

D 70298

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FIFTH SEMESTER B.TECH. (ENGINEERING) EXAMINATION, NOVEMBER 2014

AI 09 502—SIGNALS AND SYSTEMS

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.

1. What is a discrete time signal ? Give an example.
2. What is sampling ?
3. Find the Laplace transform of $x(t) = u(t)$.
4. Find the initial value $x(0^+)$ for Laplace transform $X(s) = 3/(s^2 + 5s + 1)$.
5. What is meant by Region of convergence ?

(5 × 2 = 10 marks)

Part B

Answer any four questions.

6. Check whether the system $y(t) = Ax(t) + B$ is static/dynamic, Linear/non linear and Time variant/invariant.
7. Obtain the differential equation of a series RLC circuit having a source of $v(t)$.
8. Explain about Hilbert Transform.
9. Find the Fourier Transform of $x(t) = e^{-2t} u(t)$.
10. Find the inverse z transform of $X(z) = \cos(3z)$.
11. Determine the Laplace Transform and ROC for $x(t) = tu(t)$.

(4 × 5 = 20 marks)

Part C

12. Sketch the following signals :

- | | |
|---|-----------------------|
| (i) $2u(t+2) - 2u(t-3)$. | (ii) $u(t+4)u(t+4)$. |
| (iii) $r(-t)u(t+2)$. | (iv) $r(-0.25t+1)$. |
| (v) $r(t) - r(t-1) - r(t-3) + r(t-4)$. | |

Or

Turn over

13. (a) Check whether the following systems are causal or not

(i) $y(t) = x^2(t) + x(t-2)$ (ii) $y(n) = x(n^2)$.

(iii) $y(n) = 2x(n) + x(n-3)$.

(4½ marks)

(b) Find the convolution of $x(n) = u(n) - 2u(n-3) + u(n-6)$ and $h(n) = u(n+2) - u(n-9)$

(5½ marks)

14. (a) Derive the transfer function of a system for distortion less transmission through the LTI system.

(6 marks)

(b) Determine the energy spectral density of a function of width τ and amplitude A . (4 marks)

Or

15. (a) Determine the response of the system characterized by the impulse response $h(n) = (1/2)^n u(n)$ to the input signal $x(n) = 2^n u(n)$.

(6 marks)

(b) Explain about the transmission of a rectangular pulse through an ideal Low pass filter.

(4 marks)

16. (a) Derive the Fourier series for a halfwave rectifier.

(6 marks)

(b) Determine the system function of the LTI system with $x(t) = e^{-3t} u(t)$ and $y(t) = (e^{-t} - e^{-2t}) u(t)$.

(4 marks)

Or

17. (a) Determine the system function of the LTI system with the following information. The system is rational, causal and has two poles at -2 and $s = 4$. If $x(t) = 1$ then $y(t) = 0$. The value of the impulse response at $t = 0^+$ is 4.

(4 marks)

(b) Derive the Fourier series of a triangular signal with a period T .

(6 marks)

18. (a) Explain the properties of Z Transform. (6 marks)
- (b) Find the Z transform of $x(n) = (1/2)^n u(n) * (1/4)^n u(n)$. (4 marks)

Or

19. (a) A causal system is represented by $H(z) = z + 2/(2z^2 - 3z + 4)$. Find the difference equation and frequency response of the system. (6 marks)

- b) Plot the pole-zero pattern of $y(n) = 2y(n-1) + 0.8y(n-2) + x(n) + 0.8x(n-1)$. Comment on its stability. (4 marks)

[4 × 10 = 40 marks]