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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 SCIENCE IN COMPUTER SCIENCE

KMA 2104 INTEGRAL CALCULUS

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

<u>INSTRUCTIONS TO CANDIDATES</u> <u>ANSWER QUESTION ONE (COMPULSORY)</u> AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

a) Evaluate the following integ	grals:	
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) $\int \cos 5x \sin 3x dx$		(4 Marks)
b) Determine the area of the reg	gion enclosed by $y = x^2$ and $y = x + 6$	(4 Marks)
c) The region bounded by the g	graph	`
$x^2 = y - 2, 2y - x^2 - 2 = 0, x$	= 0, $x = 1$ is rotated 360° about the $x - a$	xis.
Find the volume of the resulting s	solid	(4 Marks)
d) The velocity of a moving po	bint is given by the equation $v = (3t^2 + 2t)$	+ 1)m/s.
Find the path covered by the poir	it during 10 seconds from the start.	(4 Marks)
e) Obtain the reduction formula	ae for $l_n = \int \sin^n x dx$.	
Hence evaluate $\int sin^4 x dx$		(5 Marks)
QUESTION TWO: (20 MARK	<u>(S)</u>	
a) Use Simpson's rule with 9 o	rdinates correct to 4 decimal places to estin	nate
$\int_2^4 \frac{5\ln 2x}{5+\ln 2x} dx$		(7 Marks)
b) Show that the improper inte	egral $\int_{1}^{\infty} \frac{1}{r^2} dx$ is convergent	(4 Marks)
c) Evaluate $\int x^3 \sqrt{1-x^2} dx$ u	sing	
Trigonometric substitution.		(4 Marks)
d) Obtain the reduction formula	ae 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 $\int sin^3 x dx$	(6 Marks)
b)	Find $\int_{-\infty}^{\infty} \frac{1}{5+2x+x^2} dx$ and state if it converges or diverges	(6 Marks)
c)	Find the area of the region bounded by the curve $y = 6 - x - x^2$ and	the x-axis
fro	m x = -3 to x = 2	(5 Marks)
d)	i) State the mean value theorem	(1 Mark)
ii)	Verify the mean value theorem for $4x^3 - 8x^2 + 7x - 2$ on [2, 5].	(3 Marks)

QUESTION FOUR: (20 MARKS) a) Find $\int \frac{1}{\sqrt{9-x^2}} dx$ (5 Marks) **b)** Use partial fractions to evaluate $\int \frac{x+4}{x^3+3x^2-10x} dx$ (5 Marks) i) Use the Simpson's Rule with n = 10 to approximate the integral $\int_0^1 e^{x^2} dx$. **c**) (6 Marks) ii) Estimate the error involved in this approximation (4 Marks)

QUESTION FIVE: (20 MARKS)

a)	Find $\int \frac{\sin^2 x}{1+\cos x} dx$	(4 Marks)
b)	Find $\int \frac{4x+5}{x^2+2x+2} dx$	(4 Marks)
c)	Evaluate the integral $I = \int_{-\infty}^{1} \frac{dx}{dx}$	using transpoidal rule using 4 equal sub interval

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

$$\int_{0}^{\frac{\pi}{2}} (x+1) \sin x \, dx \qquad (3 \text{ Marks})$$

e) Using the basic formulas for integration find
$$\int \frac{x^{2}+7x+10}{(x+5)} \, dx \qquad (3 \text{ Marks})$$