Dr. Mahalingam College of Engineering and Technology, Pollachi-3

(An Autonomous Institution)

CCET II (2016Regulation)

Name of Programme: **B.E - EEE**

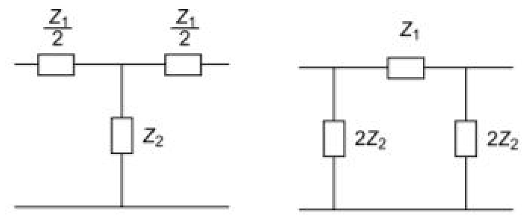
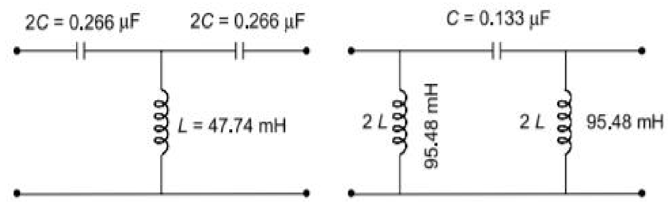
Course Code & Course Title:**16EET44 – Networks and Signals**

Sem:IV Date & Session:16.03.2018 (FN1) Duration: 1½ hours Max. Marks: 50

Part- A Objective Questions (10X1=10 Marks)

Q. No	Question	CO No	Blooms Level
1	a) zero attenuation in the pass band	CO3	U
2	a) 57.32 mH; 0.283 μF	CO3	R
3	False	CO3	R
4	K-type filters	CO3	R
5	a) Above cut off frequency	CO3	U
6	Superposition	CO4	U
7	a) Step function	CO4	R
8	c) Random signals	CO4	R
9	E= Finite and P=0	CO4	U
10	b)δ(n) = 1 , n=0 0, n# 0	CO4	U

Part- B Short Answer Questions (5X2=10 Marks)

Q. No	Question	CO No	Blooms Level
11	Draw the symmetrical T and π representation of filter network. 	CO3	R
12	Design a high pass T-section filter having a cut-off frequency of 1000Hz to operate with a terminated load resistance of 600Ω. $L = \frac{K}{4\pi f_c} = \frac{600}{4\times\pi\times1000} = 47.74\text{ mH}$ $C = \frac{1}{4\pi k f_c} = \frac{1}{4\pi\times600\times1000} = 0.133\ \mu\text{F}$ 	CO3	U
13	Differentiate pass band and stop band filters. **S.No | Band Pass Filter | Band Stop Filter** 1 | A band pass filter is one which attenuates all frequencies below a lower cut-off frequency f1 and above an upper cut-off frequency f2 | BSF is one which passes without attenuation all frequencies less than the lower cut-off frequency f1, and greater than the upper cut-off frequency f2. 2 | A band pass filter may be obtained by using a low pass filter followed by a | a band stop filter can be realized by connecting a low pass filter in parallel	CO3	R

	<table><tr><td></td><td>high pass filter</td><td>with a highpass section</td></tr><tr><td>3</td><td>cut-off frequency of the LP filter is above the cut-off frequency of the HP filter</td><td>Cut-off frequency of low pass filter is below that of a high pass filter</td></tr></table>		
14	Distinguish between Energy and Power signals. 1.Energy signals are time limited while power signals can exist over infinite time. 2.Non periodic signals are energy signals while power signals are periodic. 3.Power of an energy signal is zero and the energy of a power signals is infinite. 4.A power signal is a signal that has finite power for each point in time. So if a signal is a power signal then the value at each point should be finite. 5. An energy signal is one that has finite energy. So if you integrate the power over all time, it should be finite.	CO4	U
15	List the classifications of signals. 1. Even and Odd Signals 2. Periodic and Non-Periodic Signals 3. Energy and Power Signal 4. Deterministic and Random Signals 5. Causal and Non-causal Signals	CO4	R

Part- C **Descriptive – either or questions** **(2X15=30 Marks)**

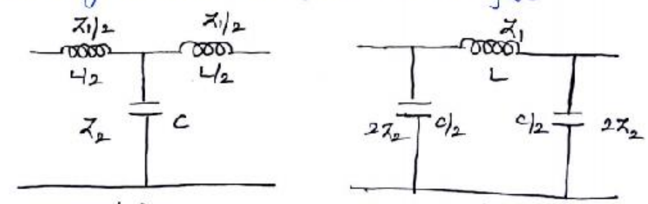
Q. No	Question	CO No	Blooms Level
16. (a)	(i) Derive the characteristic impedance of constant K low pass filter and also draw the impedance curve with frequency. (10)	CO3	U

* A network either T or π is said to be of the constant-K type if Z_1 & Z_2 of the network satisfy the condition

$$Z_1 Z_2 = K^2 \quad \text{— (1)}$$

where Z_1 & Z_2 are impedances in the T and π sections.

* A prototype T and π sections are shown in the figure where $Z_1 = j\omega L$ and $Z_2 = \frac{1}{j\omega C}$.



