MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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University Examinations 2023/2024

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MATHEMATICS AND COMPUTER SCIENCE, BACHELOR OF SCIENCE IN STATISTICS, BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE, BACHELOR OF COMPUTER SECURITY AND FORENSICS, BACHELOR OF SCIENCE IN EDUCATION, BACHELOR OF INFORMATION TECHNOLOGY, BACHELOR OF SCIENCE MATHEMATICS, BACHELOR OF EDUCATION TECHNOLOGY IN ELECTRICAL AND ELECTRONIC ENGINEERING, BACHELOR OF EDUCATION TECHNOLOGY IN MECHANICAL ENGINEERING AND BACHELOR OF EDUCATION TECHNOLOGY IN CIVIL ENGINEERING

SMA 3152: CALCULUS II

DATE: APRIL 2024   **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Determine the indefinite integrals

   i. $\int \frac{3}{x^2}dx$ (1 mark)

   ii. $\int 7\sec^2 4t\,dt$ (2 marks)

b) Evaluate

   i. $\int_0^{\frac{\pi}{4}} 3\cos 2\theta\, d\theta$ (3 marks)

ii. $\int_{1}^{2} 4e^{2x} dx$ (3 marks)

c) Evaluate $\int_{1}^{3} 5x\sqrt{2x^2 + 7}dx$ taking positive values of square route only   (3 marks)

d) Evaluate $\int_{0}^{\pi/4} 4\cos^4 \theta d\theta$ correct to 4 significant figures (3 marks)

e) Use partial fractions method to determine

$\int \frac{1}{(x^2 - 9)} dx$ (3 marks)

f) Find $\int x Inx dx$ (3 marks)

g) Use Simpson's rule with 4 intervals to evaluate $\int_{1}^{3} \frac{2}{\sqrt{x}} dx$ correct to 4 significant figures

(3 marks)

h) Determine the area enclosed by the curve $y = 4\cos\left(\frac{\theta}{2}\right)$, the θ-axis and the ordinates

$\theta = 0$ and $\theta = \pi/2$ (3 marks)

QUESTION TWO (20 MARKS)

a) Find $\int \sin^2 t \cos^4 t \, dt$ (7 marks)

b) Evaluate $\int \frac{d\theta}{5 + 4\cos\theta}$ (7 marks)

c) The curve $y = x^2 + 4$ is rotated one revolution about the axis between the limits $x = 1$ and

$x = 4$. Determine the volume of the solid of revolution produced (6 marks)

QUESTION THREE (20 MARKS)

a) Determine $\int \frac{1}{\left(a^2 + x^2\right)}dx$ (6 marks)

b) Evaluate $\int_0^1 2\cos 6\theta \cos \theta d\theta$ correct to 4 decimal places (7 marks)

c) Determine the co-ordinates of the point of intersection of the curves $y = x^2$ and $y = \sqrt{x}$

   and hence determine the area enclosed by the curves (7 marks)

QUESTION FOUR (20 MARKS)

a) Show that $\int \left(\frac{2m^2 + 1}{m}\right)dm = m^2 + In\,m + c$ (4 marks)

b) Evaluate $\int_2^3 \frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2}dx$, correct to 4 significant figures (10 marks)

c) Use the trapezoidal rule to evaluate $\int_0^{\pi/2} \frac{1}{1 + \sin x}dx$ using 6 intervals. Give the answer

   correct to 4 significant figures (6 marks)

QUESTION FIVE (20 MARKS)

a) Evaluate $\int_0^{\pi/2} 2\theta \sin \theta d\theta$ (8 marks)

b) A gas expands according to the law pv=constant when the volume is 3m³, the pressure is

   150kpa. Given that work done = $\int_{v1}^{v2} pdv$, determine the work done as the gas expands

   from 2m³ to a volume of 6m³ (5 marks)

c) Find $\int (2x + 1)\sqrt{4x - 3}dx$ (5 marks)

d) Differentiate between definite and indefinite integrals (2 marks)