2528/201
2922/201
EARTH SCIENCE AND ENVIRONMENTAL
INFORMATION SYSTEMS
Oct./Nov. 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY

MODULE II

EARTH SCIENCE AND ENVIRONMENTAL INFORMATION SYSTEMS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
        answer booklet;
        non-programmable scientific calculator.
This paper consists of TWO sections; A and B.
Answer ALL the questions in section A and any THREE questions from section B in the answer booklet provided.
Each question in section A carries 4 marks while each question in section B carries 20 marks.
Maximum marks for each part of a question are as shown.
Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the
pages are printed as indicated and that no questions are missing.

Turn over

SECTION A (40 marks)

Answer ALL questions in this section.

1. (a)   Define the term noise as used in communication systems. (2 marks)

    (b)   Name any **two** types of noise generated by an electronic device. (2 marks)

2. Distinguish between in-situ and remote sensing measurements of atmospheric components. (4 marks)

3. (a)   Define the term 'attenuation' as used in radio detection and ranging (RADAR) measurements. (2 marks)

    (b)   List any **two** effects of attenuation on a RADAR signal. (2 marks)

4. Calculate the orbital radius of a satellite in a geosynchronous orbit where the earth's rotational period is 86,164.1 seconds ($GM = 3.986005 \times 10^{14}$ m^3/s^2). (4 marks)

5. (a)   Describe the process of image classification as used in Geographical Information System (GIS). (2 marks)

    (b)   Outline the **two** steps of image classification in GIS. (2 marks)

6. Describe any **two** segments of a global positioning system (GPS). (4 marks)

7. Describe the use of earthquakes in understanding the internal structure of earth. (4 marks)

8. Distinguish between P-waves and S-waves in relation to their travel capability in materials. (4 marks)

9. Name the parts labelled **A, B, C** and **D** in the rock formation shown in Figure 1. (4 marks)
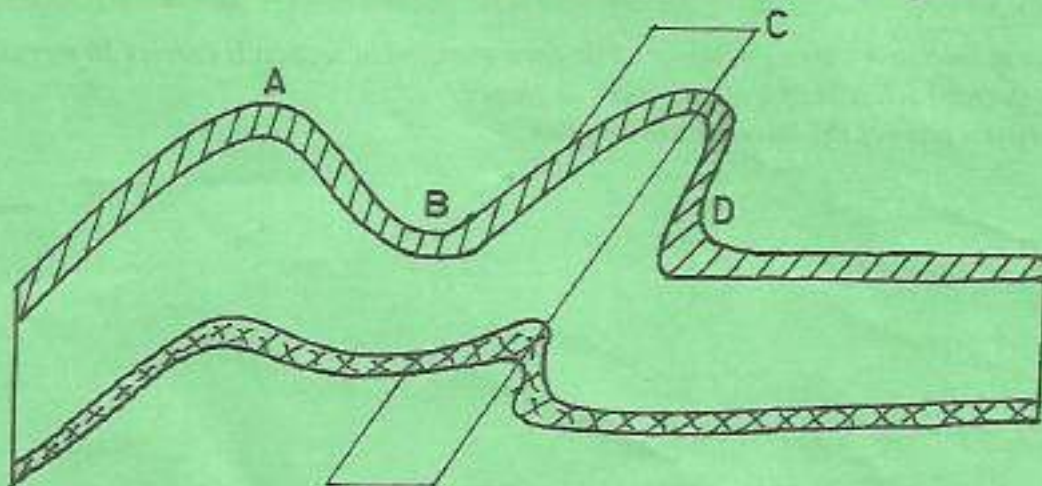

Fig.1

10. Explain the effect of volatile components in acidic magma on the texture of the formed igneous rock. (4 marks)

SECTION B (60 marks)

*Answer any **THREE** questions from this section.*

11. (a) Define 'full duplex system' as used in communication systems. (2 marks)

(b) (i) Distinguish between analog and digital messages as used in information communication systems. (4 marks)

(ii) State any **three** advantages of digital communication systems. (3 marks)

(b) (i) Name the parts labelled P, Q, R, S and T of the basic communication system shown in Figure 2. (5 marks)

