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BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Tech.(RA)-2023
Course Name – Signal Processing in Mechatronic System
Course Code - PEC-MIRA301A
(Semester III)

Full Marks: 60

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

- 1. Choose the correct alternative from the following:
- (i) Select sequence in signal processing?
 - a) A continuous signal

b) A finite set of numbers in a specific order

c) An impulse function

- d) None of the above
- (ii) Tell that which of the following is NOT an example of a discrete sequence
 - a) [1, 2, 3, 4, 5]

b) Sinusoidal signal

c) [0, 0, 1, 0, 0]

d) [1, 2, 4, 8, 16]

- (iii) Nyquist theorem relates to
 - a) Sampling theorem

b) Fourier transform

c) Signal quantization

- d) Time-domain analysis
- (iv) In signal processing, estimate the term for the process of converting a digital signal back into an analog signal.
 - a) Sampling

b) Reconstruction

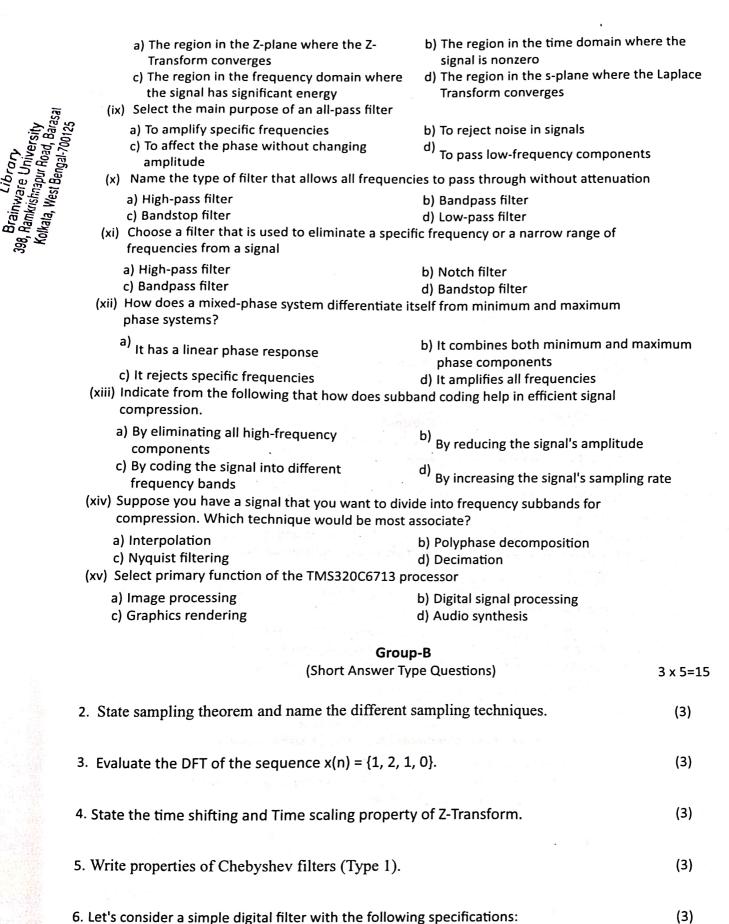
c) Quantization

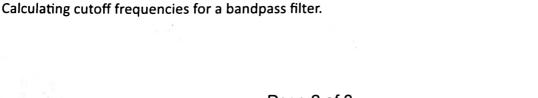
- d) Modulation
- (v) Select a sampling techniques that is commonly used in audio signal processin.
 - a) Pulse Amplitude Modulation (PAM)
- b) Pulse Code Modulation (PCM)
- c) Pulse Width Modulation (PWM)
- d) Frequency Modulation (FM)
- (vi) Select a correct statement about the sampling theorem
 - a) It states that a signal must be sampled at a rate equal to its Nyquist frequency to avoid distortion.
- b) It guarantees perfect reconstruction of a continuous signal from its samples.
- c) It allows for infinite over-sampling without any adverse effects.
- d) It applies only to periodic signals.
- (vii) Indicate the use of Z-Transform in signal processing
 - a) Time-domain analysis

b) Frequency-domain analysis

c) Both a) and b)

- d) Neither a) nor b)
- (viii) In the context of the Z-Transform, what does the region of convergence (ROC) infers





Sampling rate (Fs): 1000 Hz, Cutoff frequency (Fc): 200 Hz, Bandwidth (B): 100 Hz

OR

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Group-C

(Long Answer Type Questions)

5 x 6=30

(5)

(5)

(3)

7. Explain properties of frequency selective filter.

List the properties of continuous time unit impulse signal.

(5)

Evaluate whether the following signals are causal or non-causal.

$$y(n) = \sin[x(n)]$$

$$y(n) = x(-n)$$

10. Analyze the concept of a multirate filter and its applications in signal processing.

(5)

11. Deduce the relation between Z-Transform and Fourier Transform.

(5)

12. Explain the role of DSP in radar signal processing.

(5)

Explain the role of DSP in PET (Positron Emission Tomography) scan in medical (5) applications.