(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **MAA 123**

COURSE TITLE: **CALCULUS II**

DATE: 09/05/2022 **TIME:** 2:00 PM - 4:00 PM

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 COMPULSORY (30 MARKS)

(a) Define the following terms giving an example in each
   (i) Definite integral
   (ii) Improper integral (3 marks)

(b) Evaluate the following integrals by parts method.

i. $\int x^3 \ln x \; dx$ (3 marks)

ii. $\int x^2 \cos x \; dx$ (3 marks)

(c) Use appropriate method to evaluate $\int_0^4 \sqrt{2x+1}dx$ (5 marks)

(d) Show that $\int x \tan^{-1} x dx = \frac{x^2}{2}\tan^{-1} x + \frac{\tan^{-1} x}{2} - \frac{x}{2} + c$ (5 marks)

(e) Evaluate: $\int \frac{dx}{\sqrt{x}\left(1+\sqrt{x}\right)^2}$ (4 marks)

(f) Find the area of the region enclosed by the parabola $y = 2 - x^2$ and line $y = -x$ (4 marks)

(g) Evaluate the following indefinite integral

$\int \frac{3}{x^2+2x+5} dx$ (3 marks)

QUESTION TWO (20 MARKS)

(a) Solve $\int \frac{5}{2-x} dx$ (2 marks)

(b) Use method of substitution to evaluate $\int \sec x \, dx$ (4 marks)

(c) Using $\sec\theta$ substituion, determine $\int \frac{1}{\sqrt{25x^2-4}} dx$ (7 marks)

(d) Using $\sin\theta$ substituion, determine $\int \frac{x^2}{\sqrt{9-x^2}} dx$ (7 marks)

QUESTION THREE (20 MARKS)

(a) Determine the general formular for evaluating $\int e^{ax} \cos bx \, dx$, and use it to evaluate $\int e^{3x} \cos 5x \ \ dx$ (8 marks)

(b) Evaluate the following integrals

(i) $\int 2x \, e^{x} dx$ (2 marks)

(ii) $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{\sin 2x}{\sqrt{1-\cos 2x}} dx$ (6 marks)

(c) Determine $\int \sin^3 t \, \cos^4 t \, dt$ (4 marks)

QUESTION FOUR (20 MARKS)

(a) Find the length of the parametric curve

$$x = \cos t + t \sin t$$
$$y = \sin t - t \cos t \ ; 0 \leq t \leq \pi$$

(4 marks)

(b) The region bounded by $y = x^2 + 1$ and the line $y = -x + 3$ is rotated about the $x - axis$ to generate a solid. Calculate the volume of the solid generated. (6 marks)

(c) Evaluate the following integrals

i. $\int_{-\infty}^{0} \frac{1}{1+x^2} dx$ (3 marks)

ii. $\int \frac{x+3}{(x-1)(x^2+1)} dx$ (7 marks)

QUESTION FIVE (20 MARKS)

(a) Evaluate

i. $\int \frac{1}{3 \sin\theta - 4 \cos\theta} d\theta$ (7 marks)

ii. $\int \frac{x+4}{x^3+3x^2-10x} dx$ (6 marks)

(b) Evaluate the following integral by substitution,

(i) $\int \sin x \, e^{\cos x} \, dx$ (3 marks)

(ii) $\int \frac{x \sin\sqrt{3x^2+1}}{\sqrt{3x^2+1}} dx$ (4 marks)