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PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION- 2003

LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt ALL questions.

Q. [1] [a] What is filter? Why it is required? Define half power points, roll-off and centre frequency. [3]

[b] Plot the magnitude and phase response for filter circuit of Fig. 1[b]. Justify the plots with the help of location of poles and zeroes in the s-plane. [5]

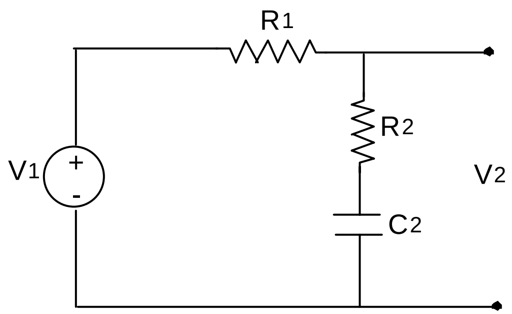

Fig.1[b]

Q. [2] [a] Realize the following network function in first foster form:

$$F(s) = \frac{6(s+2)(s+4)}{s(s+3)}$$ [4]

[b] Discuss the properties of one port LC network. [3]

[c] Determine the Z parameter in terms of Y parameters for the network given in Fig.2[c].

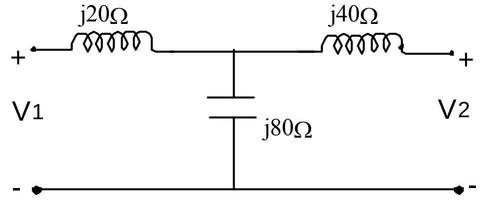

Fig. 2[c]

Q. [3] [a] Explain Bessel Thomson method of constant delay filter design. [6]

[b] Discuss Butterworth approximation in filter design. Differentiate between Chebyshev and inverse Chebyshev approximation. [8]

Q. [4] What is frequency transformation? Write the significance of CR-CR transformation in active filter design. [8]

Q. [5] [a] Design a highest sensitive low pass Butterworth active sallen key circuit with cut-off frequency of 1.2 kHz. The circuit should meet the following specifications: [8]

$\alpha_{max} = 0.5$ dB $\alpha_{min} = 20$dB

$\omega_p = 1000$ rad/sec $\omega_s = 2000$ rad/sec

(see table attached herewith)

[b] Why Two Thomas Biquad is known as universal filter? Discuss its orthogonal tuning property with necessary calculations. [6]

Q. [6] Design a fourth order doubly terminated low pass Butterworth passive filter circuit with cut off frequency 100 Hz. Realize it with FDNR. Use capacitor of 0.1 pF in your design. (see Table attached herewith).

Q. [7] Define single parameter and multi parameter sensitivities. Discuss the sensitivity calculation of two Thomas Biquad circuit. [8]

Q. [8] How can you simulate a resister with switch capacitor. Design a switched capacitor filter that satisfies the following transfer function: $T(s) = \dfrac{(s+1000)}{(s+100)}$

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PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION- 2004

LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any ALL questions.

Q. [1] [a] Realize the following specifications with a maximally flat response LPF: [10]
$\alpha_{max} = 0.5$ dB, $\alpha_{min} = 20$dB
$\omega_p = 1000$ rad/sec, $\omega_s = 2000$ rad/sec.
[b] Discuss about importance and uses of normalization and de-normalization in filter design. [6]

Q. [2] [a] What is frequency transformation? Discuss its importance in design of high pass, low pass, band stop and band pass from low pass approximations. [6].
[b] Design a Chebyshev LPF for the following specifications:
$\alpha_{max} = 1$ dB at $f_c = 500$ kHz.
$\alpha_{min} = 48$ dB at $f_s = 1.07$MHz.
Use Sallen-key sections and first order sections as needed to realize the filter. [10]

Q. [3] [a] List the properties of LC, RC, RL one port network. [6]
[b] Realize the transfer function.

$$|H(jw)|^2 = \frac{(3.2^2 - w^2)^2}{(3.2^2 - w^2) + 10.417W^2}$$

As an LC filter terminated in two equal resister R1 = R2 = R = 1.2 KΩ. The frequency is normalized with respect to 60 kHz.

