



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL ENGINEERING

ELECTRICAL POWER OPTION

TELECOMMUNICATION OPTION

INSTRUMENTATION AND CONTROL OPTION

YEAR II SEMESTER II

AMA 2251: ENGINEERING MATHEMATICS IV

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2019

TIME: 2HOURS

DATE: AUGUST 2019

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student I Mathematical table, calculator

This paper consists of **FIVE** questions. Attempt question **ONE** (Compulsory) and any other **TWO** questions.

Do not write on the question paper.

QUESTION ONE (compulsory)

(a) Find the

i) Laplace transform of $t \cos at$ (4marks)

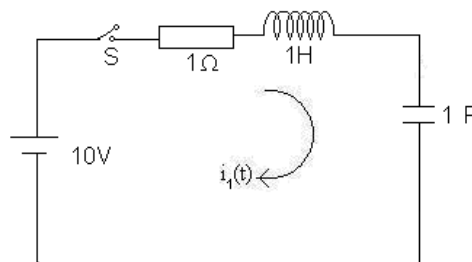
ii) Inverse Laplace transform of $f(s) = \frac{2s-1}{(s+1)(s^2+7)}$ (5marks)

b Use Maclaurin's Theorem to determine the power series of the function

$f(x) = 2x^3 - e^{-3x}$ as far as the term in x^4 (7marks)

c) The circuit in fig. 1 is dead prior to switch closure at $t=0$

Solve for the charge $q(t)$ in the circuit (8marks)



d) A student finds that the average number of amoeba in a 10ml pond of water from a particular pond is four. Assuming that the number of amoeba follows Poisson distribution, find

i) There exactly five amoebas

ii) There are no Amoebas

iii) There are fewer than three amoebas (6marks)

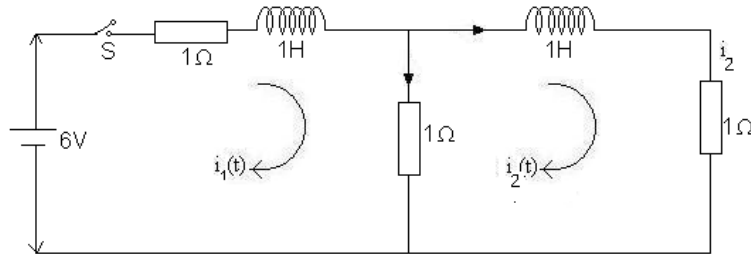
QUESTION TWO

(20MARKS)

a) Find the inverse Laplace transform of: $\frac{4s^2 - 5s + 6}{(s + 1)(s^2 + 4)}$ **(8marks)**

c) Use Laplace transform to determine the current $i_1(t)$ in the network of fig .1

assuming that the circuit is dead at $t=0$



(12marks.)

QUESTION THREE

(20MARKS)

a) A continuous random variable X has a probability density function defined by

$$f(x) = \begin{cases} c(1-x)^2, & 1 < x < 4 \\ 0, & \text{elsewhere} \end{cases}$$

Determine the

i) Value of the constant c

ii) Mean

iii) $P(1.5 \leq x \leq 2.5)$

(8marks)

b) Table! Shows the marks scored by students in a mathematics examination

marks	12-14	15-17	18-20	21-23	24-26	27-29
No of students	2	6	a	8	4	1

Given the mean is 19.9

Determine i) the value of a

li standard deviation

(12marks)

QUESTION FOUR

(20MARKS)

a) i) Use Maclaurin's theorem to expand $\ln(1+x)$ in ascending powers of x as far as the term x^5

ii) hence evaluate the integral $\int_0^1 \frac{\ln(1+x)}{x} dx$ correct to 4 d.p. (11marks)

b) By expanding $\sin\left(\frac{\pi}{6} + h\right)$ in Taylor's series as far as the term h^4 determine

the value of $\sin 32^\circ$ correct to six d.p. (9marks)

QUESTION FIVE

(20MARKS)

a) Find from first principle the Laplace transform of te^{-4t} (6marks)

b) Find the Laplace transform of $6\sin 2t \cos 3t$ (5marks)

c) A d.c. circuit consists of an e.m.f of 20V in series with a resistance of $20\ \Omega$ and an inductance of 2 H. Use Laplace transform method to find an expression for

$i(t)$ in the circuit assuming that the current is zero prior to switch closure at $t=0$ (9marks)