5E1394

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B. Tech. V - Sem. (Main / Back) Exam., Feb.-March - 2021
PCC/PEC Electronics & Communication Engineering
5EC 4-04 Digital Signal Processing

Time: 2 Hours **[To be converted as per scheme]**

Max. Marks: 82

Min. Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of eight questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Explain about zero – order hold sampling.

Q.2 Explain the Sampling theorem for band pass signal.

Q.3 Write the advantages of representing the digital filter in the block diagram form.

Q.4 Compare Canonic structure and Non-Canonic structure.

Q.5 Explain Parseval's theorem for Discrete time sequence.

Q.6 Explain the relation between DFT and Z – transform.

Q.7 Explain Picket-Fence effect.

Q.8 Explain the application of DFT in linear filtering and spectrum analysis.

Q.9 Compare FIR filters and IIR filters.

Q.10 What do you mean by linear phase response?

PART – B

(Analytical/Problem solving questions) **[4×8=32]**

Attempt any four questions

Q.1 Find the Nyquist rate for the continuous time signal given below and find x[n]-

$$x(t) = \frac{\sin(4 \times 10^3 \pi t)}{\pi t}$$

Q.2 DFT of a sequence x(n) is given by-

$X(k) = \{6, 0, -2, 0\}$

Determine x(n).

Q.3 Find direct forms – II realizations for the second order filter given by-

$y(n) = 2b\cos\omega_0 y(n-1) - b^2 y(n-2) + x(n) - b\cos\omega_0 x(n-1)$

Q.4 Find the N – Point DFT of the following sequence-

$$h(n) = \begin{cases} \frac{1}{3} & \text{for } 0 \le n \le 2 \\ 0 & \text{elsewhere} \end{cases}$$

Q.5 Show that $z\left(\frac{1}{n+1}\right) = z\log\left(\frac{z}{z+1}\right), n > 0$

Q.6 Write the short notes of design of IIR digital filter.

Q.7 A causal discrete – time LTI system is described by-

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$$

Where x(n) and y(n) are the input and output of the system, respectively. Determine the system function H(z) and impulse response h(n) of the system.

Q.8 Explain the concept of multirate signal processing and different application of DSP.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 Determine the 8-Point DFT of the following sequence-

$x[n] = \left\{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\right\}$ use in place radix – 2 decimation in time FFT Algorithm.

Q.2 Draw the cascade and parallel realizations for the following system function-

$$H(z) = \frac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$$

Q.3 Using bilinear transformation, design Butterworth filter which satisfy the following condition-

$$0.8 \leq |H/e^{j\omega}| \leq 1 \qquad 0 \leq \omega \leq 0.2\pi$$

$$|H/e^{j\omega}| \leq 0.2 \qquad 0.6\pi < \omega < \pi$$

Q.4 Compute the 8–point circular convolution for following sequence-

$x_1(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}$

$x_2(n) = \sin\left(\frac{3\pi n}{8}\right)\ 0 \leq n \leq 7$

Q.5 Determine the impulse response of h(n) for the system described by the second order difference equation-

$y(n) - 4y(n-1) + 4y(n-2) = x(n) - x(n-1)$

Where $y(-1) = y(-2) = 0$
