****

**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: ACS 102**

**COURSE TITLE: FUNDAMENTALS OF ACTUARIAL MATHEMATICS 1**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 14/12/2020 TIME: 09.00-11.00 AM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Explain briefly the concept of selection in relation to mortality **(2 marks)**
2. A fund is earning 7% simple interest. Calculate the effective rate in the 8th year **(3 marks)**
3. A certain life table has a select period of 1 year. At each integer age X the select rate mortality is 50% of the ultimate rate. Calculate e[60] given that and **(4 marks)**
4. If a fund accumulates at force of interest . Find the annual effective rate of interest over 2 years and 5 years **(4 marks)**
5. An investor wishes to accumulate $1,000 at the end of year 5. He makes level deposits at the beginning of each year for 5 years.The deposits earn a 6% annual effective rate of interest, which is credited at the end of each year. The interests on the deposits earn 5% effective interest rate annually. How much does he have to deposit each year **(4 marks)**
6. You are given that the nominal rate of discount per annum convertible every 3 months is 15%. Calculate the nominal rate of interest per annum convertible every 3 months.**(4marks)**
7. On April 1, company X purchased equipment for Kshs 100, 000. This is expected to have 5 useful life years. The salvage value is Kshs 14,000. Company X considers depreciation expense to the nearest whole month. Calculate the depreciation expense for 2012, 2013, and 2014 using declining balance method **(5 marks)**
8. An annuity-immediate consists of a first payment of $100, with subsequent payments increased by 10% over the previous one until the 10th payment, after which subsequent payments decreases by 5% over the previous one. If the effective rate of interest is 10% per payment period, what is the present value of this annuity with 20 payments **(4 marks)**

**QUESTION TWO**

1. Construct an amortization schedule of a loan of 15,000 shillings to be paid over 6 years with a 6 payment annuity immediate at effective rate of interest of 6% per year  **(10 Marks)**
2. Assuming an interest of 12% p.a convertible monthly,
3. Calculate the combined present value of an immediate annuity payable monthly in arrears such that payments are Kshs 100, 000 p.a for the first 6 years and Ksh 40, 000 p.a for the next 4 years together **(3 marks)**
4. Calculate the amount of the level of annuity payable continuously for 10 years having the same present value of the annuity in (i) above **(3 marks)**
5. Calculate the accumulated value of the first 7 years of payment at the end of the 7th payment in (i) and (ii) (**4 marks)**

**QUESTION THREE**

1. A company wants to pro­­vide a retirement plan for an employee who is aged 55 now. The plan will provide her with an annuity immediate of Shs 7,000 every year for years upon her retirement at the age of 65. The company is funding this plan with an annuity due of years. If the rate of interest is 5%. What is the amount of installment the company should pay? **(5 Marks)**
2. A loan is to be repaid by an 8 payment annual annuity immediate of 200 shillings at an interest of 5% for both the loan charged and sinking fund credit.
	1. What is the interest component of the 4th payment in the amortization schedule? **(4 marks)**
	2. What is the interest credited to the sinking fund at the end of 5 year **(4 marks)**
3. Brian can receive one of the following payment streams
4. 100 at time 0, 200 at time n and 300 at time 2n
5. 600 at time 10

At an annual effective interest rate of the present value of the two streams are equal. Given , determine **(7 marks)**

**QUESTION FOUR**

1. Find the sum of the present value of two payment of Ksh 5000 to be paid at the end of 4 and 9
2. If interest is compounded semiannually at the nominal rate of 8% per year

**(2 marks)**

1. The simple interest method of 8% **(2 marks)**
2. Calculate aand s if the nominal rate of interest is 5% per annum assuming
3. Compound interest **(3 marks)**
4. Simple interest **(2 marks)**
5. Find the present value of an annuity immediate of 100 shillings for 4 years if interest is compounded semiannually at the nominal rate of 6% **(5 marks)**
6. A Perpetuity costs 77 shillings and makes an annual payment at the end of the year. It pays 1 at the end of year 2, 2 at the end of year 3, …, n at the end of year . After year , the payment remains constant at n. Assuming an effective rate of 10.5% calculate n. **(6 marks)**

**QUESTION FIVE**

1. Payments are made to an account at continuous rate of where . Interest is credited at a force of interest . After 10 years, the account is worth 21, 600. Calculate. **(8 marks)**
2. For a certain population

 , 

Calculate

1. The complete expectation of life at birth **(3 marks)**
2. The force of mortality at age **(3 marks)**
3. The chance that a new born will die between ages and 2 **(3 marks)**
4. Show that is decreasing for. Show that**(3 marks)**