Q. [4] [a] Write down the differences between single parameter and multi parameter sensitivity. [3]

[b] Define Q-factor, centre frequency and gain. [3]

[c] A 200mV, 45KHz signal is corrupted by a 2-v, 12KHz sine wave. Design a high a high pass filter to remove the 2-v single wave such that its remaining magnitude is no larger than 2% of 200mV. The high frequency should be 0 dB, and pass attenuation α_{max} <= 1 dB will be sufficient. Assume suitable considerations. [10]

Q. [5] [a] Discuss the operation of an active RC integrating summer with its equivalent SC circuit. [6]
[b] Define group delay and phase delay. [4]
[c] Write short notes on (any TWO): [2×3=6]
[i] Wave guide filter.
[ii] CMRR
[iii] FDNR

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PURWANCHAL UNIVERSITY
VI SEMESTER BACK-PAPER EXAMINATION- 2004

LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any ALL questions.

Q. [1] [a] Define pass band and stop band of ideal filters. What are the common types of filters? Define each. [2+4]

[b] Plot the magnitude and phase response for filter circuit given below.

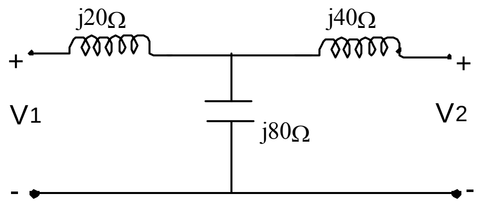

Fig. 1[b]

Justify the plots with the help of location of poles and zeros in the s-plane. [6]

Q. [2] [a] What do you mean by loss less circuits? List the properties of loss less circuits. [3]

[b] Design a highest sensitive low pass Butter worth active Sallen-key circuit with cut-off frequency of 1.2KHz. The circuit should meet the following specifications. [9]

α_{max} =0.5 dB, α_{min} = 20 dB,

ω_p = 1000 rad/sec, ω_s = 3200rad/sec

(Table is attached herewith)

Q. [3] [a] From the given transfer function, obtained the transfer function of High-pass filter. [4]

$$T(s) = \frac{1}{(s+1)(s^2+3s+1)}$$

[b] Design a switched capacitor filter to realize the transfer function. [8]

$$(s) = \frac{(s+100)(s+400)}{(s+200)^2}$$

Draw the circuit diagrams without and with switch sharing.

Q. [4] [a] Explain how inductors are eliminated by using FDNR? Also show how it is implemented using OP-AMP. [4]

[b] Define single parameter and multi-parameter sensitivities. Discuss the sensitivity calculation of Tow-Thomas Biquad circuit. [8]

Q. [5] [a] Design a fourth-order doubly terminated Butter worth filter using FDNR-having half power frequency ω_o =2000 rad/s and source and load resistance R = 3 KΩ (see table attached herewith) [6]

[b]What is meant by floating inductors? Discuss about GIC with necessary diagrams. [6]

Q. [6] [a]Compare Chebyshev and inverse Chebyshev responses. Which is more preferable? [6]

[b] Determine Z-parameter in terms of Y-parameters for the following network. [6]

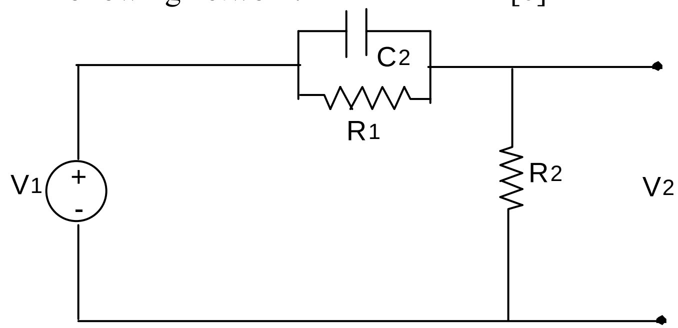

Fig. 6[b]

