

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Electronics Engineering) SEMESTER - 4 Summer 2025 (Regular)

Course :Bachelor of Technology (Electronics Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 4

Subject Code & Name: BTEXC402 - SIGNALS AND SYSTEMS

Time : 3 Hours]

[Total Marks : 60

Instructions to the Students:

1. Each question carries 12 marks.
2. Question No. 1 will be compulsory and include objective-type questions.
3. Candidates are required to attempt any four questions from Question No. 2 to Question No.6
4. Use of non-programmable scientific calculators is allowed.
5. Assume suitable data wherever necessary and mention it clearly.

- Q1. Objective type questions. (Compulsory Question) 12
- 1 Which of the following is a periodic signal?
A) $\sin(t)$ B) e^t C) t^2 D) $\ln(t)$
 - 2 Which operation is used to check linearity of a system?
A) scaling B) additivity C) both a & c D) None
 - 3 If h_1 , h_2 and h_3 are cascaded, find the overall impulse response
A) $h_1 * h_2 * h_3$ B) $h_1 + h_2 + h_3$ C) $h_1 - h_2 - h_3$ D) $h_1 - h_2 + h_3$
 - 4 What is the Laplace Transform of $\delta(t)$?
A) 0 B) 1 C) s D) -1
 - 5 Convolution in time domain is equivalent to _____ in frequency domain.
A) Division B) Addition C) Convolution D) Multiplication
 - 6 The fundamental frequency of a periodic signal with period T is:
A) $2\pi/T$ B) $1/T$ C) T D) $T/2$
 - 7 The Nyquist rate for a signal with maximum frequency $f_{max}=10$ kHz is
A) 5 kHz B) 10 kHz C) 15 kHz D) 20 kHz
 - 8 The DTFT of $x[n] = \delta[n]$ is:
A) 1 B) 0 C) $e^{-j\omega n}$ D) None
 - 9 The Fourier transform of a constant is:
A) delta function B) sinusoid C) constant D) Zero
 - 10 The Laplace Transform is a generalization of:
A) Fourier Transform B) Z- Transform C) Convolution D) None
 - 11 The convolution of $x(t)$ with $\delta(t)$ gives:
A) 0 B) $x(t)$ C) $x(t-1)$ D) $x(0)$

12 A signal that does not repeat itself over time is:

- A) Aperiodic B) even C) periodic D) Odd

Q2. Solve the following.

- A) Show that any real signal $x(t)$ can be expressed as the sum of its even and odd components. Also, write the expressions for even and odd parts. 6
- B) State and derive the expression for convolution integral for continuous-time signals. Mention its significance. 6

Q3. Solve the following.

- A) Explain the following signals with examples 6
i) Energy and Power
ii) Analog and Digital
- B) Explain Step, Ramp, delta signal and write the mathematical relationships between them. 6

Q4. Solve Any Two of the following.

- A) If $X(e^{j\omega})$ is the Fourier Transform of a real sequence $X[n]$ then, show the following: 6
(i) $X(e^{j\omega})$ is conjugate symmetric
(ii) phase of $X(e^{j\omega})$ is antisymmetric
(iii) magnitude of $X(e^{j\omega})$ is symmetric
- B) Define Convolution. Also Perform the following convolution, $x(t) = u(t)$, and $v(t) = e^{-t}u(t)$ 6
- C) Define DTFT. Write its mathematical expression. State any six properties of DTFT. 6

Q5. Solve Any Two of the following.

- A) Find the Fourier transform given signal and sketch the magnitude and phase spectrum for $e^{at} \cdot u(-t)$ 6
- B) Define Laplace Transform. Find the Laplace Transform of $x(t) = t \cdot e^{-2t} \cdot u(t)$ 6
- C) Determine the z-transform and ROC for $(0.5)^n \{u(n+4) - u(n-5)\}$ 6

Q6. Solve Any Two of the following.

- A) Sketch each of the following signals. 6
i) $u(n+4) - u(n-5)$
ii) $r(t) + r(t+2)$
- B) State and explain the Dirichlet conditions for the existence of Fourier series. 6
- C) Find the $x[n] * h[n]$ using tabular method, $x[n] = \{1, 2, 3\}$ for $n=0:2$ and $h[n] = \{1, 2, 1, -1\}$ for $n=0:3$ 6

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