

Con. 5149-08.

(REVISED COURSE)

RC-6512

(3 Hours)

[ Total Marks : 100

- N.B. (1) Attempt any **five** questions.  
 (2) Assume **suitable** data if **necessary**.  
 (3) **Figures** to the **right** indicate **full** marks.

1. Attempt any **four** :—

- (a) Determine the order of Butterworth response that realizes the following specifications and also find the Butterworth function, **5**  
 $\omega_p = 1$  rad/sec, pass-band attenuation  $k_p = 3$ dB  
 $\omega_s = 2$  rad/sec, stop-band attenuation  $k_s = 15$ dB.
- (b) Draw a neat circuit diagram of Akerberg-Mossberg filter and derive the expression for its voltage transfer function having low pass characteristics. **5**
- (c) Explain the principle of realization of a resistor in a switched capacitor. **5**
- (d) From the basic principles develop the circuit diagram of the state variable filter. **5**
- (e) From the basic diagram of a passive ladder network, develop the block diagram of a leap-frog filter. **5**

2. (a) Determine the network function for a third order Butterworth high pass filter (normalised) and synthesize it. **10**
- (b) Determine the order of Chebyshev magnitude function with the following specifications **10**  
 (i) Pass Band 0 to 1 MHz  
 (ii) Pass Band ripple 0.5 dB  
 (iii) Stop Band : 2 MHz  
 (iv) Stop Band attenuation = 40 dB.  
 Also develop the filter circuit.

3. (a) With the help of neat circuit diagram explain the working of Tow Thomas filter and derive its transfer function. **10**
- (b) Draw the neat circuit diagram of the Generalized impedance converter (GIC) and derive its transfer function. **10**

4. (a) Synthesize the following function :— **10**

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

- (b) Realize the following voltage transfer function using an LC Ladder terminated in a  $1 \Omega$  resistor :— **10**

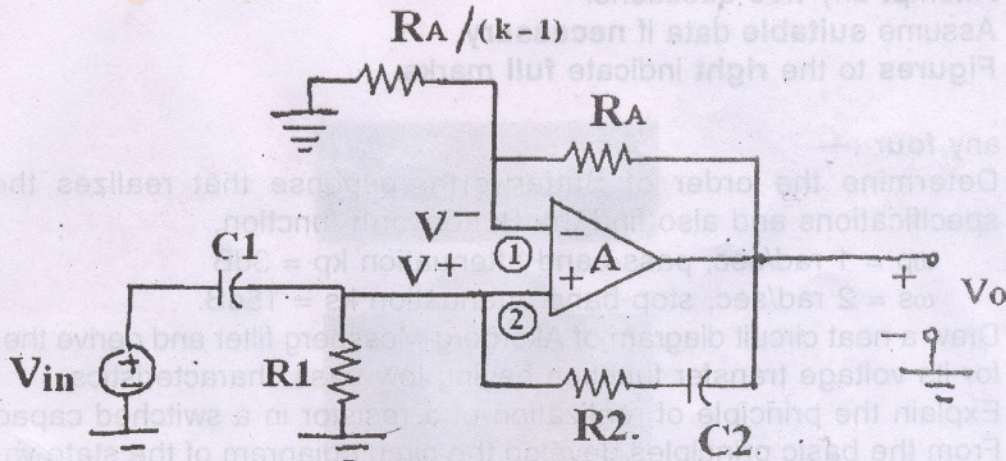
$$T(s) = \frac{s}{s^4 + 3s^3 + 3s^2 + 3s + 1}$$

5. (a) Sketch the gain versus frequency for the voltage transfer function given below :— **10**

$$T(s) = 10 \frac{s^2 + 16}{s^2 + 2s + 100}$$

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- (b) The active RC circuit shown in **Figure** below realizes a second-order high-pass function. **10**  
 Find its transfer function  $V_o / V_i$ , and derive expressions for the sensitivity of  $W$  to elements  $R_1, R_2, C_1, C_2$  and the amplifier gain  $A$ .



6. (a) Draw the schematic circuit for a Sallen and Key high pass filter and derive an expression **10**  
 for the voltage transfer function in the standard form for a second order high pass transfer function in terms of parameters  $W, Q$  and  $H_0$  and hence obtain expression for them in terms of circuit parameters.
- (b) Draw the neat circuit diagram of infinite gain single amplifier band pass filter. Realize **10**  
 it with  $f_n = 10 \text{ KHz}$  and  $Q = 10$ .
7. (a) What is bi-quadratic function, Identify the bi-quadratic parameters  $k, \omega_z, \omega_p, Q_z, Q_p$  **10**  
 from the following function :—

$$H(s) = \frac{4s^2 + 36}{2s^2 + 6s + 12}$$

- (b) Derive the voltage transfer function of the following circuit. [The switching **10**  
 frequency is  $f$ .]

