CBCS SCHEME

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17EE54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain Classification of Signals. **(06 Marks)**

b. A signal $x(t) = u(t)$, unit step function. Sketch and label each of the following signals :
i) $x(t-2)$ ii) $x(-t)$ iii) $x(t+2)$ iv) $s(t/2)$. **(08 Marks)**

c. Determine whether the following signals are periodic, if periodic determine the fundamental period :

i) $x(t) = \cos 2t + \sin 3t$ ii) $x(n) = \cos(1/5\ \pi n)\ \ \sin(\frac{1}{3}\pi n)$. **(06 Marks)**

OR

2 a. What are different elementary signals? Explain them, with neat sketch. **(04 Marks)**

b. For the system given below, determine whether or not the system is linear causal , time invariant, BIBO stable : i) $y(t) = e^{x(t)}$ ii) $y(n) = x(n)\,u(n)$. **(10 Marks)**

c. Find even and odd part of following signal :
i) $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$ ii) $x(n) = u(n)$. **(06 Marks)**

Module-2

3 a. Consider a LTI system with unit impulse response $h(t) = e^{-t}u(t)$. If the input to the system is $x(t) = e^{-3t}[u(t) - u(t-2)]$. Find the output $y(t)$ of the system. **(10 Marks)**

b. Evaluate the discrete time Convolution sum for $h[n] = u[n]$ and $x[n]\ .\ (\frac{1}{2})^n\,u[n-2]$. **(06 Marks)**

c. Find the step response for the CTI system represented by the impulse response $h(n) = (\frac{1}{2})^n u(n)$. **(04 Marks)**

OR

4 a. A discrete LTI system is characterized by the following difference equation.
$y(n) - y(n-1) - 2y(n-2) = x(n)$ with $x(n) = 6u(n)$ and initial conditions $y(-1) = -1$, $y(-2) = 4$.
Find the zero input response, zero state response and total response. **(10 Marks)**

b. Draw the direct Form I and II realization for the following system :

i) $y(n) - \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n) + 2x(n-1)$.

ii) $2\frac{d^3y}{dt^3} + \frac{dy(t)}{dt} + 3y(t) = x(t)$. **(10 Marks)**

Module-3

5 a. State and prove following properties in continuous Time Fourier Transform :
i) Time shift ii) Frequency shift iii) Convolution. **(10 Marks)**

b. Find Fourier transform of following signals :
i) $x(t) = e^{at}u(-t)$ ii) $x(t) = 1$ iii) $x(t) = \cos w_0 t$. **(10 Marks)**

OR

6 a. Using Partial fraction expansion, determine the Inverse Fourier transform of

i) $X(w) = \dfrac{5jw + 12}{(jw)^2 + 5jw + 6}$ ii) $X(w) = \dfrac{-jw}{(jw)^2 + 3jw + 2}$. **(10 Marks)**

b. A system produces output of $y(t) = e^{-2t}\,u(t) + e^{-3t}\,u(t)$ for an input $x(t) = e^{-t}\,u(t)$ Determine the Impulse response and Frequency response of the system. **(10 Marks)**

Module-4

7 a. State and prove the following properties in DTFT :

i) Parseval's theorem ii) Differentiation in frequency domain. **(10 Marks)**

b. Find DTFT of the following signal :

i) $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$ ii) $x(n) = u(n)$. **(10 Marks)**

OR

8 a. Find Inverse DTFT of

$X(e^{i\Omega}) = \dfrac{6}{e^{-j2\Omega} - 5e^{-i\Omega} + 6}$. **(06 Marks)**

b. Determine the difference equation description for the system with following impulse response $h(n) = \delta(n) + 2(½)^n\,u(n) + (-½)\,u(n)$. **(07 Marks)**

c. Obtain the frequency response and the impulse response of the system described by the difference equation : $y(n) + \frac{1}{2}\,y(n-1) = x(n) - 2x(n-1)$. **(07 Marks)**

Module-5

9 a. What is Region of Convergence? List any five properties of RoC. **(07 Marks)**

b. Determine Z – transform of the following signals :

i) $x(n) = n\,a^n\,u(n)$ ii) $x(n) = (0.2)^n\,\{u(n) - u(n-u)\}$. **(08 Marks)**

c. State and prove Initial value theorem of Z - transforms. **(05 Marks)**

OR

10 a. Using Partial Fraction expansion method, find time domain signal.

$X(z) = \dfrac{z^3 - 3z}{z^2 + \frac{3}{2}z - 1}$; RoC : $\frac{1}{2} < |z| < 2$. **(06 Marks)**

b. Solve the following difference equation $y(n) + 3y(n-1) = x(n)$, with $x(n) = u(n)$ and Initial condition $y(-1) = 1$. **(08 Marks)**

c. The output of a discrete time LIT system is found to be $y(n) = 2(\frac{1}{3})^n\,u(n)$. When input is $x(n) = u(n)$. Find Impulse response $h(n)$ of the system. **(06 Marks)**

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