PP1

TECHNICAL UNIVERSITY OF MOMBASA

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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: AUGUST 2024

TIME: 2 HOURS

DATE: AUGUST 2024

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions; Question ONE is compulsory. In addition attempt any other TWO questions.

Refer to the last page for selected Laplace transform pairs

Do not write on the question paper

QUESTION 1 [Compulsory 20 marks]

(a) Describe the major steps in analyzing a circuit using Laplace transform **(8 marks)**

(b) In the RL circuit in Fig. Q1, the switch is in position 1 long enough to establish steady state conditions, and at t=0 it is switched to position 2. By applying Lapalce Transform, find the resulting circuit current i. **(12 marks)**

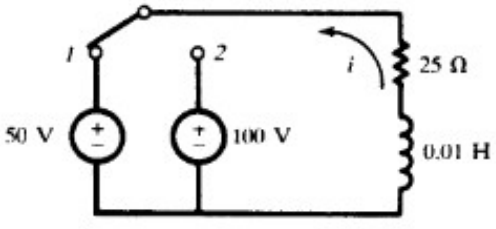

Fig. Q1

QUESTION 2 [20 marks]

(a) Determine the number of octaves and decades between the following pairs of frequencies.

(i) $10\,Hz, 1000\,Hz$

(ii) 1700rad/s, 4200rad/s

(4 marks)

(b) Draw the asymptotic Bode Magnitude Plot for the transfer function.

$$H_{(s)}=\frac{4(s+2)}{(s+1)(s+4)}$$ **(8 marks)**

(c) The asymptotic Bode plot of a minimum phase linear system is shown in Fig.Q2

Determine its transfer function. **(8 marks)**

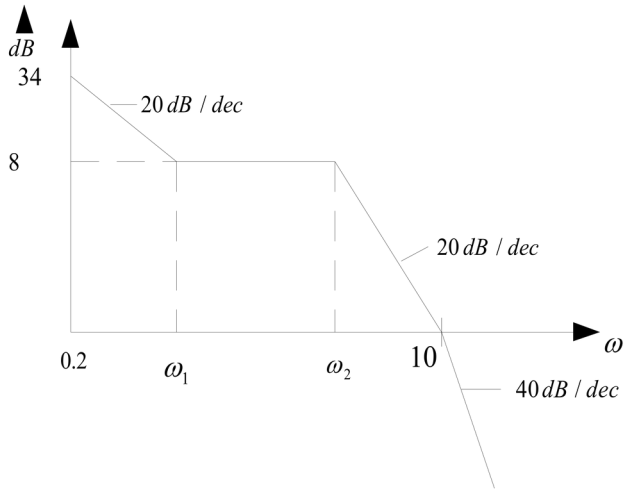

Fig.Q2

QUESTION 3 [20marks]

(a) Define the following terms in reference to analogue filters

i. Magnitude scaling
ii. Frequency scaling
iii. Robustness
iv. Bode sensitivity

(6 marks)

(b) filter has a transfer function

$$H(s)=\frac{5}{s^2+ks+5}$$

Given that the nominal value of k is 2, obtain the poles sensitivity and hence their location after a 10% increase in k

(9 marks)

(b) Determine the frequency ω_{max} that gives maximum $|T(j\omega)|$ for the function. **(5 marks)**

QUESTION 4 [20 marks]

For the circuit of Fig. Q4, 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)**

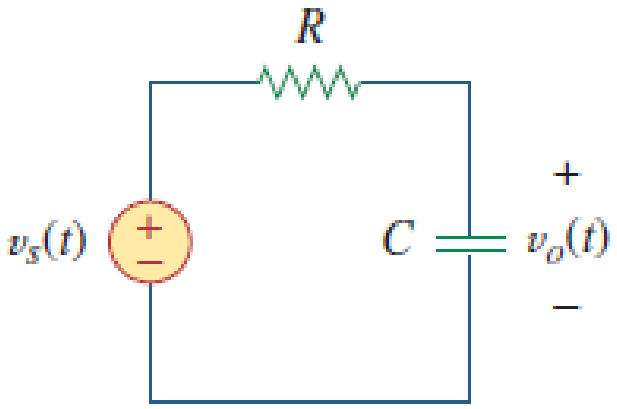

Fig.Q.4

QUESTION 5 [20 marks]

(a) With reference to transfer function, determine the type of filter in Fig. Q5.
$v_i(t)=V_m cos\omega t$. **(8 marks)**
(b) Calculate the corner or cut-off frequency given that R = 2 Ω, L = 2 H, C = 2 μF. **(12 marks)**

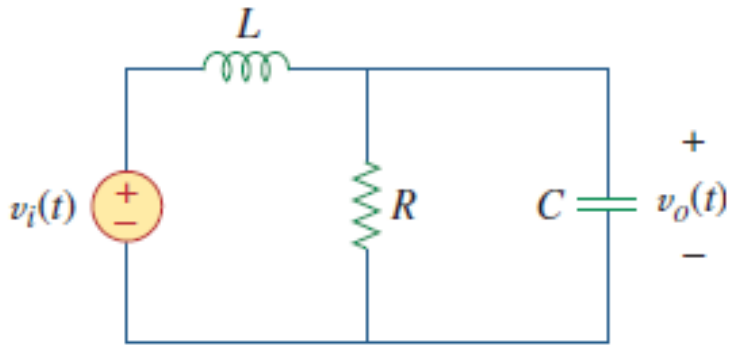

Fig. Q5

	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	$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$