TECHNICAL UNIVERSITY OF MOMBASA

A Centre of Excellence

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR THE SECOND SEMESTER IN THE FOURTH YEAR OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

MAY 2016 SERIES EXAMINATION

UNIT CODE: AMA 4432

UNIT TITLE: DESIGN AND ANALYSIS OF SAMPLE SURVEYS

TIME ALLOWED: 2HOURS

INSTRUCTIONTO CANDIDATES:

You should have the following for this examination

- Mathematical tables
- Scientific Calculator

This paper consists of **FIVE** questions

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

Maximum marks for each part of a question are as shown

QUESTION ONE (30 MARKS)

a) differentiate between the following terms:

i. simple random sample and a random sample (2 marks)

ii. sampling frame and sampling unit (2 marks)

iii. estimate and estimator (2 marks)

b) List any two situations that justifies the use of :

i. systematic sampling (2 marks)

ii. Cluster sampling (2 marks)

c) Briefly describe the procedure of carrying out simple random sampling. (6 marks)

d) Consider the following data of the household sizes for 32 households in a certain village:

5, 3, 7 ,11, 4 ,6, 10, 9, 8, 12, 11, 10, 10, 11, 8, 7, 6, 8, 9, 4, 1, 5, 7, 7, 12, 8, 9, 10, 9, 7, 6, 8.

i. Using random numbers 08, 83, 23, 49, 13 and 63, draw a simple random sample of size 6 with replacement. (6 marks)

ii. Obtain an estimate of the average household size along with its standard error. (5 marks)

iii. Construct a 95% confidence interval for the average household size in the population. (3 marks)

QUESTION TWO (20 MARKS)

a) Describe the three types of non probability sampling methods. (6 marks)

b) Consider a small population of size N= 6 having units 1, 2, 3, 4,5 6 with respective values 8, 3, 2, 11, 5 and 7. Suppose a simple random sample of size two is drawn without replacement.

i) Calculate the sample means. (2 marks)

ii) Calculate the population variance, $\sigma_{\overline{X}}^2$. (3marks)

iii). Verify that $E(\overline{x}) = \overline{X}$. (3 marks)

iv). Verify that $Var(\overline{x}) = \frac{N-n}{(N-1)n}\ \sigma^2$, where σ^2 is the population variance . (3 marks)

QUESTION THREE (20 MARKS)

a) State two reasons that make researchers to use simple random sampling without replacement the norm. (2 marks)

b) Give three situations when stratified random sampling is more appropriate rather than simple random sampling. (3 marks)

c) The following table provides sampling information obtained from a stratified random sampling.

$stratum$	N_i	n_i	$\overline{x}_i$	S_i^2
1	80	29	80	144
2	160	39	30	64
3	260	32	10	16

i. Provide an estimate of $\overline{x}_{st}$,of the population mean $\overline{X}$. (3 marks)

ii. Calculate the estimate of $Var\ (\overline{x}_{st})$. (4 marks)

iii. Compute the 95% confidence interval for the population total. (5 marks)

iv. What sort of allocation had been used? Verify using the data. (3 marks)

QUESTION FOUR (20 MARKS)

a. State Five advantages of sampling over complete enumeration. (5 marks)

b. outline the characteristics of a sampling design. (7 marks)

c. a population of size 800 is divided into three strata. Their sizes and standard deviations are as follows:

$Stata$	1	2	3
$Size\ \ (N_i)$	200	300	300
$Standard\ deviation\ (\sigma_i)$	6	8	12

A stratified sample of size 120 is drawn from the population. Determine the sample size in the case of;

i. proportional allocation (4 marks)

ii. Neyman allocation (4 marks)

QUESTION FIVE (20 MARKS)

a) What is systematic sampling? (2 marks)

b) Suppose you have a population consisting of N=nk units. Explain how you draw a systematic sample of size n from this population.

(3 marks)

c) Show how the variance of a systematic sample mean is obtained in two different ways.

(15 marks)