Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR/MAY 2024

Electronics and Communication Engineering
Semester
EC7355 Signals and Systems

ADDITIONAL CONTROLLER OF EXAMINATIONS AU CHENNAI 600 025

(Regulation 2015)

Time: 3 hrs   Max. Marks: 100

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks
1	Draw the signal $x(t) = u(t+1) - 2\,u(t) + u(t+1)$ where, $r(t)$ is unit ramp signal.	2
2	When can a system be called as recursive system? Give an example.	2
3	Let a continuous time periodic signal $x(t)$ with period of 1 ms has non-zero coefficients $c_1 = c_{-1}^* = 3\text{-}4j$. Find the signal $x(t)$.	2
4	Write Dirichlet conditions associated with Fourier transform.	2
5	Write the relationship between frequency response and transfer function of a continuous time system.	2
6	List any two properties of ROC in Laplace transform.	2
7	State low pass sampling theorem.	2
8	If a DT signal $x[n]$ has Z-transform $X(z)$, write the Z-transform of the signal $y[n] = x[n-5]$.	2
9	Compare direct form-II structure and direct form-I realization of DT systems.	2
10	Find the convolution of $x[n] = \delta[n-2]$ with $h[n] = \delta[n] - \delta[n-1]$.	2

PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks
11 (a) (i)	Classify the following signals based on energy /power $x(t) = exp(-2\|t\|)$, $x[n] = exp(-j2\pi t)$,	6+3
(ii)	Classify the following system based on linearity and time invariance $x[n] = n\,x[n-5] + x^2[n]$.	4
	(OR)	
11 (b) (i)	Draw the signal $x(t) = r(t) - 2r(t-1) + r(t-2)$, the even and odd parts of $x(t)$.	6
(ii)	Let impulse responses of two DT LTI systems are $h_1[n] = \delta[n] - \delta[n-3]$ & $h_2[n] = u[n+3] - u[n]$. Draw the resultant impulse responses of the systems obtained by cascade and parallel connections of these two.	7
12 (a) (i)	Find the Laplace transform of the signal $x(t) = exp(-2t)\, 2\sin(3t+\pi/4)\, u(t)$.	6
(ii)	State and prove Parseval's theorem of Fourier transform.	7
	(OR)	
12 (b) (i)	Find the Fourier transform $X(\omega)$ of the signal $x(t)$ obtained by the convolution of $\delta(t-2)$ with $rect(2t)$. Draw the magnitude and phase spectrum	6
(ii)	Find different possible signals x(t) which have same inverse Laplace transform of $X(s) = \frac{s+4}{s^2+3s+2}$ while Fourier transform exists.	7

13 (a)	Consider a stable LTI system has an output $y(t) = t\ exp(-\alpha t)\ u(t)$ for an input $x(t) = 2\ exp(-\beta t)\ u(t)$.	
(i)	Find the frequency response of the system.	7
(ii)	Find step response of the system	6
	(OR)	
13 (b)	A LTI system has a transfer function $H(s) = \frac{5\,(s-3)}{(s+2)\,(s^2-4s+13)}$. Determine the impulse response of the system while it is (i) stable and (ii) causal. Also comment of its causality while stable and stability while causal.	13
14 (a) (i)	Find the DTFT of $x[n] = (1/2)^n \cos[\pi n/8]\ u[n]$	7
(ii)	Let a signal x[n] has Z-transform $X(z) = \frac{z}{(z-1)\,(z-3)^2}$. Find the signal x[n] while it is right sided and while it is left sided	6
	(OR)	
14 (b) (i)	Find the Z-transform of $x[n] = (1/5)^{\|n\|} \cos(n\pi/6)$.	7
(ii)	Find inverse DTFT of $Y(e^{j\omega})$ define over one period 2π as, $Y(e^{j\omega}) = 2\ rect([\omega+\omega_c]/W) + 2\ rect([\omega-\omega_c]/W),\ \omega \in [-\pi, \pi)$.	6
15 (a)	Consider a DT LTI system has impulse response $h[n]=[\ 2\ (1/2)^n - (1/3)^n\ ]\ u[n]$.	
(i)	Find the difference equation that describes the system.	7
(ii)	Realize the system in Direct form-II, cascade form and parallel form structures.	6
	(OR)	
15 (b)	A stable DT LTI system is described by, $y[n] = (3/5)\ y[n-1] - (2/25)\ y[n-2] + 3\ x[n]$.	
(i)	Find the unit sample response of the system.	6
(ii)	Find the output of the system for the input $x[n] = [(1/2)^n + (1/5)^n]\ u[n]$.	7

PART- C (1 x 15 = 15 Marks)
(Q.No. 16 is Compulsory)

Q. No	Questions	Marks
16	Consider a signal $x(t) = 3\cos(100\pi t) + 4\cos(200\pi t)$ is sampled at a rate four times that of Nyquist rate to obtain $x[n]$. The resultant signal is passed through a filter with frequency response $H(e^{j\omega}) = rect(\omega/(2W))$ which produces y[n]. The samples $y[n]$ are passed through a digital to analog converter operated with same sampling rate and a CT signal $y(t)$ is obtained. Let W equals 3π/32 rad/sample.	
(i)	Find the signals $x[n]$, $y[n]$ for n=0,1,…, 10 and $y(t)$.	7
(ii)	Draw the magnitude spectrums of $x(t)$, $x[n]$, $y[n]$ and $y(t)$ in their respective domains.	8