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BTECH
(SEM V) THEORY EXAMINATION 2024-25
DIGITAL SIGNAL PROCESSING

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 07 = 14

Q no.	Question	CO	Level
a.	What are recursive and non-recursive systems?	1	K1
b.	Explain the difference between canonic and non-canonic structures.	1	K2
c.	List the characteristics of Butterworth filters.	2	K1
d.	What is an Infinite Impulse Response (IIR) filter?	2	K1
e.	Explain the purpose of windowing in FIR filter design.	3	K2
f.	Explain the difference between linear and circular convolution.	4	K2
g.	Define decimation in MDSP.	5	K1

SECTION B

2. Attempt any three of the following: 07 x 3 = 21

a.	Explain the basic building blocks of digital signal processing	1	K1
b.	Discuss the impulse invariant method of IIR filter designing and its properties.	2	K2
c.	Design an FIR filter to meet the following specification : Pass band edge = 2 kHz Stop band edge = 5 kHz Stop band attenuation = 42 dB Sampling frequency = 20 kHz Use Hanning window.	3	K6
d.	Compute the circular convolution of two discrete time sequences $x_1(n) = \{1, 2, 1, 2\}$ and $x_2(n) = \{3, 2, 1, 4\}$.	4	K3
e.	Explain the principle behind quadrature mirror filters (QMF) and their use in MDSP. Describe the advantages of MDSP in sub-band coding.	5	K2

SECTION C

3. Attempt any one part of the following: 07 x 1 = 07

a.	Obtain the parallel form realization for the system function given below : $H(z) = \frac{2 + z^{-1} + 1/4 z^{-2}}{\left(1 + \frac{1}{2} z^{-1}\right)\left(1 + z^{-1} + \frac{1}{2} z^{-2}\right)}$	1	K3
b.	Explain the direct form realization of FIR systems.	1	K2

4. Attempt any one part of the following: 07 x 1 = 07

a.	What is frequency warping effect? How this problem is overcome in bilinear transform method of IIR filter design ?	2	K1
b.	Design a Butterworth low pass analog filter for the following specification : i. Pass band gain required : 0.9 ii. Frequency up to which pass band gain must remain more or less steady: 100 rad/sec. iii. Gain in attenuation band : 0.4 iv. Frequency from which the attenuation must start : 200 rad/sec.	2	K6



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5. Attempt any one part of the following: 07 x 1 = 07

a.	What is Gibb's phenomenon? Describe the concept of windowing in FIR filter design.	3	K2
b.	Define coefficient quantization error and quantization noise in digital filters. Explain the effects of truncation and rounding on quantization noise.	3	K1

6. Attempt any one part of the following: 07 x 1 = 07

a.	Write a short note on the following : i. Butterfly computation ii. Bit reversal	4	K1
b.	List the key properties of the DFT and provide brief explanations of each.	4	K1

7. Attempt any one part of the following: 07 x 1 = 07

a.	Explain the significance of Multirate digital signal processing in modern communication systems.	5	K2
b.	Describe the differences between decimation and interpolation in MDSP.	5	K1

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