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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 × 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.

- | | |
|------------------|-----|
| (i) $x(n - 4)$ | (3) |
| (ii) $x(n + 3)$ | (3) |
| (iii) $x(3n)$ | (3) |
| (iv) $x(2n + 3)$ | (4) |

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 $X(s) = 4 / (s^2 + 6s + 8)$ for ROCs $\text{Re}(s) < -4$ and $-2 > \text{Re}(s) > -4$.
13. (a) The differential equation of the system is given as, $d^2y(t)/dt^2 + 7 dy(t)/dt + 12y(t) = dx(t)/dt + 2x(t)$
- (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, $X(s) = s / (s^2 + 5s + 6)$. 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 $y(n) - (1/6) y(n - 1) - (1/6) y(n - 2) = x(n)$. 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 $y(n) = 0.75 y(n - 1) - 0.125 y(n - 2) + 6x(n) + 7x(n - 1) + x(n - 2)$

PART C — (1 × 15 = 15 marks)

16. (a) Find the inverse Z Transform of $X(z) = (1 + 2z^{-1}) / (1 - 2z^{-1} + z^{-2})$ 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 $H(z) = (1 - 2z^{-1}) / (1 - 0.5z^{-1} - 0.25z^{-2})$
- (i) Find the difference equation of the system. (5)
- (ii) Draw series and parallel realization of the system. (10)