BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

DEPARTMENT: NATURAL RESOURCES

PROGRAMME: BSc NATURAL RESOURCES MANAGEMENT

COURSE CODE (4): NR128: INTRODUCTION TO SOIL SCIENCE

DURATION: 2 HOURS **TOTAL MARKS: 70**

INSTRUCTIONS TO CANDIDATES

Answer *Three* questions out of the following five questions. You must answer question *One* from Section A and any *Two* questions from Section B.

SECTION A (COMPULSORY)

1. (a) State 3 factors that influence soil bulk density. **[3 Marks]**

   (b) Distinguish the following:

   (i) Soil ped from soil clod, **[2 Marks]**

   (ii) tetrahedral from octahedral building blocks of clay minerals, **[4 Marks]**

   (iii) soil texture from soil structure and **[2 Marks]**

   (iv) calcitic from dolomitic limestone. **[3 Marks]**

   (c) Given a soil with a porosity of 40% and a particle density of 2650kgm^{-3}, calculate the bulk density of the soil in kgm^{-3}. **[3 Marks]**

   (d) Define and indicate the favourable environmental conditions for the following soil processes of the nitrogen cycle:

   (i) Immobilization, **[2 Marks]**

   (ii) mineralization, **[2 Marks]**

   (iii) nitrification, **[2 Marks]**

   (iv) denitrification, **[2 Marks]**

   (v) biological nitrogen fixation and **[2 Marks]**

   (vi) volatilization. [3 Marks]

SECTION B

2. (a) Discuss the importance of isomorphic substitution to cation retention in soils. **[10 marks]**

(b) Explain the contribution of the following processes towards acidification of soils:

(i) Leaching of bases **[5 marks]**

(ii) Pollution. **[5 marks]**

3. (a) Explain how a change in soil pH affects charge on exposed crystal edges. **[4 Marks]**

(b) List the four taxonomic levels of the Zimbabwe classification system. **[4 Marks]**

(c) Illustrate how topography and climate influence soil formation. **[12 marks]**

4. (a) List FOUR ways of expressing soil wetness. **[4 Marks]**

(b) Relate soil colour variation to the following:

(i) Organic matter, **[2 Marks]**

(ii) iron, **[4 Marks]**

(iii) calcium carbonate and **[2 Marks]**

(iv) moisture. **[2 Marks]**

(c) A soil horizon (60-80cm) has a bulk density of 1,12g cm^{-3}; a particle density of 2650kg m^{-3} and a gravimetric moisture content of 10%. Calculate the following:

(i) Porosity (%), **[2 Marks]**

(ii) Volumetric moisture content (%), **[2 Marks]**

(iii) Quantity (Qw) of water held in this horizon (mm). **[2 Marks]**

Formula: $Qw = Sd \times \theta$

Where: Qw is quantity of water (mm); Sd is the soil thickness and

θ is the fractional volumetric water content of the soil.

5. (a) Describe the formation of soil aggregates. **[4 Marks]**

(b) Give a detailed description of the classification of soil biota. **[16 Marks]**

END OF PAPER