JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

1ST YEAR 1ST SEMESTER EXAMINATION FOR THE DEGREE OF BSC. (ACTUARIAL SCIENCE)

(REGULAR)

COURSE CODE: SAC 101

TITLE: PRINCIPLES OF ACTUARIAL SCIENCE

DATE: 26/4/2013 **TIME: 9.00-11.00AM**

DURATION: 2 HOURS

INSTRUCTIONS

1. **This paper contains SIX (6) questions**
2. **Answer question 1 (Compulsory) and ANY other 2 Questions**
3. **Write all answers in the booklet provided**

QUESTION ONE

a)(i) Differentiate between insurance and assurance [2 marks]

(ii) Differentiate between Ordinary endowment plan and whole life insurance plan [4 marks]

b) Calculate the total present value as at 1 June 2008 of payments of £100 on 1 January 2009 and £200 on I May 2009, assuming a rate of interest of 12% pa convertible quarterly . [3 marks]

c)(i)An annuity payable in arrears has a first payment of kshs.300,with subsequent payments decreasing by kshs.10 each year to kshs.110 in the final year. Find an expression for the present value of this annuity. Hence, calculate the present value of the annuity payable at an effective rate of interest at 6% pa
[3 marks]

(ii)A 15 year annuity due provides payments starting at kshs.50 in year 1, kshs.70 in year 2,kshs.90 in year 3 and so on, until the payments have increased to kshs.150.Payments then continue at kshs .150 until the 15^{th} payment has been made. Calculate the present value of this annuity at an effective rate of interest of 5.2% pa. [3 marks]

(iii)An annuity certain provides payments annually in arrears for 8 years. The first payment is kshs.500 ,with subsequent payments increasing by 5 % pa compounded. Calculate the present value of this annuity at an effective rate of interest at 8% pa. [4 marks]

(d)On the basis of ELT no 12 males, find the probabilities that a life aged 30 will

(i) Survive to age 40
[2 marks]
(ii) Die before reaching age 50 [2 marks]
(iii)Die in his 50^{th} year of age i.e. between 49 and 50 [2 marks]
(iv)Die between his 40^{th} birthday and his 50^{th} birthday [2 marks]
(v)Die either between exact ages 35 and 45 or between exact ages 70 and 80 [3 marks]

QUESTION TWO

a)(i) Calculate the combined present value of an immediate annuity payable monthly in arrears such that payments are £ I ,000 pa for the first 6 years and £400 pa for the next 4 years, together with a lump sum of £2,000 at the end of the 10 years. [3 marks]

(ii) Calculate the amount of the level annuity payable continuously for 10 years having the same present value as the payments in (i). [4 marks]

(iii) Calculate the accumulated values of the first 7 years' payments at the end of the 7th year for the payments in (i) and (ii).
[3 marks]
Basis: Assume an interest rate of 12% pa convertible monthly

b)An annuity of kshs.300 pa is paid annually in advance for seven years followed by kshs.100 pa paid quarterly in arrears for a further five years. The rate of interest is 6 % pa convertible half yearly.Calculate the accumulated amount at the end of the twelve years [4 marks]

c)An investor ,who has a sum of $ 10,000 to invest wishes to purchase an annuity certain with a term of 10 years. Calculate the amount of payments that can be provided if the annuity takes each of the following forms (assuming interest of 8 % pa effective)

(i)a level annuity payable monthly in arrears [3 marks]

(ii)a level annuity due payable half – yearly ,commencing in 2 years time [3 marks]

QUESTION THREE

a)(i) Given that I=15 and R=135 i=10% and n=10 find P [3 marks]

(ii)Show that for a given security when I=iR then P= R [2 marks]

(iii)Find n if P=78.92, I=5 ,R=125 and i=10%
[3 marks]

(iv) Find a rough value of I given that P=75,I=5,R=125 and n=10 [3 marks]

(v) Find R if P= 75,I=7, n=10 and i=10%
[3 marks]

b)An investor is to pay $1000 for a property payment .The investor will then be entitled to receive rent payment for 99 years payable at the end of each year at a constant rate for the first 33 years ,increasing to double that rate for the next 33 years and three times that rate for the remaining 33 years. The value of the property at the end of the 99 years is $250,000.Find the amount of rent payable in the first year , if the investor expects to obtain a return of 8% on purchase. [6 marks]

QUESTION FOUR

a) The following data relates to the assets of an investment fund

date	Market value
1 January 2002	$4.2 m
1 January 2003	$4.6m
1 January 2004	$5.1m
1 July 2004	$5.1 m
31 December 2004	$5.5 m

The only cash flow during the calendar years 2002,2003 and 2004 that was not generated from the assets of the fund was a payment of $800,000 ,received by the fund on 30 June 2004.

For the period 1 January 2002 to 31 December 2004: Calculate

i. The money weighted rate of return

ii. The time weighted rate of return

iii. The linked rate or return (using equal year-long linking periods)

Express your answers as annual rates rounded to the nearest 0.1 % [8 marks]

b)A second fund was found to have a money weighted rate of return of 3.5 % pa and a time weighted rate of return of 3.5 %.Compare the relative performance of two fund managers [2 marks]

c)Two Projects A and B have the following expected cash flows:

	Project A	Project B
Initial Outlay	$170,000	$ 200,000
Other expenses	$20,000 at the end of year 1	-
	$ 10,000 at the end of year 2	-
Income	$20,000 at the end of year 1	$14,000 pa at the end of year of the first 6 years
	$20,000 at the end of year 2	$200,000 at the end of year 6
	$200,000 at the end of year 3	

(i) Calculate the internal rate of return (correct to 1 decimal place) for each project [4 marks]

(ii) Calculate the net present value of each project using risk discount rate of 6 % pa [3 marks]

(iii) If funds for the projects can be raised by borrowing from a bank, determine the interest rate charged by the bank above which each project becomes unprofitable. Mention any other factors that should be taken into account when deciding between the projects [3 marks]

QUESTION FIVE

Discuss in detail the 8 principles of insurance and give illustrations wherever its applicable. [20 marks]