Q. [7] Why frequency transformation is required? What are the significance of RC-CR transformation in active filter design. [8]

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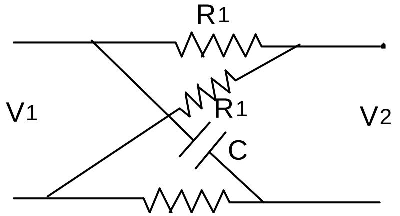
PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION- 2005

LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any ALL questions

Q. [1] [a] Define Skirt, roll-off and bandwidth. [2]
[b] Find T(s) , pole-zero plot, then find magnitude and phase responses and also determine the type of filter. [6]



Q. [2] Design a fourth order doubly terminated Butterworth low pass filter using FDNR having half power frequency 1000Hz and final design having 0.01 μF capacitors. (see table attached). [10]

Q. [3] Design a switched capacitor to realize the transfer function, T(s) = (s+100)/(s+200)
Draw the circuit diagrams with and without switch sharing. [8]

Q. [4] [a] Write the properties of lossless circuit . [3]
[b] Realize the foster parallel circuit for:
$$F(s) = \{6(s+2)(s+4)\}/\{s(s+3)\}$$
[c] (i) With terminal pair -2 open, a voltage of 100< 0 ° v is applied at terminal pair-I, resulting in I1 = 10, 0 ° A and V_2 = 25<0 ° V.
(ii) With terminal pair-1 open, the same voltage is applied to the terminal pair-2 resulting in I_2 = 20< 0 ° A and V_1 =50< 0 ° V.
Find : (a) Impedance (z) matrix.
(b) Determine y-parameters in terms of z. parameter s found above. [8]

Q. [5] [a] Differentiate between chebyshev and inverse chebyshev filters.
[b] Explain Besel-Themson Response of constant delay filter design. [8]

Q. [6] [a] What is frequency transformation and why is it needed? What is the significance of RC-CR transformation? [5]
[b] Design a fourth order butter worth low pass filter using two cascaded sallen key biquads of highest sensitive design with cut off frequency = 2 π * 1000 rad/sec and use 0.1 μ F capacitors. (see table attached for ladder circuit)

Q. [7] [a] What is inductance simulation? Explain GIC with necessary diagrams. [5]
[b] Why is TOW-Thomas called universal filter? Discuss its orthogonal tuning with necessary diagram. [6]

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PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION- 2006

LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any ALL questions.

Q. [1] [a] What are the characteristics of the practical filter? Why magnitude and frequency scaling necessary? [3+2+2]
[b] Plot the magnitude and phase response for the following filter circuit of fig. 1[b] below . Justify your plots with the help of the location of poles and zeroes in the s-plain. [5]

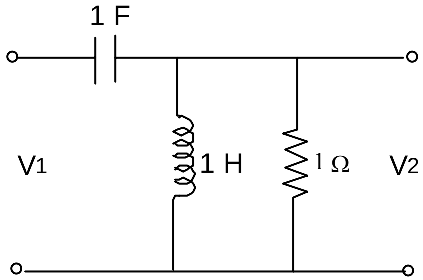

Fig.1[b]

Q. [2] [a] What are the properties of lossless circuits? Explain briefly the properties of RC impedance network? [3+3]
[b] Realize the following R-L network function in Foster form I

$$\frac{2(s+1)(s+3)}{(s+2)(s+8)}$$ [4]

[c] Explain Y parameters in terms of Z parameters. [4]

Q. [3] [a] The specification for a low pass has given below.
$\alpha_{min} = 0.2$ dB, $\alpha_{min} = 28$ dB, $\omega_p = 1$ rad/sec $\omega_s = 2$ rad/sec. Find out the required Chebyshev transfer function to realize this specification. [8]
[b] From the following prototype low pass transfer function obtained the transfer function of Band pass function with B= 100 Hz and $\omega_o = 1$ kHz.