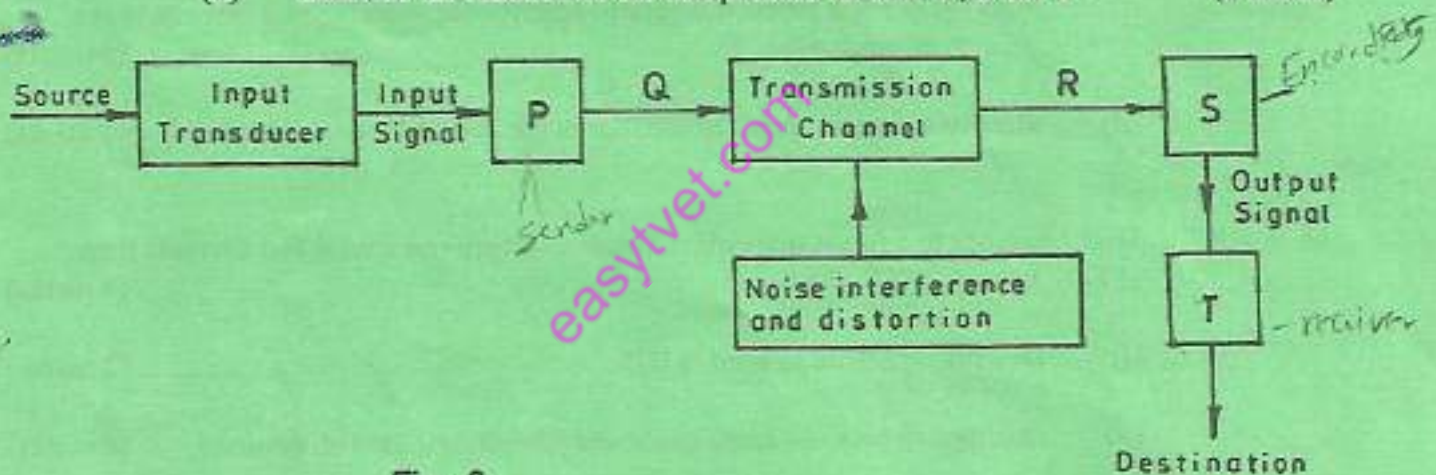(ii) Describe the function of the components labelled P, S and T. (6 marks)

Fig. 2

12. (a) State Kepler's second law. (3 marks)

(b) The orbital radii and orbital period data for three Jupiter moons are shown in Table 1. The mass of Jupiter is 1.9×10^{27} kg.

(i) Determine the $\frac{T^2}{R^2}$ ratios for the three moons. (6 marks)

(ii) Describe the pattern shown by the data determined in (i). (2 marks)

(iii) Name the Keplerian law associated with the data determined in (i). (1 mark)

Table 1

Moon	Period	Radius
Europa	3.07×10^5	6.7×10^8
Gaymede	6.18×10^5	1.1×10^9
Callisto	1.44×10^6	1.9×10^9

(c) (i) With the aid of a labelled diagram, describe the working of a satellite in the geosynchronous orbit. (6 marks)

(ii) State **two** disadvantages of satellite in the geosynchronous orbit. (2 marks)

13. (a) With reference to a forest tree cover, distinguish between spatial and attribute types of GIS data. (4 marks)

(b) (i) Describe spheroid as used in GIS. (2 marks)

(ii) Distinguish between semi-major and semi-minor axes of the earth. (4 marks)

(c) With the aid of labelled diagrams, outline the process of transforming a two-layer raster using the principal component analysis (PCA) method. (10 marks)

14. (a) Using labelled diagrams, distinguish between bending and buckling dynamic conditions for an active folding process. (4 marks)

(b) With the aid of labelled diagrams, outline the formation of:

(i) Horst fault; (4 marks)
(ii) Rift valley. (4 marks)

(c)   Name the parts labelled **W, X, Y** and **Z** in the crust of an active volcano showed in Figure 3.   (4 marks)

Fig. 3

(d)   Distinguish between a stock and a batholith as used in volcanicity.   (4 marks)

15.   (a)   List **four** characteristics of frozen water that makes it a mineral.   (4 marks)

(b)   Describe the process of forming:

(i)   intrusive igneous rocks;   (3 marks)
(ii)   sedimentary rocks.   (3 marks)

(c)   Explain why hot springs are prevalent in the Kenyan Rift Valley.   (4 marks)

(d)   Figure 4 represents a rock cycle. Name:

(i)   the components labelled **A** and **B**;   (2 marks)
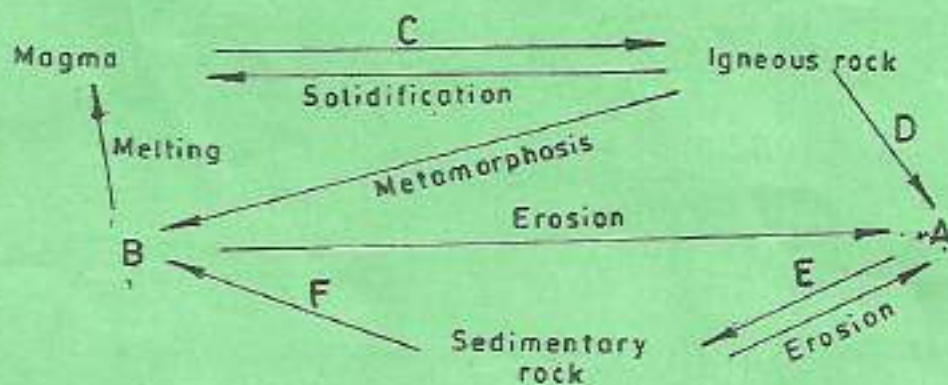(ii)   the process labelled **C, D, E** and **F**.   (4 marks)

Fig. 4

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