THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

P.O. Box 62157
00200 Nairobi - KENYA
Telephone: 891601-6
Fax: 254-20-891084
E-mail:academics@cuea.edu

MAIN EXAMINATION

AUGUST – DECEMBER 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

ACS 406: LIFE CONTINGENCIES II

Date: DECEMBER 2018	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) Evaluate 20 q [45]: [45] Basis: AM92 select for both lives **(4 marks)**

b) A life insurance company issues a reversionary annuity contract. Under the contract an annuity of Kshs 20,000 per annum is payable monthly for life, to a female life now aged 60 exact, on the death of a male life now aged 65 exact. Annuity payments are always on monthly anniversaries of the date of issue of the contract.
Premiums are to be paid monthly until the annuity commences or the risk ceases.
Calculate the monthly premium required for the contract.
Basis:
Mortality: PFA92C20 for the female and PMA92C20 for the male
Interest: 4% per annum
Expenses: 5% of each premium payment
1.5% of each annuity payment **(8 marks)**

c) Define and give the integrals of the following expressions

$i)\ \overline{A}\ xy^2$ (**2 marks**)
$ii)\ t\ q\ xy^2$ **(2 marks)**
$iii)\ x/y$ **(2 marks)**

d) The future lifetime of two lives (x) and (y) are independent and subject to a constant force of mortality of 0.05 and 0.06 respectively. Calculate the probability that their second death occurs after only 3 years but before 8 years. **(5 marks)**

e) Calculate the value of $p[50]:[60]$ for the independent lives using AM92 as your mortality table **(3 marks)**

f) Why would a company keep reserves when operating in the market? **(4 marks)**

Q2. a) The random variable *Txy* represents the time to failure of the joint-life status (*xy*). (*x*) is subject to a constant force of mortality of 0.02, and (y) is subject to a constant force of mortality of 0.03. Calculate the value of *E* (*Txy*) assuming that (*x*) and (y) are independent with respect to mortality. **(10 marks)**

b) Define $1000\ddot{a}^{(12)}\ 60:60:20]$ fully in words.
Calculate the value using PMA92C20 and PFA92C20 tables for the two independent lives at an interest of 4 % per annum. **(10 marks)**

Q3. a) On January 2017, a joint life insurance contract company issued a 10-year life Non-profit term assurance to two lives aged 50 exact. The sum assured was Kshs. 500,000 payable immediately on death of the first life. Calculate the expected present value of the contract using the PMA92C20 and PFA92C20 tables at an interest of 4 % per annum. **(10 marks)**

b) Calculate $a\ 65/\ 60$ assuming the PMA92C20 and PFA92C20 tables for two lives at an interest of 4 % per annum if:

i) Life (65) is a male and (60) is a female **(5 marks)**

ii) Life (60) is a male and (65) is a female **(5 marks)**

Q4. A life insurance company issues a special annuity to a male-aged 70 and a female aged 60 exact. An annuity of Kshs 10,000 per year is payable monthly to a female provided that it survives for the next 10 years after the death of male. An annuity commences on monthly policy anniversary following the 10th anniversary after the death of male and is payable for the balance of the lifetime of female.

i) Find the equation of value for the premium **(4 marks)**

ii) Hence, or otherwise, calculate the single premium required for the contract to be implemented **(16 marks)**
Basis:
Mortality: PMA92C20 and PFA92C20 tables for two lives

Interest: At 4 % per annum

Q5. i) A life insurance company issues an annuity policy to two lives each aged 60 exact in return for a single premium. Under the policy, an annuity of Ksh.10, 000 per annum is payable annually in advance while at least one of the lives is alive.

i) Write down an expression for the net future loss random variable at the outset for this policy. **(4 marks)**

ii) Calculate the single premium, using the equivalence principle.
Basis:
Mortality PMA92C20 for the first life, PFA92C20 for the second life
Interest 4% per annum
Expenses ignored **(8 marks)**

ii) Calculate the standard deviation of the net future loss random variable at the outset for this policy, using the basis in part (ii).
You are given that $a60{:}60 = 11.957$ at a rate of interest 8.16% per annum.
(8 marks)

END