TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF TECHNOLOGY IN ELECTRICAL & ELECTRONIC ENGINEERING.

TEE 4210: CIRCUIT AND NETWORK THEORY II

END OF SEMESTER EXAMINATIONS

SERIES: MARCH 2025

TIME: 2 HOURS

DATE: MARCH 2025

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination

-Answer Booklet, examination pass and student ID

-Refer to the selected Laplace transform pair at the last page

This paper consists of FIVE questions; attempt any THREE questions.

Do not write on the question paper

QUESTION 1 [20 marks]

(a) Find the voltage v(t) in a circuit described by integro-differential equation

$$-50\cos\left(5t+30^\circ\right)+2\frac{dv}{dt}+5v+10\int v\,dt=0$$

(10 marks)

(b) Determine I_1 and I_2 in Fig. Q1 given that $V_1 = 100 \angle 0^o mV$.

Fig. Q1

(10 marks)

QUESTION 2 [20 marks]

(a) Describe the major steps in analyzing a circuit using Laplace transform (5 marks)

(b) In the RC circuit in Fig. Q2, the switch is in position 1 long enough to establish steady state conditions, and at t=0. By applying Lapalce Transform, find the resulting v_c voltage across t he capacitor. (10 marks)

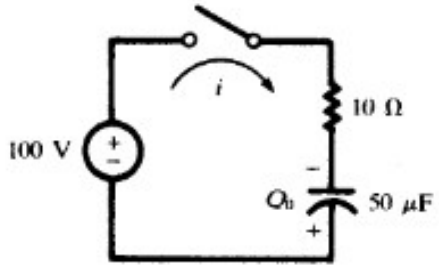

Fig. Q2

(c) Describe with the help of suitable equations, the state variable model and its general representation. **(5 Marks)**

QUESTION 3 [20 marks]

For the circuit of Fig. Q3, assuming $v_s(t) = V_m \cos\omega t$

(a) Obtain the voltage gain transfer function H(jω). **(4 marks)**
(b) Evaluate the magnitude of the transfer function hence sketch the Magnitude plot. **(10 marks)**
(c) Evaluate the Phase of the transfer function hence sketch the Phase plot **(6 marks)**

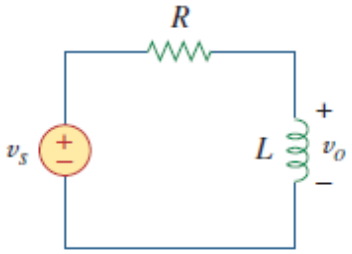

Fig.Q.3

QUESTION 4 [20 marks]

(a) With reference to transfer function, determine the type of filter in Fig. Q4. $v_i(t) = V_m \cos\omega t$. **(8 marks)**
(b) Calculate the corner or cut-off frequency given that R = 2 Ω, L = 2 H, C = 2 μF. **(12 marks)**

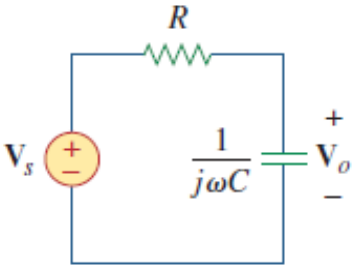

Fig. Q4

QUESTION 5 [20 marks]

(a) Describe the procedures in nodal analysis **(6 marks)**

(b) For Fig. Q.5, given that $E = 50 \angle 0^{o} V$

i. Find the total impedance Z_T

ii. Determine the branch currents I_1, I_2 and I_3

iii. Determine the power dissipated by each of branch of the circuit.

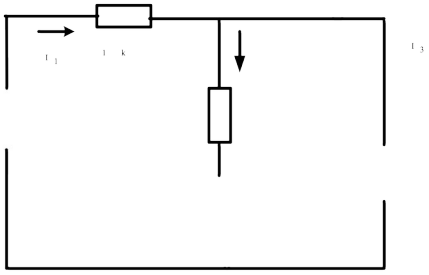

Fig. Q5.

	Laplace transform pairs	
1	*f(t)*	*F(s)*
2	1	$\frac{1}{s}$
3	t	$\frac{1}{s^2}$
4	$e^{-\alpha t}$	$\frac{1}{s+a}$
5	$te^{-\alpha t}$	$\frac{1}{(s+a)^2}$
6	$\frac{df}{dt}$	**sF(s)** $-f(0)$
7	$\int f(t)$	$\frac{F(s)}{s}$
8	$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
9	$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
10	$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
11	$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$