EEL319
Major

Time 2 hours **Marks 50**

Note : It is open book, notes exam. But no exchange is allowed.

1. Transform a second order continuous time system $H(s)=\frac{s+a}{(s+a)^2+b^2}$ into a digital step invariant system. Find the corresponding $H(z)$.

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2. Impulse invariant transformation is a method of converting analog systems into a discrete systems, by uniform sampling the impulse response h(t), i.e. g(n)=h(nT). Prove that

$$G(z)=\frac{1}{T}\sum_{k=-\infty}^{\infty}H(s+j\frac{2\pi k}{T})_{s=1/T\ln(z)}\Big|=\sum_{allpoles}\text{Re}\,sidue\left[\frac{H(s)}{1-e^{sT}z^{-1}}\right]$$

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3. Let h[n] denotes the impulse response of an ideal low pass filter with cut off at $\omega_c=\pi/2$. Let $h_{HT}[n]$ denotes the impulse response of Hilbert transform, show that

$$h_{HT}[n]=(-1)^n 2h[n]$$ 8

4. How many real additions and multiplications would be required to multiply two complex numbers A and B. Can the number of multiplication be reduced at the cost of additions.

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5. Let a(n) is defined as $a(n)=\sum_{k=-\infty}^{\infty}x(k)x(n+k)$; where x[n] is a real-valued discrete-time signal. Express discrete time Fourier transform (DTFT) of a(n) in terms of DTFT of x[n]. Suppose x[n] is finite N ($=2^m$) length sequence. Explain how FFT program be used to compute a(n) from x[n].

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6. Realize $H(z)=\frac{a+bz^{-1}}{1+cz^{-1}}$ in direct form II. Compute the expression of normalized output noise variance for each realization when quantization is done before as well as after the addition.

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7. Give two methods of obtaining IDFT from FFT structure.

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