

CS/B.TECH (ECE)/EVEN/SEM-6/EC-602/2018-19



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : EC-602

DIGITAL SIGNAL PROCESSING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own
words as far as practicable.*

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the
following : 10 × 1 = 10

i) Which of the following is a periodic signal ?

- a) $x(n) = C u(n)$ b) $x(n) = C e^{-jbn}$
c) $x(n) = C e^{bn}$ d) $x(n) = Cn$

ii) Which of the following is the causal system ?

- a) $y(n) = x(n^2)$ b) $y(n) = x^2(n)$
c) $y(n) = x(-n)$ d) $y(n) = x(2n)$

a) stable

b) unstable

c) conditionally stable d) none of these.

a) $\delta(n-3)$

b) $\delta(n+3)$

c) $\delta(n)$

d) None of these.

a) $-X(z)$

b) $X(-z)$

c) $-X(z^{-1})$

d) $X(z^{-1})$.

a) $\delta(n-3)$

b) $\delta(n+4)$

c) $\delta(n+1)$

d) none of these.

a) $|z| > 1$

b) $|z| < 1$

c) $-1 < |z| < 1$

d) none of these.

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iii) The ROC of a causal signal $x(n)$ is

- ☒ a) Entire z-plane
- b) Region in between two concentric rings
- c) Right of pole
- d) Left of pole.

iv) For a continuous time LTI system which of the following statements is are true ?

- 1) The transfer function is the ratio of Laplace transform of output and input.
- 2) The transfer function is the ratio of Laplace transform of input and output.
- 3) The transfer function is the ratio of Laplace transform of impulse response.

of these <http://www.makaut.com>

- a) 1 only
- b) 1 and 3
- ☒ c) 2 only
- d) 3 only.

v) Fourier Transform of Gaussian pulse will be

- a) another Gaussian pulse
- b) squared sinc pulse
- c) impulse train
- d) sinc pulse.

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xi) The sampling frequency of the following analog signal $x(t) = 4 \sin 100\pi t + 2 \cos 50\pi t$ is

- a) greater than 75 Hz
- b) greater than 150 Hz
- c) less than 150 Hz
- ☒ d) greater than 100 Hz.

xii) For energy signals, the energy will be finite and the average power will be

- | | |
|---|-----------|
| <input checked="" type="checkbox"/> a) infinite | b) finite |
| <input checked="" type="checkbox"/> c) zero | d) unity. |

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Determine the energy and power of the following signal :

i) $X(t) = e^{-n}u(n)$ ii) $x(n) = u(n)$ 2 + 3

3. Show that $u[n] = \sum_{k=0}^{\infty} \delta[n-k]$ and $\delta[n] = u[n] - u[n-1]$ 3 + 2

4. Draw the even part and odd part of the following signal

$$x(n)=[1 \ 2 \ 3 \ 4]$$

5. Find $h(n)$ for the system difference equation :

$$y(n) + 2y(n-1) + y(n-2) = x(n)$$

6. Z transform of $x(n)$ is $X(Z) = \frac{z^2 + 2}{z^3 + 3z^2 + 4}$. Find

Z transform of $3^n x(n)$ and $x(-n)$. 2 + 3

GROUP - C

(Long Answer Type Questions)

Answer any three of the following. $3 \times 15 = 45$

7. a) Check the causality, linearity and time invariance of the following systems :

i) $y[n] = x[-n]$ ii) $y(n) = n^2 x(n)$

- b) Find convolution of

$$x_1[n] = u[n] \text{ and } x_2[n] = 2^{-n} u[n]$$

- c) Discuss the stability of digital system in time domain with suitable example. 3 + 7 + 5

| Turn over

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8. a) Find $h(n)$ given $H(z) = e^z + e^{1/z}$

b) Find the Z transform of

$$x(n) = nu(n)$$

c) Find all possible $x(n)$ for given

$$X(Z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

5 + 4 +

9. a) Find DFT of $x(n) = [1 \ 2 \ 6 \ 4]$ and plot amplitude and phase spectrum.

b) Explain circular shift with suitable example.

c) Find circular convolution $x(n) = [1 \ 2 \ 1 \ 4]$ and $x_1(n) = [1 \ 3 \ 1 \ 5]$

5 + 5 + 5

10. a) An 8-point sequence is given by

$x(n) = [2 \ 1 \ 2 \ 1 \ 1 \ 1 \ 1 \ 1]$. Compute 8-point DFT of $x(n)$ by radix-2 DIT FFT. Also sketch the magnitude and phase spectrum.

b) Compare DIT-FFT and DIF-FFT.

12 + 3

11. a) Design linear phase FIR high pass filter with cut-off frequency of 0.8π rad/sample by taking 7 samples window sequence.

b) Compare FIR and IIR filter.

12 + 3

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2. Write short notes on any three of the following : 3 × 5

- a) Auto-correlation and Cross-correlation
 - b) Bilinear Transformation
 - c) Overlap add method
 - d) Radix-2 DIF FFT Algorithm
 - e) Instruction pipelining in TMS320C5x.
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