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) **(30MARKS)**

(a) Find the Laplace transform of

i) $f(t)=\begin{cases}\sin at, & t\geq 0\\ 0, & t<0\end{cases}$ from the definition of Laplace transform **(6marks)**

ii) $g(t)=\begin{cases}t\sin at, & t\geq 0\\ 0, & t<0\end{cases}$ by partially differentiating $G(s)$ where $G(s)$ is

the Laplace transform of $f(t)$ **(4marks)**

b) i) show that $\lim_{t\to 0}\dfrac{e^{-t}-e^{-2t}}{t}=1$ **(4marks)**

ii) Hence find the Laplace transform of $f(t)=\dfrac{e^{-t}-e^{-2t}}{t}$ **(4marks)**

c) Use Taylor's series to expand $3x^3+7x^2-x+5$ in ascending powers of $(x-1)$

as far as the term in $(x-1)^3$. Hence, determine $f\left(\dfrac{9}{10}\right)$ correct to three d.p **(8marks)**

d) If 10% of bolts produced by a machine are defective, determine the probability that

out of 10 bolts produced at random

i) One

ii) None

iii) at most two bolts will be defective **(4marks)**

QUESTION TWO **(20MARKS)**

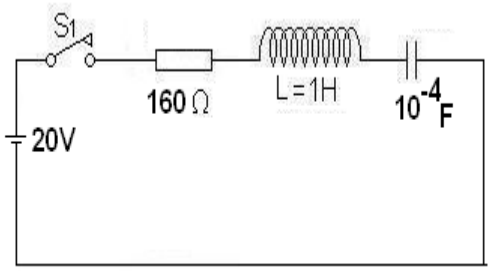
a) Find the Laplace transform of $f(s)=\dfrac{S}{(S^2+4)(S+3)}$ **(7marks)**

b) The circuit in fig 1 is dead prior to the closure of the switch at t=0, using

Laplace transforms, determine

i) The charge $q(t)$ in the circuit

ii) the current i(t) for $t \geq 0$



(13marks)

QUESTION THREE **(20MARKS)**

a) 120 students pursuing a course in electrical engineering were examined and their result summarized as shown below

Marks obtained	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of students	7	12	14	28	25	14	12	8

Using an assumed mean of 55determinethe

i) Mean mark

ii) Standard Deviation

iii) Pearson's coefficient of Skewness **(13marks)**

b) Table 2 show the percentage mark obtained by ten students in mathematics and physics

Mathematics	75	38	96	27	74	85	90	63	66	42
Physics	85	51	92	60	64	68	88	63	65	45

i) Determine product correlation coefficient

ii) Hence comment on the result **(7marks)**

QUESTION FOUR **(20MARKS)**

a) Find the first three non -zero terms in the Maclaurian expansion of $f(x)=\sin x$

and hence evaluate $\int_0^1 \frac{\sin x}{x}\,dx$ correct to three decimal places **(10marks)**

b) i) Use Taylor's series to expand $\cos(\frac{\pi}{3}+h)$ as far as the term h^4

ii) Hence determine the value of $\cos 63^\circ$ correct to 4d.p **(10marks)**

QUESTION FIVE **(20MARKS)**

a) Find the

i) Laplace transform of $t^2\cos t$ **(5marks)**

ii) Inverse Laplace transform of $f(s)=\frac{s^2+2s-3}{s(s-3)(s+2)}$ **(6marks)**

b) Use Laplace Transform method to solve the differential equation

$\frac{d^2x}{dt^2}-4\frac{dx}{dt}+4x=e^{2t}$. Given that $t=o, x=0, X'=0$ **(9marks)**