ALUPE UNIVERSITY COLLEGE
Bastion of Knowledge...
P. O.Box 845-50400 Busia(K)
principal@auc.ac.ke
Tel: +254 741 217 185
+254 736 044 469
off Busia-Malaba road

OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2017 /2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF APPLIED STATISTICS WITH COMPUTING

COURSE CODE: **STA 115**

COURSE TITLE: **INTRODUCTION TO MATHEMATICS FOR FINANCE**

DATE: 19TH APRIL, 2018 **TIME: 9AM – 12.00 NOON**

INSTRUCTION TO CANDIDATES

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THIS PAPER CONSISTS OF 5 PRINTED PAGES **PLEASE TURN OVER**

STA 115: INTRODUCTION TO MATHEMATICS FOR FINANCE

STREAM: ASC **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer Question **TWO** questions in section Aand any other **THREE** questions in section B.*

ii. *Maps and diagrams should be used whenever they serve to illustrate the answer.*

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

SECTION A (31 marks): Answer ALL questions.

QUESTION ONE (16 Marks)

a) Discuss the following terms as used in finance [4Marks]

i) Interest

ii) Annuity

iii) Sinking fund

iv) Mortgage

b) List and explain four special kinds of matrices [2Marks]

c) Given the matrix $A = \begin{bmatrix} 2 & 4 & 1 \\ 3 & 2 & 4 \\ 0 & 1 & 4 \end{bmatrix}$ Find A^{-1}[4Marks]

d) If the amount of 20,000 was invested 5 years ago so as to have amount of 40,000 now. At what rate is the amount 40 discounted? [2Marks]

e) How much money would you need to deposit today at 9% annual interest compounded monthly to have \$12000 in the account after 6 years? [4Marks]

QUESTION TWO (15Marks)

a) Ryan bought \$ 15,000 from a bank to buy a car at 10% simple Interest. If he paid \$ 9,000 as interest while clearing the loan, find the time for which the loan was given? [3Marks]

b) Give the difference between Nominal interest and effective interest [2Marks]

c) You can make a one-year investment at 7.8% compounded monthly, or 8% compounded semi-annually. Which option should you choose? [2Marks]

d) What nominal rate, compounded quarterly, is equivalent to an effective annual rate of 10%?

[2Marks]

e) Write the first six terms of the geometric sequence whose nth term is $a_n = 3(-2)^{n-1}$

[3Marks]

d) Find the sum of the series $\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\cdots+\frac{1}{729}$ [3Marks]

SECTION B (39 marks)

QUESTION THREE 13MKS

a) If you deposit $5000 into an account paying 6% annual interest compounded monthly, how long until there is $8000 in the account? [4Marks]

b) Given the series payments of amount sh. 2000 made at the end of every year for ten years at an annual effective rate of interest of 10%. Determine

i) Present value of the series [3Marks]

ii) Accumulated value of the series of payments at t=10 [3Marks]

c) Explain three purposes of equation of value in finance? [3Marks]

QUESTION FOUR 13MKS

a) John decides to make annual payments at the end of every year of amount P in order to have accumulated amount of 50,000/= at the end of ten years, at a rate of interest of 8%. Determine the value of annuity P? [3Marks]

b) Joel invested the amount of 50,000/= now so as to receive an annuity immediately beginning 10years from now of 3,000/= up to the end of 20years from now and then receive a lump sum of 50,000 at the end of the 20yrs. Determine the rate of interest that is charged for this investment. [4Marks]

c) Given the system of linear equation

$$-x + 2z - 3y = 0$$
$$-2z + 2x - 3y = 0$$
$$2x + 2y + 3y = 2$$

Determine the solution set to the variable x, y and z [6Marks]

QUESTION FIVE 13MKS

a) Define the term perpetuity in finance? [2Marks]

b) Investment A: done by making payments of amount 50,000/= at the end of every year for 15 years at the rate of interest of 8%.

Investment B: made by payments of 60,000 at the beginning of every year for 13 years at an interest rate of 8%.

If both investments are thereafter accumulated up to the end of the 20^{th} year after which they are converted to perpetuity to be received at the end of every year. Determine which perpetuity gives a higher amount? [4Marks]

c) Represent the following inequality in a graph in order to determine the set of values that satisfy all the inequalities. [4Marks]

$$5x + 3y \geq 15$$
$$6y + 5x \leq 30$$
$$y \geq 0$$

d) Define the following terms [3Marks]

i) Feasible region

ii) Constraints

iii) Feasible solution

QUESTION SIX 13MKS

a) An employer wishes to start up a contributory pension scheme to his employees. He has ten employees who are being paid an amount of 10,000 per year to the contributory scheme and in addition the employer contributes 5,000 to the individual at the end of every year.

i) Determine the amount of money in the scheme at the end of 10^{th} year if the money accrued interest at the rate of 6%. [4Marks]

ii) If at the end of the 15^{th} year all the employees retired after making the last payment due for that year. Determine the amount each individual has to receive at the end of the 16^{th} year if the fund is to be redeemed by a 10 year annuity immediate (pay at the end of the year.) [5Marks]

b) Give the difference between the following: [4Marks]

i) Annuity due and annuity immediate

ii) Row echelon form of a matrix and rank of a matrix

QUESTION SEVEN 13MKS

a) Suppose the total output of goods of the agriculture sector and manufacturing sectors and the total output of services sector are given by the variable x,y and z respectively. Then we can determine the value of agriculture product consumed in the internal process of producing this total output of various goods and services.

$$x = 0.2x + 0.2y + 0.1z$$
$$y = 0.2x + 0.4y + 0.2z$$
$$z = 0.1x + 0.1y + 0.3z$$

i) Using the above input-output matrix relating to 3 sectors of economy, find the total output of goods and services needed to satisfy a consumer demands of 100M worth of agriculture products, 80M worth of manufactured and 50M worth of services. [6Marks]

ii) Find the value of the goods and services produced in the internal process of production in order to meet this total output in (i) [3Marks]

b) Let matrix B be

$$B = \begin{bmatrix} 3 & 0 & 1 \\ 1 & 0 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$ Find the inverse of B [4Marks]

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