TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEP VI)

AMA 2302: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question One

a) Define the following terms a used in mathematics:

(i) Diagonal matrix **(1 mark)**

(ii) The order of a matrix **(1 mark)**

b) Find the eigen values of the matrix

$$A = \begin{bmatrix} 2 & 3 & -2 \\ 1 & 4 & - \\ 2 & 10 & -5 \end{bmatrix}$$

(8 marks)

c) State whether the following is a vector or scalar quantity

(i) A temperature of 100ºC **(1 mark)**

(ii) An acceleration of 9.8m/s2 **(1 mark)**

(iii) The weight of a 7kg mass **(1 mark)**

(iv) The sum of £500 **(1 mark)**

(v) A North Easterly ward of 20 knots **(1 mark)**

d) Determine the resultant of the following set of vectors

$$\overline{AB} + \overline{BC} + \overline{CD} + \overline{DE} + EF$$

(3 marks)

e) ABCD is a quandrateral with G and H the midpoints of DA and BC respectively.

$$\overline{AB} + \overline{DC} = 2\overline{GH}$$

Show that **(5 marks)**

$$I = \int_1^2 \int_0^3 x^2 y \; dx \; dy$$

f) Evaluate **(4 marks)**

g) Give any **THREE** areas where vectors can be applied in real life. **(3 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) ABCD is a quadrilateral in which P and Q are the mid points of the diagonals AC and BD respectively. Show that:

$$\overline{AB} + \overline{AD} + \overline{CB} + \overline{CD} = 4\overline{PQ}$$

(8 marks)

b) Find the second moment of area of rectangle 6cm x 4cm about an axis through one corner perpendicular to the plane of the figure. **(5 marks)**

$$\int_1^2\int_0^3\int_0^1 \left(p^2+q^2-r^2\right)dpdqdr$$

c) Evaluate (5 marks)

d) If $\begin{pmatrix}2\\8\end{pmatrix}$ is parallel to $\begin{pmatrix}-4\\x+3\end{pmatrix}$, find the value of K. **(2 marks)**

Question Three

$$Y_1^2 = 9x \text{ and } y_2 = x^2/9$$

a) Find the area enclosed by the curves **(5 marks)**

b) Given the following matrices

$$A=\begin{pmatrix}5\\2\end{pmatrix}, B=\begin{pmatrix}4 & 0 & 7 & 3\end{pmatrix}, C=\begin{pmatrix}2 & 6 & 9\\1 & 0 & 0\end{pmatrix}$$

state the order of each matrix and hence find the following;

(i) B^2

(ii) A X B **(5 marks)**

c) Show by vectors that the line joining the mid points of two sides of a triangle is parallel to the third side and half its length. **(4 marks)**

d) Given the following matrix:

$$A=\begin{pmatrix}1 & 2 & 3\\4 & 1 & 5\\6 & 0 & 2\end{pmatrix}$$

Show that $AA^{-1}=A^{-1}A=I$ where I is the identity matrix. **(6 marks)**

Question Four

a) Define the term “null matrix and hence given an example of it. **(3 marks)**

b) Find the area bounded by $y=\frac{4x}{5}$, the x-axis and the ordinate at x = 5 **(5 marks)**

c) In the figure below $\overrightarrow{OR}=\vec{r},\ \overrightarrow{OS}=2\underset{\sim}{r},\ \overrightarrow{OR}=3/2\,\underset{\sim}{p},\ \mathrm{QK}=N\overrightarrow{QR},\ \overrightarrow{PK}=n\overrightarrow{PS}$. Find two distinct expressions in terms of P, R, M and N for OK by equating these expressions. Find the value of M and N and hence determine the ratio QK:KR and PK:KS.

Figure 1

d) Define the term 'A Scalar Quantity' **(1 marks)**

e) Given the matrix $A = \begin{pmatrix} 4 & 0 \\ 3 & 1 \end{pmatrix}$ find $|A|$ and hence A^{-1} **(2 marks)**

Question Five

a) Given the following matrix $A = \begin{pmatrix} 4 & 7 \\ 5 & 2 \end{pmatrix}$ show that $AA^{-1} = A^{-1}A = I$ where I is the identity matrix. **(5 marks)**

b) ABCD is a quadrilateral with $A(2,1),\ B(5,3),\ C(7,8), D(4,6)$ show that ABCD is a parallelogram. **(5 marks)**

c) On a 3-dimensional vector space, if we let $l = \cos\alpha,\ m = \cos\beta,\ n = \cos$ show that $l^2 + m^2 + n^2 = 1$ where $\alpha, \beta,$ are the angles the resultant vector makes with the x, y, z axis respectively. **(6 marks)**

d) Evaluate $I = \int_1^2 \int_0^{\pi} (3 + \sin\theta)\ d\theta\ dr$ **(4 marks)**