$$H(s) = \frac{1}{s^3 + 1.41421s + 1}$$

[c] Why wave guide and transmission line is used as filter components at high frequency ? [2]

Q. [4] [a] Why delay equalization is important in filter design? Design third order doubly terminated Butterworth ladders with R1 = 2000 Ω and R2 = 400Ω and ω_o = 1KHz. [2+5]
[b] Design third order Butterworth filter with cutoff frequency ω_o = 3 kHz using equal element values design method. [7]

Q. [5] [a] Define single parameter and multi parameter sensitivity. If every capacitor of Tow Thomas Biquad is changed by ± c% and every resistor is changed by ± r% from nominal Values find and worst and best case deviation in ω_o. [2+5]

[b] What is floating inductor? How floating inductor can be simulated using GIC. [1+4]

Q. [6] [a] Simulate the fourth order Butterworth LC ladder circuits using the Leapfrog method of simulation.[7]
[b] Design a switch capacitor filter with the transformer characteristics as shown in the figure below. [7]

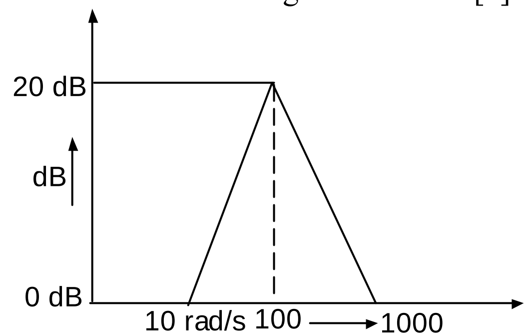

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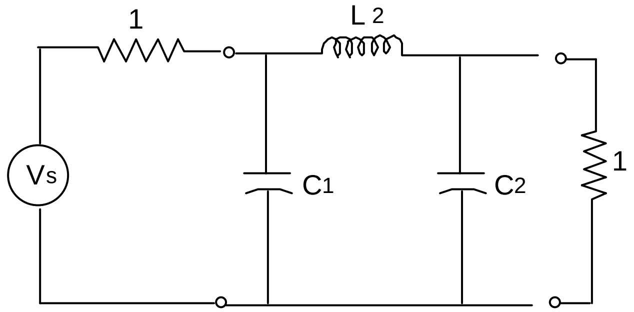
Table1: Pole location of Butter worth response.

N=2	N=3	N=4
-0.7071068 ± j 0.7071068	-0.50000000 ± j 0.8660254 -1.00000000	-0.3826834 ± j 0.9238795 -0.9238795 ± j 0.3826834

Table 2: Elemental values for Doubly Terminated Butterworth filter Normalized to half power frequency of 1 rad/sec.



n	C1	L2	C3	L4	C5
2	1.414	1.414			
3	1.000	2.000	1.000		
4	0.7654	1.848	1.848	0.7654	
5	0.6180	2.000	2.000	1.618	0.6180

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PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION- 2007

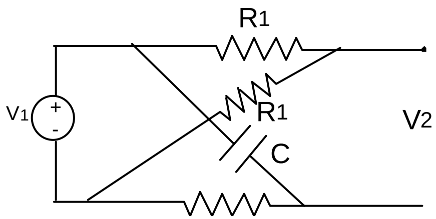
LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

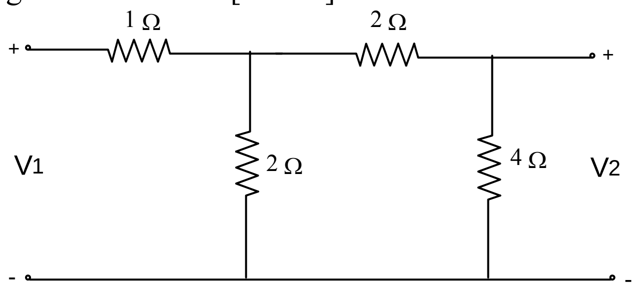
Attempt ALL questions.

