WOMEN'S UNIVERSITY IN AFRICA

Addressing gender disparity and fostering equity in University Education

FACULTY OF MANAGEMENT AND ENTREPRENEURIAL SCIENCES

BSc HONOURS DEGREE IN COMPUTER SCIENCE

MAIN PAPER

HCS 112: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

INTAKE 3: FIRST YEAR FIRST SEMESTER

TIME: 2 HOURS AFTERNOON

INSTRUCTIONS TO CANDIDATES

Answer any **four** questions.

Question 1

a) Let A = $\begin{bmatrix} 2 & 1 & 4 \\ 3 & 5 & -7 \\ 1 & 6 & 2 \end{bmatrix}$

i. Find the adjoint of the matrix A [5]

ii. Hence or otherwise find inverse of matrix A [5]

b) Let p = 2**i** – 3**j** + 4**k** and q = **i** + 2**j** + **k**, show that the vectors p and q are orthogonal [4]

c) State De Moivre 's Formula [4]

d) Show that cos 5θ = 16 $cos^5\theta$ – 20$cos^3\theta$ +5 cosθ [7]

Question 2

a) Solve:

i) $5x^2 + 2x + 2 = 0$ [3]

ii) $x^3 – 7x^2 + 17x - 15 = 0$ [5]

b) Find the vector equation of the straight line which passes through the points (1, 2, 3) and is parallel to the straight line through the points (-1, 2, 7) and (2, 3, 4) [6]

c) Let p =2**i** + 3**j** - **k** and q = **i**- 4**j** + 5**k**.Find p.q and the angle between them [4]

d) Find (2 + 3**i**) (1 + 2**i**) [2]

e) Prove that if an n X n matrix A is multiplied by a scalar k, then the determinant of k is k^ndet A [5]

Question 3

a) If $z_1 = r_1 (\cos \alpha_1 + \mathbf{i} \sin \alpha_1)$ and $z_2 = r_2 (\cos \alpha_2 + \mathbf{i} \sin \alpha_2)$ Prove that $z_1 z_2 = r_1 r_2 (\cos(\alpha_1 + \alpha_2) + \boldsymbol{i} \sin (\alpha_1 + \alpha_2))$ [9]

b) Show that $\cos^3 \alpha = x = \frac{1}{4} \cos 3\alpha + \frac{3}{4} \cos \alpha$ [9]

c) Find the square root of 8 - 6**i** [7]

Question 4

a) Find the solution of the linear system using Cramer's rule

$x_1 + 2x_2 + 4x_3 = 14$

$2x_1 + 6x_2 + 6x_3 = 28$

$3x_1 + 6x_2 + 10x_3 = 34$ [13]

b) Prove that if the determinant of an nXn matrix A is 0, then the matrix does not have an inverse [12]

Question 5

a) Find A^{-1} if $A = \begin{bmatrix} 1 & -2 & 4 \\ -4 & 0 & 3 \\ 2 & -1 & 0 \end{bmatrix}$ [6]

b) A straight line passes through the points (2, 1, 7) and (-3, 2, 5). Find

i. Parametric equations of the line l [3]

ii. Symmetric equation of the line l [4]

c) Show that $\sin 4\,\theta = \frac{1}{4}\cos 4\theta - \cos 2\theta + \frac{3}{4}$ using Euler's formula [12]

Question 6

Solve the system of equations

a) $2x_1 + 3x_2 - x_3 = 4$

$x_1 - 2x_2 + x_3 = 6$

$x_1 - 12x_2 + 5x_3 = -10$ [15]

b) Convert each of the following complex numbers to a polar form

$2\sqrt{3} + 2i$ [5]

c) Let $R = \begin{bmatrix} 3 & 4 & 1 \\ 0 & 2 & -6 \\ 8 & 5 & 7 \end{bmatrix}$ and $R^t = \begin{bmatrix} 3 & 0 & 8 \\ 4 & 2 & 5 \\ 1 & -6 & 7 \end{bmatrix}$ find $R - R^t$ and name the special name given to this matrix [5]

END