KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2011/2012 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN TELECOMMUNICATION

MATH 210: ENGINEERING MATHEMATICS II

DAY: WEDNESDAY **DATE: 01/08/2012**

TIME: 9.00 – 11.00 A.M. **STREAM: Y2S1**

INSTRUCTIONS:

- **Answer Question ONE and any other TWO Questions**

QUESTION ONE (30 MARKS)

a) Let the matrix and the matrix . Find the matrix and hence or otherwise solve the system

(8 marks)

b) State De Moivre's theorem for positive integral index and use it to prove that
$\sin 3\phi = 3\cos^2\phi \sin\phi - \sin^3\phi$ (5 marks)

c) c). Find the volume of the Tetrahedron with sides given by and (6 marks)

d) Let $\dim_R V = 2$ and define T on V by

$$v_1T = av_1 + bv_2$$
$$v_2T = xv_1 + yv_2,$$

where $a, b, x, y \in R$. In terms of a, b, x, y, find necessary and sufficient conditions that T have two distinct eigenvalues in R. (5 marks)

e) Find all the 5^{th} roots of unity (6 marks)

QUESTION TWO (20 MARKS)

a) Let the mapping and defined by, and Find

i.

ii.

iii. f(f(f(2, 5)))

iv. (9 marks)

b) Find the area of a triangle that has the vertices .

(5 marks)

c) If $\tilde{A} = xz^3\hat{i} - 2x^2yz\hat{j} + 2yz^4\hat{k}$ find $\nabla \times \tilde{A}$ at (1, -1, 1). (6 marks)

QUESTION THREE (20 MARKS)

a) Evaluate $\int_C \frac{(1-2z)dz}{z(z-1)(z-2)^2}$ where C is a positively oriented circle .

(5 marks)

b) Let $F: R^2 \to R^2$ be defined by $F(x, y) = (2x+3y, 4x-5y)$. Find the T of F relative to the basis $S = (u_1, u_2) = \{(1,-2),(2,-5)\}$ (6 marks)

c) Consider the space curve $x = 3\cos t$, $y = 3\sin t$, $z = 4t$.

Find i). The unit tangent $\hat{T}$

ii). The principal normal $\hat{N}$

iii). Curvature k and radius of curvature ρ

iv). The Binormal $\hat{B}$

v). Torsion τ and radius of torsion σ (9 marks)

QUESTION FOUR (20 MARKS)

a) Use Cramers rule to solve the system

(12 marks)

b) If $\tilde{A} = \cos xy\hat{i} + (3xy - 2x^2)\hat{j} - (3x + 2y)\hat{k}$ show that —— —— (4 marks)

c) If $F(z) = \dfrac{3z+1}{(z-4)(z-1)}$, find the poles and residues at the poles for $F(z)$. (4 marks)

QUESTION FIVE (20 MARKS)

a) Show that if is analytic inside and on a simple closed curve C and a is any point inside C then — —— (7 marks)

b) A particle moves along the curve $\tilde{r} = (t^3 - 4t)\hat{i} + (t^2 + 4t)\hat{j} + (8t^2 - 3t^3)\hat{k}$, where t is the time. Find the magnitude of the tangential and normal components of its acceleration when .

c) Given that matrix $A = \begin{pmatrix} -7 & 3 \\ 5 & 1 \end{pmatrix}$ and matrix $B = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$, find where;

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