



**JARAMOGI OGINGA ODINGA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR  
THE DEGREE OF BACHELOR OF .....**

**SMA 200: CALCULUS II**

*Date: ..... August, 2013*

*Time: ..... - .....*

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**INSTRUCTIONS:**

1. This examination paper contains five questions. Answer **question one**, and **any other two** questions.
2. Start each question on a fresh page.
3. Indicate question number clearly at the top of each page.

### QUESTION ONE (COMPULSORY) (30 marks)

- a) State the Fundamental Theorem of the calculus. (4 marks)  
b) Evaluate the integral

$$\int_1^9 \frac{2t^3 + t^2\sqrt{t} - 1}{t^2} dt \quad (4 \text{ marks})$$

- c) Verify by differentiation that the formula is correct

$$\int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1}\left(\frac{x}{a}\right) + C \quad (5 \text{ marks})$$

$(x > a > 0)$

- d) Evaluate the indefinite integral

$$\int \sqrt{\frac{1 - \cos 4x}{2}} dx \quad (4 \text{ marks})$$

- e) Evaluate the integral

$$\int_0^{\pi/4} (1 + e^{\tan x}) \sec^2 x dx \quad (4 \text{ marks})$$

- f) Find the length of the curve  $y = \left(\frac{1}{3}\right)(x^2 + 2)^{3/2}$  from  $x = 0$  to  $x = 3$  (5 marks)

- g) Determine whether the following series converges or diverges

$$\sum_{n=1}^{\infty} \frac{5^n}{n^2} \quad (4 \text{ marks})$$

### QUESTION TWO (20 marks)

- a) By completing the square and using appropriate substitution to reduce to standard form, evaluate the integral

$$\int_1^2 \frac{x+2}{\sqrt{x^2+4x}} dx \quad (6 \text{ marks})$$

- b) Using a substitution to reduce to standard form, evaluate

$$\int \frac{2}{x\sqrt{1-4\ln^2 x}} dx \quad (4 \text{ marks})$$

- c) By making the appropriate substitution for  $u$ :

- i. express the following integral in terms of  $u$
- ii. evaluate the integral as function of  $x$

$$\int_0^1 \frac{(x+3)^2}{\sqrt{x+2}} dx \quad (6 \text{ marks})$$

- d) By multiplying by a form of 1, evaluate the integral

$$\int \frac{1}{\csc x - \cot x} dx \quad (4 \text{ marks})$$

### QUESTION THREE (20 marks)

- a) Express the integrand as a sum of partial fractions and evaluate the integral

$$\int \frac{1-x+2x^2-x^3}{x(x^2+1)^2} dx \quad (8 \text{ marks})$$

- b) Evaluate the following integral by using a substitution prior to integration by parts

$$\int x^3 e^{5x} dx \quad (7 \text{ marks})$$

- c) Obtain a reduction formula that expresses the integral  $\int \sin^n x dx$  in terms of an integral of a lower power of  $\sin x$ . (5 marks)

### QUESTION FOUR (20 marks)

- a) Find the volume of the solid generated by revolving the region bounded by the curve  $y = x^2 + 1$  and line  $y = x + 3$  about the  $x$ -axis. (7 marks)

- b) Determine the area of the surface generated by revolving the curve  $y = \sqrt{x+1}$ ,  $1 \leq x \leq 5$  about the  $x$ -axis. (6 marks)

- c) Find the area of the region enclosed by the line  $4x - y = 16$  and the curve  $y^2 - 4x = 4$ . (7 marks)

### QUESTION FIVE (20 marks)

- a) Using eleven ordinates, apply Simpson's rule to evaluate the integral

$$4 \int_0^1 \frac{dx}{1+x^2} \quad (5 \text{ marks})$$

- b) Find a power series for the logarithmic function

$$L(x) = \ln(1+x) \quad (6 \text{ marks})$$

- c) Show that the Taylor series about  $x = 0$  for the function  $f(x) = e^x$  is  $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$ . (5 marks)

- d) Evaluate the following improper integral

$$\int_{-\infty}^{\infty} \frac{1}{1+x^2} dx \quad (4 \text{ marks})$$