(a) (b)

* $Z_1 Z_2 = K^2$

$\Rightarrow j\omega L \times \frac{1}{j\omega C} = K^2 \Rightarrow K^2 = \frac{L}{C}$

$\therefore K = \sqrt{\frac{L}{C}}$ which is independent of frequency — (2)

classification of pass & stop band, the cut off frequencies are

$\frac{Z_1}{4Z_2} = 0$

And also $\frac{Z_1}{4Z_2} = -1$

$$\frac{-\omega^2 LC}{4} = -1$$

$$\frac{\omega^2 LC}{4} = 1$$

$$\therefore \frac{(2\pi f_c)^2 LC}{4} = 1$$

$$f_c = \frac{1}{\pi\sqrt{LC}} \quad \text{— (3)}$$

Calculation of characteristic impedance:

The characteristic impedance can be (given) as,

$$Z_{0T} = \sqrt{Z_1 Z_2\left(1+\frac{Z_1}{4Z_2}\right)}$$

$$= \sqrt{j\omega L \times \frac{1}{j\omega C}\left(1 - \frac{\omega^2 LC}{4}\right)}$$

$$= \sqrt{\frac{L}{C}\left(1-\frac{\omega^2 LC}{4}\right)}$$

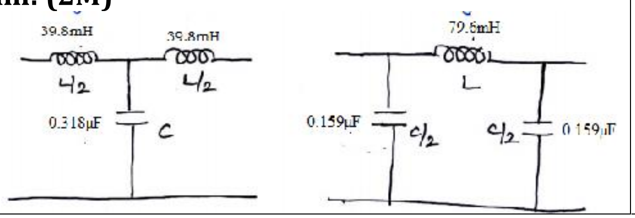
$$Z_{0T} = k\sqrt{1-\left(\frac{f}{f_c}\right)^2}$$

(ii) Design a low pass filter (T or pi network) having the cut off frequency of 2 kHz with load resistance of 500Ω. (5)

Design of L and C (3M)

For low pass filter, L= $\frac{K}{\pi f_c}$ = 79.6mH C = $\frac{1}{\pi k f_c}$ = 0.318μF

Diagram: (2M)



OR

16. (b)	Design a m derived high pass filter with a cut off frequency of 10KHz, design impedance of 5Ω and m=0.4.	CO3	U

i) Design of L and C (4 Marks)

For high pass filter, L= $\frac{K}{4\pi f_c}$ **= 0.398μH**

C = $\frac{1}{4\pi k f_c}$ **= 1.59μF**

ii) Elements of modified high pass filter: (7 M)

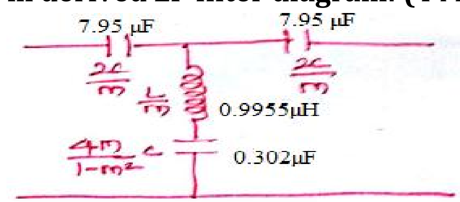
T section Elements are, 2C/m =7.95 μF,

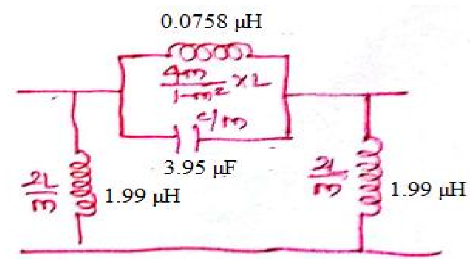
L/m =0.9955μH,(4m/1-m²)C =0.302μF

π section Elements are, 2L/m =1.99 μH,

C/m = 3.95 μF,(4m/1-m²)L =0.0758 μH

iii) m derived LP filter diagram: (4 M)





17. (a)	Check the following systems are causal or non-causal, time variant or invariant, linear or nonlinear, static or dynamic, stable or unstable. **(i) y(n)= x(2n) : Time variant, Non-causal, Dynamic, Linear , Stable** **(ii) y(n)=Ax(n)+B (7) : Time invariant, causal, static, Non-Linear, Stable** **(iii) y(n) = n x(n): Static, Linear, Time Variant, Causal, Unstable**	CO4	Ap
	OR		
17. (b)	i) Check whether the following signals are periodic and find its fundamental period. (6) **x(n)=Sin 2πn (3M)** compare with x(n) = Sin 2πfn 2πfn = 2πn , f = (2πn/2πn)=1/1=K/N Signal is periodic with fundamental period N =1 **x(n)= cos 2πn +cos 8πn (5 M)** $2\pi f_1 n = 2\pi n$, $f = (2\pi n/2\pi n)=1/1=K_1/ N_1$ $2\pi f_2 n = 8\pi n$, $f = (8\pi n/2\pi n)=4/1=K_2/ N_2$ $N_1/ N_2 = 1/1$ Signal is periodic with fundamental period N =1 ii) Check the signal x(n)= sin(nπ/3)is energy signal or power signal. (5) $E = \sum_{n=-\infty}^{\infty} \lvert x(n)\rvert^2 , \quad P = \lim_{N\to\infty}\left(\frac{1}{2N+1}\sum_{n=-N}^{N}\lvert x(n)\rvert^2\right).$ E = Infinity and P=1/2. It is a power signal.	CO4	Ap

	iii) If x(n)={ 0,2,-1,0,2,1,1,0,-1} determine x(n-3) and x(-n). Also represent graphically. (4)