KENYA METHODIST UNIVERSITY
END OF SECOND TRIMESTER 2006/2007 EXAMINATIONS

FACULTY : SCIENCES
DEPARTMENT : MATHEMATICS AND COMPUTER SCIENCE
COURSE CODE : MATH 221
COURSE TITLE : VECTOR ANALYSIS
TIME : 2 HRS

Instructions:
- Answer question 1 (compulsory) and any other 2 questions.

Question 1

a) If $\underset{\rightarrow}{A}$ and Φ are a vector point function and a scalar point respectively find :

i) grad Φ (ii) curl $\underset{\rightarrow}{A}$ at the point (1,1,1) (7 mks)

b) Evaluate $\iint_{5} \underline{F}.d\underline{S}$ given that

$\underline{F} = (x-2)\underline{i} + (x+3y)\underline{j} + 2z\underline{k}$ over the closed surface of the tetrahedron formed by the planes x = 0, y = 0 and 2x + 2y + z = 2 (8 mks)

c) Evaluate $\int_{c} \underline{F}.d\underline{r}$ if $\underline{F} = x\underline{i} - y\underline{j} + z\underline{k}$ and C is the straight line segment from (1,1,1) to (-2,2,3)

(5 mks)

d) Find the angle between the vectors

$\underline{A} = 3\underline{i} - \underline{j} + 2\underline{k}$ and $\underline{B} + 2\underline{i} + \underline{j} - \underline{k}$ (5 mks)

e) Prove that the line joining the mid points of a triangle is parallel to the third side and has one half of its magnitude. (4 mks)

Question 2

a) State Green's Theorem in the plane. (5 mks)

b) Verify Green's Theorem in the plane for:

$$\oint_{c} (xy + y^2)dx + x^2 dy$$

Where C is the closed curve of the region bounded by y = x and y = x ^{2} (15 mks)

Question 3

Evaluate $\int_{v} \underline{F}dv$ where V is the region bounded by the planes x = 0, y=0, z = 0 and 2x +y +z = 2 and

$\underline{F} = 2Z\underline{i} + y\underline{k}$ (20 mks)

Question 4

Verify the divergence theorem for the vector field $\underline{F} = x^2\underline{i} + z\underline{j} + y\underline{k}$ taken over the region bounded by the planes z=0, z=2, x=0, x=1, y=0, y=3 (20 mks)