Ref No: Ex/EE/5/T/414/2018

B.ELE.ENGG. (EVENING) 4TH YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - Digital Signal Processing

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	*Answer **any three** questions. **Two marks** are reserved for neatness.*	
1. (a)	Determine the DFT of the sequence $x_k = \begin{cases} \frac{1}{6}, & \text{for } 0 \le k \le 2 \\ 0, & \text{otherwise} \end{cases}$	05
(b)	What is an N-point DFT pair? How is a twiddle factor utilized in calculating an N-point DFT pair?	04+02
(c)	How can FFT be employed for computation of amplitude spectrum of a finite real data sequence?	05
2. (a)	The gain of a 7-tap causal linear-phase FIR digital is given as: for $\frac{-\omega_s}{2} \le \omega \le \frac{\omega_s}{2}$, $\lvert H(\omega)\rvert = 1.2, for \frac{\omega_s}{8} \le \omega \le \frac{\omega_s}{4}$ $= 0.8, for \frac{\omega_s}{4} \le \omega \le \frac{\omega_s}{3}$ $= 1.2, for -\frac{\omega_s}{4} \le \omega \le -\frac{\omega_s}{8}$ $= 0.8, for -\frac{\omega_s}{3} \le \omega \le -\frac{\omega_s}{4}$ $= 0, otherwise$ where each symbol has its usual meaning. The sampling frequency is chosen as 1kHz. The design employs Hann window for smoothing filter coefficients. Determine the filter coefficients. Draw the schematic realization of the filter.	12
(b)	What are the causal and non-causal forms of Hamming window and Bartlet window, employed for FIR filter design?	04

No. of Questions	PART B–I	Marks
3. (a)	Prove that, for a direct realization of an M-order linear-phase FIR digital filter, with an odd M, the number of multiplications required is $\frac{M+1}{2}$.	08
(b)	Derive the expression of frequency response for a causal FIR filter having a delayed and truncated real and symmetric impulse sequence.	08
4. (a)	"In case of FIR digital filters employed for off-line analysis, the length of output sequence is smaller than the length of input sequence." - Justify or rectify the statement.	04
(b)	In image processing, what is the importance of a two-dimensional sampling function and a two-dimensional sampled sequence? How are FIR high-pass image filters designed to sharpen images?	05+04
(c)	What is the periodicity property of DFT?	03
5.	Write short notes on ***any two*** of the following:	08×2 =16
(i)	Discrete Fourier transform of a finite sequence.	
(ii)	Image contrast enhancement by histogram equalization.	
(iii)	Phase delay and group delay in a distortion-less filter.	

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B.E.E. (EVENING) 4TH YEAR 1ST SEMESTER EXAMINATION, 2018

SUBJECT: - ELECTRICAL INSTRUMENTATION

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART-II	Marks
	Answer any five (5X10=50)	
1.	Prove that "Uniform Sampling" of a CT signal can be represented as "Impulse Modulation".	10
2. a)	State and explain ***sampling theorem.***	5
b)	Explain in details how the entire left half of *s*-plane maps on to *z*-plane.	5
3. a)	Show that, ROC of Z-transfer function of an infinite duration **causal signal** is entire exterior of a circle centred at origin & that of infinite duration **anti-causal** sequence is entire interior of a circle centred at origin in z-plane.	5
b)	Derive the transfer function and block diagram (structure) representation of a **discrete time integrator** with trapezoidal integration.	5
4.	If $X(z) = \frac{-1+z^{-1}}{1-7z^{-1}+12z^{-2}}$ $Find\ Z^{-1}[X(z)]$ When, a)ROC of X(z) is $\|z\|>4$ b)ROC of X(z) is $3<\|z\|<4$ c)ROC is $\|z\|<3$	10
5.	Using bilinear Z-transform and frequency pre-warping, design the digital equivalent of a second-order Butterworth lowpass filter, according to the following specification i) Digital filter cutoff frequency = 1kHz. ii) DC gain = 5 iii) Sampling period = 25 micro-second. Write the difference equation relating output and input sequences of the filter. Draw the **Direct form I structure** for realizing the filter.	10
6.	The transfer function of a DTLTI system is given as $H(z) = \frac{2 - z^{-1}}{1 - 0.7z^{-1} + 0.07z^{-2} + 0.015z^{-3}}$ Draw the **Direct form II and parallel structures** for realizing the system. You may use the information that the system has a pole at z=0.5.	10
7.	Write short notes **(any two)** on:	(2X5=10)
a)	Designing of digital filters using Impulse Invariant Transformation	
b)	Region of Convergence (ROC) of z-transform	
c)	Importance of frequency pre-warping in designing of digital filters using bilinear transformation.	