



STAMFORD COLLEGE

SCHOOL OF ENGINEERING

FOUNDATION STUDIES IN ENGINEERING (ELECTRICAL AND ELECTRONIC)

KE012: ALGEBRA

Date : 24 May 2006 (Thursday)

Time : 10.00 am – 12.00 pm

Duration: 2 hours + 10 minutes reading time

Instructions to Candidates

1. SIX questions set.
2. Answer any FOUR questions.
3. All questions carry equal marks.
4. Maximum marks attainable: 100

Please ensure that this examination paper contains SIX questions on FIVE printed pages before you start the examination.

Books, papers and other written materials are not allowed to be brought into the examination hall. A candidate who violates the examination rules of Stamford College or commits a malpractice will be disqualified from the examination.

Write your Examination Index Number on each page of your answer booklet.

ANSWER ANY FOUR QUESTIONS**Question 1**

(a) Simplify the following:

$$\text{i) } (4a^3b^{-1}c)^3 \times (a^{-2}b^4c^{-2})^{1/2} \div [64(a^6b^4c^2)^{-1/2}] \quad (4 \text{ marks})$$

$$\text{ii) } \sqrt[3]{8a^3b^6} \div \sqrt{\frac{1}{9}a^4a^7} \times (4\sqrt{a^6b^2})^{-1/2} \quad (4 \text{ marks})$$

(b) Solve the following for x :

$$4 \log_a \sqrt{x} - \log_a 3x = \log_a x^{-4} \quad (4 \text{ marks})$$

(c) For the given polynomial equation :

$$4x^4 - 19x^3 + 24x^2 + x - 10 = 0$$

i) What is the degree of the polynomials ? (2 marks)ii) Find the roots of the polynomial. (8 marks)iii) Express the polynomial roots in the form of a linear equation. (3 marks)**(Total = 25 marks)****Question 2**

(a) Solve the following linear equation:

$$2(x-1) - 4(x+2) = 3(x+5) + (x-1) \quad (3 \text{ marks})$$

(b) Convert the following non-linear equation to a linear equation and solve the linear equation obtained.

$$\frac{3}{x+2} - \frac{5}{x} = -\frac{2}{x-1} \quad (4 \text{ marks})$$

(c) Solve the following pair of simultaneous equations:

$$4x - 2y = 16$$

$$6x + 5y = 24$$

(5 marks)

(d) Solve the following:

$$\frac{5}{x} + \frac{1}{y} = 8$$

$$\frac{4}{x} - \frac{2}{y} = 12$$

(5 marks)

(e) Solve the following set of simultaneous equations:

$$x + y + z = 6$$

$$2x - y + 3z = 9$$

$$x + 2y - 3z = -4$$

(8 marks)

(Total = 25 marks)

Question 3

a) Plot the graph for the equation $y = 2x^2 + 3x + 1$ and find the roots of the equation.

(8 marks)

b) Expand the equation $(x - 3)(x - 6)$ as a quadratic equation and find the roots of the equation.

(4 marks)

c) Find the roots of the following quadratic equations:

i) $x^2 + 7x + 10 = 0$

ii) $6x^2 - 8x - 9 = 0$

(4 marks)

(d) Factorise the equation $x^2 - 6x + 2 = 0$ by completing the square.

(5 marks)

(e) Solve the following inequalities:

i) $3x + 7 < x - 5$

ii) $2x^2 - 7x + 3 < 0$

(4 marks)

(Total = 25 marks)

Question 4

- (a) Solve the equation $\log_2 x + \log_2 (x + 2) = 3$. (3 marks)
- (b) Write down the binomial formula for $(x + y)^n$. (3 marks)
- (c) Write the expansion of $(2a - b^2)^6$ and simplify the expansion obtained. (6 marks)
- (d) Write a formula to calculate the n^{th} term in the binomial expansion $(a + b)^n$. (2 marks)
- (e) Find the 10^{th} term in the binomial expansion of $(1 + x)^{15}$. (3 marks)
- (f) Find the value of the first 100 natural numbers (excluding zero). (3 marks)
- (g) Evaluate $\sum_{r=1}^n (4r + 3)$ (5 marks)

(Total = 25 marks)**Question 5**

- (a) Solve the following linear equations by matrix method:

$$x_1 + 3x_2 + 2x_3 = 3$$

$$2x_1 - x_2 - 3x_3 = -8$$

$$5x_1 + 2x_2 + x_3 = 9$$

(12 marks)

- (b) If $A = \begin{pmatrix} 7 & 2 \\ 3 & 1 \end{pmatrix}$ & $B = \begin{pmatrix} 4 & 6 \\ 5 & 8 \end{pmatrix}$, determine the following:

i) $A + B$ (2 marks)

ii) $A - B$ (2 marks)

iii) AB (3 marks)

iv) A^T (2 marks)

v) Inverse of (A) (4 marks)

(Total = 25 marks)

Question 6

(a) Simplify the following:

i) $(6 - 3j)(2 + j5)(6 - 2j)$ (4 marks)

ii) j^{10} (1 marks)

iii) j^{23} (1 marks)

iv) $\frac{(2 + j3)(1 - j2)}{3 + j4}$ (4 marks)

(b) Express $2 + j3$ in the polar form. (6 marks)

(c) Express $3\angle 300$ in the rectangular form. (3 marks)

(d) Simplify $\frac{4 - j5}{2 + 2j}$. (3 marks)

(e) Express $z = 5(\cos 140 + j \sin 140)$ in the rectangular form and plot it. (3 marks)

(Total = 25 marks)

– END OF PAPER –