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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 $X(z) = \dfrac{z+1}{3(z-1)(z+0.9)}$.

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 — ($5 \times 13 = 65$ 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

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

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

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

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

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

13. (a) A causal LTI system having a frequency response $H(j\Omega) = \dfrac{1}{j\Omega + 3}$ 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 $H(s) = \dfrac{s(s+2)}{s^3 + 8s^2 + 19s + 12}$.

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

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

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 $H(e^{jw})$ 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 $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$ with initial conditions $y(0) = 0;\ \left.\frac{dy(t)}{dt}\right|_{t=0} = 1$ 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 $x(n) = \cos(\pi n)u(n)$.