Reg. No. : | | | | | | | | | | | | |

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 $x(t) = 1 + \sin 2wt + 2\cos 2wt + \cos\left(3wt + \frac{\pi}{3}\right)$.

4. Draw the spectrum of a CT rectangular pulse.

5. Given $x(t) = \delta(t)$. Find $X(s)$ and $X(w)$.

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 $x(t)=te^{-at}u(t)$. (6)

Or

(b) (i) If $x(t)\Leftrightarrow X(w)$, then using time shifting property show that $x(t+T)+x(t-T)\Leftrightarrow 2X(w)\cos wT$. (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 $\dot{y}(o^+)=3$. (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 $fs=1000\,Hz$. 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) $nx(n) \Leftrightarrow j\frac{dX(\Omega)}{d\Omega}$

(2) $x(n)e^{j\Omega_c n} \Leftrightarrow X(\Omega-\Omega_c)$. (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 $x(n)=(n-2)\left(\frac{1}{3}\right)^{n-2}u(n-2)$. (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 $x(n)=\left(\frac{1}{2}\right)^n u(n)$. (12)

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