KENYA METHODIST UNIVERSITY
THIRD TRIMESTER
April 2008

FACULTY	**:**	**SCIENCE & SOCIAL STUDIES**
DEPARTMENT:		**COMPUTER & INFORMATION SCIENCE**
COURSE CODE	**:**	**MATH 320**
COURSE TITLE	**:**	**Numerical Analysis**
MODE	**:**	**School based**
TIME	**:**	**2 HRS**

Instructions: Attempt Question 1 in **Section A** and any other two questions in **Section B.**

SECTION A

Question 1 (20 Mks)

1. Write the Maclaurin expansion for sin x. (5 Mks)

2. Find the highest common factor of $f(x) = x^3 - 4x^2 + 5x - 2$ and $g(x) = 3x^2 - 8x + 5$ (5 Mks)

3. Using the Elimination method, solve the system:

   $2x_1 + 3x_2 + 5x_3 = 5$

   $3x_1 + 4x_2 + 7x_3 = 6$

   $x_1 + 3x_2 + 2x_3 = 5$ (5 Mks)

4. Solve the System

   $x_1 - 2x_2 = 1$

   $x_1 + 4x_2 = 4$

   by the Gauss-Sidel Method. (5 MKs)

SECTION B

Question 2

1. For a five digit floating point number define the following terms: (2 Mks)
   i. Mantissa
   ii. Exponent

2. Define and give an example of (4 Mks)
   i. Truncation error
   ii. Rounding error

3. If the exact answer is A and the computed answer is B, find the absolute and relative error when

A = 10.147	B = 10.159
A = 0.0047	B = 0.0045
A = 0.671×10^{12}	B = 0.669×10^{12}

(3 Mks)

4. Let a = 0.471×10^{-2} and b = -0.185×10^{-4}. Use 3 digit floating point arithmetic to compute

   i. a + b
   ii. a – b
   iii. a/b
   iv. a*b

   (4 MKs)

5. Find the six digit binary floating point representations of

   7, 27, 0.125, 14.75, 0.3 (7 Mks)

Question 3

1. Using Taylor Series or otherwise derive the Newton-Raphson method. Use four iterations to find x such that

   $f(x) = x^4 - 5 = 0$ taking $x_0 = 2$ as an initial estimate. (10 Mks)

2. Express the numbers

   x = 12.74 and y = 0.0025 and z = -12.55 as three digit decimal, floating point numbers. Compute the expression $(x - y)/(x + z)$ using three digit floating point arithmetic. Identify the rounding errors at each step of the calculation, and, calculate the total error due to rounding in the calculation. (10 Mks)

Question 4

1. Solve the system of equations

   i. $x_1 - x_2 + 2x_3 = 4$
   $-x_1 + 4x_2 + x_3 = -7$
   $2x_1 + x_2 + 5x_3 = 5$

   ii. $x_1 - x_2 + 2x_3 = 0$
   $-x_1 + 4x_2 + x_3 = 3$
   $2x_1 + x_2 + 5x_3 = 1$

By Gaussian elimination (10 Mks)

2. Sketch the cubic polynomial

$p(x) = 4x^3 - 10x^2 + 2x + 5$ to get a rough estimate of its roots. Use the Newton-Raphson method to approximate each root to 4 decimal places (10 Mks)