

**TECHNICAL UNIVERSITY OF MOMBASA**

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FACULTY OF APPLIED AND HEALTH SCIENCES  
DEPARTMENT OF MATHEMATICS & PHYSICS  
**UNIVERSITY EXA 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. A curve has parametric equation

$$x = 2t^3 + 1$$

$$y = 3t^2 - 1$$

Find the gradient to the normal to the curve at the point  $t=5$ . (5 marks)

- b). Given that  $\cosh x = \frac{17}{15}$ . Determine,

i)  $\sinh x$  (2 marks)

ii)  $\tanh x$  (2 marks)

c. Determine  $\int_2^3 \frac{dx}{3x+1}$  (4 marks)

d. Find the area of the region enclosed by  $x = y^2$  and  $y = x - 2$  (5 marks)

e. Evaluate  $\int \sin 3x \cos 5x dx$  (4 marks)

f. Find the numerical value of  $\sinh 2$  correct to 2 decimal places. (2 marks)

g. Use Trapezoidal rule to approximate  $\int_1^2 \frac{1}{x} dx$  for  $n=5$  (6 marks)

### QUESTION TWO (20 MARKS)

a. Find the length of the asteroid  $x = \cos^3 t$   $y = \sin^3 t$   $0 \leq t \leq 2\pi$  (7 marks)

b. Find the horizontal and vertical asymptotes of the curve and sketch the curve  
 $y = \frac{-8}{x^2-4}$  (5 marks)

c. Evaluate  $\int \frac{\log_2 x}{x} dx$  (3 marks)

d. Evaluate  $\int \frac{2x^2-x+4}{x^3+4x} dx$  (5 marks)

### QUESTION THREE (20 MARKS)

a. Evaluate  
 i).  $\int x \sin hx dx$  (4 marks)

ii).  $\int x^2 e^{2x} dx$  (5 marks)

c. Solve the ordinary differential equation  $\frac{dy}{dx} = \frac{x(y^2+1)}{x+1}$  (5 marks)

d. Find the tangent and the normal to the curve  $x^2 - xy + y^2 = 7$  at the point  $(-1,2)$ . (6 marks)

### QUESTION FOUR (20 MARKS)

a. Use Simpson's rule to approximate the integral with  $n=10$   
 $f(x) = \int_0^1 e^{x^2} dx$  (7 marks)

b. Evaluate the triple integral  $\int_0^1 \int_0^{x^2} \int_{xy}^{x+y} xyz dz dy dx$  (5 marks)

c. Evaluate  $\int e^x \cos x dx$  (4 marks)

d. Verify the derivative  $\frac{d}{dx} \cot h^{-1} x = \frac{1}{1-x^2}$ . (4 marks)

### QUESTION FIVE (20 MARKS)

a) i) Find the partial fractions for  $\frac{6x^2 + 7x - 25}{(x + 2)(x - 1)(x - 3)}$  (5 marks)

(ii) Use the result in b) (i) above to evaluate  $\int \frac{6x^2 + 7x - 25}{(x + 2)(x - 1)(x - 3)} dx$  (3h marks)

b. Evaluate  $\int \sec x dx$  (3 marks)

c. Use mid ordinate rule to approximate  $\int_0^2 \frac{x^2}{3} dx$  for  $n=5$  (4 marks)

d. Find the Cartesian equation of the polar equation  $r \cos\left(\theta - \frac{\pi}{3}\right) = 3$  . (5 marks)