JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF EDUCATION AND ACTUARIAL SCIENCE

SPECIAL RESITS DECEMBER 2022

MAIN REGULAR

COURSE CODE: WMB 9201

COURSE TITLE: CALCULUS II

EXAM VENUE: **STREAM: (Bed/BSc. Actuarial)**

DATE: EXAM SESSION:

TIME: 2.00 HOURS

Instructions:

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (COMPULSORY) (30 marks)

a) Evaluate the integral
$\int_{-2}^{2}(x^3 - 2x + 3)\,dx$ (4 marks)

b) Verify by differentiation that the formula is correct
$\int \frac{dx}{\sqrt{a^2-x^2}} = sin^{-1}\left(\frac{x}{a}\right) + C$ (6 marks)

c) Using appropriate substitution, evaluate the indefinite integral
$\int (x+2)\,sin(x^2 + 4x - 6)\,dx$ (4 marks)

d) By separating the fraction and using a substitution (if necessary) to reduce to standard form, evaluate
$\int_{2}^{3} \frac{1-x}{\sqrt{1-x^2}}\,dx$ (6 marks)

e) Evaluate the integral:
$\int \frac{1}{1-sin\,x}\,dx$ (5 marks)

f) By using appropriate substitution, evaluate
$\int_{\frac{\pi}{2}}^{\pi}(sin y)\,e^{cos y}\,dy$ (5 marks)

QUESTION TWO (20 marks)

a) By reducing the improper fraction and using a substitution (if necessary) to reduce it to standard form, evaluate
$\int \frac{4x^2 - x^2 + 16x}{x^2+4}\,dx$ (5 marks)

b) Evaluate:

$$\int (\sec x + \cot x)^2\,dx$$

using trigonometric identities and substitution to reduce to standard form (5 marks)

c) By making the appropriate substitution for u:
   i. express the following integral in terms of u
   ii. evaluate the integral as function of x
   $\int (x+1)^2\sqrt{x-2}\,dx$ (6 marks)

d) By using appropriate substitution to reduce to standard form, evaluate
$\int_{1}^{2} \frac{18x}{\sqrt{9x^2+1}}\,dx$ (4 marks)

QUESTION THREE (20 marks)

a) Express the integrand as a sum of partial fractions and evaluate the integral
$\int \frac{x^2+6x-1}{(x+4)(x+1)} dx$ (7 marks)

b) Evaluate the following integral by using a substitution prior to integration by parts
$\int x^2 e^{3x} dx$ (7 marks)

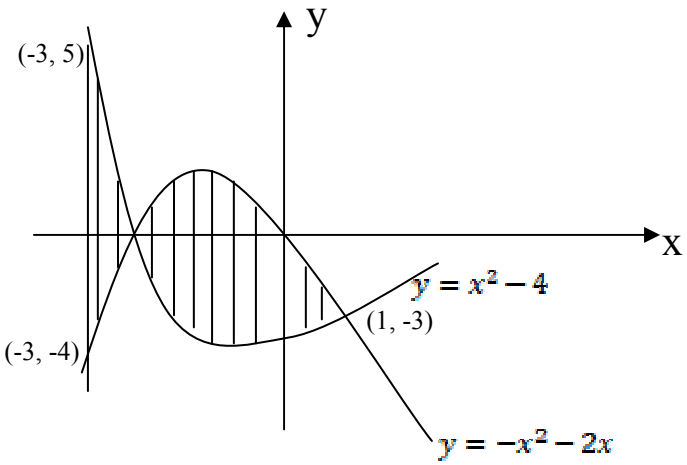
c) Evaluate the following improper integral
$\int_1^{\infty} \frac{x^2}{(x^3+2)} dx$ (6 marks)

QUESTION FOUR (20 marks)

a) Find the volume of the solid generated by revolving the region bounded by the line $y = 2 - x$ and the curve $y = 4 - x^2$ about the x -axis. (7 marks)

b) Determine the area of the surface generated by revolving the curve $y = \frac{x^3}{9}, 0 \leq x \leq 2$ about the x -axis. (6 marks)

c) Find the total area of the shaded region



(7 marks)

QUESTION FIVE (20 marks)

a) Using ten ordinates, apply Simpson's rule to evaluate the integral
$\int_1^2 \left(\frac{1}{x}\right) dx$ (7 marks)

b) For what value of x is the series $\sum_{n=1}^{\infty} \frac{(x-3)^n}{n}$ convergent. (6 marks)

c) Use a Taylor polynomial of degree 8 to approximate
$\int_0^1 e^{-x^2} dx$ (7 marks)