# KISII UNIVERSITY

## UNIVERSITY EXAMINATIONS
### SECOND YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND ACTUARIAL SCIENCE
### FIRST SEMESTER 2022/2023
### [SEPTEMBER-DECEMBER, 2022]

### MATH 211: CALCULUS II

**STREAM: Y2S1**                                              **TIME: 2 HOURS**

**DAY: MONDAY, 3:00 –5:00 PM**                    **DATE: 19/12/2022**

**INSTRUCTIONS**
1. *Do not write anything on this question paper.*
2. *Answer question ONE and any other TWO questions.*

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**SECTION A (30 MARKS)**

1.

a. Integrate $\int_1^2 x\ln x\, dx$ (5 marks)

b. Use integration by substitution to solve $\int_{-\frac{1}{2}}^{\frac{1}{2}} \frac{1}{\sqrt{1-y^2}}\, dy$ (5 marks)

c. Use integration by partial fractions to solve $\int \frac{2x^3-4x^2-x-3}{x^2-2x-3}\, dx$ (5 marks)

d. Use integration by parts to solve $\int_0^\pi [x^3 \cos x]\, dx$ (5 marks)

e. Find the Taylor series for

$f(x) = \sin 2x \quad at\ x_0 = 0$      to the 7th approximation (5 marks)

f. Integrate $\int_0^1 \frac{dt}{t^2-6t+10}$ (5 marks)

**SECTION B (40 MARKS)**

2.

   a. Find $\int_0^e \frac{\sqrt{1+lnx}}{x}\,dx$                                   (5 marks)

                                                                (5 marks)

   b. Find the area between the $x$ axis, the curve $y = \frac{1}{x}$ and the lines

      $x = -e^3$ and $= -e$.                            (5 marks)

   c. States MV Theorem and check if it is satisfied in $\frac{x^2-5x}{x-3}$, on [0,5] (5 marks)

3.

   a. Let $P(t)$ denote the population of bacteria in a certain colony at time $t$. Suppose that $P(0) = 100$ and that $P$ is increasing at a rate of $20e^{3t}$ bacteria per day at time $t$. How many bacteria are there after 50 days?

                                                             (5 marks)

   b. Evaluate $\int_0^1 sin^3 x cosx dx$                          (5 marks)

   c. Integrate$\int \left\{ \frac{1}{x} + \sin\left(\frac{1}{4}x\right) + \sqrt{4x} - e^{-3x} + 4^x - \frac{6x}{3x^2-5} + ln2x \right\} dx$ (10marks)

4.

   a. Fid if $\lim_{x \to 0} \frac{tan3x}{tan2x}$m exists                        (5 marks)

   b. Solve $\int_0^{\frac{\pi}{2}} cos3xsin2xdx$                        (5 marks)

   c. State Rolle's Theorem                                (5 marks)

   d. State the Rolle's Theorem. Hence verify that the function $f(x) = x^2 - 4x + 3$satisfies the conditions of Rolle's Theorem.         (5 marks)

5.

   a. Differentiate giving examples between definite and indefinite integration.

                                                                (5 marks)

   b. Find the area between the graphs of $cosx$ and $sinx$ on $[0,\frac{\pi}{4}]$ (5 marks)

   c. Evaluate $\int_{-\pi}^0 sin^4 x\, dx$                             (5 marks)

   d. $\int \frac{x}{1+x^4} dx$                                      (5 marks)