



Q.1: [20]

- A frequency synthesizer uses a PLL to synthesize a 1-MHz signal from a 25 KHz reference frequency. If the detector gain $K_d=2V/\text{rad}$, and the VCO gain factor $K_0=100\text{Hz}/V$. Find the PLL transfer function if a first order low pass filter was used. Hence, compute (i) the natural frequency, (ii) the overall PLL gain factor, and (iii) the PLL magnitude and phase response.
- Explain the basic structures of AM transmitters/receiver circuits.
- Derive an expression for the noise margin of basic TTL circuits.

Q.2: [20]

- If the quantized analog input is rapidly changed in sign, Design a suitable ADC suitable for this type of waveforms.
- If the input voltage of a dual slope ADC is considered to be positive: (a) Derive mathematical expressions for the corresponding binary output and (b) Draw a timing diagram at each stage output.

Q.3: [20]

- An LC dp function has infinite impedance at 1000 Hz and 4000 Hz and the impedance is zero at 2500 Hz. The impedance at 500 Hz is $1k\Omega$. Find the function.
- Find a Butterworth approximation function for the following band reject requirements: $A_{\max}=0.2 \text{ dB}$, $A_{\min}=40 \text{ dB}$, pass bands: below 1000 Hz and above 6000 Hz, and stop band: 2000 Hz to 3000 Hz.

Q.4: [20]

- A singly terminated high pass filter. Find an LC network terminated by a load resistor of 1Ω resistor satisfying the high pass Butterworth filter requirements: $\omega_p=3000 \text{ rad/sec}$, $\omega_s=1000 \text{ rad/sec}$, $A_{\max}=0.5 \text{ dB}$ and $A_{\min}=25 \text{ dB}$.
- The impedance of an LC network is infinite at 20 rad/sec and 40 rad/sec; zero at 30 rad/sec and 50 rad/sec; and 200Ω at 10 rad/sec, find the network meeting these specifications.

Q.5: [20]

- Use the circuit shown in Fig.3b to realize a Butterworth low pass requirements of $A_{\max}=0.5 \text{ dB}$, $A_{\min}=35 \text{ dB}$, $\omega_p=1000 \text{ rad/sec}$, and $\omega_s=$
- Synthesize the high pass filter function:

$$T(s) = \frac{s^2}{s^2 + 200s + 640,000}$$

using the topology shown, with practical elements.

