Reg. No. :

26-4 DN

Question Paper Code : 73443

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

Third Semester

Electronics and Communication Engineering

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

(Common to Biomedical Engineering)

(Regulations 2008/2010)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are singularity functions?
2. What is an LTI system?
3. State Dirichlet conditions.
4. Define region of convergence of Laplace transform for a causal signal.
5. Define state variable and state equations.
6. State the condition for a continuous time system to be stable and causal.
7. What is aliasing?
8. Give the transform pair equations of DTFT.
9. Give the N^{th} order linear constant coefficient difference equation of discrete system.
10. Find the stability of the system whose impulse response is $h(n) = 2^n u(n)$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How are signals classified? Explain with example. (8)

(ii) Determine fundamental period of the signal $x(t) = 2\cos(10t+1) - \sin(4t-1)$. (4)

(iii) Determine whether the signal $x(t) = \cos^2 w_o t$ is energy signal or power signal. And calculate their energy and power. (4)

Or

(b) (i) Check whether the system $y(n) = nx(n)$ is (5 × 2 = 10)

(1) static or dynamic

(2) linear or nonlinear

(3) shift invariant or shift variant

(4) causal or noncausal

(5) stable or unstable.

(ii) Sketch the signals

(1) $u[n-2] - u[n-5]$

(2) $x[n] = \{\underset{\uparrow}{1}, 2, 6, 4, 8, 10\}$

sketch $x[2n]$ (6)

12. (a) (i) Find the trigonometric Fourier series of the waveform shown in Fig.12 (a) (i). (8)

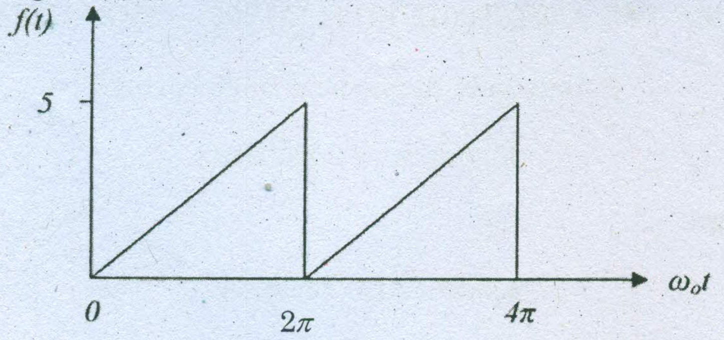

Fig. 12 (a) (i)

(ii) Find the Fourier transform of $f(t) = t\cos at$. (8)

Or

(b) (i) Find the Laplace transform of the waveform shown in Fig.12 (b)(i) (6)

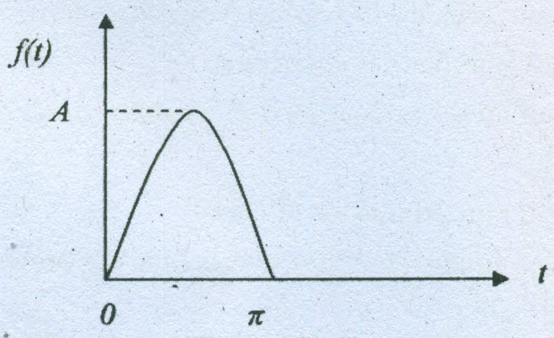

Fig. 12 (b) (i)

(ii) Find the inverse Laplace transform of $F(s) = \frac{s-2}{s(s+1)^3}$. (10)

13. (a) (i) Derive an expression for convolution integral. (8)

(ii) Determine the frequency response and impulse response of the system having following differential equation.

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 2\frac{dx(t)}{dt} + 4x(t).$$ (8)

Or

(b) (i) Determine $H(s)$ for the following differential equation $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$.

Also determine $h(t)$ for each of the following cases:

(1) The system is stable

(2) The system is causal

(3) The system is neither stable nor causal. (10)

(ii) Construct the state variable model for the transfer function $T(s) = \frac{Y(s)}{R(s)} = \frac{s+3}{s^3 + 5s^2 + 8s + 3}$. (6)

14. (a) (i) State and prove sampling theorem. (8)

(ii) For the given signal $x(t) = \cos(200\pi t + \theta)$

(1) If $x(t)$ is sampled at 250 Hz, 500 Hz and 100 Hz. At which frequency does aliasing phenomena take place?

(2) What is the discrete time signal $x_d(n)$ if sampling frequency is 100 Hz? (4)

(iii) State any four properties of DTFT. (4)

Or

(b) (i) Find the z-transform of $x(n) = \cos w_0 n$ for $n \geq 0$. (8)

(ii) Find the inverse z-transform of $X(Z) = \frac{1}{(z-0.25)(z-0.5)}$; $ROC\,|z| > 0.5$ (8)

15. (a) (i) A discrete time causal system has a transfer function $H(Z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$.

(1) Determine the difference equation of the system

(2) Show pole zero diagram

(3) Find impulse response of the system. (10)

(ii) Compute $y(n) = x(n) * h(n)$, where

$$x(n) = \begin{cases} 1, & 3 \leq n \leq 8 \\ 0, & \text{otherwise} \end{cases}$$

$$h(n) = \begin{cases} 1, & 4 \leq n \leq 15 \\ 0, & \text{otherwise} \end{cases}.$$ (6)

Or

(b) (i) Draw direct form, cascade form and parallel form representations of the second order system function $H(z) = \frac{1}{(1+0.5z^{-1})(1-0.25z^{-1})}$. (8)

(ii) Determine the system function for the causal LTI system with difference equation $y(n) - \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n)$. Also determine $y(n)$ if $x(n) = \left(\frac{1}{2}\right)^n u(n)$. (8)