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**GARISSA UNIVERSITY**

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

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: ACS 201**

**COURSE TITLE: FUNDAMENTAL OF FINANCIAL MATHEMATICS I**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 14/02/2020 TIME: 2.00-4.00 PM**

**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. Describe the cash flow of an organization that issues a zero coupon bond **(2 Marks)**
2. A fund is earning 7% simple interest. Calculate the effective rate in the 8th year **(3 Marks)**
3. An investment of 100,000 shillings in an account accumulated to 250, 000 shillings after 4 years.
4. State the accumulation factor A(0, 4) **(2 Marks)**
5. Find the simple annual interest rate and annual compound interest rate which could give the accumulation factor in part (i) above **(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 month. **(4 Marks)**
7. An 8-month loan is repayable by a single payment of 800, 000 shillings. If the loan is issued at a commercial discount of 15% pa, how much was initially lent to the borrower? **(3 Marks)**
8. A payment of Kshs. 800 is due in 5 years’ time. Calculate the present value of this payment at an interest rate of 9% convertible monthly. **(4 Marks)**
9. Find the present value as at 1 January 2005 of a series of 10 annual payment starting at 500 shillings on 1 January 2006 and increasing by 100 shillings each year. Assume an effective rate of interest of 8%pa. **(5 Marks)**

**QUESTION TWO**

1. Calculate the present value as at 1 January 2003 of an annuity payable annually in arrears for 15 years. The first payment is 500 and subsequent payments increase by 3% per annum compound interest. Assume an effective rate of interest of 10% per annum **(5 Marks)**
2. 250 shillings is invested at a discount rate of 18% pa convertible monthly for the first 3 months followed by an interest rate of 20% pa convertible quarterly for the next 9 months. Calculate the accumulated sum at the end of the year. **(6 Marks)**
3. Assume an interest of 12% pa convertible monthly
4. Calculate the combined present value of an immediate annuity payable monthly in arrears such that payments of Kshs. 100,000 is for the first six years and Kshs. 40,000 pa is for the next 4 years **(2 Marks)**
5. 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)**
6. Calculate the accumulated value of the first 7 years of payments at the end of the 7th payment in (i) and (ii) **(4 Marks)**

**QUESTION THREE**

1. A man makes payment into an investment account of 200 shillings at time 5, 190 shillings at time 6 and 180 shillings at time 7 and so on until a payment of 100 shillings at time 15. Assuming an annual effective rate of 3.5%, calculate
2. The present value of the payment at time 4 **(3 Marks)**
3. The present value of the payment at time 0 **(3 Marks)**
4. The accumulated value of the payment at time 15 **(3 Marks)**
5. The present value at 6% pa of the following series of payment is 245.32 shillings. 1 shilling at time 1, 4 shillings at time 2, 9 shillings at time 3,… 100 shillings at time 10. What is the present value of the series of payments if, instead of being paid at the end of each year, the payments are made in three equal installments at the end of each third of a year **(4 Marks)**
6. Payments are made to an account at continuous rate of $\left(8k+tk\right) where 0\leq t\leq 10$ interest is credited at a force of interest $\left(t\right)=\frac{1}{8+t}$ . After 10 years, the account is worth 21,600. Calculate k **(7 Marks)**

**QUESTION FOUR**

1. Find the present value of an annuity immediate of Kshs. 100 for 5 years if interest is compounded semiannually at a nominal rate of 6%. **(4 Marks)**
2. 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$ n+1$. After $n +1$ , the payment remains constant at n. Assuming an effective rate of 10.5% calculate n  **(6 Marks)**
3. If the force of interest at time t is $δ\left(t\right)=0.02+0.01t$, find the accumulated value at $t=8$ of an investment of Kshs. 1000 at time $t=0$ **(4 Marks)**
4. A company expects to receive for the next 5 years continuous cash flows of 250 shillings pa. It also expects to have a pay of 600 shillings at the end of the first year and 400 shillings at the end of the third year. Calculate the net present value of these cash flow if $v\left(t\right)=1-\frac{t}{100 } for 0\leq t\leq 5$ **(5 Marks)**

**QUESTION FIVE**

1. Find the accumulated profit after 20 years of project that pays out 20, 000 shillings at time 0 and then receives 5,000 shillings at time 5 to 15, inclusive. Assume an annual effective rate of 3% **(6 Marks)**
2. Find the sum of the present value of two payments of Kshs. 4,000 to be paid at the end of fourth and ninth year.
3. If interest is compounded semiannually at the nominal rate of 12% **(3 Marks)**
4. If the simple interest method of 12% was applied **(3 Marks)**
5. If the force of interest

$$δ\left(t\right)=\left\{\begin{array}{c}0.08 0\leq t<5\\0.13-0.01t, 5\leq t\end{array}\right.$$

Find expression for the accumulation factor from time 0 to time t **(8 Marks)**