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**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 2015/2016 ACADEMIC YEAR**

**REGULAR (MAIN)**

**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 [30 Marks]**

a).i)State the two fundamental characteristics of an insurance [2 marks]

 ii)Explain why its important for one (the insured) to contribute a premium even if he does not encounter a loss or damage [4 marks]

b)Calculate the rate of interest convertible monthly corresponding to:

 i)Effective rate of 14.2% pa [1 mark]

 ii)A nominal rate of 11% pa convertible 3 times a year [1 mark]

c)The force of interest  is:

 for all t

 i)At t=8 , calculate the accumulated value of an investment of $ 100 made at time t=0 [3 marks ] ii)Calculate the constant annual effective rate of interest over the eight year period [3marks]

d).i) 2.A nominal rate of discount at 10% pa convertible every 2 years equivalent to what nominal rate of interest convertible every four months [3 marks]

 ii) A single investment of $500 is accumulated at a nominal rate of discount of 6% pa convertible half-yearly for 1 year,followed by a nominal rate of interest of 6 % pa convertible every four months for 1 year .Calculate the accumulated amount of this investment after 2 years. [3 marks]

e)For a certain population, 

 Calculate the force of mortality at age:

 i)9 months

 ii)21 years. [6 Marks]

f)The force of interest is a function of time and at any time t,measured in year is given by the following

$$δ\left(t\right)=\left\{\begin{array}{c}0.08 for 0\leq t<5\\0.06 for 5\leq t<10\\0.04 for t\geq 10\end{array}\right.$$

 Calculate the present value of $100 due at time 9 [4 marks]

**QUESTION TWO [20 marks]**

a)At a nominal rate of interest convertible bi- annually, an investment of 1000 immediately and 1500 at the end of the first year will accumulate to 2600 at the end of the second year. Calculate  [6 marks]

b).An annuity is payable for 15 years .The annuity is payable half yearly for the first five years, quarterly for the next 5 years and monthly for the final five years. The annual amount of the annuity is doubled after each five year period.On the basis of an interest of 8% per annum convertible for the first four years,8% per annum convertible half-yearly for the next 8 years and 8%per annum effective for the final three years.The present value is $2,049.Find the initial amount for the annuity [7 marks]

c)In a certain population,



Find the:

1. Limiting age.
2. Probability that a new born will celebrate his 18th birthday.
3. Probability that a life aged 32 will die between ages 55 and 65. [7 Marks]

**QUESTION THREE [20 marks]**

a)Given that:



Calculate

 i)  and  [2 marks]

 ii)  [2 marks]

b Fill up the missing entries in the following life table: [12 marks]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| 25 | 87,509 |  |  |  |  | 47.66 |
| 26 | 87,245 | 276 |  |  |  |  |
| 27 |  |  |  |  |  |  |
| 28 | 86.686 |  | 3.3 |  |  |  |
| 29 |  |  |  |  |  |  |
| 30 |  | 289 |  | 85,967.50 | 3,737,217.40 |  |

Given that A is 26 years, B=27 years and C=28 years

Find the probability that:

(i)At least one of them will be alive for more than one year [2 years]

 (iii)All will be dead in two years time [2 years]

**QUESTION FOUR [20 marks]**

1.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 [6marks]

ii.Calculate the net present value of each project using risk discount rate of 6 % pa [4 marks]

6.A company is set to refurbish old mills and turn them into retail outlets. The company purchases 5 mills each costing kshs.500,000.One mill is purchased at the start of each of the next 5 years. The cost of refurbishment is kshs.20,000 per mill and is payable continouosly for one year after the purchase.Once the refurbishment for a particular mill is complete,retail stores pay rent to the company for the mill at a rate of kshs.48,000 per year payable monthly in arrears.Each mill is sold 10 years after completion of its refurbishment for kshs.600,000.The company employs a manager to run this project.She is paid kshs50,000 pa payable at the end of each month,whilst the company has ownership of any of the mills

Calculate:

i)the net present value of the project assuming an interest rate of 4% pa effective [4 marks]

ii)Calculate the internal rate of return for the project [6 marks]

**QUESTION FIVE [20 marks]**

a)Explain the 4 principles of insurance [4 marks]

b)State the purposes for reinsurance [4 marks]

c) On the basis of interest rate of 12% per annum convertible quarterly, find the present value of an annuitity of $9,000 per annum for 25 years payable : [4 marks]

 ii)Quarterly in arrears

 iii)Monthly in arrears

c.)Measure time in years from the present and suppose that: [4 marks]

 for all t

Find a simple expression for  and hence find the discounted present value of $ 100 due in 3.5 years

d).Evaluate using i=25% [4 marks]

 i.)  ii) 