MACHAKOS UNIVERSITY

University Examinations 2018/2019
SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SECOND YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR
BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS)
BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)
BACHELOR OF SCIENCE (CIVIL ENGINEERING)
ECU 200: ENGINEERING MATHEMATICS V

DATE: 23/9/2019 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

Answer Question **One** and Any Other T**wo** Questions

QUESTION ONE (COMPULSORY) (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)