JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS 2012/2013
SPECIAL/ SUPPLEMENTARY EXAMINATIONS FOR THE DEGREES OF
BACHELOR OF SCIENCE IN FINANCIAL ENGINEERING
&
BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE
STA 2120: FOUNDATIONS OF FINANCIAL MATHEMATICS
STA 2191: FINANCIAL MATHEMATICS I

DATE: NOVEMBER 2012 TIME: 2 HOURS

INSTRUCTIONS: Answer question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

(a) With respect to accumulation factors, explain the principle of consistency. [2 marks]

(b) Define a nominal rate of interest [1 mark]

(c) What is the "force of interest per unit time"? [1 mark]

(d) The force of interest is

$$\delta(t) = \begin{cases} 0.08t \text{ for} & 0 \leq t < 5 \\ 0.1 - 0.01t \text{ for} & 5 \leq t < 10 \end{cases}$$

Find an accumulation factor from time 0 to time t. [3 marks]

(e) Given that $\ddot{a}_{\overline{n}|} = 7.029584$ and $\ddot{a}_{\overline{2n}|} = 10.934563$, find the rate of interest i and n. [8 marks]

(f) An individual wishes to receive an annuity which is payable monthly in arrears for 15 years. The annuity is to commence in exactly 10 years at an initial rate of £12,000 per annum. The payments increase at each anniversary by 3% per annum. The individual would like to buy the annuity with a single premium 10 years from now. Calculate the single premium required in 10 years' time to purchase the annuity assuming an interest rate of 6% per annum effective. [6 marks]

(g) Bruce deposits 100 into a bank account. His account is credited interest at a nominal rate of interest of 4% convertible semi-annually. At the same time, Peter deposits 100 into a separate account. Peter's account is credited interest at a force of interest of δ. After 7.25 years, the value of each account is the same. Calculate δ. [4 marks]

(h) An amount X is deposited in an account that grows interest at an annual effective rate of interest 6%. Another amount $\frac{X}{2}$ is deposited in another account that earns interest at an annual effective rate of discount d. After 10 years, the total interest earned by both accounts is equal. Find d [5 marks]