TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UPGRADING MATHEMATICS (UMTH 13S)

AMA 1104: COMMERCIAL ARITHMETIC & STATISTICS

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2013
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 **FOUR** printed pages

Question One (Compulsory)

a) Define the following terms as used in Mathematics:

(i) Skew symmetric matrix **(1 mark)**

(ii) Data **(1 mark)**

b) Illustrate the following inequalities on a number line:

(i) $x \leq 3$ **(2 marks)**

(ii) $1 \leq x < 6$ **(2 marks)**

c) State whether each of the following is a discrete or continuous variable:

(i) The number of lecturers in a university **(1 mark)**

(ii) The capacity of a container **(1 mark)**

(iii) The size of non-teaching staff in a school **(1 mark)**

(iv) The speed of rotation of a shaft **(1 mark)**

(v) The temperature of a coolant **(1 mark)**

d) A machine is set to produce metal washers of nominal diameter 20.0mm. The diameters of 34 samples are measured and the following results in mm obtained.

19.6	19.8	19.9	19.7	19.8	19.8	19.6	19.9	19.9
3	2	6	5	6	2	1	7	0
19.8	20.1	19.5	20.0	19.7	19.9	19.6	19.8	19.8
9	6	6	5	2	6	8	7	7
19.7	19.9	20.0	19.8		19.7	19.7	19.7	
3	3	3	6	19.8	7	8	5	
19.6	19.7	19.9	20.0	20.1	20.0	19.8	20.0	
6	7	9	0	1	1	4	7	

Arrange the values above in classes of width 0.10mm in a frequency distribution table (**7 marks)**
And hence find the following:

(i) The lower class boundary of the third class

(ii) The upper class boundary of the seventh class

(iii) The central value of the fifth class **(1 mark)**

e) Fifteen percent of castings are found to be outside prescribed tolerance. Determine the number of acceptable items likely to be present in a batch of 120 such castings. **(3 marks)**

f) Given the following sets below.

$A = \{1,2,3\},\ B = \{3\}$

Find $A \Delta B$ and represent this on a Venn diagram **(6 marks)**

Question Two

a) Name any FOUR identity laws in set theory. **(4 marks)**

b) Given the following sets:

$A = \{2\ 4\ 6\},\ B = \{2\ 6\ 10\ 14\}$ $(A \cap B) = A' \cup B'$

show that **(6 marks)**

$(A \cup B) \cup C = A \cup (B \cup C)$

c) Show that in set theory **(6 marks)**

d) Given that $X_1, X_2 .... Xn$ is a sample of a given population. Show 1that the sum of squares of the deviations of a set of data from any number say B is least only when $B - \overline{X} = 0$ where $\overline{X}$ is the arithmetic mean. **(4 marks)**

Question Three

a) Show that the variance of a set of data can also be expressed as:

$$\text{var}(x) = \frac{1}{n}\sum_{i=1}^{n} x^2 - \overline{X}^2$$

(7 marks)

b) Calculate the standard deviation from the following distribution:

Marks	0 – 10	10 – 20	20 – 30	30 - 40	40 - 50
No. of Students	7	6	15	12	10

(6 marks)

c) State the FOUR steps that a statistical exercise consists of: **(4 marks)**

d) Display the following data on a pie chart:

Department	Science	Business	Forestry
No. of Students	642	820	317

(3 marks)

Question Four

a) Define the term 'A frequency polygon' and hence draw a frequency polygon using the following data.

Class	10.0 – 15.9	16.0 – 21.9	22.0 – 27.9	28.0 – 33.9
Frequency	1	3	7	4

(6 marks)

b) State any THREE uses of an ogive curve **(3 marks)**

c) Find the mean of the following data using an appropriate assumed mean.

Class	5 – 20	21 – 36	37 – 52	53 – 68	69 – 84	85 – 100

Frequency	6	12	17	11	3	1

(7 marks)

d) Solve the following inequalities:

$x+1<3<5+x$

(i) **(2 marks)**

$\frac{2}{3}x-\frac{4}{5}<\frac{1}{2}-\frac{1}{4}x$

(ii) **(2 marks)**

Question Five

a) Define the following terms as used in matrices:

(i) Double suffix notation **(2 marks)**

(ii) Null matrix **(1 mark)**

b) Solve for the unknowns in the following set of equations below using Gaussian reduction method.

$x_1-4x_2-2x_3=21$

$2x_1+x_2+2x_3=3$

$3x_1+2x_2-x_3=-2$

(7 marks)

c) Given that matrix A is of order mxn, B is of order p x q C is of order r x s. Predict the order of the following:

$A\cdot B$

(i) **(1 mark)**

$A\cdot B^2$

(ii) **(2 marks)**

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

d) Given that . Find the determinant of the above matrix. **(2 marks)**

And hence find the inverse of the matrix **(5 marks)**