

AQ – 2922

First Semester M. E. (Electronics and Tele.) Full Time (CGS) Examination

DIGITAL SIGNAL PROCESSING AND APPLICATIONS

1 ENTIC 4

P. Pages : 3

Time : Three Hours]

[Max. Marks : 80

- Note :** (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer book must be used for Section A and B in Pharmacy and Cosmetic Tech.
(2) Answer **Three** questions from Section A and **Three** questions from Section B.
(3) Due credit will be given to neatness and adequate dimensions.
(4) Assume suitable data wherever necessary.
(5) Illustrate your answer wherever necessary with the help of neat sketches.
(6) All questions carry marks as indicated.
(7) Use pen of Blue/Black ink/refill only for writing the answer book.

SECTION A

1. (a) Explain the following terms as applied to analogue and digital filters :
(i) Phase delay.
(ii) Group delay.
(iii) Linear phase.
(iv) Minimum phase. 7
(b) Explain why discrete time FIR filters can be made exactly linear phase whereas analogue and digital filters with infinite impulse responses cannot. 7

OR

2. (a) Distinguish between frequency response of Chebyshev Type-1 and Type-II filter. 7
(b) Derive the expression to determine the poles of Butterworth filter. 7 -
3. (a) Explain the FIR filter design by Fourier series method. 6

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- (b) Design a linear phase FIR low pass filter using hamming window by taking 5 samples of window sequence and with a cutoff frequency, $w_c = 0.35\pi$ radians / sample. 7

OR

4. (a) Compare rectangular and hamming window functions. 6
 (b) Explain the procedure for designing FIR filters using windows. 7
5. (a) Why impulse invariant method is not preferred in the design of IIR filter other than low pass filter ? 4
 (b) Consider a LTI system governed by the equation.
 $y(n) + 0.8301y(n-1) + 0.7348y(n-2) = x(n-2)$. Discuss the effect of coefficient quantization on pole locations, when the coefficients are quantized by,
 (i) 3-bits by truncation.
 (ii) 4-bits by truncation. 9

OR

6. (a) For the analogue transfer function,

$$H(S) = \frac{0.8}{S^2 + 1.6S + 9.64}$$

Determine $H(t)$ using bilinear transformation if (i) $T = 1$ sec. and (ii) $T = 0.6$ Sec. 7

- (b) What is warping effect ? What is its effect on magnitude and phase response ? 6

SECTION B

7. (a) Explain the process of polyphase decomposition of an IIR filter with an example. 7
 (b) Derive an expression for the spectrum of output signal of an interpolator. 7

OR

8. (a) What do you mean by multirate DSP ? 4
- (b) A signal $x(n)$ is sampled with a Sampling frequency of 50 KHz. Design a decimator that down samples this signal by a factor $D = 5$. The following specifications should be fulfilled by the filter used in the decimator:
 Passband = 0–4 KHz
 Passband ripple : 0.1 dB
 Transition zone : 4.5 KHz
 Stopband attenuation : 30 dB
 Sketch the block diagram of the decimator and calculate order of FIR equiripple filter that fulfills the specifications. 10

9. (a) Explain the role of DSP in Radar systems. 7
- (b) Explain in detail about :—
 (i) MAC unit.
 (ii) Pipelining
 Used in DSP processors. 6

OR

10. (a) What is the total memory space in TMS320C6713 DSP processor and how is it divided between program, data and I/O ? 4
- (b) Draw and explain the architecture of DSP processor TMS 320C6713. 9
11. (a) Explain various phases in sub-band coding algorithm. 6
- (b) Prove the orthogonality relations of Doughties Wavelets. 7

OR

12. (a) Prove "If $f(t)$ has continuous wavelet transform given by $CWT_f(a, b)$ then $f'(t) = f(t-b')$ leads to the following transform. $CWT_{f'}(a, b) = CWT_f(a, b-b')$ ". 8
- (b) Explain different steps to be followed for analysis of continuous wavelet transform. Show related signals also. 5



