KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2016/2017 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SPECIAL/SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 252

COURSE TITLE: ENGINEERING MATHEMATICS II

DATE: 22/09/17   TIME: 11.30 AM -1.30 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (COMPULSORY) (30MARKS)

(a) Use the bisection method to determine the positive root of the equation
$x + 3 = e^x$, correct to 2 decimal places. (5 marks)

(b) Show that
$$\Delta(u_k v_k) = v_{k+1}\Delta u_k + u_k \Delta v_k.$$ (4 marks)

(c) Evaluate $\Delta^n(e^{3x+5})$. (4 marks)

(d) Evaluate $\int_0^{2.4} e^{-\frac{x^2}{3}} dx$, correct to 4 significant figures, using the mid-ordinate rule with six intervals. (6 marks)

(e) Use Euler's method to obtain a numerical solution of the differential equation
$\frac{dy}{dx} + y = 2x$, given the initial conditions that at $x = 0$, $y = 1$, for the range
$x = 0(0.2)0.6$. Draw the graph of the solution in this range. (7 marks)

(f) Compute the missing values in the following table

x	0	5	10	15	20	25
y	6	10	–	17	–	31

(4 marks)

QUESTION TWO (20 MARKS)

(a) Fit a polynomial of degree three which takes the following values using Newton-Gregory backward interpolation formula. Hence find $y(-1)$ and $y(4.5)$.

x	3	4	5	6
y	6	24	60	120

(8 marks)

(b) Using forward differences find the first and second derivatives of $f(x)$ at $x = 16$ for the data given below:

x	15	17	19	21	23	25
$f(x)$	3.873	4.123	4.359	4.583	4.796	5.000

(12marks)

QUESTION THREE (20 MARKS)

(a) Compute the value of x, when y=8 by inverse interpolation using Lagrange's formula

x	-2	-1	1	2
y	-7	2	0	11

(8 marks)

(b) State and derive Newton-Gregory forward interpolation formula. (12 marks)

QUESTION FOUR (20MARKS)

(a) Evaluate $\Delta^2 \left\{ \dfrac{4x^2 - 25x + 31}{(x-1)(x-2)(x-3)} \right\}$. (10 marks)

(b) Find the approximate value of the real root of the equation $2x - \log_{10} x - 7 = 0$ by using Newton-Raphson method. (10 marks)

QUESTION FIVE (20 MARKS)

(a) Given that $y = \ln x$, $h = 0.2$, evaluate $I = \int_4^{5.2} \ln x \, dx$ by:

   (i)   Trapezoidal rule; (6 marks)

   (ii)   Simpson's $^1/_3$ rule; (3 marks)

   (iii)   Compare the above results with exact value. (4 marks)

(b) Find the approximate value of $\int_0^{1.1} e^x \, dx$, $n = 12$ by Weddle's rule and determine the percentage error. (7 marks)