M.E. First Semester (Electrical Engg. (Electrical Power System))

13570 : Digital Signal Processing and Applications : EP 2103

P. Pages : 2

Time : Three Hours

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AW - 3591

Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.
4. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Consider analog signal $x(t) = 3\cos 2000\pi t + 5\sin 6000\pi t + 10\cos 12000\pi t$. **6**

i) Find Nyquest rate.
ii) If signal is sampled at FS = 5000 Hz. Obtain discrete signal after sampling.
iii) Find reconstructed signal obtained from sampled signal.

b) State and explain sampling theorem. **7**

OR

2. a) $x(n) = 0,\ n < 0$ find expression for x(n) in term of its even part and using this find x(n), when $xe(n) = (0.9)^n u(n)$. **7**

b) A sampled signal that varies between –2V to +2 volts is quantized using 'B' bits. What value of 'B' will ensure an rms quantization error less than 5 mV? **6**

3. a) Compute autocorrelation of signal $x(n) = a^n u(n),\ 0 < a < 1$. **6**

b) Find inverse Z.T of following signals. **7**

i) $x(z) = \dfrac{8z-19}{z^2-5z+6}$ ROC $|z| > 3$ ii) $x(z) = \dfrac{z^{-1}/4}{\left(1-\dfrac{z^{-1}}{2}\right)\left(1-\dfrac{z^{-1}}{4}\right)}$ ROG $|z| > 1/2$

OR

4. Examine the following systems with respect to static/dynamic, linear/Nonlinear, Time variant/Time invariant, causal/Non causal, stable/unstable. **13**

i) $y(n) = \sum_{K=-\infty}^{n+1} x(u)$ ii) y(n) = Round (x(n)]

iii) $y(n) = x|n|$ iv) $y(n) = x(2n)$

v) $y(n) = x(n) + nx(n-1)$ vi) y(n) = even x(n)]

5. a) Find y(n) using DTFT. **7**

$$x(n) = \sin\frac{\pi n}{8} - 2\cos\frac{\pi n}{4}$$

$$h(n) = \frac{\sin\frac{\pi n}{6}}{\pi n}$$

b) Find convolution using DFT 7
$x(n) = [1, 3, 2, 1]$
$h(n)[1, 2, 1, 1]$

OR

6. a) Find inverse Fourier Transform of $x(\omega)$ 7

$$x(\omega) = \left(\frac{\sin \frac{3}{2}\omega}{\sin \omega / 2} \right) \frac{1}{1 - e^{-j\omega}} + 5\pi\delta(\omega)$$

b) Find DTFT of x(n). 7

$$x(n) = \frac{\sin \frac{\pi}{5} n}{\pi n} \cos 7\frac{\pi}{2} n$$

SECTION – B

7. a) Design a digital Butterworth filter using BLT for following specifications. 14
$0.8 \le \mu(\omega) \le 1, \quad 0 \le \omega \le 0.2\pi$
$\mu(\omega) \le 0.2, \quad 0.6\pi \le \omega < \pi$
$T = 1$

OR

8. a) Convert the following analog filter with Transfer function 7

$$H(s) = \frac{s + 0.2}{(s + 0.2)^2 + 16}$$

into digital IIR filter using
i) Impulse invariant method. ii) Bilinear Transformation.

b) Convert the analog filter with $H(s) = \frac{s+2}{(s+1)(s+3)}$ into digital filter by Impulse invariant transformation T = ½. 6

9. a) Find polyphase decomposition of IIR Digital system with transfer function $H(z) = \frac{1 - 4z^{-1}}{1 + 5z^{-1}}$. 7

b) Explain applications of multi rate Digital signal processing. 6

OR

10. a) Find expression for output y(n) in terms of input x(n) for multi sampling rate system given in fig. 10 a. 7

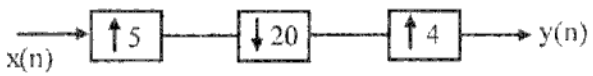

Fig. 10 a

b) Explain interpolation process for an integer factor I with an example. 6

11. Explain how DSP hardware / algorithm can improve speech processing. 13

OR

12. Explain the applications of DSP in power system. 13

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