Q. [1] [a] Plot the magnitude and phase responses for given RC filter. Justify the plot with the help of location of plkes ar zeroes in s-plane.



[b] Define normalization and denormalization with its importance. [3]

[c] What is PRF? Discuss the properties of one port RC network in impedance or admittance function. Find Z-parameters of a given network. [1+2+5]



Q. [2] [a] Obtained the order and cut-off frequency of the filter using butterworth response to realize the following specifications of low pass filter:

$\alpha_{max} = 0.5$ dB $\alpha_{max} = 20$ dB $\omega_p = 1000$rad/sec
$\omega_s = 2000$ rad /sec

[b] Discuss the difference between chebyshev and inversechebyshev approximation in filter design.[4]

[c] On what parameters do the frequency transformation affect? Realize the doubly terminated ladder filter with a low pass butterworth response with n=3, R1 = 60 Ω and R2 = 120 Ω. [2+6]

Q. [3] [a] Define GBP and CMRR. Realize the 1st order non-inverting filter which satisfies the following transfer function: [3+4]

$$T(s) = \frac{S+4}{S+8}$$

[b] Why filter element sensitivities are important in filter design. Discuss single-parameter and multi-parameter sensitivities. [3+3]

[c] What do you mean by Gain enhancement in sallen key Biquad circuit? Explain. [3].

Q. [4] [a] Design a low pass Butterworth active sallen key filter with unity voltage gain. The designed filter circuit must meet the following specifications:

$\alpha_{max} = 0.5$ dB $\alpha_{min} = 20$ dB $\omega_p = 1000$rad/sec
$\omega_s = 2000$ rad/sec

Choose appropriate element values so that the filter can be practically realized. [8]

[b] What is GIC? Design a 4th order Butterworth filter with half frequency of $\omega_o = 200{,}000$ rad/sec and source and load resistance are R = 3 KΩ. The design should make the use of FDNR: [1+7]

Q. [5] [a] Design a switched capacitor filter to realize the transfer function:

$$T(s) = \frac{(s+100)(s+400)}{(s+200)^2}$$

Choose the suitable MOS switching frequency in your design. [8]

[b] Write short notes on (any TWO): [4+4]
[i] Waveguide filter
[ii] Filter and its importance

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[iii] RC-CR transformation.

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PURWANCHAL UNIVERSITY
VI SEMESTER BACK-PAPER EXAMINATION- 2007
LEVEL : B. E. (Electronics & communication)
SUBJECT : BEG337EC, Filter Design.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answer in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] [a] What is filter? Explain its type according to their functioning along with various plots. [8]
[b] Plot the magnitude and phase response for given R-C filter circuit. Justify the plots with the help of location of poles and zeroes in s-plane. [8]

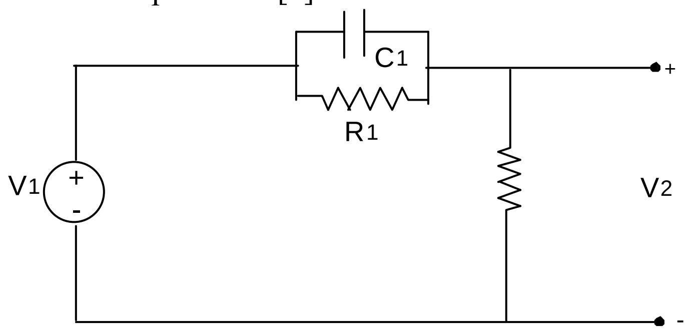

Fig. 1[b]

Q. [2] [a] Why do we need magnitude and frequency scaling? Discuss the properties of one port LC in impedance or admittance function. [3+3]
[b] Realize the following network function in second foster form $F(s) = \frac{(s+1)(s+3)}{(s+2)(s+4)}$ [5].
[c] Determine the Y-parameter of the given network. [5]

