TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Soil Conservation and Watershed Management *(Elective I) (CE72506)*

- ✓ 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. Point out the need of Soil and Water Conservation in the context of Nepal. [5]
2. List out the methods of flood prediction for design of watershed structures. Determine the design flood for 20 years depth of rainfall which are 2, 3 and 4 cm during 5, 20 and 40 minutes respectively in a watershed of 2 sq.km having longest flow path of 950 m and a slope of 0.5%. Assume the watershed loss as 45%. [8]
3. Why land capability classification is necessary? Which classes are not recognized as suitable for agricultural purposes? Describe briefly. [6]
4. What types of agronomic measures are suitable for soil and water conservation in Nepal? Describe briefly. [5]
5. Design a contour bund for a watershed having a lateral slope of 19%. Daily maximum rainfall of 10 years frequency in the area is 145 mm. Assume top width of bund equal to 0.65 m and side slope 1:1. Also compute total area lost due to bunding and earthwork for bunding, if the area under bunding is 6 ha. [5]
6. Design a grassed waterway of parabolic shape to convey a flow of $3m^3/s$; down a slope of 3%. The roughness coefficient for the grass is equal to 0.045. [8]
7. Design a surplus rectangular weir for a catchment of 45 ha and intensity of rainfall equal to 60 mm/hr. Assume HFL over the crest equal to 50 cm. Runoff coefficient may be taken equal to 0.4. [6]
8. Design a straight inlet drop structure for controlling a gully, which is 2.5m deep and 3.2m wide. The peak discharge through the gully is 1.15 cumecs. Also, determine the spacing of drops, if longitudinal slope of gully is 1.6%. [8]
9. Calculate the minimum bottom width required for a dam a height 6.5m. Maximum depth of water to be impounded is 5.4m and the face in contact with water is vertical. Top width of section is to be 1.5m. Assume the density of masonry equal to 2.3gm/cc and the coefficient of friction between masonry and earth equal to 0.72. [8]
10. Describe bio engineering measures for soil and water conservation with sketches. [8]
11. Briefly describe small weirs and sand dams for water conservation and harvesting. How the ground water reserve can be maintained and suitably used? [8]
12. Briefly describe the objectives, steps and people's participation of watershed management. [5]

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06E TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2075 Ashwin

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

Subject: - Soil Conservation and Watershed Management *(Elective I) (CE72506)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *__All__ questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. a) What is watershed management? Why is it necessary in context of Nepal? What is the importance of participatory approach in context of Nepal?

   b) Using universal soil loss equation (USLE), estimate soil loss from a watershed having topographic factor equal to 1.5 and average value of soil erodibility factor equal to 0.6. The soil conservation practice factor is equal to 0.8. Rainfall erossivity factors for two seasons are 250 and 65 respectively and crop management factors are 0.45 and 0.25 respectively.

2. a) What is Land Capability classification? Describe the land capability classes for agricultural lands with their land use and soil conservation practices.

   b) Design a contour bund with the following data:

   Hill slope = 15%

   Soil type = sandy soil

   24-hour rainfall = 120 mm

   Top width = 0.5 m

   Side slope = 1h:1v

   Also calculate the area lost due to bunding and earthwork for bunding if the area under bunding is 6 ha.

3. a) Write short notes on:

   i) Contour cultivation
   ii) Strip cropping
   iii) Conservation farming
   iv) Horticulture

   b) Design a trapezoidal grassed waterway with the following data

   Longitudinal gradient = 2%
   Permissible velocity = 1.5m/sec
   Manning's n = 0.04
   Design discharge = 3 cumecs

4. a) Design a straight inlet drop structure for controlling a gully which is 2.0 deep and 3.0 m wide. The peak discharge through the gully is 1 m^3/s. Determine the spacing of the drops if longitudinal slope of gully is 2%.

   b) Design an earth dam with following data;

   RL of natural surface at dam site = 100.00 m
   Reduced level of F.R.L = 118.3 m
   Reduce level at H.F.L = 121.3 m
   Fetch of the wave = 25 km
   Slope of the saturation line = 4H:1V

5. a) Illustrate with sketch the co-relation between bio-engineering measures and civil engineering structures for slope stabilization. Explain any two Bio-engineering methods.

   b) What is watershed management plan? If you were a government authority what provisions would you make in the policy for watershed management and soil conservation?

