

MAT 114e

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OFFICE OF THE DEPUTY PRINCIPAL  
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

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## UNIVERSITY EXAMINATIONS

### 2017 /2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

**FOR THE DEGREE OF BACHELOR OF  
EDUCATION SCIENCE & ARTS**

**COURSE CODE: MAT 114e**  
**COURSE TITLE: INTEGRAL CALCULUS**

**DATE: 18<sup>TH</sup> APRIL, 2018**

**TIME: 9AM – 12.00 NOON**

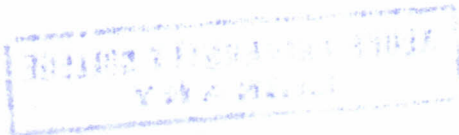
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### INSTRUCTION TO CANDIDATES

- SEE INSIDE

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## MAT 114e: INTEGRAL CALCULUS

STREAM: Bed(Sc/Arts)

DURATION: 3 Hours

## INSTRUCTION TO CANDIDATES

- i. Answer *ALL* questions from *section A* and any *THREE* from *section B*
- ii. Do not write on the question paper.

## SECTION A [31 Marks] ANSWER ALL QUESTIONS

## Question one (16 marks)

a) Evaluate the following integral calculus

(i) (3mks)

$$\int_{-1}^1 (2x^2 - x^3) dx$$

(ii) (3mks)

$$\int_3^{11} \sqrt{2x+3} dx$$

(iii) (4mks)

$$\int \frac{x+3}{(x^2+6x)^{1/3}} dx$$

(iv) (3mks)

$$\int \frac{1}{2} \sin^2 x dx$$

b) Find the arc length of the curve  $y = x^{3/2}$  from  $x = 0$  to  $x = \frac{4}{3}$  (3mks)

## Question two (15 marks)

a) Use the method of integration by parts to evaluate the following integrals.



(i) (4mks)

$$\int x^2 e^{-x} dx$$

(ii) (4mks)

$$\int e^x \cos x dx$$

b) Find the area of the region bounded above by  $y = x + 6$  bounded below by  $g = x^2$  and bounded on the sides by lines  $x = 0$  and  $x = 2$  (3mks)

c) Evaluate (4mks)

$$\int \sin^2 x \cos^3 x dx$$

### SECTION B (39 MARKS) [Answer Any Three Questions]

#### Question three (13 marks)

a) Calculate  $\int_1^2 \frac{1}{x} dx$  using

i. trapezoidal rule with five intervals to four decimals (3mks)

ii. Assume  $\int \frac{1}{x} dx = \ln x$  to four decimals (2mks)

Hence, calculate the percentage error (3mks)

b) Evaluate the integrals;

(i) (2mks)

$$\int_0^2 x(x^2 + 1)^3 dx$$

(ii) (3mks)

$$\int 8x^2(x^3 + 2)^{-3} dx$$

**Question four (13 marks)**

a) Evaluate(3mks)

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

b) Find the area of the region that is between the curves  $g = x^2$  and  $y = x + 6$  hence sketch the graph. (4mks)

c) Evaluate

(i) (4mks)

$$\int \tan^{-1}x dx$$

(ii) (2mks)

$$\int \ln x dx$$

**Question five (13 marks)**

(a) Use the method of substitution to evaluate the following integrals

(i) (3mks)

$$\int \frac{x}{\sqrt{9x^2 - 4}} dx$$

(ii) (3mks)

$$\int \frac{x^2}{\sqrt[4]{x^3 + 2}} dx$$

(b) Evaluate the following definite integral

(i) (3mks)

$$\int_0^2 (2 - x)^2 dx$$

(ii) (4mks)

$$\int_{-1}^4 x(5+x)^{-1/2} dx$$

Question six (13 marks)



- a) Solve the integral  $\int \frac{3x+7}{(x-1)(x^2+1)} dx$  (4mks)
- b) Evaluate the integral by completing the square (4mks)

$$\int \frac{dx}{\sqrt{5-4x-2x^2}}$$

- c) Show that the improper integral  $\int_1^{\infty} \frac{1}{x^2} dx$  is convergent (5mks)

Question seven (13 marks)

- a) The curve  $y = x^2 - 1$  is rotated about the x-axis through  $360^\circ$ . Find the volume of the solid generated when the area contained between the curve and the x-axis is rotated about the x-axis by  $360^\circ$ . (3mks)
- b) Determine the number  $c$  that satisfies the MVT for integrals for the function  $f(x) = x^2 + 3x + 2$  on the interval  $[1,4]$  (4mks)
- c) By application of definite integrals show that a cone of height  $h$  and radius  $r$  has volume (3mks)

$$\frac{1}{3}\pi r^2 h$$

- d) Evaluate the integral (3mks)

$$\int_0^{1.2} e^x dx$$

Taking six intervals by using trapezoidal rule up to 3 significant figures

