



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY
(BSEE/BSME/BSCE/BTIT)

SMA 2173/AMA 4105: CALCULUS II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Evaluate the following integrals:

(i) $\int x^2 \sqrt{x^3 + 5} \, dx$ (4 marks)

(ii) $\int_0^1 \sinh^2 x \, dx$ (3 marks)

(iii) $\int \frac{5x - 3}{(x + 1)(x - 3)} \, dx$ (4 marks)

$$\frac{d}{dx}(2x^3y^2)$$

b) Determine (3 marks)

$$f(x) = \frac{x^2 + 2x}{x^2 - 1}$$

c) Find the vertical and horizontal asymptotes for (4 marks)

$$y = x^3 - 2x^2 + 3x - 1$$

d) Find the equation of the tangent and normal to the curve at the point (2, 5)
(5 marks)

$$f(x) = (4 - x^2)^2$$

e) Find the volume of the solid formed by rotating about the x-axis the area bounded by and the x-axis (5 marks)

$$\int \frac{\sqrt{x} + 1}{x^2} dx$$

f) Evaluate (2 marks)

Question Two

a) Evaluate:

$$\int \frac{1}{2 \sin^2 x + 4 \cos^2 x} dx$$

(i) (6 marks)

$$\int 2x^2 e^{-3x} dx$$

(ii) (3 marks)

$$\int_{-\pi/4}^0 \sec x \tan x dx$$

(iii) (4 marks)

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x) \quad \sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

b) Use the identities and to evaluate:

$$\int \sin^4 2x dx$$

(i) (4 marks)

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

(ii) (3 marks)

Question Three

$$y = \cos 2t, \quad x = \sin t \quad \frac{dy}{dx} \quad \frac{d^2y}{dx^2}$$

a) Given find and (8 marks)

b) Define what is meant by convergence of an improper integral and hence investigate the convergence

$$\int_{-\infty}^{\infty} \frac{dx}{1 + x^2}$$

of (8 marks)

$$\int_2^3 \frac{dx}{x^2 - 4x + 13}$$

c) Find the value of (4 marks)

Question Four

- a) Use the trapezoidal rule and the Simpson's rule with $n = 8$ to approximate:

$$\int_0^2 \sqrt{x^2 + 1} dx$$

How do the two results compare with each other?

(8 marks)

- b) Find the following integrals:

$$\int_0^{\infty} 4e^{-2x} dx$$

(i)

(3 marks)

$$\int_{\pi/6}^{\pi/3} (1 - \cos 3t) \sin 3t dt$$

(ii)

(4 marks)

- c) Find the area of the surface generated by revolving about the x-axis the arc of the curve $y = x^3$ on $[0, 1]$

(5 marks)

Question Five

$$\int \left(\frac{1}{9 - x^2} \right) dx = \arcsin \frac{x}{3} + c$$

- a) Show that

(4 marks)

- b) Evaluate:

$$\int \frac{dx}{2 + 2 \sin x + \cos x}$$

(i)

(8 marks)

$$\int_1^e \frac{\ln x}{x^2} dx$$

(ii)

(4 marks)

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

(iii)

(4 marks)