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6 E TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

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

Subject: - Soil Conservation and Watershed Management *(Elective I) (CE72506)*

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

1. a) What is watershed and what are the basic concepts of watershed management? [2]
   b) Define the term runoff and describe about methods of runoff estimation. [2+4]
2. a) Land capability classification (LCC) is the basis of any soil conservation and watershed management programmes. How do you define LCC? Describe about different land capability class and their characteristics. [2+4]
   b) Among different soil conservation measures, agronomic measures of soil conservation is considered effective method of soil conservation. Justify this statement with example. Also explain about strip cropping. [8+2]
3. a) What are terraces? Describe about various types of bench terraces. [2+4]
   b) If grassed waterway is required to carry a flow of 5 cumec, calculate the dimensions of the waterway which is parabolic in shape and the downslope of the land is 5%. Assume Manning's roughness coefficient n = 0.05. [6]
4. a) Gully control structures are constructed for various purposes. Discuss about different types of gully control structures. [8]
   b) Design a drop spillway for watershed with area of 1.5 sq km. The drop is 1.5 m and the intensity of rainfall to be considered for the watershed is 120 mm/hr. The coefficient of surface runoff for the watershed is 0.3. [8]
5. a) Write down the site requirements, procedure and problems for the implementation of live check dam as a bio-engineering system. What can be achieved after its construction? [3+3]
   b) Given the following parameters, calculate the dimensions of and earthen dam: [10]

   RL of ground = 112 m — RL of FRL = 120.3 m
   RL of HFL = 123.3 m — Slope of natural line = 4:1

6. Write short notes on: (Any two) [6×2]
   a) Soil erosion and USLE
   b) Crop Rotation and Multiple Cropping
   c) Bunding vs Terracing

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04F TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2072 Kartik

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

Subject: - Soil Conservation and Watershed Management *(Elective I) (CE72506)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ ***All** questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Describe the major factors affecting watershed operations.

   b) Estimate soil loss using USLE from a watershed having topographic factor equal to 1.2 and average value of soil erodibility factor equal to 0.6. The watershed having two crop seasons has no soil conservation practice. Rainfall erosivity factor of two seasons are 280 and 45 and crop factor of two seasons are 0.45 and 0.25.

2. a) Describe land capability classification for non-agricultural lands with their land use and soil conservation practices.

   b) Introduce any five agronomic measures with its advantage and limitations.

3. a) Design a contour bund for a watershed having a lateral slope of 15%. Daily maximum rainfall of 10 years frequency in the area is 140 mm. Assume top width of bund equal to 0.6 m and side slope 1:1. Also compute total area lost due to bunding and earthwork for bunding, if the area under bunding is 6 ha.

   b) Design a grassed waterway of parabolic shape to convey a flow of 3.2 m^3/s: down a slope of 4%. The roughness coefficient for the grass is equal to 0.042.

4. a) Design an earthen dam with following data:
   RL of natural surface = 105 m
   RL of FRL (full reservoir level) = 120 m
   RL of HFL (high flood level) = 122 m
   Saturation gradient = 4:1
   Fetch of wave (f) = 25 km

   Assume other data suitability

   b) Define bio-engineering and describe any three common bio-engineering techniques used for soil conservation.

5. a) Design a straight inlet drop structure for controlling a gully, which is 2.5 m deep and 3.2 m wide. The peak discharge through the gully is 1.2 cumecs. Also, determine the spacing of drops, if longitudinal slope of gully is 1.8%.

   b) Give an account on policy framework for watershed management in Nepal. Explain project planning in watershed management.

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04J TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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

Subject: - Solid Waste Management *(Elective I) (CE72511)*

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

1. **a)** Define assimilation capacity. Explain how ISWM approach can be useful to solve the present waste management problems seen in emerging town of Nepal, outside the Kathmandu valley. **[8]**

b) Explain the history of development of solid waste management in Nepal highlighting the positive and negative aspects of the German project in Kathmandu valley. **[8]**

2. **a)** What are the type of Solid Waste? Define hazardous and clinical wastes. Explain the different sources of hazardous waste. **[8]**

b) How is heat value of solid waste calculated? Explain the solid waste management techniques in low, high and medium rise buildings? **[8]**

3. **a)** What is SCS and HCS? Solid waste from large hotels of Pokhara Lakeside is collected in HCS basis using hoist truck. Time taken to reach the first container site from the garage is 30 min. and to the garage from the last location is 45 min. If the average time required to drive between containers is 5 min. and one way distance to the disposal site is 20 km (speed limit 40 kmph); determine number of containers that can be emptied per day based on 8 hr/d working schedule. What would be the amount of waste that can be collected in a day by this truck if the 4 m^3 containers are in an average $3/4^{th}$ full. Take Pc + Uc = 0.067 and S = 0.053 hrs/trip. [2+8]

b) Describe 3R principles that are in used either in your college or locality. **[6]**

