THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN ELECTRICAL/ELECTRONICS ENGINEERING

SMA 2471: NUMERICAL ANALYSIS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: MAY/JUNE 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

Question 1 (Compulsory - 30 Marks)

$$f(x) = \sin x, x = 0^O(10)50^O$$

a) By tabulating and using Newton's forward difference interpolation formula of degree four, estimate sin 7° to four decimal places. (6 marks)

$$\frac{dy}{dx} = -y \ \ for\ x = 0.6\ and\ h = 0.2$$

b) Use Euler's modified method to solve with boundary conditions when $y = 1$ when $x = 0$ (7 marks)

$$\int_0^6 \sqrt{1+x^4}\,dx$$

c) Estimate using Simpson's Rule with n = 6 (6 marks)

d) Apply Newton-Raphson method to find the real roots of $x^2 - 5x + 2 = 0$ correct to 4 decimal places (7 marks)

e) Determine the maximum step size to be used in the tabulation of $f(x) = (1+2x)^6 \; on \; [0,1]$ so that the truncation error for Linear interpolation is correct to 5 decimal places. (4 marks)

Question 2 (20 Marks)

a) Using Picard's process of successive approximations, obtain a solution to the fifth approximation

$$\frac{dy}{dx} = y + x, y(0) = 1, h = 0.1$$

of the equation (6 marks)

$$\int_0^1 \frac{dx}{1+x}$$

b) Use Romberg method to computer correct to 4 decimal places given that for

$h = 0.5, I(h) = 0.7084, \; I\left(\frac{h}{2}\right) = 0.6970$ and $I\left(\frac{h}{4}\right) = 0.6941$ (4 marks)

c) Fill in the table for the missing values of f(x) correct to 3 decimal places

x	$\pi/6$	$\pi/9$ 2	$5\pi/18$	$\pi/3$	$7\pi/18$
$F(x) = \sin^2 \frac{1}{2} x$					

Use Simpson's Rule to find the area under the curve represented by f(x). Determine the truncation effort expected in the calculated value (10 marks)

Question 3 (20 Marks)

$$\frac{dy}{dx} = x^3 + y^2, y(0) = 0$$

a) For the equation use h = 0.2 to find y(0.2), y(0.4) and y(0.6) using the Runge – Kutta fourth order method. (10 marks)

$$I = \int_5^{12} \frac{dx}{x}$$

b) Apply the Gauss' quadrature formula to compute the integral choosing n = 3 in the interval (-1,1) (7 marks)

c) Using sin 0.1=0.09983 and sin 0.2=0.198867 find an approximate value of sin 0.15 by Lagrange interpolation. (3 marks)

Question 4 (20 Marks)

a) By means of Newton's divided difference formula find the value of f(15) from the following table

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

(6 marks)

$\frac{dy}{dx} = x + y$

b) Using the Taylor's series method to the 4th order derivative, estimate y(0,5) given that $y(0) = 1$

with taking h = 0.1 to 4 decimal places (6 marks)

c) Approximate y(0.4) using the Adams-Bashforth predictor corrector method for the equation $\frac{dy}{dx} = -2xy$

given that:

x	0	0.1	0.2	0.3	0.4
y	1.00	0.990	0.9608	0.9139	0.8522

(7 marks)

Question 5 (20 Marks)

$$\int_0^1 \frac{dx}{1+x}$$

a) Use Trapezoidal rule to evaluate (6 marks)

$f(8)$

b) Apply Newton's divided difference to find the value of if $f(1=3),\ f(3) = 31,\ f(6) = 223,\ f(10) = 1011,\ f(11) = 1343$

(8 marks)

U_x $U_0 = 8, U_1 = 11, U_4 = 68, U_5 = 123$

c) Find the function in powers of x-1 given that (6 marks)