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Question Paper Code : 71726

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

(Codes/Tables/Charts to be permitted if any, may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the summation $x(n) = \sum_{n=-\infty}^{\infty} \delta(n-1) \sin 2n$.
2. Define a linear system.
3. What is the condition for the existence of Fourier series for a signal?
4. State Parseval's theorem for a continuous time aperiodic signal.
5. Give the expression for convolution integral
6. Given $h(t)$, what is the step response of a CT LTI system.
7. What is the z transform of a unit step sequence.
8. Find $x(\infty)$ of the signal for with the z -transform is given by
$$X(z) = \frac{z+1}{3(z-1)(z+0.9)}$$
9. What is the necessary and sufficient condition on impulse response for stability of a casual LTI system?
10. What is the difference between recursive and nonrecursive systems?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Find out whether the following signals are periodic or not. If periodic find the period $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$
 $x(n) = \cos(0.1 \pi n)$.
- (ii) Find out whether the following signals are energy or power signal or neither power nor energy. Determine power or energy as the case may be for the signal $x(t) = u(t) + 5u(t - 1) - 2u(t - 2)$.

Or

- (b) Determine the properties viz linearity, causality, time invariance and dynamicity of the given systems

$$y(t) = \frac{d^2 y}{dt^2} + 3t \frac{dy}{dt} + y(t) = x(t)$$

$$y_1(n) = x(n^2) + x(n)$$

$$y_2(n) = \log_{10} x(n)$$

12. (a) Obtain the Fourier co-efficient and write the quadrature form of a fully rectified sine wave.

Or

- (b) Determine the inverse-Laplace Transform of the following

$$(i) \quad x(s) = \frac{1 - 2s^2 - 14s}{s(s+3)(s+4)}$$

$$(ii) \quad x(s) = \frac{2s^2 + 10s + 7}{(s+1)(s^2 + 3s + 2)}$$

13. (a) A causal LTI system having a frequency response $H(j\Omega) = \frac{1}{j\Omega + 3}$ is producing an output $y(t) = e^{-3t}u(t) - e^{-4t}u(t)$ for a particular input $x(t)$. Determine $x(t)$.

Or

- (b) Realize the given system in parallel form $H(s) = \frac{s(s+2)}{s^3 + 8s^2 + 19s + 12}$

14. (a) State and prove Sampling theorem.

Or

- (b) State and prove the following properties of DTFT

- (i) Differentiation in frequency
 (ii) Convolution in frequency domain.

15. (a) Perform convolution to find the response of the systems $h_1(n)$ and $h_2(n)$ for the input sequences $x_1(n)$ and $x_2(n)$ respectively.

$$(i) \quad x_1(n) = \{1, -1, 2, 3\} \quad h_1(n) = \{1, -2, 3, -1\}$$

$$(ii) \quad x_2(n) = \{1, 2, 3, 2\} \quad h_2(n) = \{1, 2, 2\}$$

Or

- (b) 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 the impulse response $h(n)$ of the system.

PART C — (1 × 15 = 15 marks)

16. (a) Using Laplace Transform determine the response of the system described by the equation $\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$ with initial conditions

$$y(0) = 0; \quad \left. \frac{dy(t)}{dt} \right|_{t=0} = 1 \text{ for the input } x(t) = e^{-2t}u(t).$$

Or

- (b) Determine the steady state response for the system with impulse response $h(n) = [j 0.5]^n$ for an input $x(n) = \cos(\pi n)u(n)$.