



## TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

**UNIVERSITY EXAMINATION FOR:**

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING, MECHANICAL  
ENGINEERING, ELECTRICAL ENGINEERING, BSMD AND BTIT**

**SMA 2102/AMA 4105/SMA 2173: CALCULUS II**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: Pick Date May 2016**

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

**QUESTION ONE (30 MARKS)**

- a. Solve the integral  $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sqrt{1 - \sin^2 t} dt$  (6 marks)

b. Simplify  $\tan h^{-1} \frac{1}{2}$  (4 marks)

c. Evaluate  $\int \sqrt{\tan x} \sec^2 x dx$  (4 marks)

d. Find the volume of a solid that is obtained when the region under the curve  $y = \sqrt{x}$  over the interval  $[1,4]$  is revolved about the x axis (5 marks)

e. Show that the point  $(2,4)$  lies on the curve  $x^3 + y^3 - 9xy = 0$ . Find the normal to the curve at the point (5 marks)

f. Use trapezoidal rule to evaluate  $\int_0^1 x^3 dx$  for  $n=5$  (6 marks)

### QUESTION TWO (20 MARKS)

a. Find the horizontal and vertical asymptotes of the curve  $y = \frac{x+3}{x+2}$  hence sketch the curve (6 marks)

b. Evaluate  $\int \tan^5 x dx$  (4 marks)

c. Find  $\int \frac{5x-4}{2x^2+x-1} dx$  (5 marks)

d. Evaluate  $\int \sin^2 3x \cos^2 3x dx$  (5mks)

### QUESTION THREE (20 MARKS)

a. Evaluate  $\int_0^1 \sin h^2 x dx$  (4 marks)

b. Solve the  $\int_2^3 \frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2} dx$  correct to 4 significant figures (6 marks)

c. Solve the ordinary differential equation  $\frac{dy}{4x^2} = \frac{dx}{3y^3}$  (4 marks)

d. The area enclosed by the curve  $y = 3e^{\frac{x}{3}}$ , the x-axis and ordinates  $x = -1$  and  $x = 3$  is rotated  $360^\circ$  about the x-axis. Determine the volume generated. (6 marks)

### QUESTION FOUR (20 MARKS)

a. Approximate  $\int_{0.8}^{1.6} t(8 - t^3)^{\frac{1}{2}} dt$  with  $n=8$  using Simpson's rule (7 marks)

b. Evaluate  $\int_{-1}^1 \int_2^3 \int_0^1 (xy + yz) dz dy dx$  (5 marks)

c. Use integration by parts to find  $\int x^2 e^x dx$  (4 marks)

d. Verify  $\sinh 2x = 2 \sin h x \cosh x$  (4 marks)

### QUESTION FIVE (20 MARKS)

- a. Solve the ordinary differential equation

$$\frac{dy}{dx} = \frac{2x^2}{y^3}$$

(6 marks)

- b. Use mid ordinate rule to approximate  $\int_0^2 e^{x^2} dx$  for  $n=10$

(8 marks)

- c. Decompose  $\frac{4-2x}{(x^2+1)(x-1)^2}$  into partial fractions and hence evaluate

$$\int \frac{4-2x}{(x^2+1)(x-1)^2} dx.$$

(6mks)