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Question Paper Code : 21354

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Electronics and Communication Engineering

EC 2204/EC 35/EC 1202 A/10144 EC 305/080290015 – SIGNALS AND SYSTEMS

(Regulation 2008/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Check whether the discrete time signal $\sin 3n$ is periodic.
2. Define a random signal.
3. State the time scaling property of Laplace transform.
4. What is the Fourier transform of a DC signal of amplitude 1?
5. Define the convolutional integral.
6. What is the condition for a LTI system to be stable?
7. What is the z transform of $\delta(n + k)$?
8. What is aliasing?
9. Is the discrete time system described by the difference equation $y(n) = x(-n)$ causal.
10. If $X(\omega)$ is the DTFT of $x(n)$, what is the DTFT of $x^*(-n)$?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Define an energy and power signal. (4)
(ii) Determine whether the following signals are energy or power and calculate their energy or power.

$$(1) \quad x(n) = \left(\frac{1}{2}\right)^n u(n). \quad (4)$$

$$(2) \quad x(t) = \text{rect}\left(\frac{t}{T_0}\right). \quad (4)$$

$$(3) \quad x(t) = \cos^2(\omega_0 t). \quad (4)$$

Or

- (b) (i) Define unit step, Ramp, Pulse, Impulse and exponential signals. Obtain the relationship between the unit step function and unit ramp function. (10)

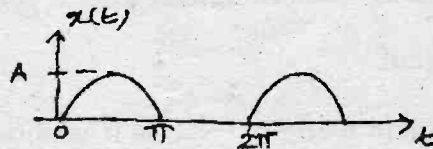
- (ii) Find the fundamental period T of the signal
 $x(n) = \cos(n\pi/2) - \sin(n\pi/8) + 3 \cos(n\pi/4 + \pi/3)$. (6)

12. (a) (i) Compute the Laplace transform of $x(t) = e^{-b|t|}$ for the cases of $b < 0$ and $b > 0$. (10)

- (ii) State and prove Parseval's theorem of Fourier transform. (6)

Or

- (b) (i) Determine the Fourier series representation of the half wave rectifier output shown in figure below. (8)



- (ii) Write the properties of ROC of laplace transform. (8)

13. (a) (i) Determine the impulse response $h(t)$ of the system given by the differential equation $\frac{d^2 y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2y(t) = x(t)$

with all initial conditions to be zero. (8)

- (ii) Obtain the direct form I realization of

$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}. \quad (8)$$

Or

- (b) The system produces the output $y(t) = e^{-t}u(t)$ for an input $x(t) = e^{-2t}u(t)$.

Determine

- (i) frequency response
 (ii) magnitude and phase of the response
 (iii) the impulse response. (16)

14. (a) (i) Determine the Z transform of $x(n) = a^n \cos(\omega_0 n)u(n)$. (8)
- (ii) Determine the inverse Z transform of $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ for $ROC|Z| > 1$. (8)

Or

- (b) (i) State and prove the time shift and frequency shift property of DTFT. (8)
- (ii) Determine the DTFT of $\left(\frac{1}{2}\right)^n u(n)$. Plot its spectrum. (8)
15. (a) (i) Obtain the impulse response of the system given by the difference equation $y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n)$. (10)
- (ii) Determine the range of values of the parameter "a" for which the LTI system with impulse response $h(n) = a^n u(n)$ is stable. (6)

Or

- (b) Compute the response of the system $y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2)$ to the input $x(n) = nu(n)$. Is the System stable? (16)