THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

DIPLOMA IN TECHNOLOGY
ELECTRICAL POWER ENGINEERING (DEPE4)
TELECOMMUNICATION & INFORMATION ENGINEERING (DIEP)
COMPUTER SCIENCE ENGINEERING (DCSE 4)
ELECTRONIC & AUTOMOTIVE ENGINEERING (DIAE4)

EEE 2204: ENGINEERING MATHEMATICS IV

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012

TIME: 2HOURS

INSTRUCTION TO CANDIDATES
You should have the following for this examination
- *Answer booklet*
- *A Non-programmable scientific calculator*

This paper consists of **FIVE** questions.
Attempt any **THREE** questions
Maximum marks for each part of a question are as shown.
This paper consists of **THREE** printed pages

QUESTION ONE (20 MARKS)

a) Given the **THREE** vectors $A = i + 4j - 7k$, $B = 2i + j - 4k$ and $C = 9i + 18k$. Determine the following

(i) $\left(A + B \right) - C$ (2 marks)

(ii) $A \bullet \left(B \times C \right)$ (2 marks)

b) (i) Using the definition of a Laplace transform show that $L\{e^{at}\} = \frac{1}{s-a}$ (4 marks)

(ii) Use the table of Laplace transform to determine $L\{2e^{3t}(4\cos 2t - 5\sin 2t)$ (6 marks)

c) Determine the power series for $f(x) = x^3 - 10x^2 + 6$ using Taylor's theorem about $x = 2$ (6 marks)

QUESTION TWO (20 MARKS)

a) Taking the first approximation as to determine the root of the equation $x^2 - 3\sin x + 2 In(x+1) = 3.5$.
Correct to 3 significant figures by using Newton-Raphson iterative method (12 marks)

b) Using Newton Gregory formula estimate the number of students who obtained less than 45 marks from the following:

Marks	1- 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of Students	31	42	51	35	31

(8 marks)

QUESTION THREE (20 MARKS)

a) Evaluate $\int_{0.2}^{0.4} x In(1+x) dx$ using Maclaurins series, correct to 3 decimal places (10 marks)

b) Given $\sin(45°) = \frac{1}{\sqrt{2}}$ and $\cos(45°) = \frac{1}{\sqrt{2}}$ approximate $\sin(44°)$ using power series expansion, correct to five decimal places (10 marks)

QUESTION FOUR (20 MARKS)

a) (i) Using the Laplace transform of the second derivative show that

$$L\{\sin h\,3t\} = \frac{3}{s^2 - 9}$$

(6 marks)

(ii) Determine the inverse Laplace transform of $\dfrac{s-2}{6s^2 - 20}$

(4 marks)

b) Using Laplace transform technique, solve the following initial value problem

$$\frac{d^2 y}{dt^2} + 2\frac{dy}{dt} + 2y = 5\sin t \qquad \text{where} \qquad y(0) = y'(0) = 0$$

(10 marks)

QUESTION FIVE (20 MARKS)

a) Given the function $\phi = x^2 z + 2xy^2 + yz^2$ determine the directional derivative of ϕ at point (1, 2, -1)

in the direction of the vector $\vec{A} = 2\vec{5} + 3\,\vec{j} + 4\,\vec{k}$

(6 marks)

b) (i) Given a vector field $\vec{F} = yz^2 + \vec{s} + xy\,\vec{j} + yz\,\vec{k}$ determine $div\left(url\,\vec{F} \right)$

(5 marks)

(ii) Given $\phi = 2x^3 y^2 z^4$ determine div grad ϕ

(4 marks)

c) A plane contains three points p = (1, 0, 0), Q = (1, 1, 1) and R = (2, -1, 3). Determine a vector or thogonal to the plane

(5 marks)