TECHNICAL UNIVERSITY OF MOMBASA

ENGNINEERING AND TECHNOLOGY

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

Bsc Electrical and Electronics Engineering

EEE2303: CIRCUIT AND NETWORK THEORY.

END OF SEMESTER EXAMINATION

SERIES: April 2017

TIME: 2 HOURS

DATE:

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

This paper consists of FIVE questions. Attempt question ONE compulsory and any other TWO

Do not write on the question paper.

Question ONE

(a) (i) Define the following using appropriate illustrations:

(I) Half power bandwidth
(II) Cut off frequency
(III) Stop band
(IV) Pass band

(ii) (I) Derive the transfer function of a low pass RC filter.

(II) Determine the expression for magnitude and phase.

(10 marks)

(b) Explain the meaning of the following:

(i) Driving point function

(ii) Bilinear transfer function

(4 marks)

(c) (i) Determine the transfer function of the circuit of Fig. Q1(c)
(ii)Plot its magnitude and phase responses.

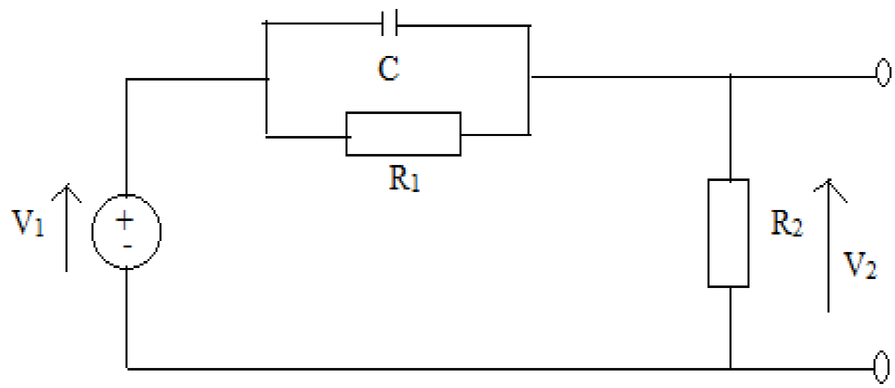


Fig. Q1(c)

(ii) Pole and zero location on s-Plane.

(16 marks)

Question TWO

(a) Explain with the aid of suitable diagrams the meaning of magnitude and frequency scaling and state relationship between circuit component values before and after scaling.

(7 marks)

(b) (i) A filter has a transfer function:

$$T(s) = 5/s^2 + Ks + s$$

If the nominal value is 2, obtain the pole sensitivity and hence, their location after a 10% increases in K.

(ii) Determine the point at which the transfer function is a maximum.

(13 marks)

Question THREE

(a) Derive from first principles the transfer function for a Butterworth low pass filter and show that its response is maximally flat and plot the magnitude for different values of n.

(10 marks)

(b) A Butterworth low pass filter has the following:

$$\alpha_{\max} = 0.5dB, \ \alpha_{\min} = 20dB, \quad \omega_p = 15000 rad/s, \quad \omega_s = 30{,}000 rad/s$$

Determine:

(i) order of the filter n
(ii) Location of the poles on the s domain.
(iii) Q of each pole
(iv) Half power frequency, ω_o

Question FOUR

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

(i) 10,000Hz, 100,000Hz
(ii) 1,800 rad/s, 5,500 rad/s

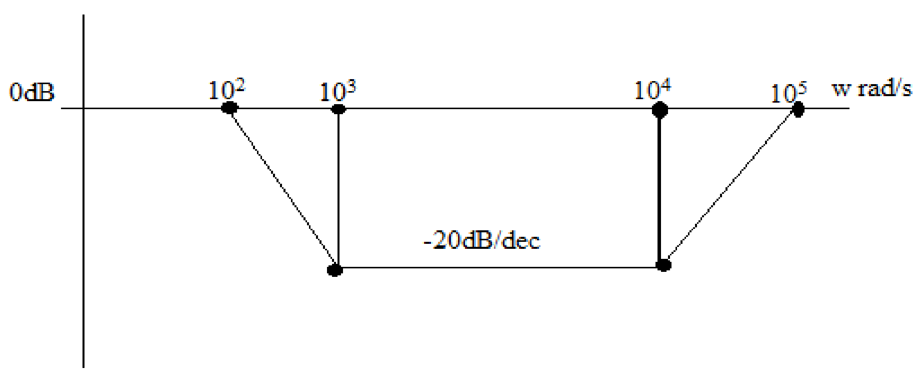
(4 marks)

(b) Draw the asymptotic Bode magnitude plot for the transfer function:

$$T(s) = \frac{4(s+2)}{(s+1)(s+4)}$$

(8 marks)

(c) A system is represented by the following asymptotic bode approximation.



(i) Derive the transfer function for asymptotic bode plot.
(ii) Using appropriate frequency and magnitude scaling realize the network.

(8 marks)

Question FIVE

(a) (i) With the aid of suitable sketches show the 4th order Chebyshev and Butterworth low pass filter response.

(ii) Differentiate between the response of Butterworth and Chebyshev low pass filters.

(6 marks)

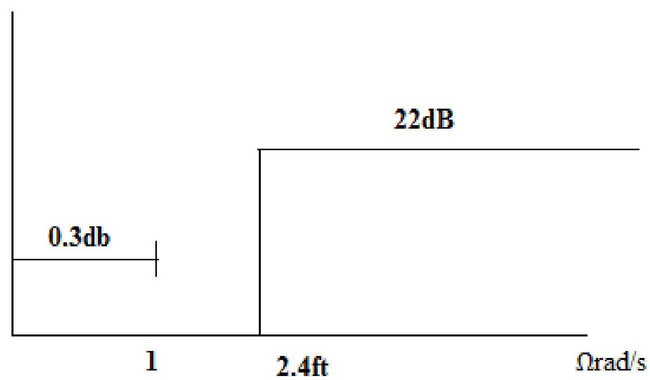
(b) The specifications for a Chebyshev low pass filter are given as follows:

$\omega_p = 1, \ \ \omega_s = 2.32, \ \ \alpha_{\max} = 0.5dB, \ \ \alpha_{\min} = 22dB.$

Determine:

(i) the order of the filter n
(ii) The half power frequency
(iii) The values necessary to meet the above specifications for a Butterworth response

(c) Design a low pass Chebyshev filter with specifications given in Fig. Q5(c).



(8 marks)

Fig Q5(c)