on permeable foundation. [8]

U/S sheet pile	$\phi_{E1} = 100\%$,	$\phi_{D1} = 90\%$,	$\phi_{C1} = 85\%$,
Intermediate pile	$\phi_{E2} = 80\%$,	$\phi_{D2} = 70\%$,	$\phi_{C2} = 65\%$,
D/S sheet pile	$\phi_{E3} = 55\%$,	$\phi_{D3} = 45\%$,	$\phi_{C3} = 0\%$,

   Distance between the U/S and intermediate piles is 20m and that between the intermediate and D/S piles is 40m. Assuming that the floor is horizontal throughout, draw the HGL for the subsoil flow. If the net head is 10m, determine the thickness of D/S floor at a distance of 20m and 30m away from the intermediate sheet pile. Assume G for the floor material equal to 2.2. The symbols has usual meanings.

   b) Derive an expression which determines spacing 'S' between subsurface tile drains capable of lowering the water table at a depth of 'b' from the impervious layer. The centre of the drains is located at height 'a' from the impervious layer and 'Q_D' is the design flow per meter length of drain. [8]

3. a) Design syphon of a syphon aqueduct for the following data: [12]
   Canal: $Q = 50 m^3/s$; FSL = 201.80m; CBL = 200.00m; B = 36m; z (side slope) = 1.5
   Drainage: $Q_{max} = 450 m^3/s$; HFL = 200.50m; DBL = 198.00m; GL = 200.00m

   Assume that the aqueduct will be made of RCC having flumed width of 18m. Assume other data suitably, if necessary.

   b) Design a canal to carry a discharge of 18 m^3/s, using Lacey's theory. Take silt factor = 1.5 and side slope = 0.5:1. [4]

4. a) Determine the length and thickness of launching apron for the straight portion of a guide bund in a river: Design flood = 5000 m^3/s; av. dia. of bed material = 1mm; HFL = 225.00m; River bed level = 222.00m. [8]

   b) Differentiate among, semi-theoretical, Kennedy's, and Lacey's approaches of canal design. [8]

5. a) Why irrigation and drainage are necessary in the development of agriculture? Discuss about the suitability of irrigation methods in the different topography of Nepal. [4+4]

   b) Describe various methods of aligning main canal with appropriate sketches. Explain functions of non-modular and semi-modular outlets with neat sketches. [4+4]

6. Write short notes on four of the following: [4×4]
   a) Irrigation system planning
   b) Stages of rivers and their meandering process
   c) Specific design consideration for hilly irrigation canals
   d) Problems of sprinklers
   e) Considerations for local materials in designs

***

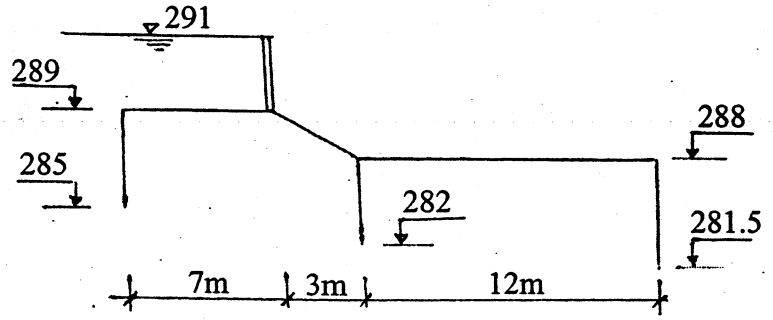
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain how will you justify the economics of canal lining for the existing canal. [8]
   b) Describe with the help of a diagram various forms of soil moisture available to that plant. [8]
2. a) What are the purposes of guide bunds? Explain with plan and sectional views at critical locations design of components of guide bunds. [2+8]
   b) Design a regime canal to carry a discharge of 90 cumecs. The average particle size of bed and bank material of the canal is 0.2cm. [6]
3. a) Explain the importance of drainage system. What are different types of drainage system adopted in agricultural land? [7]
   b) Define canal outlet. What are the criteria for judging the performance of modules? [5]
   c) Differentiate between silt exculder and silt extractor. [4]
4. Using Khosla's theory (Analytically), calculate the uplift pressure percentage at key points and also mention the floor thickness required at the d/s floor of canal head regulator as shown in figure below. [16]



5. a) Design a fall for a canal having a discharge of 12 cumecs for the data given below.

