

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF ENGINEERING AND PHYSICS

MAR 2023

PROGRAMME: BSc HONOURS AGRICULTURAL ENGINEERING PART III

AEH306: SOIL AND WATER CONSERVATION ENGINEERING [2]

DURATION: 3 HOURS

TOTAL MARKS: 100

INSTRUCTIONS TO CANDIDATES

1. Answer any FOUR (4) questions. Each question carries 25 marks.

QUESTION 1

Discus how human activities effect soil erosion.

[25 marks]

QUESTION 2

- a) Distinguish between erosivity and erodibility [4 marks]
b) Outline the limitations of Universal Soil Loss Equation (USLE) [6 marks]
c) The following mass curve reading was taken from a recording type rain-gauge chart to analyse the rainfall.

Time (PM)	4:00	4:20	4:27	4:30	4:44	4:57	5:00	5:10	5:20
Cumulative Rainfall (mm)	0	1	3	9	27	30	32	32	33

Calculate rainfall erosivity index.

[15 marks]

QUESTION 3

- a) Distinguish between contour bunds and graded bunds [8 marks]
b) Calculate using Ramser's formula the vertical interval of the contour bunds on a 4.5% land slope. The rainfall is moderate with average infiltration rate and good coverage of the land vegetation. [5 marks]
c) A rectangular graded bund channel lined with planed wood ($n = 0.012$) has a width of 8.2 m. When the depth of water is 1.0m the flow is 10.5 m³/s. Determine
(i) The required slope [4 marks]
(ii) The specific energy [4 marks]
(iii) Type of flow [4 marks]

QUESTION 4

- a) Briefly distinguish the following terms as used in theory of sediment transport
- (i) Contact load [3 marks]
 - (ii) Suspended load [3 marks]
 - (iii) Saltation load [3 marks]
- b) Discuss the environmental problems associated with sedimentation [10 marks]
- c) Determine the sediment yield from a storm with a total runoff volume of 120 m^3 and a peak discharge of $5 \text{ m}^3/\text{s}$. Use $K = 0.33$, $LS = 0,697$, $C = 0.04$ and $P = 0.5$. [6 marks]

QUESTION 5

- a) Distinguish between windbreaks and shelter breaks [10 marks]
- a) Explain how the following design factors influence effectiveness of a windbreak
- (i) Windbreak height [4 marks]
 - (ii) Windbreak length [4 marks]
 - (iii) Windbreak orientation [3 marks]
 - (iv) Windbreak density [4 marks]

QUESTION 6

- a) Distinguish between the following terms
- (i) U shaped gully and V shaped gully [5 marks]
 - (ii) Active gully and Inactive gully [5 marks]
- b) Describe gully control measures that can be used for
- (i) Retention of runoff around gullied area [5 marks]
 - (ii) Diversion of runoff from gullied area [5 marks]
 - (iii) Conveyance of runoff through the gully [5 marks]

END OF PAPER