Total No. of Questions :10]

SEAT No. :

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[4958] - 1076

T.E. (Instrumentation & Control)

DIGITAL SIGNAL PROCESSING

(Semester - II) (2012 Course)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) Explain in detail classification of system. **[4]**

b) If the impulse response of the system is **[6]**

$h(n) = [(0.5)^n + n\,(0.2)^n]\,u(n)$

i) Find the Transfer Function

ii) Obtain the differential equation of the system.

OR

Q2) a) Find inverse z- transform of **[5]**

$$X(z) = \frac{z(z-0.5)}{(z-0.8)(z-1)}.$$

b) Find DFT of a sequence for N = 4 **[5]**

$$X(n) = 0.5 \qquad 0 \le n \le 2$$
$$= 0 \qquad \text{otherwise}$$

P.T.O.

Q3) a) Find impulse and step response for the following system **[6]**

$$X(n) = y(n) - 3/4\, y(n-1) + 1/8\, y(n-2).$$

b) Compute 4 - point DFT of the sequence **[4]**

$X(n) = \{3, 1, 5\}$.

OR

Q4) a) Determine the Circular convolution of the given two sequence. **[6]**

$X(n) = \{1, 2, 3, 2\}$ $h(n) = \{1, 2, 1, 2\}$.

b) Explain any two properties of Discrete Time Fourier Transform (DTFT) with proof. **[4]**

Q5) a) Obtain the 8-point DFT of a given sequence using DIT FFT Algorithm **[12]**

$X(n) = \{1, 1, 2, 1\}$.

b) Explain the concept of bit reversal technique in FFT Algorithm. **[4]**

OR

Q6) a) Obtain the 4-point DFT of a given sequence using DIT & DIF FFT Algorithm **[12]**

$X(n) = \{4, 3, 2, 1\}$.

b) Sketch Signal flow graph of 8-point Decimal in Frequency (DIF) FFT Algorithm. **[4]**

Q7) a) Explain various window functions used in FIR filter design. **[6]**

b) Design a low pass filter with 11 coefficients for following specification Pass band frequency edge = 250 Hz, Sampling frequency = 1000 Hz Use Rectangular and Hamming Window for Design. **[12]**

OR

Q8) a) Design a linear phase FIR filter using Hamming window for desired frequency response **[12]**

$$H_d(\omega) = e^{-j(N-1)\omega/2}, \qquad 0 < |\omega| < \pi/4$$
$$0 \quad , \qquad \pi/4 < |\omega| < \pi \qquad \text{for } N = 7$$

b) Differentiate between FIR & IIR filter. **[6]**

Q9) a) Find the order of analog low pass Butterworth filter for the given specification **[6]**

αp = 1 dB, αs = 30 dB, Ωp = 200 rad/sec, Ωs = 600 rad/sec.

b) Design a Chebyshev filter with a max pass band attenuation of 2.5 dB at Ωp = 20 rad/sec & stop band attenuation of 30 dB at Ωs = 50 rad/sec. **[10]**

OR

Q10)a) Design a Butterworth filter using Impulse invariance method for following specification. **[10]**

$$0.9 \le |H(e^{j\omega})| \le 1 \qquad 0 \le \omega \le \Pi/2$$
$$|H(e^{j\omega})| \le 0.2 \qquad 3\Pi/4 \le \omega \le \Pi$$

b) Compare the features of digital Butterworth and Chebyshev type-1 filter in terms of **[6]**

i) Filter order

ii) Transition width