BE Semester-VII EC Question Bank

Digital Signal Processing

All questions carry equal marks (10 marks)

Q.1	Prove the following properties of Fourier Transform. (1) Linearity (2) Frequency shifting
Q.2	For each of the following system, determine whether the system is (1) stable (2) Cuasal (3) Linear (4) Time Invariant (5) memoryless (i) $y(n)= x[n-n_0]$ (ii) $y(n) = x[-n]$
Q.3	Perform the linear convolution of the sequences graphically. $x[n] = \{1, 2, 0.5, 1\}$ and $h[n] = \{1, 2, 1, -1\}$
Q.4	Define DTFT. Using DTFT, find impulse response of a LTI system described by different equation $y(n) - {}^{1}/_{2}\, y(n-1) = x(n) - {}^{1}/_{4}\, x(n-1)$
Q.5	Explain the properties of Discrete Time Fourier Transform.
Q.6	List the properties of the region of convergence for the Z transform with suitable example.
Q.7	Prove the following properties of Z-transform. (1) Differentiation of X(z) (2) Time Shifting
Q.8	Prove the following properties of Z-transform. (1) Convolution of sequences (2) Time Reversal
Q.9	Determine the z-transform including the region of convergence for the following sequences. (a) $\left(\frac{1}{2}\right)^{n} u[n]$ (b) $\left(\frac{1}{2}\right)^{n} (u[n] - u[n-10])$
Q.10	Find the inverse z- transform : (i) $X(z) = \frac{1-az^{-1}}{z^{-1}-a}$, $\quad |z| > |{}^{1}/_{a}|$ (ii) $X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$, $\quad |z| > 1$
Q.11	The input to a causal linear time invariant system is $x[n] = u[-n-1] + \left(\frac{1}{2}\right)^{n} u[n]$ The z-transform of the output of this system is $Y(z) = \frac{-\frac{1}{2}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)(1+z^{-1})}$ (a) Determine H(z), the z-transform of the system impulse response. Indicate ROC. (b) What is ROC of Y(z). (c) Determine y[n].
Q.12	Consider the following linear constant coefficient difference equation: $y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = 2x[n-1]$ Determine the impulse response h[n].
Q.13	Explain frequency domain representation of sampling.

Q.14	Explain how bandlimited signal can be reconstructed from its sample?
Q.15	Find the Direct form-I and Direct form-II for a causal LTI system with the following transfer function. $$H(z) = \frac{1 + \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-1}\right)}$$
Q.16	Explain structures for Linear Phase FIR systems.
Q.17	Explain the Direct-I and Direct-II structure of IIR filter system.
Q.18	For the system function given by $$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}$$ Draw a signal flow graph that implements this system as a cascade form & parallel form realization.
Q.19	Consider a causal linear time invariant system whose system function is $$H(z) = \frac{1 - \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-1}\right)}$$ Draw the signal flow graphs for implementations of the system in each of the following forms: (i) Direct form I (ii) Direct form II (iii) Cascade form using first order and second order direct form II sections.
Q.20	Prove & explain time shifting property of DFT. Find 4 point DFT of $x(n)=\cos(n\pi/4)$.
Q.21	How linear & circular convolution differs from each other. Find circular convolution of $x(n)=(4,3,2,1)$ & $h(n)=(3,2,1,0)$
Q.22	Explain with block diagram various features of a typical DSP processor.
Q.23	Compare IIR & FIR filter.
Q.24	Explain window method in FIR filter design.
Q.25	Differentiate between FFT & DFT. Draw Decimation in Frequency FFT algorithm.
Q.26	Differentiate between FFT & DFT. Draw Decimation in Time FFT algorithm.
Q.27	Explain applications of DSP.
Q.28	Define DFT. Explain the properties of DFT.
Q.29	Determine linear convolution of the given sequences $x[n]=\{1,2\}$ & $h[n]=\{2,1\}$ using DFT and IDFT methods. Compare it with circular convolution of x[n] & h[n].
Q.30	Prove circular shift of a sequence property of DFT.
Q.31	Compare computational complexity using direct DFT computation and using FFT. Compute the 8-point DFT of the sequence $X(n)=1 \ , 0 \le n \le 7$ $= 0$ otherwise Use DIT-FFT algorithm. (Show flow graph)
Q.32	Compare the commonly used windows of FIR filter design method. Use Kaiser window method to design a discrete-time filter with generalized linear phase that meets specifications of the following form:

	$\|H(e^{jw})\| \leq 0.01,\ 0 \leq \|w\| \leq 0.25\pi$, $0.95 \leq \|H(e^{jw})\| \leq 1.05,\ 0.35\ \pi \leq \|w\| \leq 0.6\ \pi$, $\|H(e^{jw})\| \leq 0.01,\ 0.65\ \pi \leq \|w\| \leq \pi$ Determine the minimum length (M+1) of the impulse response and the value of the Kaiser window parameter β for a filter that meets the Preceding specifications. What is the delay of the filter?
Q.33	State the procedure for the design of IIR filter from analog filter Specifications.
Q.34	State the procedure for the design of FIR filter.
Q.35	Write a short note on impulse invariance method for designing IIR filter.
Q.36	Write a short note on bilinear transformation method for designing IIR filter.
Q.37	Write a short note on Goertzel algorithm.
Q.38	Explain types of FIR filter.Also explain Gibbs phenomena.
Q.39	Explain Discrete Fourier series and Discrete Fourier transform.
Q.40	(a)Show relationship between DTFT and Z transform. (b) What is the relationship between DTFT and DFT?