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Question Paper Code : 90983

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Third Semester

Electronics and Communication Engineering

EC 3354 – SIGNALS AND SYSTEMS

(Common to : Computer and Communication Engineering/Electronics and
Telecommunication Engineering/Medical Electronics)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the conditions for a system to be causal.
2. Determine whether the signal $x(t) = \sin^2(2\pi t)$ is periodic or not.
3. Mention the relationship between Fourier transform and Laplace transform.
4. List the properties of Fourier transform.
5. Given the input $x(t) = u(t)$ and $h(t) = \delta(t - 1)$. Find the response $y(t)$.
6. State the initial and final value theorem of Laplace transform.
7. Find DTFT of $x(n) = \delta(n) + \delta(n - 1)$.
8. Summarize the methods of obtaining inverse Z transform.
9. Determine the convolution of the following signals: $x[n] = \{1, 2, 3\}$, $h[n] = \{1, 2\}$
10. What are recursive and non-recursive systems?

PART B — (5 × 13 = 65 marks)

11. (a) Determine whether the system $y(n) = 2x(n) + 5x(n-1)$ is static, linear, time invariant, casual and stable or not.

Or

- (b) A discrete time sequence $x(n) = \{-1, 0.5, 1.5, 1, 2, 3\}$. Determine each of the following sequences. (3+3+3+4)

(i) $x(n-4)$

(ii) $x(n+3)$

(iii) $x(3n)$

(iv) $x(2n+3)$

12. (a) Find the continuous time fourier transform of the signal $x(t) = A \sin(2\pi f_c t)u(t)$ and plot its amplitude spectrum.

Or

- (b) Analyze the inverse laplace transform of the function $X(s) = \frac{4}{s^2 + 6s + 8}$ for ROCs $\text{Re}(s) < -4$ and $-2 > \text{Re}(s) > -4$.

13. (a) The differential equation of the system is given as,

$$\frac{d^2 y(t)}{dt^2} + 7 \frac{dy(t)}{dt} + 12y(t) = \frac{dx(t)}{dt} + 2x(t)$$

- (i) Find the frequency response $H(j\Omega)$ of the system. (6)

- (ii) Find the output $y(t)$ of the system for the input $x(t) = e^{-2t}u(t)$. (7)

Or

- (b) The system transfer function is given as, $X(s) = \frac{s}{s^2 + 5s + 6}$. The input to the system is $x(t) = e^{-t}u(t)$. Determine the output assuming zero initial conditions.

14. (a) Explain the following properties of discrete time fourier transform.
- (i) Differentiation in frequency domain (5)
 - (ii) Time reversal (4)
 - (iii) Convolution (4)

Or

- (b) State and prove sampling theorem.
15. (a) For a causal LTI system the input $x(n)$ and output $y(n)$ are related through a difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$. Determine the frequency response $H(e^{j\omega})$ and impulse response $h(n)$ of the system.

Or

- (b) Obtain direct form-I and direct form-II realization of the following system $y(n) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$

PART C — (1 × 15 = 15 marks)

16. (a) Find the inverse Z Transform of $X(z) = \frac{1 + 2z^{-1}}{1 - 2z^{-1} + z^{-2}}$ when
- (i) $x(n)$ is causal (8)
 - (ii) $x(n)$ anticausal (7)

Or

- (b) The transfer function of the discrete time causal system is given as

$$H(z) = \frac{1 - 2z^{-1}}{1 - 0.5z^{-1} - 0.25z^{-2}}$$

- (i) Find the difference equation of the system. (5)
- (ii) Draw series and parallel realization of the system. (10)

