



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

ECU0202: MATHEMATICS VI

DATE 25/9/2019

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Evaluate $f(15)$ given the following table of values

x	10	20	30	40	50
F(x)	46	66	81	93	101

- b) i) Derive the Newton Raphsons formula (5 marks)

- ii) Use the formulae to prove that a better approximation to the root of the polynomial $4x^3 + 2x^2 - 200x - 50 = 0$ is given by

$$x_{n+1} = \frac{8x^3 + 2x^2 + 50}{12x^2 + 4x - 200} \quad (10 \text{ marks})$$

- iii) take $x_0 = 7$ to find the root of the equation correct to four decimal (5 marks)

- c) Define the terms interpolation and extrapolation as used in numerical analysis (5 marks)

- d) Obtain the maclaurins series of the function $f(x) = \cos 2x$ (5 marks)

QUESTION TWO (20 MARKS)

- a) i) Given the polynomial $f(x) = x^3 - 6x^2 + 6x - 8$ prove that the newton Raphsons interpolation formulae is given by

$$x_{n+1} = \frac{2x^3 - 6x^2 + 8}{3x^2 - 12x + 5}$$

- ii) taking $x_0 = 5$ obtain a better approximation to the root of the equation $x^3 - 6x^2 + 6x - 8$ correct to four decimal place (9 marks)

- b) Given the table

X	0	1	2	3	4	5	6
F(x)	-1	2	11	38	95	194	347

- i) Construct a finite table of differences (4 marks)
- ii) Use the table to obtain the values of $f(4.8)$, $f(6.4)$ correct to three decimal places (7 marks)

QUESTION THREE

- a) The table below satisfies a function $f(x)$

x	0.1	0.3	0.5	0.7	0.9	1.1	1.3
F(x)	0.003	0.067	0.148	0.248	0.370	0.518	0.697

Use the newton-gregory finite difference interpolation formulae to determine the value of $f(0.15)$ (10 marks)

- b) obtain the taylor's series of the functions

i) $f(x) = \sinh 2x$

ii) $f(x) = e^{2x}$ (6 marks)

- c) Find the cubic polynomial in x which takes on the values -3,3,11,27,57, and 107 when the values of $x=0,1,2,3,4$ and 5

(4 marks)

QUESTION FOUR (20 MARK)

a) Given that $x_1 = 3$ is an approximation to the $\sqrt{15}$ use iteration to find a better approximation to the root. (10 marks)

b) Given $x_{n+1} = 1.2345$ $x_{n+1} = 1.2447$
 $x_{n+2} = 1.3124$ $x_{n+3} = 1.3233$
 $f(x_n) = 12.5674$ and $f(x_{n+2}) = 13.9831$

Use linear interpolation and extrapolation to calculate

$f(x_{n+1})$ and $f(x_{n+3})$ to 5 decimal places (10 marks)