

Con. 2783-09.

Filter Theory

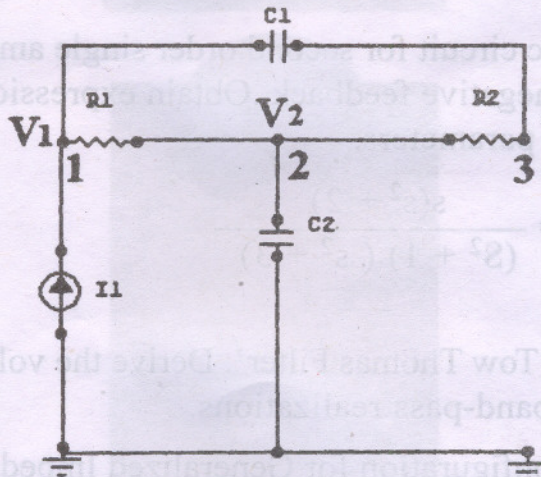
(REVISED COURSE)

(3 Hours)

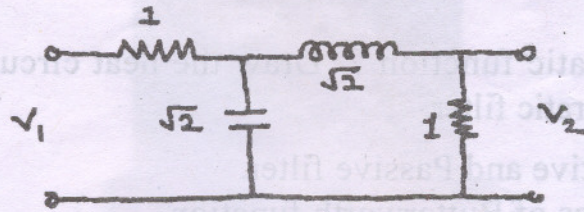
[Total Marks : 100]

- N.B. : (1) Attempt any **five** questions.
 (2) Assumptions made should be **clearly** stated.
 (3) **Figures** to the **right** indicate **full** marks.

1. (a) Find the S-domain transfer function $V_3(s)/I_1(s)$ for the circuit shown in **figure**. 10



(b) Transform the given filter to band-pass filter. Find transfer function of transformed filter. Find new values of components, if $f = 15 \text{ kHz}$, $C = 0.1 \mu\text{F}$. 10



2. (a) Determine the order of Butterworth response with the following specification 10 and also realize the filter circuit.

$$\omega_p = 1 \text{ rad/sec}; K_p = 3 \text{ dB}$$

$$\omega_s = 2 \text{ rad/sec}; K_s = 15 \text{ dB.}$$

(b) Explain how a leap-frog filter is developed, use this concept and realize third order low pass filter. 10

3. (a) Find the order of Chebyshev magnitude function required to meet the following specifications :— 10

$$\omega_p = 1 \text{ rad/sec.}, K_p = 0.5 \text{ dB}$$

$$\omega_s = 233 \text{ rad/sec.}, K_s = 20 \text{ dB}$$

Determine transfer function and synthesize it for a termination in 50Ω .

(b) Explain how resistor is realized by a MOS switched capacitor. 10

4. (a) Design a band pass Sallen and Key filter to meet the specifications $f = 5$ kHz, $Q = 5$ and $C = 10^{-8}$ F. Also draw its circuit diagram. How do we transform low pass Sallen and Key filter to high pass filter? Hence design high pass filter to meet the specifications $f = 5$ kHz, $Q = 1/\sqrt{2}$ $C = 10^{-8}$ F. 10
- (b) Develop state variable filter and derive the expressions for voltage transfer function of high pass and band pass filter. 10
5. (a) Draw the schematic circuit for second order single amplifier band-pass filter with positive and negative feedback. Obtain expressions for ω_n , $1/Q$ and H_0 in terms of circuit parameters. 10
- (b) Synthesize $z(s) = \frac{s(s^2 + 2)}{(s^2 + 1)(s^2 + 3)}$ 10
6. (a) Draw and explain 'Tow Thomas Filter'. Derive the voltage transfer functions for low-pass and band-pass realizations. 10
- (b) Draw the circuit configuration for Generalized Impedance Converter (GIC). Derive the transfer function and determine its components for realizing inductance. 10
7. (a) What is Biquadratic function? Draw the neat circuit diagram of single amplifier bi-quadratic filter. 10
- (b) (i) Compare Active and Passive filter. 5
(ii) List properties of Butterworth function. 5