# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

**UNIVERSITY EXAMINATION FOR:**

# DIPLOMA IN ELECTRICAL ENGINEERING

ELECTRICAL POWER OPTION

TELECOMMUNICATION OPTION

INSTRUMENTATION AND CONTROL OPTION

YEAR III SEMESTER II

AMA 2351: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION

**SERIES: AUGUST** 2019

**TIME:** 2HOURS

**DATE: AUGUST** 2019

**Instructions to Candidates**

You should have the following for this examination

-*Answer Booklet, examination pass and student I Mathematical table, calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** (Compulsory) and any other **TWO** questions.

**Do not write on the question paper.**

**Question One (Compulsory)** **(30marks)**

a) Determine the unit vector normal to the surface $\Phi(x,y,z)=3x^3+2y^3+4xyz$ at a Point $(1,0,-1)$ **(5marks)**

b) Determine the Eigen values and corresponding Eigen vectors of the Matrix

$$A=\begin{bmatrix}3 & 1\\ 2 & 2\end{bmatrix}$$ **(9marks)**

c) i) Evaluate $I=\iint xy(x+y)dxdy$ over the area between $y=x^2$ *and* $y=x$ **(6marks)**

ii) Evaluate the triple integral $\int_0^1\int_0^{\sqrt{1-y^2}}\int_{x^2+y^2}^{1-x^2-y^2} xdzdxdy$ **(6marks)**

d) Find the value of the constant p given that the three vectors

$\underset{\sim}{A}=\underset{\sim}{i}-2\underset{\sim}{j}+p\underset{\sim}{k},\quad B=-2\underset{\sim}{i}+3\underset{\sim}{j}-4\underset{\sim}{k},\quad C=\underset{\sim}{j}+2\underset{\sim}{k}$, are coplanar **(4marks)**

**QUESTION TWO** **(20marks)**

a) Evaluate:-

i) $\int_1^3\int_0^{\ln y} dxdy$ **(5marks)**

ii) $\int_0^{\frac{\pi}{2}}\int_0^{x} x\sin y\,dydx$ **(7marks)**

b) Find the volume enclosed by the curve $x^2+y^2=16$, and the planes z = 0 and $z=5-x$ **(8marks)**

**QUESTION THREE** **(20marks)**

Evaluate :

a) $\int_0^{\frac{\pi}{2}}\int_0^{y} y\cos x\,dx\,dy$ **(4marks)**

b) Use double integration to determine the area enclosed by the curve

$y = x^2$ *and the line* $y = x$ **(7marks)**

c) $\iiint \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$ over the region for which: $x \geq 0, y \geq 0, z \geq 0$

and $x^2 + y^2 + z^2 = 1$ **(9marks)**

**QUESTION FOUR** **(20marks)**

a) Given that D is a square defined by $-1 \leq x_1 \leq 1, \quad -1 \leq x_2 \leq 1$ and $F_1$ and $F_2$

defined on D by $F_1(x_1, x_2) = -x_2 e^{x_1}$ and $F_2(x_1, x_2) = x_1 e^{x_2}$ , prove Greens

Theorem. **(12marks)**

(b) Given $A = xyz\tilde{i} + (xy - 2yz)\tilde{j} + yz^2\tilde{k}$ and $\phi = 2x^2y - 2xyz + 3y^2z^2$ .

Find at a point $(2,1,2)$

i) Curl A

ii) Div grad $\phi$ **(8 marks)**

**QUESTION FIVE** **(20marks)**

a) Given that $A=\begin{bmatrix}3 & 1\\ 4 & 3\end{bmatrix}$ and the characteristic polynomial.

$f(\lambda)=\det[A-\lambda I]$, Solve the characteristics equation $f(\lambda)=0$ and hence

Show that $f(A)=0$, zero matrix. **(8marks)**

b) i) Show that $A=\begin{bmatrix}1 & 4\\ 1 & 1\end{bmatrix}$ is zero of $f(\lambda)=\lambda^2-2\lambda-3$. Hence or otherwise,

find the eigen values of A and corresponding eigen vectors **(6marks)**

ii) Diagonalize the matrix b (i) above **(6marks)**