PEC
EXPLORE INNOVATE EXCEL

PUNJAB ENGINEERING COLLEGE, CHANDIGARH
Mid-Term Examination
February 2020

Programme: B.Tech.

Course Name: Digital Signal Processing

Maximum Marks: 40

Year/Semester: 2nd/ 4th

Course Code: ECN 209

Time Allowed: 90 min

1.	Consider the sequence $x(n) = u(n) - u(n-4)$. (a) Find 4-point DFT of x(n). (b) If y(n) is 4-point circular convolution of x(n) with itself, find 4-point DFT of y(n).	4 3
2.	(a) Find 4-point inverse DFT of sequence X(k)= {15, -3+j6, -5, -3-j6} using radix-2 DIT IFFT. (b) Hence, compute the reduction in number of multiplications and additions as compared to direct method.	4 2
3.	Suppose that we have a 1025-point data sequence. (a) How many complex multiplications and additions are required to compute DFT of this sequence, using radix-2 FFT algorithm? (b) How many multiplications and additions would be required to compute a 1025-point DFT directly?	3 2
4.	A system is defined by following difference equation: $$y(n) = x(n) + 2x(n-1) + 3y(n-2)$$ This system is an example of non-recursive system. Is this statement correct? Justify.	2
5.	Convert an analog filter with system function H(s) into digital IIR filter using impulse invariant technique (assume T=1s). $$H(s) = \frac{1}{s^2 + 8s + 25}$$	4
6.	(a) Discuss the advantages of FIR filters over IIR filters. (b) The desired frequency response of a low pass FIR filters is $$H_d(\omega) = \begin{cases} e^{-j\omega\tau}, & 0 \leq |\omega| \leq 0.35\pi \\ 0, & 0.35\pi < |\omega| \leq \pi \end{cases}$$ Determine the impulse response of causal FIR filter, using windowing technique with a window having minimum transition width. Given that transition band is $[0.297\pi, 0.393\pi]$ and τ represents constant phase delay.	2 7
7.	(a) What are the limitations of windowing technique for FIR filter design? (b) A 5-length linear phase FIR filter is to be designed using frequency sampling type-I design technique. If the desired filter response is given as: $$H_d(\omega) = \begin{cases} 0, & 0 < |\omega| < 0.25\pi \\ e^{-j2\omega}, & 0.25\pi \leq |\omega| \leq 0.4\pi \\ 0, & 0.4\pi < |\omega| \leq \pi \end{cases}$$ Find the filter coefficients of linear phase FIR filter.	2 5