4. **a)** Why transfer station is needed? What will be the break even haul distance between a direct haul system and a transfer station operation with the following properties: [2+8]

- Direct haul system uses 4 m3 skips
- Cost of operation of skip vehicles = Rs. 9/m3-km
- The transfer station (TS) uses 20 m3 transfer trailer
- The cost of operation of tractor trailer = Rs. 3.50/m3-km
- Initial investment in TS = Rs. 35000000 (for buildings, equipments, facilities, etc.)
- Useful life of TS = 20 years
- Interest rate = 10%
- Cost of operation and maintenance of TS = Rs. 500000/yr
- Volume of waste handled = 400000 m3/yr

b) What are the factors considered in selection of LFS (Land Fill Site)? **[6]**

5.a) Define composting? What are the different uses of composting byproduct? Explain the different types of composting? **[8]**

b) Define necessary of solid waste. What are the various methods adopted for the recovery of organic waste in Nepal? [2+6]

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06F TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Soil Conservation and Watershed Management *(Elective I) (CE725)*

- ✓ 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) What are the objectives of watershed management? [3]
   (b) Design a parabolic shaped grassed waterway to carry a flow of 2.0 m^3/s down a slope of 3%. The waterway has a good stand of grass and a velocity of 1.75m/s can be allowed. Take Manning's n = 0.045. [8]
2. (a) Differentiate between rill and sheet erosion. [4]
   (b) Explain sand dams with sketch. [6]
   (c) The data obtained from a field plot where no soil conservation practice has been used is as under: [4]

   A = 10 t/ha/year, R = 40, C = 0.35, LS = 1.2. Determine the value of K using USLE equation.
3. (a) Describe contour cultivation and strip cropping technique for soil conservation. [6]
   (b) In a hilly region, a bench terrace is proposed for cultivation purpose. The general land slope is 20%. Average soil depth is about 1m. Riser is to be laid on 1:1 gradient. The intensity of rainfall of the area is 15cm/hr for the duration equal to time of concentration. Design the inward sloping bench terrace. (Take C = 0.6). [8]
4. (a) Describe briefly the different types of water conservation methods for cropland. [8]
   (b) Determine the depth of flow in a surplusing structure, having design length equal to 1.7m. Surplus water is due to 73mm/hr rainfall from 0.9 km^2 catchment. Assume necessary data suitably. [6]
5. (a) Define check dams and explain different types of them with sketch. [6]
   (b) Calculate the minimum bottom width required for a dam of height 6.5m. Maximum depth of water to be impounded is 5.8m and the face in contact with water is vertical. Take top width = 1.5m, density of masonry = 2.2gm/cc and density of water = 1gm/cc, coefficient of friction between masonry and earth = 0.5. [9]
6. Write short note on: (any three) [3x4]
   (a) Stream bank protection
   (b) Wattling and mulching
   (c) Causes and consequences of watershed deterioration
   (d) Land capability classification

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06F TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

Subject: - Soil Conservation and Watershed Management *(CE70506) (Elective I)*

- ✓ 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) Write about the concept of Integrated Watershed Management. Discuss the importance of participatory approach on watershed management. [8]

   b) For a catchment of 10 sq km arial coverage, the values of topographic factor = 1.25, crop management factor = 0.2, conservation practice factor = 1.0. Estimate the soil erodibility factor (k) for the catchment soil, if in a particular season the soil loss was measured as 18 tons/ha with following rainfall data: [8]

Cumulative Time (min)	0	15	22	32	52	60	63
Cumulative rainfall depth (mm)		1	3	9	27	30	32

   Maximum I30 = 40 mm/hr.

2. a) What are the different factors limiting land capability? Discuss the characteristics of land system suitable for agricultural purpose. [8]

   b) Design a concrete chute spillway for the discharge of 4 m^3/sec and drop of 3 m. The channel width and depth in upstream are 4 m and 1 m respectively. The ground has slope of 2:1 (H:V). [8]

3. a) Describe different types of Bench Terraces with sketches. [6]

   b) Design a contour bund with following data: [10]

   Slope of watershed (S) = 25%
   Maximum daily rainfall to retain (i) = 10 cm
   Assume top width of bund = 0.5 m and side slope of bund = 1:1
   Find out the cross section of bund, Area lost due to bunding and required earth work for bunding, if the area under bunding is 4 ha.

