TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

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

Subject: - Hill Irrigation Engineering *(Elective II) (CE76508)*

- ✓ 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. Briefly describe physiographic regions and farming systems of Nepal. [4+4]
2. Describe Mountain Zone Classification with neat sketch. Why this classification is required? [7+1]
3. Why farmer's participation is necessary for planning and implementation of HIS? [4]
4. Estimate long term mean monthly and 80% reliable flows for catchment A which has only 3 years mean flow data. A hydrological similar catchment B has been identified nearby which has long term flow data. Same 3 years mean flows; long term mean flows and long term mean flows and long term standard deviations for catchment B have been worked out. [10]

Catchments with available data		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A	3 year mean flows, m^3/s	5.5	4.9	4.3	4.0	4.4	7.5	12.8	21.7	18.4	11.6	8.4	6.6
B	3 year mean flows, m^3/s	6.5	5.4	4.9	4.7	5.2	9.1	15.7	25.1	20.2	14.3	10.2	7.8
	Long term mean flows, m^3/s	6.1	5.1	4.5	4.2	4.7	8.2	14.1	23.4	19.1	13.0	9.2	7.1
	Long term standard deviation	1.2	1.14	1.17	1.15	1.18	1.3	1.8	2.1	1.6	1.5	1.5	1.25

5. Design a steel rack for a bottom intake of HIS. Flow rate upstream of the rack = 450 lps; flow rate downstream of the rack = 250 lps; rack opening = 14 mm; bar diameter = 28 mm; plugging coefficient = 0.16 and $C_d = 0.52$. [4]
6. Design a cascade to drop the canal bed by 2.5 m . The canal is carrying a discharge of 242 lps, having bed width 90 cm. The existing ground slope at the drop is 1:1.5 (V:H). Also draw the designed structure. [8]
7. Design a gravel trap for HIS having a discharge of 500 lps and maximum sediment concentration of 1.4 kg/m3. The gravel should be trapped at a rate of 1.2 kg/m3. Assume bulk density of gravel equal to 1950 kg/m3. The gravel trap should be cleaned in every 20 days. Assume the depth of gravel trap equal to 2m. [4]
8. Estimate sediment concentration in ppm during monsoon in the absence of local data for a catchment of 10000 ha. Assume density of sediment equal to 2 gm/cc and the river transports about 60% of the annual sediment load in 4 month of the monsoon. The average discharge of the river in monsoon is 18.5 m^3/s. [8]
9. Briefly describe suitable cross drainage structures used in HIS with neat sketches. [8]
10. Point out the advantages and disadvantages of sprinkler irrigation. [5]
11. A 16 mm drip line can discharge 2.0, 2.6, 3.0, 3.3 and 3.6 lit/hr for 1.0, 1.5, 2.0, 2.5 and 3.0 atmospheres respectively. The soil type used for dripping is clay which has an average intake rate of 3 mm/hr. Select the suitable discharging dripper for given soil and compute number of hours of irrigation per day if lateral spacing of drip line is 125 cm and dripper spacing is 75 cm. Extractable water from clay can be taken as 12 cm per m depth of soil. The crop is cauliflower having water requirement equal to 6 mm/day and rooting depth equal to 60 cm. [8]
12. Discuss about the suitability and design considerations of gabion structures in remote hills.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

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

Subject: - Hill Irrigation Engineering *(Elective II) (CE 76508)*

- ✓ 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. Flow measurement made on 16th January on a river stream was 930 lps, drained from a catchment of 42 sq. km. Estimate the mean monthly flow and 80% reliable flow from this catchment, if predicted 80% April flow is 37% of April mean monthly flow. MIP non-dimensional regional hydrographs for mean monthly and 80% reliable flow of the region are given below: [8]

Flow,m^3/s\Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean monthly	2.42	1.82	1.36	1.00	0.91	2.73	11.21	13.94	10.00	6.52	4.55	3.33
80% reliable	2.38	1.77	1.35	1.00	1.08	2.23	6.15	13.85	10.77	6.54	4.42	3.27

2. Determine half monthly values from 80% reliable monthly rainfall (mm) for 12 months. [6]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
13	19	22	35	66	158	326	264	142	56	17	14

3. Design a settling basin for a HIS having poor intake site. Design discharge = 600 lps; size of silt to be trapped = 0.5 mm. Take Q/As = 0.019 and critical bottom velocity = 0.25 m/s. Assume scour velocity for flushing = 1.9 m/s. [8]

