TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DEGREE IN BACHELOR OF SCIENCE MATHEMATICS (BSMA)

SMA 2379: LINEAR BOOLEAN ALGEBRA

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) If $A = \begin{pmatrix} 2 & 3 \\ 1 & -4 \end{pmatrix}$ and $B = \begin{pmatrix} -5 & 7 \\ -3 & 4 \end{pmatrix}$, find A x B **(2 marks)**

b) Use matrices to solve the simultaneous equations **(4 marks)**

$$3x + 5y - 7 = 0$$
$$4x - 3y - 19 = 0$$

c) If A and B are the points (3, 4, 5) and (6, 8, 9) find vector $\underset{\sim}{AB}$ **(3 marks)**

d) Solve $\left(\hat{i} + 2\hat{j} + 3\hat{k}\right) \times \left(2\hat{i} + \hat{j} - \hat{k}\right)$ **(3 marks)**

e) Construct the truth table for $\underset{\sim}{} p \vee q$ **(4 marks)**

f) Find the equation of the plane passing through the three points (2, 3, 4), (-3, 5, 1), (4, -1, 2) **(6 marks)**

g) Determine the rank of $A=\begin{pmatrix}3 & 4 & 5\\ 1 & 2 & 3\\ 4 & 5 & 6\end{pmatrix}$ **(4 marks)**

h) Simplify $A\cdot B\cdot \overline{C}+A\cdot B\cdot C+\overline{A}\cdot B\cdot C$ **(4 marks)**

Question Two

a) Find the Eigen values and Eigen vectors of the matrix $A=\begin{pmatrix}1 & -6 & -4\\ 0 & 4 & 2\\ 0 & -6 & -3\end{pmatrix}$ **(12 marks)**

b) If $\underset{\sim}{A}=A_1\hat{i}+A_2\hat{j}+A_3\hat{k}$ and $\underset{\sim}{B}=B_1\hat{j}+B_2\hat{j}+B_3\hat{k}$ prove that $\underset{\sim}{A}\bullet\underset{\sim}{B}=A_1B_1+A_2B_2+A_3B_3$ **(4 marks)**

c) If $\underset{\sim}{A}=\hat{i}+\hat{j},\quad \underset{\sim}{B}=2\hat{i}-3\hat{j}+\hat{k},\quad \underset{\sim}{C}=4\hat{j}-3\hat{k}$, find $(\underset{\sim}{A}\times\underset{\sim}{B})\times\underset{\sim}{C}$ **(4 marks)**

Question Three

a) Determine λ and μ by using vectors such that the points (-1, 3, 2), (-4, 2, -2) and $(5,\ \lambda,\ \mu)$ lie on a straight line. **(8 marks)**

b) Find the equation to the plane through P (2, 6, 3) at right angle to OP, O being the origin. **(5 marks)**

c) Reduce the following matrix to upper triangular form: $\begin{pmatrix}1 & 2 & 3\\ 2 & 5 & 7\\ 3 & 1 & 2\end{pmatrix}$ **(3 marks)**

d) Find the value of x, y, z and a which satisfy the matrix equation $\begin{pmatrix}x+3 & 2y+x\\ z-1 & 4a-6\end{pmatrix}=\begin{pmatrix}0 & -7\\ 3 & 2a\end{pmatrix}$ (4 marks)

Question Four

a) Convert (i) 0.1011_2 to a decimal fraction **(4 marks)**

(ii) The hexadecimal number $C9_{16}$ into decimal **(3 marks)**

b) Verify that $\overline{(A+B)} = \overline{A} \cdot \overline{B}$ using a truth table. **(7 marks)**

c) A force of 4N is inclined at an angle of 45° to a second force of 7N, both force acting at a point. Calculate the resultant force of the two forces. **(6 marks)**

Question Five

a) Simplify the Boolean express: $\overline{P} \cdot \overline{Q} + \overline{P} \cdot Q + P \cdot \overline{Q}$ **(3 marks)**

b) Solve the following simultaneous equation using Creamers rule:

$$x + y + z = 4$$
$$2x - 3y + 4z = 33$$
$$3x - 2y - 2z = 2$$

(10 marks)

c) If $\underset{\sim}{a} = 4\hat{i} + \hat{j} + \hat{k},\ \underset{\sim}{b} = 2\hat{i} + \hat{j} + 2\hat{k}$ and $\underset{\sim}{c} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. Find $(\underset{\sim}{a} + \underset{\sim}{b}) \cdot (\underset{\sim}{b} + \underset{\sim}{c})$ **(6 marks)**

d) Define a vector. **(1 mark)**