   Full supply level u/s and d/s = 204 and 202.5
   Bed level u/s and d/s = 202.5 and 201
   Bed width u/s and d/s = 8m
   Drop height = 1.5m
   Side Slope of canal = 1:1
   Bligh's creep coefficient = 8

   b) Define intensity of irrigation. [2]
6. Write short notes on: [4×4]
   a) Maintenance of irrigation system
   b) Sub surface irrigation
   c) Canal escape
   d) Types of spur

***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2064 Jestha

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain different types of surface and subsurface irrigation methods. [10]

   b) With following data: [6]

   FC = 80%, PWP = 35%, root depth = 60cm, soil density = 1.5gm/cc, ETc = 5mm/day, application efficiency = 80% and RAM = 70% AMC, where the abbreviations have usual meanings.

   i) Calculate available moisture contents
   ii) Calculate readily available moisture contents
   iii) Calculate depth of irrigation at the outlet of the field
   iv) Calculate irrigation interval

2. a) Using Lacey's basic equation, establish a relationship between R, Q and f, where symbols have usual meanings. [8]

   b) Design a canal using Kennedy formulation with following data [8]

   Q = 10 cumec, Manning roughness coefficient = 0.0245, slope of bed 0.0002, m = 1 and side slope of canal 0.5:1 (H:V).

3. Canal Data: [16]

   Discharge = $20m^3/s$, Depth of water 1.5m and FSL = 251.5m

   Drainage data:

   Discharge = $200m^3/s$, HFL = 250.7m. Bed Level = 248.5m and Ground level = 250.0m

   From above data, design following components of siphon aqueduct.

   a) canal waterway
   b) drainage waterway
   c) afflux and head losses through siphon barrel
   d) uplift on drainage slab

4. a) Write down the causes and effects of water logging. Also explain methods of reclamation of water logged area. [6]

   b) Derive the expression for subsurface drainage spacing. [5]

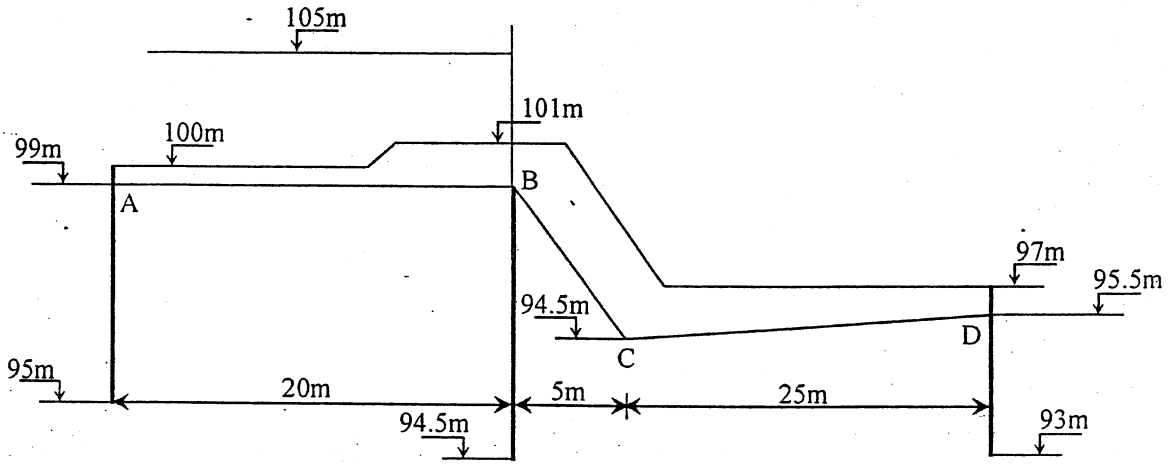
   c) Explain different types of outlets used in irrigation projects. [5]

5. a) Neatly sketch a guide bund and design the following components of a guide bund for a river discharge of $4000m^3/s$ and silt factor 1.1. High flood depth = 5 0m. [8]

   i) length of guide bund
   ii) thickness of pitching
   iii) width of launching apron
   iv) depth of launching apron

b) Explain different level of planning in irrigation projects, also explain different types of maintenance in irrigation projects. [8]

6. Calculate the uplift pressure at key points in figure shown below using Khosla Theory. Check the exit gradient and thickness of the floor at A, B, C and D locations as shown in figure. The safe exit gradient is 0.15. [16]



