MERU UNIVERSITY COLLEGE
OF SCIENCE & TECHNOLOGY
P.O. Box 972-60200 Meru - Kenya. Tel: 020-2092048, 020 2069349
Fax: 020-8027449

University Examinations 2012/2013

FIRST YEAR, THIRD SEMESTER EXAMINATION FOR MASTER OF SCIENCE IN APPLIED MATHEMATICS

SMA 3137: NUMERICAL ANALYSIS II

DATE: DECEMBER 2012 **TIME: 3HOURS**

INSTRUCTIONS: *Answer questions **one** and any other **two** questions*

QUESTION ONE - (30 MARKS)

a) Approximate the singular integral $\int_0^{\infty} e^{-x^2-\frac{1}{x^2}}dx$ (9 Marks)

b) Find the value of the integral $\int_2^3 \frac{\cos 2x}{1+\sin x}dx$, Using the Gauss-Legendre 3-point formula giving your answer correct to 6 decimal places. (7 Marks)

c) Given the differential equation $\frac{dy}{dt} = t - y^2$, $y(0) = 1$, compute $y(0.1)$, $y(0.2)$and $y(0.3)$ using the modified Euler method with $h = 0.1$ (6 Marks)

d) Use the finite difference method to solve the boundary value problem
$\frac{d^2y}{dx^2} = y$,
$y(0) = 0$, $y(2) =$ 3.627. Use h = 0.5 (8 Marks)

QUESTION TWO – (20 MARKS)

a) Approximate the integral
$\int_0^1 e^{x^2}dx$ Using Newton – Cotes method corresponding to $n = 3$ (11 Marks)

b) Use Romberg integration method to find an approximation to the integral
$\int_0^3 f(x)dx$ from the following functional data:

x	0.00	0.75	1.50	2.25	3.00
$f(x)$	1.0000	0.47235	0.22313	0.10540	0.04979

(9 Marks)

QUESTION THREE – (20 MARKS)

a) Estimate $\int_0^{0.5}\int_0^{0.5}\frac{\sin(xy)}{1+xy}dxdy$ Using Simpson's rule for double integrals with both steps $sizes = 0.25$ (10 Marks)

b) Using Schmidt explicit formula solve the equation
$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ Subject to the conditions $u(x,0) = \sin \pi x,\ 0 \le x \le 1, u(0,t) = u(1,t) = 0$
Carry out computation for two levels taking $h = {}^1/_3,\ k = {}^1/_{36}$. (10 Marks)

QUESTION FOUR – (20 MARKS)

Use the ABAM and Runge-Kutta methods to approximate $x(2)$ for the initial value problem

$\frac{dx}{dt} = 5t - 2x, x(0) = 1$ Using step size $h = 0.5$ correct to 5 d.p. (20 Marks)