MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR EXAMINATION FOR

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF SCIENCE IN BUILDING AND CIVIL ENGINEERING

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

SUPPLEMENTARY EXAMINATION

ECU 200: ENGINEERING MATHEMATICS V

DATE: 1/9/2017 **TIME: 8:30 – 10-30 AM**

INSTRUCTIONS: Answer Question ONE and any other TWO questions

QUESTION ONE (30 MARKS)

a) Prove that $\int e^{ax+b}dx = \frac{e^{ax+b}}{a} + c$ using the extension of the basic formulae where a and b are constants (4 marks)

b) Find the length of the curve in the first quadrant of $y = 2x^{\frac{3}{2}}$ from $x = 0$ to $x = \frac{1}{3}$ (5 marks)

c) Find $\int x^2 e^{2x}dx$ (5 marks)

d) Expand $\sin x$ as an infinite series (8 marks)

e) Find the area of the rectangle bounded by the line $y = 2$, the $x-$axis, the ordinate $x = 1$ and $x = 5$ using the formula $A = \int ydx$ (8 marks)

QUESTION TWO (20 MARKS)

a) Verify Rolle's Theorem for the function

$$f(x) = (x-2)^6(x-5)^{11}$$

in the interval $[2 < x < 5]$ (5 marks)

b) Show that the

$$\lim_{n\to 0} \frac{1}{n} = 0$$ (5 marks)

c) i. Sketch the curve $y = x^3 - 3x^2 + 2x$ from $x = 0$ to $x = 3$ (3 marks)

ii. Find the area included between the curve $y = x^3 - 3x^2 + 2x$ and the axis of x from $x = 0$ to $x = 2$ (4 marks)

iii. Evaluate $\int_0^2 (x^3 - 3x^2 + 2x)dx$, interpret the results. (3 marks)

QUESTION THREE (20 MARKS)

a) Find $\int \left(\frac{x^2+5x+6}{x+2}\right) dx$ (4 marks)

b) Show the improper integral $\int_1^\infty \frac{1}{x^2} dx$ is convergent (6 marks)

c) Find the surface area generated by the loop of the curve $x = t^2, y = t - \frac{t^3}{3}$ about the axis (10 marks)

QUESTION FOUR (20 MARKS)

a) Show that the series $1 + \frac{1}{2} + \frac{1}{2^2} + \cdots$ converges and also find its sum. (5 marks)

b) Find $\int \cos 12x \sin 3x \ dx$ (5 marks)

c) Evaluate $\int \frac{3x^2-2x-7}{x^2-x-2} dx$ using partial fractions technique (10 marks)

QUESTION FIVE (20 MARKS)

a) Verify Rolle's Theorem for the function $f(x) = (x-3)(x-8)$ in the interval $[3 \le x \le 8]$ (5 marks)

b) Consider the curve $y = \frac{1}{x}$ between $x = 1$ and $x = 2$. The interval is divided into 5 equal parts at these points are $y_0, y_1, y_2, y_3, y_4, y_5$

i. Calculate $\int_1^2 \frac{1}{x} dx$ using trapezoidal rule with 5 interval (Assume $\int \frac{1}{x} dx$ is not known) (6 marks)

ii. Suppose that you know $\int \frac{1}{x} dx = lnx + c$. Calculate the area under curve (5 marks)

iii. Calculate the percentage error (4 marks)