4. Compute irrigation interval and irrigation hours per day for a 16 mm drip line 3.6 lit/hr dripper (working pressure of 3.0 atm.), if lateral spacing of drip line is 950 mm and dripper spacing is 750 mm. The soil type is clay which has an average intake rate of 3 mm/hr. Extractable water from clay can be taken as 12 cm per m depth of soil. The crop is cauliflower having water requirement equal to 4.2 mm/day and rooting depth equal to 60 cm. Also determine the required pressure at the head of the lateral, if length of lateral is 65 m and f = 0.04 for the drip line. [8]

5. Design a cascade drop to lower the water level in the canal by 2.25 m. The canal is carrying a discharge of 325 lps, having bed width 65 cm. The existing ground slope at the drop is 1:1.2 (V:H) [8]

6. Design a steel rack for a bottom rack intake of HIS. Flow rate upstream of the rack = 500 lps; flow rate downstream of the rack = 200 lps; rack opening = 15 mm; bar diameter = 30 mm; plugging coefficient = 0.02. Take $C_d = 0.5$. [6]

7. What can go wrong with super passages? Also provide the solutions. [6]

8. What are the points, which should be kept in mind while designing canal cross section in hilly areas? [6]

9. Why escape structures are required in hilly canals? What types of escapes are being used by farmers? Illustrate by clear sketches the automation used by farmers. [8]

10. Write short notes on any four of the following: [4×4]
    a) Characteristics of HIS
    b) Sediment control structures for hilly canals
    c) Difference between WECS and MIP methods
    d) Advantages and suitability of sprinkler irrigation in hills
    e) Seepage problems in hilly canals and their solutions
    f) Advantages of gabion construction in hills

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5 H 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	IV / II	Time	3 hrs.

Subject: - Hill Irrigation Engineering *(Elective II) (CE76508)*

- ✓ 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. Flow measurement made on 26th February on a river stream was 172 lps, drained from a catchment of 14 sq. km. Estimate the mean monthly flow and 80% reliable flow from this watershed, if predicted 80% April flow is 35% of April mean monthly flow. MIP non-dimensional regional hydrographs for mean monthly and 80% reliable flow of the region are given below: [10]

Flow,m^3/s\Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean monthly	2.42	1.82	1.36	1.00	0.91	2.73	11.21	13.94	10.00	6.52	4.55	3.33
80% reliable	2.38	1.77	1.35	1.00	1.08	2.23	6.15	13.85	10.77	6.54	4.42	3.27

2. Determine half monthly values from monthly evapo-transpiration (mm/day) for 12 months. [6]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.212	2.213	3.391	4.665	5.302	5.478	5.387	4.925	4.200	2.940	1.819	1.191

3. Design a settling basin for a HIS having medium intake site. Design discharge = 550 lps; size of silt to be trapped = 0.5 mm. Take $Q/A_s = 0.019$ and critical bottom velocity = 0.24 m/s. Assume scour velocity for flushing = 1.8 m/s. [8]

4. Define the rate of a sprinkler application for a crop having root depth 1.25 m and ET_{crop} equal to 4.75 mm/day. The sprinklers are decided to be operated 16 hours. Assume that the extractable water from the given soil condition is 0.25 fraction. [8]

5. Design a cascade drop to lower the water level in the canal by 2.5 m. The canal is carrying a discharge of 350 lps, having bed width 65 cm. The existing ground slope at the drop is 1.5:1 (H:V). [8]

6. Design a steel rack for a bottom rack intake of HIS. Flow rate upstream of the rack = 480 lps; flow rate downstream of the rack = 220 lps; rack opening = 16 mm; bar diameter = 33 mm; plugging coefficient = 0.03. Take $C_d = 0.5$. [6]

7. "Sprinkler and Drip irrigation are appropriate and sustainable methods in the hills of Nepal". Justify this. [6]

8. Point out the basic problems of canal irrigation in the hills of Nepal. Also suggest respective solutions for these problems. [8]

9. Write short notes on any five of the following: [5*4]
   a) Farming Systems of Nepal
   b) Sediment control structures for hilly canals
   c) Suitable cross drainage structures in HIS
   d) Need of escapes and their types used in HIS
   e) Seepage problems in hilly canals and their solutions
   f) Advantages of gabion construction in hills
   g) Vegetative measures in cutting area

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5 H TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

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

Subject: - Hill Irrigation Engineering *(Elective II) (CE76508)*

- ✓ 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) Design a RCC chute for a HIS. The earthen canal has a discharge of 500 lps having bed width 0.8m and water depth 0.6m with side slope 1:1. The ground slope at the drop is about 1:1.25 (V:H) and the canal is to be dropped by 3.25 m. [8]

   b) Compute irrigation interval and numbers of hours of irrigation per day for a 16 mm drip line 2.2 lit/hr dripper, if lateral spacing of drip line is 1.1 m and dripper spacing is 0.75 m. Available water for the given soil is 18%. The crop having 90 cm rooting depth consumes water 6 mm daily. [8]