4. a) Discuss the benefits of using bio-engineering measures along with civil engineering structures. Write about the use of palisade vegetative conservation technique an soil and water conservation. [4+4]

   b) Design a earthen dam having fetch of wave (F) = 30 km. The RL of natural surface is 310 m, RL of full reservior level is 318 and RL of high flood level is 320 m. Assume saturation gradient equal to 4:1 (Assume slopes of dam suitable) [8]

5. Write short notes on: (any four) [4x4]

   i) Agro-forestry for soil and water conservation
   ii) Contour and staggered trenching
   iii) Watershed measurement plan
   iv) Road slope stabilization
   v) Conservation ponds (Farm ponds)

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

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

Subject: - Soil Conservation and Watershed Management *(Elective)*

- ✓ 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 cause and consequences of watershed deterioration? Describe in context of Nepal. [8]

b Describe the design steps of Chute spillway with necessary sketch. [8]

2 a For a catchment the values for Topographic factor = 1.3, Crop Management factor = 1.5, Conservation Practice factor = 1.0 . Estimate the soil Erodibility factor (K)of the catchment Soil, if in a particular season the soil loss was measured as 18 tons/ha with following rainfall: [8]

Duration (min)	15	10	7	12	8	5
Rainfall depth (mm)	1	3	2	6	4	2

Maximum I_{30} = 34 mm/hr

b What are the different measures for Gully Control? Describe with necessary sketch. [8]

3 a What do you know about land capability classification? Write about the land classes suitable for agricultural lands. [8]

b Find out the dimensions of trapezoidal grassed waterways for peak discharge of 3.5 m3/sec. The channel should be designed with 0.3 % of grade. Allwoable flow velocity is 1.2 m/sec and side slope (z)= 2. Assume manning's roughness coefficient equal to 0.045. [8]

4 a Design a contour bund for a watershed having lateral slope of 25 %. Daily maximum rainfall equal to 13 cm. Assume top width of bund and side slope equal to 0.5 m and 1.1 respectively. Find out the percentage (%) of area lost due to bunding and required earth work for bunding, if the area under budning is 5 ha. [8]

b Descibe about the Universal Soil loss equation (USLE). What are the limitations of USLE. [8]

5 a What are the different vegetative techniques used for soil conservation? Describe two of them briefly with sketches. [8]

b Find the required surface area of settling basin to catch fine sand (settling velocity=0.007m/sec). the discharge entering the basin is 310 lps. Find the required storage depth within basin id total annual volume of sediment is equal to 320 m^3. [8]

6 Write short notes (any four) [4×4]

a) Conservation pond
b) Contour and staggered trenching
c) Mechanics of water erosion
d) Watershed management plan
e) Graded bunding

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R. Bank of watersheet

06D 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	3hrs

Subject: - Soil Conservation and Watershed Management *(Elective I)*

- 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) Why Land Capability Classification is necessary? Which classes are recognized as suita agricultural purposes? Describe briefly. [2

b) Design a contour bund for a watershed having lateral slope of 22%. Daily maximum rainfal area is 11 cm. Assume top width of bund equal to 0.6 m and side slope 1:1. Also compute ar due to bunding and earthwork for bunding, if the area under bunding is 5 ha. [4

2. a) What are the causes and consequences of watershed deterioration? [5

b) Design a grassed waterway of parabolic shape to carry a flow of 3.2 m^3/s, down a slope of The waterway has a well-established sod of excellent quality and a velocity of 1.5 m/s can be per Assume n= 0.045. [8

3. a) A masonry dam is 5.8 m high, 1.2 m wide at top and 4.8 m at bottom and has a vertica face. The dam impounds water to a height of 4.8 m. Calculate the magnitude of the resultant force point of application with the base, when the reservoir is full and when it is empty. [8

b) Design an earthen dam having fetch of wave equal to 30 km. The reduced levels of river bed a reservoir level are 850 m and 868 m respectively. Assume saturation gradient equal to 3.5:1, upsi dam slope 2.5:1 and downstream dam slope 2:1. [8

4. a) Describe engineering measures for erosion control in non - agricultural land. [8

b) Design a concrete chute spillway for a flood of 3 m^3/s and drop of 3 m. The channel width and d upstream are 3m and 1m respectively. The ground slope at drop is 2:1 (H:V). [8

5. a) Describe engineering measures adopted for erosion control in agricultural land. [8

b) Briefly describe vegetative techniques for soil conservation with neat sketches. [8

6. Write Short notes on any four of the following: [4

a) Need and Scope of Soil and Water Conservation in Nepal
b) Bench Terrace
c) Universal Soil Loss Equation
d) Soil Texture and Structure
e) Small Storage Structures

6