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**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
SECOND YEAR FIRST SEMESTER
MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE**

COURSE CODE: MAA 213 / MAA 212

COURSE TITLE: INTEGRAL CALCULUS / CALCULUS II

DATE: 13/12/2022

TIME: 9:00 AM – 11:00 AM

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) Define the terms:
- (i) Integration (1 mark)
 - (ii) Differential coefficient (1 mark)
- (b) If $x = a \sin \theta$, $y = b \cos \theta$, find the area under the curve between $\theta = 0$ and $\theta = \pi^c$ (4 marks)
- (c) Evaluate
- i. $\int \cos^4 x \, dx$ (4mks)
 - ii. Using integration by parts find $\int x \cos x \, dx$
- (d) Find the following:
- (i) $\int x^3(1+x^4)^5 \, dx$ (3 marks)
 - (ii) $\int \frac{4x}{\sqrt{x^2+1}} \, dx$ (3 marks)
 - (iii) $\int \frac{dx}{\sqrt{2x^2+8x+15}}$ (3 marks)
- (e) Find the mean value of $y = 3x^2 + 4x + 1$ between $x = -1$ and $x = 2$ (3 marks)
- (f) Evaluate the given integral
If $\frac{dy}{dx} = x^2 + 2x - 3$, find y in terms of x given that $x = 1$ when $y = 4$ (4 marks)
- (g) Find the length of the curve $y = 10 \cosh\left(\frac{x}{10}\right)$ between $x = -1$ and $x = 2$ (4 marks)

QUESTION TWO (20 MARKS)

- (a) Evaluate $\int (1 - \cos 3x) \sin 3x \, dx$ (4marks)
- (b) Find $\int x \ln x \, dx$ (4 marks)
- (c) Find the area bounded by the curve $y = x^2 - 9$, x -axis, $x = -3$ and $x = 3$ (4 marks)
- (d) Integrate $\frac{\tan^{-1} x}{1+x^2} \, dx$ (4 marks)
- (e) Find the volume generated when the plane figure bounded by the curve $y = x^2 + 5$, the x -axis and the ordinates $x = 1$ and $x = 3$, rotates about the y -axis through a complete revolution (4 marks)

QUESTION THREE (20 MARKS)

- (a) Evaluate $\int \frac{dy}{y^2 - 2y + 1}$ (3 marks)
- (b) Find $\int \frac{1}{3} \cos 5x \sin x \, dx$ (4 marks)
- (c) Parametric equations of a curve $x = 3t^2$, $y = 3t - t^2$. Find the volume generated when the plane figure bounded by the curve, x -axis and the ordinates corresponding to

$t = 0$ and $t = 2$ rotates about the x -axis (5 marks)

(d) Find $\int_0^1 \frac{3}{1+t^2} dt$ (4 marks)

(e) Evaluate $\int \frac{3x}{(x-1)(x-2)(x-3)} dx$ (4 marks)

QUESTION FOUR (20MARKS)

- a) A particle moves in a straight line so that t seconds after passing a fixed point in the line its velocity v m/s is given by $v = \frac{1}{2}t^2 - 3t + 7$. Find
- i. The velocity after 8s (3mks)
 - ii. The acceleration when $t = 0$ (3mks)
 - iii. The minimum velocity (3mks)
 - iv. The distance travelled in the first two seconds of motion (5mks)
 - v. The distance travelled in the third second (3mks)
- b) Find the area of the region bounded above by $y = e^x$, bounded below by $y = x$ & bounded on the sides by $x = 0$ & $x = 1$ and sketch (3mks)

QUESTION FIVE (20MARKS)

- a) Find the area of the region enclosed by the parabolas $y = x^2$ & $y = 2x - x^2$ and make a sketch (3mks)
- b) Calculate and sketch the area of each of the two segments of $y = x(x+1)(x-2)$ cut off by the x -axis (7mks)
- c) Find the volume of revolution between the lines $x = 2$ & $x = 5$ & $y = 2x^2$ if rotated about x -axis. (5mks)
- d) Given the curves $y = 2x$ and $4y = x^2$ revolves around the y -axis. Find the value generated. (5mks)

END