



MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 210: INTEGRAL CALCULUS

DATE: 8/12/2021

TIME: 8:30 – 10:30 AM

INSTRUCTION:

Answer ALL the questions in Section A and ANY TWO Questions in Section B

SECTION A

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Evaluate

$$\int 3^x dx \quad (5 \text{ marks})$$

- b) Evaluate

$$\int \frac{\cos \varphi}{2 + \sin \varphi} d\varphi \quad (5 \text{ marks})$$

- c) Integrate the following functions with respect to x

$$y = \frac{dx}{4 + 9x^2} \quad (5 \text{ marks})$$

- d) Integrate the following function with respect to x, $y = \frac{2x^2 + 1}{(x-1)(x+2)}$ (5 marks)

- e) Evaluate the following integral using the given change of variable

$$\int \frac{x(x-4)}{(x-2)^2} dx, \quad u = x - 2 \quad (4 \text{ marks})$$

- f) Evaluate the following definite integrals

$$\int_0^\pi \sin 5x \cos 6x dx \quad (3 \text{ marks})$$

- g) Evaluate the area enclosed by the curve $y = x^3 - 4x$ and the x-axis (3 marks)

SECTION B

QUESTION TWO (20 MARKS)

Evaluate the following definite integrals

- a) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sqrt{\sec^2 x - 1} dx$ (4 marks)
- b) $\int_1^2 \ln x \, dx$ (4 marks)
- c) $\int_0^\pi \cos^5 x \, dx$ (4 marks)
- d) $\int_0^2 \frac{x^3 - 2x^2 + 1}{x^2 - x} dx$ (4 marks)
- e) $\int_0^2 x^4 \sqrt{x^5 + 5} \, dx$ (4 marks)

QUESTION THREE (20 MARKS)

- a) Determine the area bounded by the $x = 9 - y^2$ and the y-axis (5 marks)
- b) Determine the volume of the solid generated by the region $y = x^2 + 1$, x-axis and the lines $x = -1$ and $x = 1$, rotated 360° about the x-axis. (5 marks)
- c) The region bounded by the y-axis, $y = x^3$, $y = 1$ and $y = 8$ is rotated 360° about the y-axis. Evaluate the volume of the resulting solid. (5 marks)
- d) Determine the volume generated by revolving the region bounded by $y = \sqrt{x}$, the lines $x = 1$ and $x = 4$ about the line $y = 1$ (5 marks)

QUESTION FOUR (20 MARKS)

- a) Integrate the following function with respect to x $\int \cos 4\phi d\phi$ (5 marks)
- b) It took 20 seconds for a thermometer to rise from 10°F to 212°F when it was taken from a freezer and placed in boiling water. Show that somewhere along the way the mercury was rising at exactly 10.1°F/sec (5 marks)
- c) Given that $y = f(x) = x^3 - 7x + 6$
Find the intercepts (5 marks)
- d) Evaluate the following integral
 $\int e^{x^5} x^4 \, dx$ (5 marks)

QUESTION FIVE (20 MARKS)

Using appropriate integration techniques evaluate

- a) $\int x^2 e^x dx$ (5 marks)
- b) $\int \cos^4 x dx$ (5 marks)
- c) $\int \frac{3}{\sqrt{3+2x-x^2}} dx$ from $x = 0$ to $x = 5$ (5 marks)
- d) $\int x^4 (7 - x^5)^3 dx$ (5 marks)