2. a) Design a settling basin for a Hill Irrigation System having poor intake site. Design discharge = 550 lps; size of silt to be trapped = 0.5 mm. Take Q/As = 0.018 and critical bottom velocity = 0.28 m/s. Assume scour velocity for flushing = 1.9 m/s. [8]

   b) Design a steel rack for a bottom rack intake of HIS. Flow rate upstream of the rack = 500 lps; flow rate downstream of the rack = 250 lps; rack opening = 15 mm; bar diameter = 30 mm; plugging coefficient = 0.02. Take $C_d = 0.5$. [8]

3. a) Flow measurement made on 21st May on a river stream was 420 lps, drained from a catchment of 40 sq.km. Estimate the mean monthly flow and 80% reliable flow from this catchment, if predicted 80% April flow is 40% of April mean monthly flow. MIP non-dimensional regional hydrographs for mean monthly and 80% reliable flow of the region are given below: [8]

Flow,m^3/s\Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean monthly	2.42	1.82	1.36	1.00	0.91	2.73	11.21	13.94	10.00	6.52	4.55	3.33
80% reliable	2.38	1.77	1.35	1.00	1.08	2.23	6.15	13.85	10.77	6.54	4.42	3.27

   b) Determine half monthly values from 80% reliable monthly rainfall data (mm) for 12 months. [8]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
11	17	20	32	64	156	324	260	240	150	25	12

4. a) What is a prerequisite for government assistance to farmer's irrigation projects? What type of detail it should contain? How the project is selected for government assistance? [2+4+2]

   b) Describe types of cross drainage structures used in HIS with neat sketches. [8]

5. a) "Micro irrigation methods are sustainable in the hills of Nepal". Justify this statement. [8]

   b) How drop structures can be used to control erosion and water level of canal in HIS? Illustrate your answer with neat sketches. [8]

6. a) Write down the stepwise procedures for the calculation of Gross Irrigation Water Requirement. [8]

   b) What are the advantages of gabion construction in HIS. Enumerate characteristics of fill materials and gabion wire for such constructions. [6+2]

05H TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Magh

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

Subject: - Hill Irrigation Engineering *(Elective II) (CE76508)*

- ✓ 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) Flow measurement made on 9th April on a river stream was 400 lps Estimate the mean monthly flow and 80% reliable flow from this catchment, if predicted 80% April flow is 40% of April mean monthly flow. MIP non-dimensional regional hydrographs for mean monthly and 80% reliable flow of the region are given below: [10]

Flow,m^3/s\Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean monthly Flow	2.42	1.82	1.36	1.00	0.91	2.73	11.21	13.94	10.00	6.52	4.55	3.33
80% reliable	2.38	1.77	1.35	1.00	1.08	2.23	6.15	13.85	10.77	6.54	4.42	3.27

b) Enumerate important guidelines to be considered for the success of hill irrigation systems [6]

2. a) Design a bank intake for a canal with design discharge of 650 lps. Nominal trap velocity for sediment is 0.15 m/s, upstream orifice velocity = 0.25 m/s, outlet gate velocity = 0. 5 m/s, sill velocity = 0.15 m/s. Minimum level of river = 90m, full supply level of canal = 89 m, bed level of canal = 88.2m. Assume extra flow in the canal at the time of flood = 30% and depth of flow at this time = 1.0 m. Maximum level of river = 92 m. [10]

b) Describe about the use and advantages of gabion construction in remote hill areas. [6]

3. a) Why escape structures are needed in HIS? Describe about fully automatic escape used in HIS with sketch. [8]

b) Describe about the types of drainage crossings used in HIS. Which of them is most suitable in remote hills and explain why? [8]

4. a) Determine the storage volume of a gravel trap having a discharge of 630 lps and maximum sediment concentration of 1.2 kg/m^3. Assume that the gravel is trapped at a rate of 1 kg/m^3 of flow, having bulk density of 2.1 t/m^3. The gravel trap should be cleaned in every eight days. [8]

b) Compute irrigation interval and numbers of hours of irrigation per day for a 16 mm drip-line 2 lit./hr dripper, if lateral spacing of drip-line is 1 m and dripper spacing is 0.6 m. Available water for the given soil is 19%. Take crop water requirement equal to 5 mm/day. The crop has 85 cm rooting depth. Assume efficiency of dripper as 85% [8]

5. Write short notes on: (any four) [4×4]
   a) Farming systems in Nepal
   b) Suitable drop structures in HIS
   c) Mountain zone classification
   d) Planning and implementation of Hill Irrigation
   e) Advantages and suitability of sprinkler in hills

05D 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	IV / II	Time	3 hrs.

