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Question Paper Code : 20927

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third Semester

Computer and Communication Engineering

EC 3354 – SIGNALS AND SYSTEMS

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

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Give the conditions for a system to be linear and time invariant.

2.   Determine whether the signal $x(t) = \cos^2(2\pi t)$ is periodic or not.

3.   State Dirichlet conditions for the existence of Fourier series.

4.   Obtain the continuous time Fourier transform of the impulse function.

5.   Write the convolution property and final value theorem of laplace transform.

6.   What is the relationship between Fourier transform and Laplace transform?

7.   State the sampling theorem for baseband signals.

8.   Prove Parseval's theorem using discrete time fourier transform.

9.   List the properties of linear convolution.

10. What are recursive and non-recursive systems?

PART B — (5 × 13 = 65 marks)

11. (a) Determine whether the system $y(t) = 10x(t) + 5$ is static, linear, time invariant, casual and stable or not.

Or

(b) Give the detailed classification of signals with examples for each of the category.

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

Or

(b) Find the inverse Laplace transform of the function $X(S) = \dfrac{1}{S^2 + 3S + 2}$ with ROC as : $2 < \text{Re}(S) < -1$.

13. (a) The differential equation of the system is given as, $\dfrac{d^2 y(t)}{dt^2} + 5\dfrac{dy(t)}{dt} + 6y(t) = -\dfrac{dx(t)}{dt}$. Using Fourier transform determine the impulse response of the system.

Or

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

14. (a) Identify and explain the following properties of discrete time fourier transform.

(i) Differentiation in frequency domain (5)

(ii) Time reversal (4)

(iii) Convolution (4)

Or

(b) (i) Explain the relationship between Fourier transform and Z transform. (6)

(ii) Explain the time shifting and differentiation in Z domain property of Z transform. (7)

15. (a) A difference equation of the system is given as $y(n) = 0.5\,y(n-1) + x(n)$. Determine

   (i) System function (4)

   (ii) Pole zero plot of the system function (5)

   (iii) Unit sample response of the system. (4)

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) Realize the system function $H(S) = \dfrac{1}{(S+1)(S+2)}$ in series and parallel forms.

Or

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

$$H(z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$$

   (i) Find the difference equation of the system. (5)

   (ii) Draw series and parallel realization of the system. (10)

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