# MACHAKOS UNIVERSITY

**University Examinations 2017/2018**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**DEPARTMENT OF MATHEMATICS AND STATISTICS**

**SECOND YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

**SCO 210: INTEGRAL CALCULUS FOR COMPUTER SCIENCE**

**DATE: 11/12/2017** **TIME: 11.00-1.00 PM**

**INSTRUCTIONS**: Attempt Question 1 and any other 2 Questions.

**QUESTION ONE (COMPULSORY) (30 MARKS)**

a) Find $f$ if $f''(x) = 12x^2 - 6x + 2, f(0) = 1, f(2) = 11$ (5 marks)

b) Estimate the area under the graph of $f(x) = \frac{1}{x}$ using 4 approximating rectangles and right endpoints. (5 marks)

c) The acceleration function in $m/s^2$ is $a(t) = t + 4$ $and\ initial\ velocity\ is$ $v(0) = 5$. Find the velocity at time t and the distance traveled during the time interval $0 \leq t \leq 10$ (5 marks)

d) Evaluate $\int_0^1 x^2 cos3x dx$ (5 marks)

e) Find the partial derivative $f_x(3,4)$ of the function $f(x, y) = \sqrt{x^2 + y^2}$ (5 marks)

f) Find the area of the region $y = x + 1, y = 9 - x^2, x = -1, x = 2$ (5 marks)

**QUESTION TWO (20 MARKS)**

a) State the Fundamental Theorem of Calculus (3 marks)

b) If $a(t) = 10sint + 3cost, s(0) = 0, s(2\pi) = 12$, find the position of the particle (5 marks)

c) Estimate the area under the graph $f(x) = x^3 + 2$ from $x = -1$ $to$ $x = 2$ using 6 six rectangles and right endpoints and left endpoints; then find the average. (7 marks)

d) If $f(x) = \sqrt{x} - 2, 1 \leq x \leq 6$, find the Riemann sum with n = 5 correct to 6 decimal places, taking the sample points to be the midpoints. (5 marks)

**QUESTION THREE (20 MARKS)**

a) Express the limit $\lim_{n\to\infty} \sum_{i=1}^{n} [2(x_i^*)^2 - 5x_i^*]\Delta x, [0,1]$ (7 marks)

b) Evaluate $\int_{-2}^{3} |x^2 - 1|\, dx$ (6 marks)

c) Evaluate $\int_{1}^{0} x^2\, (1 + 2x^3)^5 dx$ (7 marks)

**QUESTION FOUR (20 MARKS)**

a) Evaluate $\int_{-2}^{-\sqrt{2}} \frac{dx}{x\sqrt{x^2-1}}$ (6 marks)

b) Perform the integration $\int e^{-sinx}(cosx)\, dx$ (6 marks)

c) Evaluate $\int_{0}^{1} \frac{5x^2+3x-2}{x^3+2x^2} dx$ (8 marks)

**QUESTION FIVE (20 MARKS)**

a) Calculate the iterated integral $\int_{1}^{3} \quad \int_{0}^{1} (1 + 4xy) dxdy$ (6 marks)

b) Show that the equation $x^2 + y^2 + z^2 + 2x + 8y - 4z - 28 = 0$ represents a sphere and find its centre and radius (7 marks)

c) Determine whether the integral $\int_{1}^{\infty} \frac{1}{(3x+1)^2} dx$ is convergent or divergent. Evaluate the integral if it is convergent. (7 marks)