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Question Paper Code : 77113

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulation 2013)

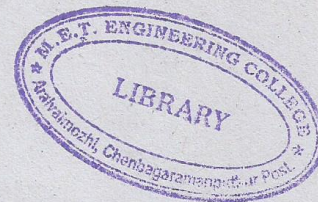
Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define a power signal.
2. How the impulse response of a discrete time system is useful in determining its stability and causality?
3. Find the Fourier coefficients of the signal
$$x(t) = 1 + \sin 2\omega t + 2 \cos 2\omega t + \cos\left(3\omega t + \frac{\pi}{3}\right).$$
4. Draw the spectrum of a CT rectangular pulse.
5. Given $x(t) = \delta(t)$. Find $X(s)$ and $X(\omega)$.
6. State the convolution integral
7. Determine the Nyquist sampling rate for $x(t) = \sin(200\pi t) + 3 \sin^2(120\pi t)$.
8. List the methods used for finding the inverse Z transform.
9. Name the basic building blocks used in LTIDT system block diagram.
10. Write the n^{th} order difference equation.



PART B — (5 × 16 = 80 marks)

11. (a) (i) Give an account for classification of signals in detail (10)
 (ii) Sketch the following signals
 (1) $[u(t-2) + u(t-4)]$
 (2) $(t-4)[u(t-2) - u(t-4)]$. (6)

Or

- (b) (i) Check if $x(t) = 4 \cos\left(3\pi t + \frac{\pi}{4}\right) + 2 \cos(4\pi t)$ is periodic. (6)
 (ii) For the system $y(n) = \log[x(n)]$, check for linearity, causality, time invariance and stability. (10)
12. (a) (i) Determine the fourier series expansion for a periodic ramp signal with unit amplitude and a period T . (10)
 (ii) Find the fourier transform of $x(t) = te^{-\alpha t}u(t)$. (6)

Or

- (b) (i) If $x(t) \leftrightarrow X(\omega)$, then using time shifting property show that $x(t+T) + x(t-T) \leftrightarrow 2X(\omega)\cos\omega T$. (6)
 (ii) Find the inverse Laplace transform of $X(s) = \frac{8s+10}{(s+1)(s+2)^3}$ (10)
13. (a) (i) Solve the differential equation $(D^2 + 3D + 2)y(t) = Dx(t)$ using the input $x(t) = 10e^{-3t}$ and with initial condition $y(0^+) = 2$ and $\dot{y}(0^+) = 3$. (10)
 (ii) Draw the block diagram representation for $H(s) = \frac{4s+28}{s^2+6s+5}$. (6)

Or

- (b) (i) For a LTI system with $H(s) = \frac{s+5}{s^2+4s+3}$ find the differential equation. Find the system output $y(t)$ to the output $x(t) = e^{-2t}u(t)$. (10)
 (ii) Using graphical method convolve $x(t) = e^{-2t}u(t)$ with $h(t) = u(t+2)$. (6)

14. (a) (i) A continuous time sinusoid $\cos(2\pi ft + \theta)$ is sampled at a rate $f_s = 1000 \text{ Hz}$. Determine the resulting signal samples if the input signal frequency f is 400 Hz, 600 Hz and 1000 Hz respectively. (8)

(ii) Prove the following DTFT properties

$$(1) \quad nx(n) \Leftrightarrow j \frac{dX(\Omega)}{d\Omega}$$

$$(2) \quad x(n)e^{j\Omega_c n} \Leftrightarrow X(\Omega - \Omega_c). \quad (8)$$

Or

(b) (i) Find the DTFT of $x(n) = \left(\frac{1}{2}\right)^{n-1} u(n-1)$. (5)

(ii) Using suitable z transform properties find $X(z)$ if

$$x(n) = (n-2) \left(\frac{1}{3}\right)^{n-2} u(n-2). \quad (6)$$

(iii) Find the z transform of $x(n) = a^{|n|} 0 < a < 1$. (5)

15. (a) (i) Determine the impulse response and step response of $y(n) + y(n-1) - 2y(n-2) = x(n-1) + 2x(n-2)$. (10)

(ii) Find the convolution sum between $x(n) = \{1, 4, 3, 2\}$ and $h(n) = \{1, 3, 2, 1\}$. (6)

Or

- (b) (i) A causal system has $x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$ and $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$. Find the impulse response and output if

$$x(n) = \left(\frac{1}{2}\right)^n u(n). \quad (12)$$

(ii) Compare recursive and nonrecursive systems. (4)

