MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

FIRST YEAR **SECOND** SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE

SOFTWARE ENGINEERING
INFORMATION TECHNOLOGY
ANALYTICAL CHEMISTRY
ACTUARIAL SCIENCE
APPLIED STATISTICS
MATHEMATICS AND ECONOMICS
MATHEMATICS AND COMPUTER SCIENCE
BACHELOR OF EDUCATION SCIENCE

AMM 104 – CALCULUS II

DURATION: 2 HOURS

DATE: 25TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) State the fundamental theorem of calculus and explain it (3 marks)

b) Evaluate the following integrals;

i. $\int_{-2}^{0}(2x+5)dx$ (2 marks)

ii. $\int_{-3}^{4}\left(5-{}^{x}/_{2}\right)dx$ (2 marks)

iii. $\int\left(\frac{t^3+3t^2-1}{t^2}\right)dt$ (2 marks)

c) By making the relevant substitutions, evaluate the following indefinite integrals

i. $\int 2(2x+4)^5dx$ (3 marks)

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

d) Evaluate the integral

$\int_0^1\int_1^2(1-y)x^2\,dxdy$ (3 marks)

e) Find the length of the curve defined by the equation $y=2x^{3/2}$ between the lines x = 0 and x =1 (3 marks)

f) Decompose the following expression into a sum of partial fractions: $\frac{5(x+1)}{25-x^2}$

Hence evaluate the integral $\int\frac{5(x+1)}{25-x^2}\,dx$ (5 marks)

g) Find the area of the region between the curve $y=4-x^2, 0\le x\le 3$ and the x-axis (4 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) Differentiate between a definite integral and an indefinite integral (2 marks)

b) Evaluate the following integral by making a proper trigonometric substitution

$\int\frac{x^2}{\sqrt{16-x^2}}\,dx$ (5 marks)

c) i. What is a rational fraction? (5 marks)

ii. A rational fraction R(x) is defined as: $R(x)=\frac{x^3+x^2+2}{x^2-1}$

Evaluate $\int R(x)dx$ by first decomposing R(x) into a sum of partial fractions (5 marks)

d) Determine the surface area of the solid obtained by rotating $y = \sqrt{9 - x^2}, -2 \leq x \leq 2$ about the x-axis (4 marks)

e) State and explain the mean value theorem for integrals (3 marks)

QUESTION THREE

a) i. What is an improper integral? (1 mark)

ii. Evaluate the following integral

$\int_{-\infty}^{\infty} x\, dx$ (3 marks)

b) Assume that in a certain city, the temperature (in °F) t hours after 9.00 a.m. is represented by the function:

$\mathrm{T}(t) = 50 + 14 \text{ Sin } \left(\frac{\pi t}{12}\right)$, using the mean value theorem, find the average temperature in that city during the period from 9.00 a.m. to 9.00 p.m. (3 marks)

c) Fubini's theorem states that double integrals over rectangles can be calculated as iterated integrals

Use a double integral to find the volume of a solid that is bounded above by the plane z=4-x-y, and below by the rectangle D=[0,1] x [0,2]. Check your result using Fubini's theorem (5 marks)

d) Evaluate by parts the integral:

$\int e^x\, Cos\, x\, dx$

(Hint: Make use of a proper reduction formula) (4 marks)

e) Determine the volume of the solid obtained by rotating the area bounded by the curve $y = 4x - x^2$ and the line y=3, about the line y=3 (4 marks)

QUESTION FOUR

a) Find the Taylor polynomials $\mathrm{P}_1(x), \mathrm{P}_2(x)$ and $\mathrm{P}_3(x)$ for $\mathrm{Sin}x$ about $x = {}^{\pi}/_{3}$ (5 marks)

b) Find the n^{th} Mclaurin polynomial for ln(y+1) (5 marks)

c) Evaluate the following integrals; by making suitable substitutions:

i. $\int \frac{dx}{x^2+2x+2}$ (3 marks)

ii. $\int \frac{dx}{\sqrt{4+x^2}}$ (4 marks)

iii. $\int \mathrm{Sin}^4 x\ \mathrm{Cos}\ x\ dx$ (3 marks)

QUESTION FIVE

a) Evaluate the integral $\int_{y=0}^{3}\int_{x=1}^{\sqrt{4-y}}(x+y)dx\,dy$ by interchanging/reversing the order of integration. Show by sketching, the area represented by the above integral (7 marks)

b) Find the length of the curve $x=t^2, y=t^3$ between the co-ordinate points (1,1) and (4,8) (5 marks)

c) Evaluate $\int_0^1 x\,e^x\,dx$ using a suitable technique (3 marks)

d) Evaluate the integral $\int_1^\infty \frac{dx}{x^2}$ and check whether it diverges (5 marks)