1) Design a Butterworth filter (LP) for the following specifications.

$K_p = -3dB$, $K_s = -15dB$, $\Omega_p = 500 r/s$, $\Omega_s = 1000 r/s$

2) Design a Butterworth HPF to meet the following specifications.

i) Pass band attenuation = 3dB
ii) — " — edge freq = 200 r/s.
iii) stop band attenuation ≥ 25dB
iv) — " — edge freq ≤ 100 r/s.

3) Transform a 3rd order Butterworth normalized filter to HPF with pass band edge freq of 2 r/s.

4) If $H_{N}(s) = \frac{1}{s^2+\sqrt{2}s+1}$ is TF of LPF with pass band of 1 r/s. use freq. transformation to find TF of following analog filters.

i) A LPF with passband of 10 r/s.
ii) A HPF with passband of 100 r/s.

5) Consider 2nd order LPF with cutoff freq of 500 Hz. Find the attenuation in dB at 1 KHz.

6) Design a chebyshev - I analog filter to meet following specification.

i) Pass band attenuation of 2dB at 4 r/s.
ii) Stop band attenuation of 10dB at 7 r/s.

7) Find half power freq of fifth order chebyshev-I LPF with 2dB passband edge at 1KHz.

[Hint: find TF $H(j\Omega)$ & substitute $|H(j\Omega)| = \frac{1}{2}$ & find Ω]

8) Let Ω_p & Ω_s denote desired passband & stopband edge freq. of an analog filter. Let δ_p & δ_s be passband & stopband attenuations. S.T the order of the filter required to meet given specifications is

$$N \geq \log(1/d) \div \log(1/K)$$

where $d = \sqrt{\dfrac{(1-\delta_p)^{-2} - 1}{\delta_s^{-2} - 1}}$ is discrimination factor

& $K = \dfrac{\Omega_p}{\Omega_s}$ is selectivity factor.

9) Find order for analog butterworth filter & chebyshev-I filter for the following specification and comment on the result.

Pass band attenuation = 0.1
Stop band —"— = 0.1
Pass band edge freq = 100 Hz
stop —"— = 200 Hz.

(10) Design a analog chebyshev-1 filter (High pass) to have -3dB cut off freq of 200 Hz. & a stopband attenuation of ≥ 25dB for all freq. below 100 Hz.

(11) using Billinear transformation design HPF monotonic in passband with cut off frequency of 1000 Hz & 10 dB attenuation at 350 Hz. Sampling frequency 5000 Hz. RB - 5.49, 50

[Hint : Passband attenuation not given so can be assumed as 3dB]

(12) Obtain an analog chebyshev - I filter transfer function that satisfies the constraints $1/\sqrt{2} \leq |H(j\Omega)| \leq 1$; $0 \leq \Omega \leq 2$ r/s RB - 5.25

$|H(j\Omega)| \leq 0.1$; $\Omega \geq 4$ r/s.

(13) The system function of an analog filter is given by. Ch - 4.82 obtain H(z) using impulse invarient method.

$H_a(s) = \frac{1}{(S+1)(S+2)}$ obtain $H(z)$ using impulse invarient method.

Take sampling frequency of 5 samples / sec.

Ch - 4 - 129

(14) The specification of the LPF are given as

$0.8 \leq |H(\omega)| \leq 1$ for $0 \leq \omega \leq 0.2\pi$

$|H(\omega)| \leq 0.2$ for $0.32\pi \leq \omega \leq \pi$

Design chebyshev filter using Bilinear transformation.

Ch-4-118

Assuming T = 2.

(15) Design IIR filter that when used in prefilter A/D-H(z)-D/A structure will satisfy the following equalient analog specification.

(i) LPF with -1 dB at 100π r/s

(ii) Stop band attenuation of 35 dB or greater. 1000π r/s

(iii) Monotonic Passband & stopband Ch-4-131

(iv) Sampling rate of 2000 sample / seconds.

(16) Design a digital LPF to satisfy the following passband ripple & Stopband attenuation

$1 \leq |H(j\Omega)| \leq 0$ for $0 \leq \Omega \leq 1404\pi$ r/s. Sampling interval T_s =

$H(j\Omega) \geq 60$ dB for $\Omega \geq 8268\pi$ r/s. Use Bilinear transformation. assuming $\frac{2}{T} = 1$.

$T_s = 1/10^4$ sec.