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UNIVERSITY OF SWAZILAND
SUPPLIMENTARY EXAMINATION PAPER

PROGRAMME: BSC AGRIC. 4 (LWM)

COURSE CODE: LUM 412

TITLE OF PAPER: SOIL AND WATER CONSERVATION

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION I: COMPULSORY QUESTION

QUESTION 1

(a) Mulching is recognised as a very effective means of controlling erosion. Briefly discuss the mechanics of mulch in controlling erosion.

(20 Marks)

(b) It has been established that different soils require different rates of mulch application. Estimate the required application rates of maize mulch on the following soils with a 7° slope and a flow depth of 75mm.

(i) Fine sedimentary soil;
(ii) Clay loam soil. (20 Marks)

SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION

QUESTION 2

When one drives through Swaziland one sees different types of ecological zones with the following soil and water problems.

(a) Overgrazing;
(b) Deforestation;
(c) Gullying;
(d) Streambank erosion;
(e) Hillside cultivation.

Outline the measures you would recommend combating each of the above problems.

(30 Marks)

QUESTION 3

(a) Briefly discuss the following components of the hydrologic cycle with reference to soil and water conservation:

(i) Infiltration; (5 Marks)
(ii) Runoff. (5 Marks)

(b) It is recognised that characteristics of rainfall play a major role in soil erosion. Discuss how the following characteristics of rainfall affect the rate and amount of soil erosion:

(i) Rainfall intensity; (5 Marks)
(ii) Raindrop size. (5 Marks)

(c) List different rainfall patterns. (2 Marks)

(d) Of the patterns listed in (c) above, which do you think would cause high rates of soil erosion and why. (8 Marks)

QUESTION 4

Discuss the following approaches to soil and water conservation:

(a) Agronomic measures
(b) Soil management
(c) Mechanical measures (30 Marks)

APPENDIX

$n_m = 0.105M^{0.84}$ (for maize stalk mulch)

where M = mulch rate (kg/m^2)
n_m = value of Manning's n due to the mulch

$$v = \frac{r^{2/3}s^{1/2}}{n}$$

where r = hydraulic radius, for simplicity assume it is approximated by the depth of flow
s = slope, can be represented by the tangent of the slope angle
n = Manning's roughness coefficient,

$$n_m = (n^{3/2} - n_s^{3/2})^{2/3}$$

where n_s = Manning's n due to the soil

Maximum safe velocities in channels (maximum velocity on cover expected after two seasons

Material	Bare m/s	Medium grass cover m/s	Very good grass cover m/s
Very light silty sand	0.3	0.75	1.5
Light loose sand	0.5	0.9	1.5
Coarse sand	0.75	1.25	1.7
Sandy soil	0.75	1.5	2.0
Firm clay loam	1.0	1.7	2.3
Stiff clay or stiff gravelly soil	1.5	1.8	2.5
Coarse gravels	1.5	1.8	unlikely to form
Shale, hardpan, soft rock, etc.	1.8	2.1	very good grass cover
Hard cemented conglomerates	2.5	–	–
Intermediate values may be selected			