***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2063 Baishakh

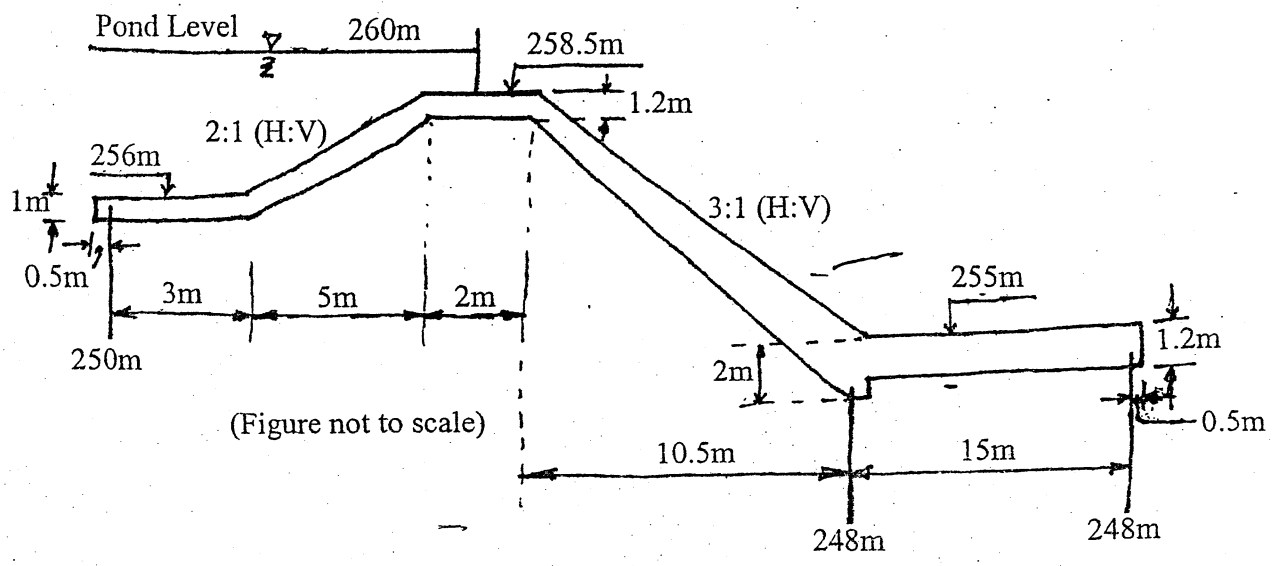
Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Describe about the components of head works with neat sketches. [8]
   b) Determine the discharge at the end of the irrigation channel. CCA at outlet = 400 ha; Intensity of irrigation for rabi = 65%; Intensity of irrigation for kharif = 30%; outlet discharge factors for rabi = 1500 ha/cumec and for kharif = 800 ha/cumec. Assume losses in conveyance = 6% of the outlet discharge. [8]
2. a) Make critical comparisons among semi-theoretical approaches, Kennedy and Lacey's approaches of canal design. [8]
   b) Write down the steps for crop water requirement calculation. [5]
   c) Enlist the various types of lining applied in irrigation canal. [3]
3. a) Why river training is necessary? Describe the various methods of river control. [8]
   b) Design the length and thickness of launching apron for the straight portion of a guide bund in a river: [8]

   Design flood = 7000 m^3/s
   Average diameter of river bed material = 1mm
   River bed level = 111.00; HFL = 114.00
   Provide a neat sketch of designed apron.
4. Using Khosla's method, obtain the residual seepage pressures at the 'key' points for the weir profile shown below. Also calculate the value of the exit gradient. Consider the case of no flow at pond level. Also draw the subsoil HGL. [16]



5. a) Design an aqueduct for the following data. Draw a neat sketch of designed aqueduct showing all dimensions and parameters. [12]

   Canal: Q = 35 m^3/s; FSL = 200.00; CBL = 198.5; B = 22m; side slope 1.5:1
   Drainage: Q = 350 m^3/s; HFL = 196.5; DBL = 193.5; GL = 199.0; f (Lacey's) = 1

   Assume flumed width of canal = 12m and depth in transition = canal depth.

   b) How the bed load is controlled at head works? [4]

6. Write short notes on the following [4×4]

   a) Drip and sprinkler methods of irrigation
   b) Soils for agricultural purposes
   c) Institutional aspects of irrigation system management
   d) Design of drainage of irrigated land

***

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2063 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain following terms [8]

   i) GCA ii) CCA iii) NCA
   iv) Cropping Intensity v) Cropping Pattern

   b) Write down the steps for calculating irrigation requirement for rice crop. [4]

   c) The field capacity of soil is 40%, permanent wilting point is 20%, density of soil is 1.2 gm/cc, effective root depth is 90cm, ET crop is 10 mm/day. Calculate the irrigation interval if the readily available moisture is 75% of available soil moisture capacity. [4]