Subject: - Hill Irrigation Engineering *(Elective II) (CE76508)*

- ✓ 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) Point out the need, scope, limitations and advantages of micro irrigation methods in the hills of Nepal. [10]

b) Determine the storage volume of a gravel trap having a discharge of 625 lps with maximum sediment concentration of 2.1 kg/m^3. Assume that the gravel is trapped at a rate of 1.6 kg/m^3 of flow having bulk density of 1900 kg/m^3. Assume that the gravel trap should be cleaned in every 30 days. [6]

2. a) Compute irrigation interval and irrigation hours per day for a 16 mm drip line 3 lit/hr dripper, if lateral spacing of drip line is 90 cm and dripper spacing is 70 cm. Available water for the given soil is 0.28 fraction. Take crop water requirement equal to 4 mm/day. The crop rooting depth is 90 cm. [8]

b) Describe the flow assessment techniques in Nepal with their data requirements and reliability. [8]

3. a) Design a settling basin for HIS having good intake site. Design flow = 0.4 m^3/s; size of silt to be trapped = 0.5mm. Take Q/A_s = 0.02 and critical bottom velocity = 0.25 m/s. Assume scour velocity for flushing = 1.8 m/s. Provide a neat sketch showing designed dimensions. [10]

b) Calculate 80% reliable April flow for an ungauged catchment A using the data of Hydrologically Similar Catchment B. A has mean April flow equal to 4 m^3/s from 4 years of measurement. B has mean April flow for the same period equal to 5.0 m^3/sec. The long term mean April flow and standard deviation for B are equal to 5.5 m^3/sec and 1.25 respectively. [6]

4. a) Determine half monthly values from monthly ETo data (mm/day) for 12 months. [8]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.58	2.32	3.76	4.52	4.85	5.28	5.28	4.27	3.47	3.15	2.46	1.86

b) Design a cascade drop to lower the water level in the canal by 3.5 m. The canal is carrying a discharge of 350 lps, having bed width 0.45 m. The existing ground slope at the drop is 1:1. Provide a neat sketch. [8]

5. a) What type of intakes are suitable for hill irrigation? Describe your answer with neat sketches. [8]

b) Describe with neat sketches, the layout patterns of distribution systems appropriate to hill irrigation canals. [8]

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

a) Design issues for head works of HIS
b) Appropriate drainage crossings for HIS
c) Vegetative measures against surface erosion and land slides
d) Difference between sprinkler and drip irrigation methods
e) Suitable escape structures for HIS with sketch
f) Appropriate and cost effective methods of sediment control in HIS

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05H TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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

Subject: - Hill Irrigation Engineering ***(Elective II) (CE76508)***

- ✓ 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) Describe mountain zone classification and its use for Hill Irrigation System. [8]
   b) Describe about limitation of drip irrigation system and its operational with examples. [8]
2. a) Discuss about the characteristics of Hill Irrigation System in Nepal. [8]
   b) Design a steel rack for a bottom rack intake. Flow rate u/s of the rack = 300 l/sec, flow rate d/s of the rack = 150 l/sec. Rack opening = 18 mm, bar diameter = 25 mm, plugging coefficient = 0.2, discharge coefficient (C_d) = 0.5. [8]
3. a) Find the rate of application of sprinkler for a crop having root depth 75 cm and daily crop water requirement 6.5 mm/day, if the sprinklers are to be operated from 7 AM to 7 PM. Assume that available moisture in the soil is 25%. [8]
   b) Determine half monthly values from monthly ETo (mm/day) data for 12 months. [8]

1	2	3	4	5	6	7	8	9	10	11	12
1.4	1.9	2.6	3.1	4.1	4.9	4.5	4.0	3.5	2.7	2.3	1.9

4. a) Describe about the canal distribution system in hill irrigation system. [8]
   b) Design a chute for hill irrigation canal having discharge of 600 lps and bed width equal to 1.2 m with water depth 0.6 m. The ground slope at drop is equal to 2:1 and the canal is to be dropped by 3 m. [8]
5. Write short notes of the following: [16]
   a) Design Consideration for Gabion Structures
   b) Participatory approach on hill irrigation system development
   c) Drainage crossing in hill irrigation system
   d) WECS methods of flow assessment

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