310.

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

MAIN CAMPUS (REGULAR PROGRAM)

UNIVERSITY EXAMINATIONS FOR 2022/2023 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF

BACHELOR OF SCIENCE (COM/SIT)

COURSE CODE: MAT 124

COURSE TITLE: INTEGRAL CALCULUS

DATE: FRIDAY 21ST APRIL, 2023 TIME: 3.00-5.00 P.M

INSTRUCTIONS TO CANDIDATES

*Answer **Question ONE** and **any other TWO Questions***

Time: 2 hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

Question One (30 Marks)

a. Find the average value of the function $f(x)=x^2+3x-1$ on the interval $[-1,2]$.(3 Marks)

b. Decompose $\frac{4x^2+13x-9}{x^3+2x^2-3x}$ into partial fractions (5 Marks)

c. Evaluate $\int x^2e^x dx$ (4 Marks)

d. Evaluate $\int x^2 \ln x dx$ (4 Marks)

e. Evaluate the integral $\int e^x \cos x dx$ by parts. (5 Marks)

f. Find $\frac{d}{dx}\int_{x^3}^{1}\frac{1}{\sqrt{t^4+2}}dt$ (4 Marks)

g. Show that the area bounded by the curves $y=4-x^2$ and $y=x^2-2x$ is 9 sq. units (5 Marks)

Question Two (20 Marks)

a. Define $I_n=\int \sin^n x dx$. Show that $I_n=\frac{-\sin^{n-1}x\cos x}{n}+\frac{n-1}{n}\int \sin^{n-2}x dx$. Hence or otherwise evaluate $\int_0^{\frac{\pi}{2}}\sin^4 x dx$ (10 Marks)

b. Evaluate $\int \sec(3x+\frac{1}{4})dx$ (5 Marks)

c. Find the area bounded by $y=4x-x^2$, $x=1$, $x=2$ and the x-axis. (5 Marks)

Question Three (20 Marks)

a). Evaluate $\int \frac{x^2+2x-1}{2x^3+3x^2-2x}dx$ (7 mks)

b). Find the area bounded by the curves $y=4-x^2$ and $y=x^2-2x$ (4 mks)

c). Find the $\int \frac{x^3}{\sqrt{9-x^2}}dx$ (4 mks)

d). The curve $y=3+2\sin x$ is rotated about the x-axis from the lines $x=0$ and $x=\pi$. Find the volume generated by the resulting surface. (5 mks)

Question Four (20 Marks)
Evaluate the following integrals

a. $3\int \frac{dx}{x^2+9}$ (3 Marks)

b. Evaluate

$$\int_{-\infty}^{\infty} xe^{-x^2}dx$$ (5 Marks)

c. The curve $y=3+2\sin x$ is rotated about the X-axis from the lines $x=0$ and $x=\pi$. Find the volume generated by the resulting surface (5 Marks)

d. The arc of the parabola $y^2=8x$ from $(0,0)$ to $(2,4)$ is rotated about the x-axis. Find the area of the resulting surface (7 Marks)

Question five (20 Marks)

a. Evaluate the following integrals

i. $\int \cot^5 x \cos ec^2 x dx$ (4 Marks)

ii. $\int \tan^3 x \sec^2 x dx$ (3 Marks)

iii. $\int_0^{\frac{\pi}{2}} \cos^2 x \sin x dx$ (5 Marks)

b. Determine the position function $s(t)$ of an object if its velocity is $v(t)=3-12t$ and the initial position is $s(0)=3$ (3 marks)

c. Use partial fractions to evaluate $\int \frac{x^4}{x^2-1}dx$ (5 marks)

END OF EXAMINATION: GOOD LUCK