NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

SCHOOL OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSAM	**LEVEL:** 6
COURSE CODE: CLS601S	**COURSE NAME:** CALCULUS 2
SESSION: JULY 2023	**PAPER:** THEORY
DURATION: 180 MINUTES	**MARKS:** 100

SUPPLEMENTARY/SECOND OPPORTUNITY QUESTION PAPER	
EXAMINERS	MR BENSON OBABUEKI DR SERGE NEOSSI-NGUETCHUE
MODERATOR:	DR DAVID IIYAMBO

INSTRUCTIONS
1. Answer ALL questions in the booklet provided. 2. Show clearly all the steps used in the calculations. 3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 2 PAGES (excluding this front page)

Question 1 (29 marks)

Determine the following indefinite integrals using the indicated techniques:

1.1 $\int x^2 e^{3x+2} dx$ by parts. (7)

1.2 $\int \frac{4x+3}{x^3-x} dx$ by partial fractions. (7)

1.3 $\int \frac{2dx}{\sqrt{4-144x^2}}$ by trigonometric substitution. (8)

1.4 $\int \sin^3 \alpha \cos^4 \alpha d\alpha$. (7)

Question 2 (10 marks)

2.1 Determine the area enclosed by $y = x^2 - 9$ and $y = 3x + 9$. (5

2.2 Calculate the volume of the solid generated if $y = \cos\theta$ is rotated about the θ-axis through a complete revolution, $0 \leq \theta \leq \frac{\pi}{4}$. (5)

Question 3 (14 marks)

The definite integral $\int_0^1 e^{x^2+3} dx$ is to be estimated using the Trapezoidal Rule, correct to within an error of 0.5.

3.1 Determine the number of subintervals needed. (6)

3.2 Use $n = 8$ to estimate the given definite integral. (8)

Question 4 (19 marks)

4.1 Determine the position of the centroid of the plane figure bounded by $y = e^{2x}$, the x-axis, the y-axis and the ordinate $x = 2$. (9)

4.2 Consider the parametric curve given by $x = t^2$ and $y = 4t^2 - t^4$ in the interval $0 \le t \le 2$.

4.2.1 Determine the area under the given curve using $\int_{t=0}^{t=2} f(t)g'(t)dt$. (5)

4.2.2 Determine the area under the given curve using $\int_{x=?}^{x=?} ydx$. (5)

Question 5 (15 marks)

5.1 Using the infinite series approach, determine the indefinite integral $\int \frac{e^{x^2}}{x} dx$. (Hint $e^y = \sum_{n=0}^{\infty} \frac{y^n}{n!}$) (7)

5.2 Determine the surface area of the solid generated by rotating the parametric curve $x = \cos^3\theta$, $y = \sin^3\theta$ $0 \le \theta \le \frac{\pi}{2}$ about the -axis. (8)

Question 6 (13 marks)

6.1 Convert $y^2 + (x-5)^2 = 25$ to polar coordinates. (6)

6.2 Convert $r = \sin 2\theta$ to rectangular coordinates. (7)

End of paper **Total marks: 100**