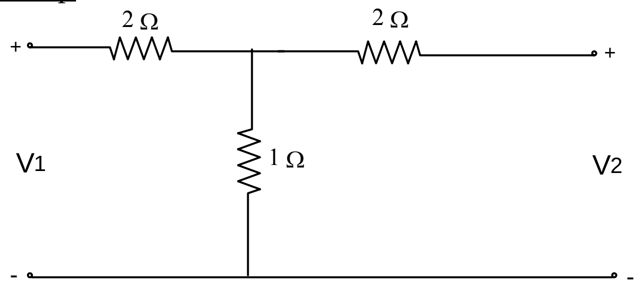

Fig. 1[c]

Q. [3] [a] Obtain the 4[th] order network function of a low pass chebyshev filter with $\alpha_{max} = 0.75$ dB. [8]
[b] Why frequency transformation is important? The filter shown below is a 4[th] order chebyshev low pass passive filter with $\alpha_p = 1$dB $\omega_p = 1$. Obtained a band pass filter from this low pass $\Omega_o = 400$ rad/sec and B = 150. [2+6]

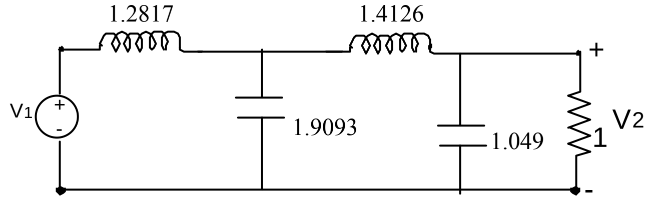

Fig. 2[b]

Q. [4] [a] What is RC-CR transformation? Explain it with the help of example. [4]
[b] Realize the 1[st] order inverting filter which satisfies the transfer function $T(s)\frac{1000}{s+1000}$ [4]
[c] Realize a doubly terminated ladder filter with butterwoth response for n=3 and for [i] R1 = R2 = 1 Ω and [ii] R1 = 1 Ω and R2 = 2 Ω

Q. [5] [a] Design a 4[th] order low pass Betterworth filter using equl element desing of sallen key circuit. [Take $\omega_o = 2\pi 1000$ rad/sec. and capacitor of 0.1 µF.]
[b] Discuss the role of sensitivity in filter design. [2]
[c] What is leapfrog simulation of passive filter and why it is needed? Explain in detail. [7]

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Q. [6] [a] Design a switched capacitor filter which satisfies the given magnitude response in Bode plot. Choose the suitable MOS switching frequency in your design. [7]

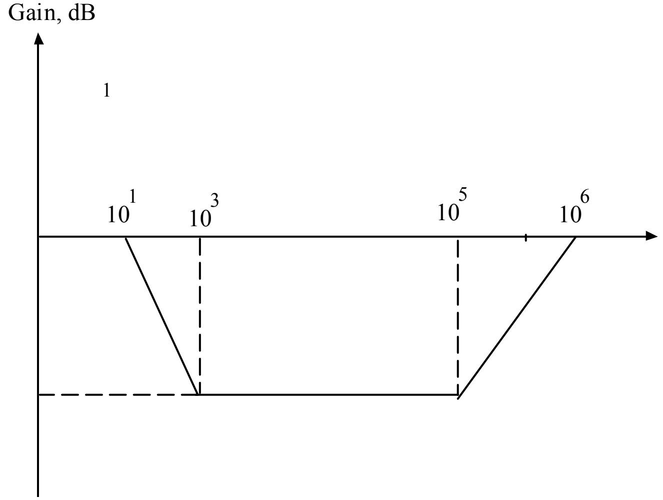

Fig. 6[b]

[b] Write short note on: [3×3=9]

[i] Waveguide filter.

[ii] FDNR

[iii] Importance of delay equalization in filter design.