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# KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
## UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
## FIRST YEAR, SECOND SEMESTER EXAMINATION
## FOR THE DEGREE OF BACHELOR OF EDUCATION(ARTS)
## KMA 2201 INTEGRAL CALCULUS

**Date: 12TH AUGUST, 2024**
**Time: 8:30 AM – 10:30 AM**

**INSTRUCTIONS TO CANDIDATES**
**ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

## QUESTION ONE: COMPULSORY (30 MARKS)

**a)** Evaluate the following integrals:

i) $\int 2x\sqrt{1+x^2}\ dx$ **(3 Marks)**

ii) $\int x^3\ ln\,x\ dx$ **(3 Marks)**

iii) $\int \frac{5x-3}{(x+1)(x-3)}\ dx$ **(3 Marks)**

iv) $\int cos\,5\,x\ sin\,3\,x\ dx$ **(4 Marks)**

**b)** Determine the area of the region enclosed by $y = x^2$ and $y = x + 6$ **(4 Marks)**

**c)** The region bounded by the graph $x^2 = y - 2, 2y - x^2 - 2 = 0, x = 0, x = 1$ is rotated 360°about the $x$ −axis. Find the volume of the resulting solid **(4 Marks)**

**d)** The velocity of a moving point is given by the equation $v = (3t^2 + 2t + 1)m/s$. Find the path covered by the point during 10 seconds from the start. **(4 Marks)**

**e)** Obtain the reduction formulae for $l_n = \int sin^n\ xdx$.
Hence evaluate $\int sin^4 xdx$ **(5 Marks)**

## QUESTION TWO: (20 MARKS)

**a)** Use Simpson's rule with 9 ordinates correct to 4 decimal places to estimate $\int_2^4 \frac{5\ ln\,2x}{5+ln\,2x}\,dx$ **(7 Marks)**

**b)** Show that the improper integral $\int_1^\infty \frac{1}{x^2}\,dx$ is convergent **(4 Marks)**

**c)** Evaluate $\int x^3\sqrt{1-x^2}dx$ using Trigonometric substitution. **(4 Marks)**

**d)** Obtain the reduction formulae for $l_n = \int x^n e^x\,dx$.
*Hence evaluate* $\int x^4 e^x\,dx$ **(5 Marks)**

**QUESTION THREE: (20 MARKS)**

**a)** Find the integral $\int \boldsymbol{sin^3 x\, dx}$ **(6 Marks)**

**b)** Find $\int_{-\infty}^{\infty} \frac{\mathbf{1}}{\mathbf{5+2x+x^2}}\boldsymbol{dx}$ and state if it converges or diverges **(6 Marks)**

**c)** Find the area of the region bounded by the curve $\boldsymbol{y = 6 - x - x^2}$ and the x-axis from $x = -3$ to $x = 2$ **(5 Marks)**

**d)** i) State the mean value theorem **(1 Mark)**

ii) Verify the mean value theorem for $\boldsymbol{4x^3 - 8x^2 + 7x - 2}$ on $[\mathbf{2, 5}]$. **(3 Marks)**

**QUESTION FOUR: (20 MARKS)**

**a)** Find $\int \frac{\mathbf{1}}{\sqrt{\mathbf{9-x^2}}}\boldsymbol{dx}$ **(5 Marks)**

**b)** Use partial fractions to evaluate

$\int \frac{\boldsymbol{x+4}}{\boldsymbol{x^3+3x^2-10x}}\boldsymbol{dx}$ **(5 Marks)**

**c)** i) Use the Simpson's Rule with $\boldsymbol{n = 10}$ to approximate the integral $\int_0^1 \boldsymbol{e^{x^2}\, dx}$. **(6 Marks)**

ii) Estimate the error involved in this approximation **(4 Marks)**

**QUESTION FIVE: (20 MARKS)**

**a)** Find $\int \frac{sin^2 x}{1+cosx}\,dx$ **(4 Marks)**

**b)** Find $\int \frac{4x+5}{x^2+2x+2}\,dx$ **(4 Marks)**

**c)** Evaluate the integral I $= \int_0^1 \frac{dx}{1+x}$ using trapezoidal rule using 4 equal sub intervals. **(6 Marks)**

**d)** Evaluate the following definite integrals

$\int_0^{\frac{\pi}{2}} \boldsymbol{(x+1)\, sin\, x\, dx}$ **(3 Marks)**

**e)** Using the basic formulas for integration find

$\int \frac{x^2+7x+10}{(x+5)}\,dx$ **(3 Marks)**