2901/102
APPLIED MATHEMATICS
AND ECONOMICS
Oct./Nov. 2022
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN PETROLEUM GOESCIENCE

MODULE I

APPLIED MATHEMATICS AND ECONOMICS

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 a total of **FIVE** questions taking at least **TWO** questions from each section.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 3 printed pages.

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

SECTION A: APPLIED MATHEMATICS

*Answer at least **TWO** questions from this section.*

1. (a) (i) By neglecting the cubic and higher powers of x, use the binomial theorem to show that:

$$\sqrt{\frac{1+4x}{1-4x}} = 1+4x+8x^2$$

(ii) By letting $x = \frac{1}{200}$ determine the value of $\sqrt{51}$. (8 marks)

(b) Use the elimination method to solve the equations:

$$x+2y+3z=-19$$
$$-2x+y+2z=-13$$
$$3x-y-z=8$$

(8 marks)

(c) Solve the equation $\log_y 16 + 3\log_y 4 = 10$. (4 marks)

2. (a) Prove the identity:

$$\frac{1+\cos\theta+\sin\theta}{1+\cos\theta-\sin\theta} = \frac{\cos\theta}{1-\sin\theta}$$

(6 marks)

(b) Express the polar equation $r = \frac{6}{1-\sin\theta}$ in the cartesian form. (7 marks)

(c) Solve the equation $20.2\sinh y - 16.4\cos hy = 11.7$. (7 marks)

3. (a) Determine the derivative of $\frac{4}{3+x}$ from the first principle. (5 marks)

(b) The period T of a simple pendulum is given by $T = 2\pi\sqrt{\frac{L}{g}}$. If g decreases by 2% and L increases by 3%, determine the percentage change in T using the partial differentiation. (7 marks)

(c) The acceleration of a particle is given by $a = 2t^2+3t+4$. Determine the displacement of the particle at t = 3, if the particle starts from the rest. (8 marks)

4. (a) The data in table **I** shows the scores of 50 students in a math test.

Table I

Marks	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of students	4	5	6	a	6	5	b	5	6	2

Given that the median is 22.5, determine the:

(i) values of a and b;
(ii) mean;
(iii) standard deviation. (14 marks)

(b) The diameters of bolts produced by a machine are normally distributed with a mean 2.4 cm and standard deviation 0.8. Determine the probability that the diameters:

(i) are greater than 3.2 cm;

(ii) lie between 1.6 and 4.2 cm.

(6 marks)

SECTION B: ECONOMICS

*Answer at least **TWO** questions from this section.*

5. (a) Distinguish between land and labour as factors of production. (4 marks)

(b) Explain **four** functions of the Central Bank of Kenya. (8 marks)

(c) Explain **four** factors that may account for increased unemployment in the developing countries. (8 marks)

6. (a) Explain **four** benefits that a country may derive from international trade. (8 marks)

(b) Explain **four** ways in which inflation may affect a country. (8 marks)

(c) State the difference between Gross Domestic Product (GDP) and Gross National Product (GNP). (4 marks)

7. (a) Explain **five** features of a perfectly competitive market. (10 marks)

(b) Explain **five** factors that may determine the optimum size of a firm. (10 marks)

8. (a) Explain **two** ways in which the government may use fiscal policy to intervene in the economy. (4 marks)

(b) Explain each of the following terms:

(i) economics;
(ii) equilibrium;
(iii) opportunity cost.

(6 marks)

(c) Certain factors cause a shift in the demand for a commodity even when the price remains the same. Explain **five** such factors. (10 marks)

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