2. a) Write down the concept of Kennedy and Lacey's Slit theory. [8]

   b) Prove that $P = 4.75 (Q)^{0.5}$, using Lacey's theory. [4]

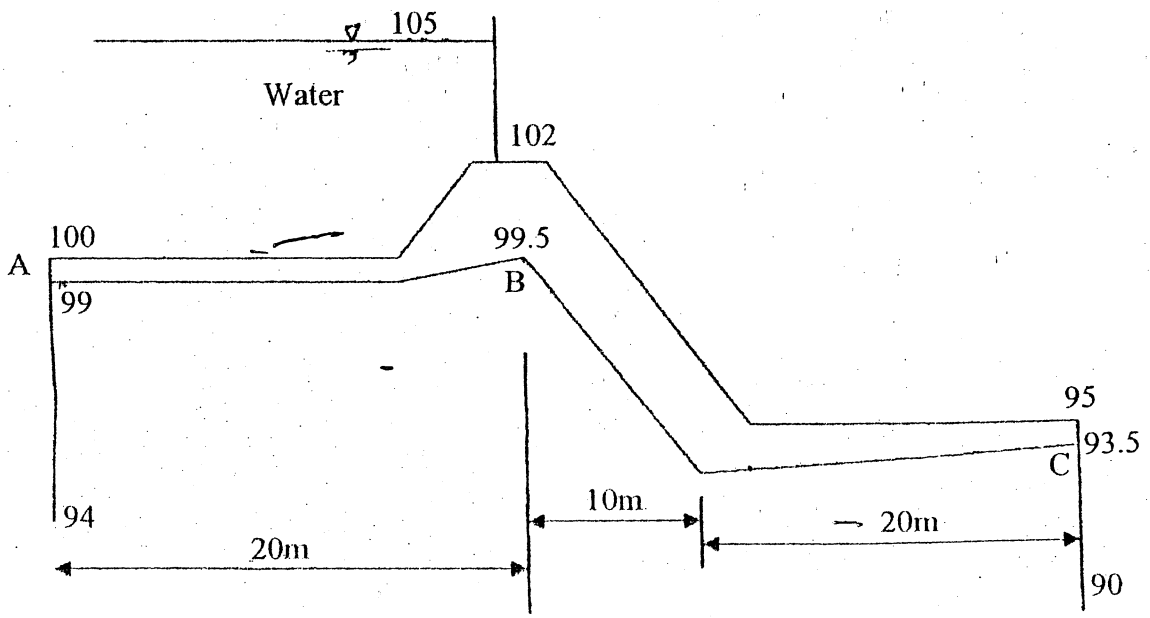
   c) Design a canal to carry a discharge of 20 cumecs, using Lacey's theory. Take silt factor = 1.5 and side slope is 0.5:1. [4]

3. a) Enumerate conditions of application of C/D works with neat sketches. [6]

   b) How the bed load is controlled at head works? [4]

   c) Explain the procedures for design of a fall structure. [6]

4. Calculate the uplift pressure at key points of two piles in figure below. Also check the thickness of the floor at A, B, C locations and exit gradient. The safe exit gradient is 0.2. [16]



5. a) What are the causes and effects of water logging? Discuss various preventive measures to control water logging problems. [8]

   b) Discuss design criteria of a guide bund showing neat plan views and sectional views at critical locations. [8]

6. Write short notes [4×4]

   a) Types of Irrigation Method
   b) Operation and Maintenance of Irrigation System
   c) Modular and Non-modular Outlets
   d) Structural Measures of Flood Control

***

01/1-14 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2062 Baishakh

Exam.	Regular/Back		
Level	B.E	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

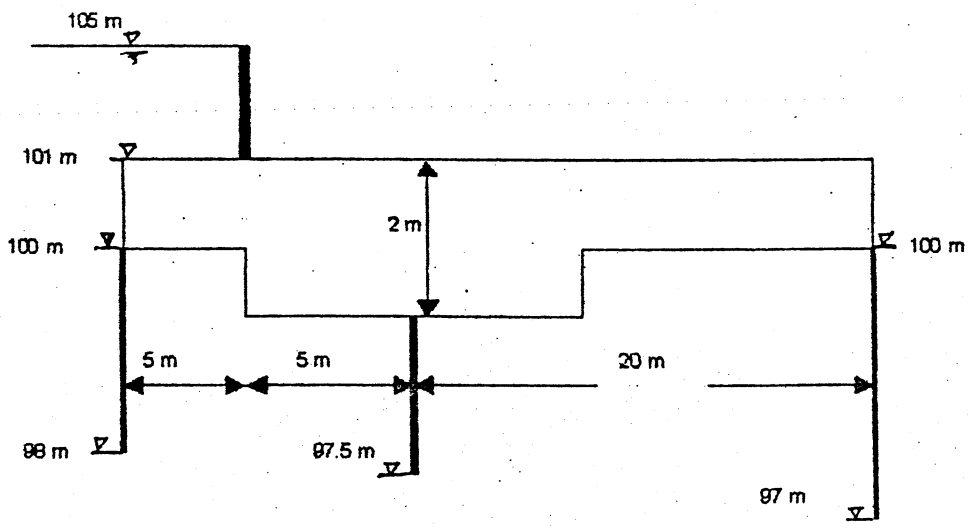
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Design following components of a vertical fall [16]
   a) crest level
   b) crest width
   c) cistern elements
   d) floor length and floor thickness using Bligh's creep theory

