KISII UNIVERSITY
UNIVERSITY EXAMINATIONS
SECOND YEAR EXAMINATION FOR THE AWARD OF
THE DEGREE OF BACHELOR OF SCIENCE, EDUCATION AND
BACHELOR OF SCIENCE ARTS
FIRST SEMESTER 2021/2022
(FEBRUARY-JUNE, 2022)

MATH 211: CALCULUS II

STREAM: Y2 S1   **TIME: 2 HOURS**

DAY: THURSDAY, 9:00 AM – 11:00 AM   **DATE: 05/05/2022**

INSTRUCTIONS:

1. Do not write anything on this question paper.
2. Answer ALL Questions in section A (Compulsory) and any other TWO Questions in section B.

SECTION A (30 MARKS)

1.

   a. Integrate $\int_2^5 x \ln x \, dx$ (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 the function $f(x) = \frac{x}{(x+5)}$ at $x = 2$. (5 marks)

   f. The electrostatic potential on all parts of a conducting circular disc of radius r is given by the equation: $v = 2\pi\sigma \int_0^6 \frac{R}{\sqrt{R^2 + r^2}} \, dR$. Solve the equation by determining the integral.   (5 marks)

SECTION B (40 MARKS)

2.

   a. Find $\int_0^e \frac{\sqrt{1+\ln x}}{x}\,dx$ (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. Determine all the numbers c which satisfy the conclusions of the Mean Value Theorem for the function $h(z) = z^3 - 2z^2 - z$ on $[-1, 2]$ (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 $\int_0^1 \sin^3 x \cos x\,dx$ (5 marks)

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

4.

   a. $\lim\limits_{x \to 0} \frac{\tan 3x}{\tan 2x}$ (5 marks)

   b. Solve $\int_0^{\frac{\pi}{2}} \cos 3x \sin 2x\,dx$ (5 marks)

   c. State Rolle's Theorem, hence verify that the function $f(x) = 2x^2 - 8x + 6$ satisfies the conditions of   (5 marks)

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

5.

   a. Differentiate giving examples between definite and indefinite integration.
                                      (5 marks)

   b. Find the area between the graphs of $\cos x$ and $\sin x$ on $\left[0, \frac{\pi}{4}\right]$ (5 marks)

   c. Evaluate $\int_{-\pi}^0 \sin^4 x \cos^3 x\, x\,dx$ (5 marks)

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