QUESTION BANK - GUJARAT UNIVERSITY

DIGITAL SIGNAL PROCESSING

B.E. Semester – 7 (Inst. & Control)

Each question carries 10 marks

Bold figure in digital sequence indicates reference value of the signal

Q-1	**Answer the following questions in brief (any five)** (i) If x[n]=[-1,0,**5**,1,2,6,7] then write x[n-2]? (ii) What is memory less system? Give an example of it. (iii) Determine whether the system y[n]=x[-n] is time invariant or time variant? (iv) Draw the complete block diagram for digital processing of an analog signal. (v) What is meant by aliasing? How can it be avoided? (vi) Find the energy and power of $x(n) = Ae^{j\omega n}\,u(n)$.
Q-2	**Answer the following questions in brief (any five)** (i) Define multi channel and multi dimensional signals (ii) Define symmetric and anti symmetric signals. (iii) Differentiate recursive and non recursive difference equations. (iv) Sketch the discrete time signal x(n) =4 δ (n+4) + δ(n)+ 2 δ (n-1) + δ (n-2) - 5 δ (n-3**)** (v) What are the advantages of DSP? (vi) State the Sampling Theorem.
Q-3	Find inverse Z – transfer of $X(Z) = 1/(1- 1.5\,z^{-1} +0.5\,z^{-2})$ if (i) ROC : |z| > 1, (ii) ROC : |z| < 0.5, (iii) ROC : 0.5 < |z| <1
Q-4	Determine the transfer function, and impulse response of the system $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$.
Q-5	Find the convolution sum of $x(n) = \begin{cases} 1 & n = -2, 0, 1 \\ 2 & n = -1 \\ 0 & otherwise \end{cases}$ and $h(n) = \delta(n) - \delta(n-1) + \delta(n-2) - \delta(n-3)$.
Q-6	Find the Z transform and ROC

	(i) $x(n) = 2^n\, u(n-2)$ (ii) $x(n) = n^2\, u(n)$
Q-7	Using DFT and IDFT method, perform circular convolution of the sequence x(n) = {1, 2, 2, 1} and $h(n)$ = {1, 2, 3}.
Q-8	Find DFT of the sequence $x(n)$ = { 1, 1, 1, 1, 1, 1, 0, 0} using radix -2 decimation in frequency FFT algorithm. Draw flow graph.
Q-9	Compute the eight point DFT of the given sequence $x(n)$ = { ½, ½, ½, ½, 0, 0, 0, 0} using radix – 2 decimation in time FFT algorithm. Draw flow graph.
Q-10	Determine whether the following system are (a) linear or non linear, (b)time-invariant or time-variant. i)y(n) =x(2n) ii)y(n) =n x^2 (n)
Q-11	Check whether following systems are (a)causal or non causal (b) stable or unstable i) y(n) = cos (x(n)) ii) y(n) =x(n) +n x (n+1)
Q-12	Find the periodicity of the signal x(n) =sin **(2**πn / 3)+ **cos (**π n / 2)
Q-13	State and prove the properties of Z transform.
Q-14	Find the Z transform of the following signal with ROC i) x(n) =[$(1/2)^n$ – $(1/4)^n$] u(n) ii) x(n) = n$(-1)^n$ u(n)
Q-15	Find the Z transform of the following sequence and ROC. Sketch the pole zero diagram i) x(n) = a^n u(n) +b^n u(n) + c^n u(-n-1) , |a| <|b| <| c| ii) x(n) = cos ωn u(n)
Q-16	Compute the convolution of the signal x(n) = $(1/3)^n$; 0<= n<=5 = 0 ; otherwise h(n) = 1 ; -2<= n<=2 = 0 ; otherwise
Q-17	Determine the response y(n),n ≥ 0 of the system described by the second order difference equation y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1) to the input x(n)=4^nu(n)
Q-18	Compute the convolution of the following signal by means of z-transform x(n) = $(1/3)^n$; n≥0 = $(1/2)^{-n}$; n< 0 h(n) = $(1/2)^n$u(n)
Q-19	Using long division method determine the inverse Z transform of X(Z)= $(1+2Z^{-1})$/

	$(1+2Z^{-1}+Z^{-2})$ if (a) x(n) is causal, and (ii) x(n) is anticausal
Q-20	Explain in detail the symmetry properties of the DFT.
Q-21	Calculate 8-point DFT of x(n)= {1,2, 1,2}
Q-22	Find circular convolution of the following sequences: X(n)={1,2,3,4} h(n)= {2,1,3,2}
Q-23	Consider the signal x(n)= 2 + 2cos (πn/4)+ 2cos (πn/2)+ (1/2) cos (3πn/4) (i) Determine and sketch its power density spectrum (ii) Evaluate power of the signal
Q-24	Explain in detail lattice structure for FIR filter.
Q-25	Determine the cross correlation $r_{xy}(l)$ of the following sequence x(n)**=**{…,0,0,2,**-1**,3,4,2,1,-2,0,0,…} y(n)**=**{…,0,0,1,-1,**2**,-2,3,1,-2,4,0,0,…}
Q-26	The zero-state response of a causal LTI system to the input x(n)={1,3,3,1} is y(n)={1,4,6,4,1}. Determine its impulse response.
Q-27	Determine the Fourier transform X(w) of the signal x(n)={1,2,**3**,2,1,0}
Q-28	Obtain the direct form I, direct form II, cascade, and parallel structures for the following sequence y(n) = (-0.1) y(n-1) - 0.52y(n-2) - x(n) + 0.234x(n-1)
Q-29	For the given sequence x(n)={2,0,0,1} and h(n)={4,3,2,1} (i) Find 4-point DFT of x(n) and h(n) (ii) Perform Y(k)= X(k)*H(k) (iii) Find IDFT of Y(k)
Q-30	Given a three stage lattice filter with coefficient K1=1/4, K2=1/4, K3=1/3, determine the FIR filter coefficients for the direct form structure.
Q-31	Determine the lattice coefficients corresponding to the FIR filter with system function $H(z) = A_3(z) = 1+(13/24)z^{-1} + (5/8)\, z^{-2} + (1/3)\, z^{-3}$
Q-32	Determine the unit step response of the system given by difference equation y(n) = 0.9 y(n-1) – 0.81y(n-2) + x(n).
Q-33	(i) Prove the convolution property in z-plane (ii) Prove the initial value theorem and differentiation properties in Z-plane.
Q-34	Discuss the properties of the region of convergence for the z-transform with relevant sketches and illustrations.
Q-35	Explain the bilinear transformation method for IIR filter design. How does this method overcome the limitation of other filter design methods?
Q-36	Write a brief note on rectangular window technique of FIR filter.

Q-37	Find the output sequence y(n) if h(n) =(1,1,1) and x(n) =(1,2,3,1) using a circular convolution.
Q-38	**Answer the following questions in brief (any five)** (i) What are Energy and Power signals? (ii) Whether the system defined by the impulse response $h(n) = 2^{n} u(-n) + 2^{-n} u(n)$ is causal ? Justify your answer. (iii) What do you mean by BIBO stable? (iv) Differentiate between analog, discrete, quantized and digital signals. (v) Differentiate between one dimensional and two dimensional signal with an example for each. (vi) For the signal f (t) = cos2 (4000πt) + 2 sin (6000πt), determine the minimum sampling rate for recovery without aliasing.
Q-39	(i) State and prove the Parseval's relation of DFT. (ii) What is FFT and what are its advantages?
Q-40	Find the linear and circular convolution of the sequences x(n)={1,0.5,2} and h(n)={0.5,1,2}