



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE

ACTUARIAL

1ST YEAR 1ST SEMESTER 2018/2019 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: SAC 101

COURSE TITLE: PRINCIPLES OF ACTUARIAL SCIENCE

EXAM VENUE:

STREAM: (BSc. Actuarial)

DATE:

EXAM SESSION:

TIME: 2.00 HOURS

Instructions:

- 1. Answer question 1 (Compulsory) and ANY other 2 questions**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE

- a) Briefly explain the seven principles of insurance, giving a relevant example in each case. [7 marks]
- b) Suppose that the life table function is given by $l_x = 20900 - 80x - x^2$, where x denotes the age.
- Compute the radix of the table. [2 marks]
 - Calculate the following probabilities ${}_{10}p_{20}$ and q_x . [4 marks]
- c) An insurance company has to pay 20 million dollars 4 years from now to its pensioners. Suppose that it can invest money at an annual rate of 7% compounded semi-annually. Obtain the effective annual rate and the amount the company should invest. [6 marks]
- d) Suppose that for an initial investment of 1000 dollars you obtain a payment of 400 dollars after one year and 770 dollars after two years. Obtain the yield of this deal. [5 marks]
- e) In a certain country, censuses are held on 30th June each year. The enumerated male population on 30th June, 1993, 1994 and 1995 at ages 30, 31, 32 and 33 last birthday was as follows.

Age	Year		
	1993	1994	1995
30	306421	303606	307412
31	300112	305169	302121
32	299408	299168	304003
33	299133	298977	299015

Estimate the central exposed to risk from 1993 to 1995 at each ages 30, 31, 32 and 33 last birthday using

- The repeated mid-point rule
- The formula used in ELT No. 14. [6 marks]

QUESTION TWO

- a) A customer is offered an investment where interest is calculated according to the following force of interest at any time t .

$$\delta_t = \begin{cases} 0.02t & 0 \leq t \leq 3 \\ 0.045 & t > 3 \end{cases}$$

The customer invests sh. 1000 at time $t=0$. What nominal rate of interest compounded monthly is earned over the first four year period? [4 marks]

- b) Jane, Lori and Lucy each borrow a loan of sh. 5000 for five years at a nominal interest rate of 12% compounded semi-annually.

Jane has interest accumulated over the five years and pays all the interest and principal in a lump sum at the end of five years.

Lori pays interest at the end of every six-month period as it accrues and the principal at the end of the five years.

Lucy repays her loan with 10 level payments at the end of every six-month period.

Calculate the amount of interest paid on the three loans. [8 marks]

- c) Compare and contrast the graphical method and mathematical formula of graduation. [8 marks]

QUESTION THREE

- a) Discuss the main types of life insurance. [5 marks]
- b) An extract from a life table is given below where the symbols used have their usual meanings. Use it to answer the following questions.

x	l_x	d_x
30	100000	34.78
31	9965.22	38.1
32	9927.12	41.76
33	9885.35	45.81
34	9839.55	50.26
35	9789.29	55.17
36	9734.12	60.56
37	9673.56	66.49

Calculate the following;

- i. The number surviving to age 38. [2 marks]
- ii. The ${}_8p_{30}$. [2 marks]
- iii. ${}_5q_{30}$ [2 marks]

- iv. The probability that a life currently aged exactly 30 dies between ages 35 and 36. [3 marks]
- c) The Delta company is planning to purchase a machine known as machine x. the machine would cost Ksh 25000 and have a useful life of 10 years with zero salvage value. The expected annual cash inflow of the machine is Ksh 10000. Compute the payback period of the machine and conclude whether or not the machine would be purchased if the desired payback period of the company is 3 years. [4 marks]
- d) Differentiate between the nominal rate of interest and the effective rate of interest. [2 marks]

QUESTION FOUR

- a) A project requires an initial investment of Ksh 225000 and is expected to generate the following net cash inflows;

Year	1	2	3	4
Cashflow	95000	80000	60000	55000

Compute the net present value of the project if the rate of return is 12%.

[5mks]

- b) Given that a savings bank charges a nominal interest rate of 10% compounded monthly. What is the corresponding effective annual rate of interest? [2 marks]
- c) Interest is compounded monthly. The monthly rate of interest is 1%.
- Find the annual equivalent rate of interest [4 marks]
 - Find the annual equivalent rate of discount. [3 marks]
 - How much interest should be paid in arrears for the use of £5,000 over a one year period? [3 marks]
 - How much interest should be paid in advance for the use of £5,000 over a one year period? [3 marks]

QUESTION FIVE

- a) Joe Bloggs has a debt of Ksh 2,000 due 2 years from now and another one of Ksh 1,000 due 3 years from now. If Joe is allowed to discharge these debts

by a single payment of £P in one year's time, what should this payment be if the interest is charged at 10% per annum? [5 marks]

b) Consider placing a lump sum deposit of 8500 dollars today in a savings account that earns interest at 5% per annum. How long does it take to realize a savings balance of 15000 dollars, if the compounding period is

- i. quarterly
- ii. annually
- iii. semi annually
- iv. monthly

[4 marks]

c) Consider the following information on three proposals by a firm.

	Proposal		
	X	Y	Z
Present value of cash inflow	212000	171800	185200
Investment required	200000	160000	180000

Find the one to be undertaken by using the profitability index. [5 marks]

d) Discuss the three methods of investment appraisal techniques. [6 marks]