   With the data given below

   a) full supply discharge = 1.0 m^3/s
   b) drop = 1.0m
   c) full supply depth = 0.75m
   d) bed level U/S and D/S = 100m/99m
   e) bed width = 3.0m
   f) Bligh's coefficient = 6.0

2. Check the thickness and exit gradient from Khosla theory. The safe exit gradient is 0.2. [16]



3. a) Illustrate various form of soil moisture and ~~write~~ down the factor affecting crop water requirement. [10]
   b) Using Lacey's Regime equations, prove that [6]

$$R = 1.35\left(\frac{q^2}{f}\right)^{\frac{1}{3}}$$

Where R = Scour depth, q = specific discharge, f = silt factor

4. a) Write down the advantage and disadvantage of surface and sub surface irrigation. [4]

   b) Establish a relationship between duty and delta. [4]

   c) Calculate the discharge required at the outlet for wheat and rice crop using following data. [8]

Crop	command area (Ha)	kor period	kor depth
Rice	5000	18	19
Wheat	3500	26	15

5. a) Explain the causes and effects of water logging. Describe different methods of reclamation of water logged areas. [4+4]

   b) Define river training works. Enumerate different methods of river training works. Explain the design of different components of a guide bank. [1+2+5]

6. Write short notes on: [4×4]

   a) Methods of flood control
   b) Operation and maintenance of irrigation systems
   c) Classification of irrigation outlets
   d) Status of irrigation development in Nepal

***.

Q1 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2062 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Irrigation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) What are the factors which must be determined during the planning stage of a irrigation project? [4]

   b) Design a syphon-aqueduct with the following data: [12]

   Canal – discharge $30 m^3/s$; bed width 23m; depth of water 1.7m; bed level 230.00; side slope 1.5:1

   Drainage – high flood discharge 800 m^3/s; high flood level 231.25; bed level 227.60; general ground level 230.00

2. a) Compare Kennedy's and Lacey's silt theories. Why Lacey's theory is superior than Kennedy's theory? [6]

   b) Design a regime channel by Lacey's theory for 40 m^3/s discharge and silt factor 0.9. [10]

3. a) Determine the field capacity of the soil from following data: [8]

   depth of root zone = 1.5m
   present water content = 5%
   dry density of soil = 1600 kg/m^3
   water applied to the soil = 7000m^3
   water loss due to evaporation = 10%
   area of the plot = 1 hectare

   b) Determine the length and thickness of launching apron for the straight portion of a guide bund in a river. [8]

   design flood = 8,000 m^3/s
   average diameter of river bed material = 1mm
   river bed level = 125.00
   highest flood level = 128.50

4. a) Derive an expression for balancing depth in designing canal section. [8]

   b) Find the spacing of tile drains with following data: [8]

   annual rainfall = 900mm
   drainage coefficient = 0.012
   depth of impervious layer below GL = 9m
   depth of tile drains below GL = 1.6m
   depth of highest position of water table below GL = 1.2m
   coefficient of permeability = 0.012 cm/sec

5. a) Why under sluice is provided in head works? How does it work? [4]

   b) What are the silt controlling devices? Explain briefly. [4]

   c) Following data were observed in a canal fall: FSL of canal = 115m; Bed level of canal = 112m; Bed width of canal = 15m; Design discharge = 30 m^3/s; Side slope of canal = 2:1; Length of rectangular crest of the fall = 10m (Broad crested weir). Calculate the crest level of the fall. [8]

6. Write short notes on any four of the following: [4×4]

   a) Canal outlets
   b) Safety against piping and uplift
   c) Crop-water requirement
   d) Design of lined canals
   e) Irrigation methods
   f) Operation and maintenance of irrigation systems

***