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Total Number of Pages: 02

B.Tech
FECS64017th Semester Regular/Back Examination 2017-18

Introduction to Digital Signal Processing

BRANCH: CSE, IT, ITE

Time: 3 Hours

Max Marks: 70

Q.CODE: B142

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions :** (2 x 10)
- Write at least four major applications of DSP in modern life.
 - Determine the values of power and energy signal of $x(n) = \left(\frac{1}{3}\right)^n u(n)$.
 - Represent the sequence $x(n) = \{4, 2, -1, 1, 3, 2, 1, 5\}$ as sum of shifted unit impulses.
 - State the difference between FIR and IIR filter.
 - Find the Z-transform of the signal $x(n) = \cos(n\theta) u(n)$.
 - What is zero padding? What are its uses?
 - What is twiddle factor? What are its properties?
 - How many multiplications and additions are required to compute 32-point DFT using radix-2 FFT?
 - What is wrapping?
 - How one can design digital filters from analog filters?
- Q2 a)** Show that the following systems are nonlinear and time invariant. (5)
 $y(n) - x(n)y(n-1) = x(n)$
- b)** (5)
 Using Residue Method, find inverse Z-transform of $X(Z) = \frac{1 - \frac{1}{4}Z^{-1}}{1 - \frac{1}{4}Z^{-2}}$,
 ROC: $Z > \frac{1}{3}$.
- Q3 a)** Find the natural response of the system described by difference equation (6)
 $y(n) + 2y(n-1) + y(n-2) = x(n) + x(n-1)$ with initial conditions
 $y(-1) = y(-2) = 1$.
- b)** Distinguish between recursive realization and non-recursive realization. (4)
- Q4 a)** Find the DFT of a sequence $x(n) = \{1, 1, 3, 4, 4, 3, 2, 1\}$ (5)
- b)** Find the Z-transform of $x(n) = (1/8)^n u(n)$ and its ROC. (5)
- Q5 a)** Obtain the direct form I, direct form II and Cascade form realization of the (6)
 following system functions.
 $Y(n) = 0.1 y(n-1) + 0.2 y(n-2) + 3x(n) + 3.6 x(n-1) + 0.6 x(n-2)$.

- b) Using impulse invariance method, with $T=1$ sec determine $H(z)$ if **(4)**

$$H(s) = \frac{1}{s^2 + \sqrt{2}s + 1}$$

- Q6 (a)** The linear convolution of a length 50 sequence with the length of 500 sequences is to be computed using 64-point DFTs and IDFTs. **(5)**

What is the smallest numbers of DFTs and IDFTs needed to compute the linear convolution using over-lap add method?

What is the smallest numbers of DFTs and IDFTs needed to compute the linear convolution using over-lap save method?

- (b)** The system function of the analog filter is given as $H_a(s) = \frac{(S + 0.1)}{(S + 0.1)^2 + 9}$. **(5)**

Obtain the system function of the IIR digital filter by using Impulse Invariance Method.

- Q7** Perform the circular convolution of the following sequences **(10)**

$x(n) = \{1, 1, 2, 1\}$ and $h(n) = \{1, 2, 3, 4\}$ using DFT and IDFT Method.

- Q8** **Write short answer on any TWO :** **(5 x 2)**

- a) Section Convolution
- b) DIF FFT
- c) ROC of Z-transform
- d) DCT is an orthogonal transform