

AUC

MAT 114
SCA 100

MAIN EXAMINATION



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COLLEGE

... Bastion of Knowledge...

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**OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH**

UNIVERSITY EXAMINATIONS

2020 /2021 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

**FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE & BACHELOR OF
EDUCATION ARTS**

COURSE CODE:

MAT 114
SCA 100

COURSE TITLE:

INTEGRAL CALCULUS II

DATE: 27/7/2021

TIME: 0800-1100HRS

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER

REGULAR - MAIN EXAM

STA 100: INTEGRAL CALCULUS II

STREAM: EDA & EDS

DURATION: 3 Hours

INSTRUCTIONS TO CANDIDATES

Answer All questions from Section A and any Three from Section B

SECTION A (31 MARKS). Answer ALL Questions**Question One [16 Marks]**

- (a) Define the term integrand. [1 Marks]
- (b) Compute the integral of the following functions;
- (i) $f(x) = \frac{2x^3+5x^2+8x+9}{x}$; [3 Marks]
- (ii) $f(x) = \frac{x^2+5x+6}{x+2}$. [3 Marks]
- (c) If $\int(2x - 9)dx = 0$, find the value of x . [3 Marks]
- (d) Show that $\int_1^{\infty} \frac{1}{x^2} dx$ is convergent. [3 Marks]
- (e) Evaluate $\int_0^{\frac{\pi}{2}} x \sin x dx$ [3 Marks]

Question Two [15 Marks]

- (a) Prove $\int(ax + b)^n dx = \frac{(ax+b)^{n+1}}{a(n+1)} + c$ [4 Marks]
- (b) Determine the area under the curve $f(x) = 2 + 6x - x^2$ in the domain $[1, 5]$ using Riemann sums. [5 Marks]
- (c) Determine $\int x^3 \sqrt{x^4 - 1} dx$. [3 Marks]
- (d) Evaluate $\int \frac{3x^2 + \cos x}{x^3 + \sin x} dx$. [3 Marks]

SECTION B (39 MARKS)**Question Three [13 Marks]**

- (a) Evaluate the following integrals
- (i) $\int x e^x dx$ [3 Marks]
- (ii) $\int \frac{x-11}{(x+3)(x-4)} dx$. [5 Marks]
- (b) Find the volume generated by rotating the area under the curve $y = 1 + x$ between $x = 1$ and $x = 2$ about the axis of x [5 Marks]

Question Four [13 Marks]

- (a) Integrate $\int \frac{1}{(x+2)(x-1)^2} dx$ [6 Marks]
- (b) Find $\int_0^6 y dx$, given the following values, using Simpson's rule for the interval $(0 \leq x \leq 6)$ [7 Marks]

x	0	1	2	3	4	5	6
y	8	12	14	11	9	3	1

Question Five [13 Marks]

- (a) State the fundamental theorem of integral calculus. [2 Marks]
- (b) Evaluate $\int_0^3 e^{2x} dx$. [3 Marks]
- (c) Evaluate the area of the rectangle bounded by the line $y = 3$, the x -axis, the ordinate $x = 1$ and $x = 5$ using the formula $A = \int y dx$. [5 Marks]
- (d) Show that $\int_{-2}^3 \frac{dx}{x^4}$ does not converge. [3 Marks]

Question Six [13 Marks]

- (a) Sketch the curve $y = 3x^2$ from $x = 0$ to $x = 5$. Evaluate the area enclosed by the curve, the x -axis and the ordinates $x = 1$ to $x = 4$. [5 Marks]
- (b) Show that $\int_1^\infty \frac{1}{x} dx$ is divergent. [3 Marks]
- (c) Find the length of the arc from $\theta = 0$ to $\theta = \frac{\pi}{4}$ of the curve given by $x = 3 \cos \theta$, $y = 3 \sin \theta$. [5 Marks]

Question Seven [13 Marks]

- (a) Define a proper fraction. [1 Mark]
- (b) Sketch the curve $y = x^3 - 3x^2 + 2x$ from $x = 0$ to $x = 3$. [3 Marks]
- (c) Find the area enclosed between the curve in (a) and the axis of x from $x = 0$ to $x = 2$. [5 Marks]
- (d) Evaluate $\int_0^2 (x^3 - 3x^2 + 2x) dx$ and interpret your answer based on the solution from (b). [4 Marks]