EASTERN UNIVERSITY OF SRI LANKA

THIRD YEAR SECOND SEMESTER EXAMINATION IN AGRICULTURE–2002/2003 (DEC 2003)

AEN 3201 – SOIL & WATER CONSERVATION ENGINEERING AND METEOROLOGY

nswer all questions.

me allowed: 2 hours.

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01. (a) Define the terms **Erodibility** and **Erosivity.**

(b) What is erodibility index?

(c) Write short notes on splash erosion.

(d) Calculate the $EI_{30}$ and KE > 25 indices of rainfall erosivity for the storm data given below.

| Time from the start of storm (min) | Rain Fall (mm) |
|---|---|
| 1 – 10 | 0.8 |
| 11 – 20 | 4.7 |
| 21 – 30 | 5.4 |
| 31 – 40 | 2.0 |

(Note: KE = 11.9 + 8.7 log I, $I_{30}$ = 24 mm/hr when kinetic energy of rainfall in $J/m^2/mm$)

02. (a) Briefly discuss the designing principles of mechanical protection works.

(b) Briefly discuss the factors affecting the erodibility of soil.

(c) Design a channel to carry 3.75 m3/sec on a gradient of 1 in 250 over sandy clay loam.

03. (a) What is data homogeneity of temperature and give the reasons for non- homogeneity.

(b) Following table shows the air temperature reading collected for a month in two stations A and B from 1982 – 1993.

| Year | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 32.2 | 31.8 | 31.9 | 32.4 | 30.8 | 32.2 | 32.1 | 30.4 | 31.1 | 29.9 | 29.8 | 30.2 |
| B | 29.8 | 30.6 | 29.7 | 29.9 | 30.2 | 30.3 | 30.0 | 29.7 | 29.5 | 30.2 | 30.5 | 29.8 |

i. Check the data homogeneity of both stations. (For n=12, if u = 5-8 record is homogeneous).

ii. If the instrument in station A is shifted in 1989, adjust its records for data homogeneity.

04. Write short notes on the followings.

(a) Campbell stokes sunshine recorder.

(b) Essential requirements of field stations for making useful meteorological observations.

| *Material* | *Maximum velocity on cover expected after two seasons* | | |
|---|---|---|---|
| | *Bare* | *Medium grass cover* | *Very good grass cover* |
| | *m sec* | *m sec* | *m sec* |
| 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 very good grass cover |
| Shale, hardpan, soft rock, etc. | 1·8 | 2·1 | |
| Hard cemented conglomerates | 2·5 | — | — |

Intermediate values may be selected

Table 4 Maximum safe velocities in channels - V values



| $^{1}/_{n}$ *Slope* S | V 0·25 | 0·50 | 0·75 | 1·00 | 1·50 | 2·00 | 2·50 |
|---|---|---|---|---|---|---|---|
| 1·00 100 | | | | | 0·30 | 0·45 | 0·60 |
| 0·66 150 | Minimum value | | | 0·20 | 0·40 | 0·60 | 0·85 |
| 0·50 200 | 0·20 | | | 0·25 | 0·50 | 0·75 | 0·90 |
| 0·40 250 | | | 0·20 | 0·30 | 0·60 | 0·90 | |
| 0·33 300 | | | 0·25 | 0·35 | 0·65 | 1·00 | |
| 0·25 400 | | | 0·30 | 0·45 | 0·85 | | |
| 0·20 500 | | | 0·35 | 0·50 | 1·00 | | |
| 0·17 600 | | 0·20 | 0·40 | 0·60 | | | |

*Note* 1 V is velocity of flow in metres per second (from table 8.2)
*Note* 2 1 in S is gradient of channel
*Note* 3 Missing values above 1·0 suggest that these combinations of velocity and gradient are unsuitable.
*Note* 4 Minimum value of excavation is 0·2 m
*Note* 5 Depth values are rounded to the nearest 0·05 m

Table 5 Maximum depth of cut channel - D values

| S / D (m) | 100 | 150 | 200 | 250 | 300 | 400 | 500 | 600 |
|---|---|---|---|---|---|---|---|---|
| 0·2 | 0·35 | 0·25 | 0·20 | 0·20 | 0·20 | 0·15 | 0·15 | 0·15 |
| 0·3 | 0·60 | 0·45 | 0·40 | 0·35 | 0·30 | 0·25 | 0·25 | 0·25 |
| 0·4 | 0·90 | 0·75 | 0·65 | 0·60 | 0·55 | 0·45 | 0·40 | 0·35 |
| 0·5 | 1·30 | 1·15 | 0·95 | 0·85 | 0·80 | 0·65 | 0·60 | 0·55 |
| 0·6 | 1·80 | 1·55 | 1·30 | 1·20 | 1·10 | 0·95 | 0·80 | 0·75 |
| 0·7 | 2·25 | 2·00 | 1·70 | 1·50 | 1·35 | 1·20 | 1·05 | 1·00 |
| 0·8 | 2·80 | 2·45 | 2·15 | 1·90 | 1·70 | 1·50 | 1·30 | 1·25 |
| 0·9 | 3·40 | 3·00 | 2·65 | 2·35 | 2·10 | 1·80 | 1·60 | 1·50 |
| 1·0 | 4·05 | 3·60 | 3·15 | 2·75 | 2·50 | 2·15 | 1·90 | 1·85 |

Table 6 Values of F