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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. (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 $\mathrm{Re}(s)<-4$ and $-2>\mathrm{Re}(s)>-4$.

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

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

(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 $H\left(e^{jw}\right)$ 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 — ($1 \times 15 = 15$ 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)