CBCS SCHEME

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15EE54

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
Signals and Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Distinguish between :
i) Continuous Time Signals and Discrete Time Signals
ii) Even Signals and Odd Signals
iii) Periodic and Non-Periodic Signals. **(06 Marks)**

b. Check whether the signals given below are periodic. If periodic find the fundamental period
i) $x(t) = \cos t + \sin\sqrt{2}\, t$
ii) $x(n) = \cos\frac{\pi}{3} n + \sin\frac{\pi}{4} n$. **(06 Marks)**

c. A system has an input output relation given by $y(t) = \frac{d}{dt}\left[e^{-t} x(t)\right]$. Determine whether the system is : i) memory-less ii) stable iii) linear iv) causal. **(04 Marks)**

OR

2 a. A triangular pulse signal is shown in Fig.Q2(a) sketch x(3t) + x(3t + 2).

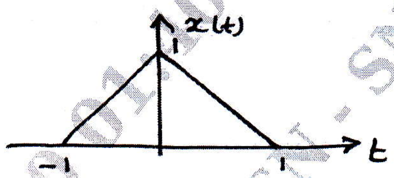

Fig.Q2(a) **(04 Marks)**

b. The signals x(n) and y(n) are as shown in Fig.Q2(b) sketch x(n + 2) y(n – 2).

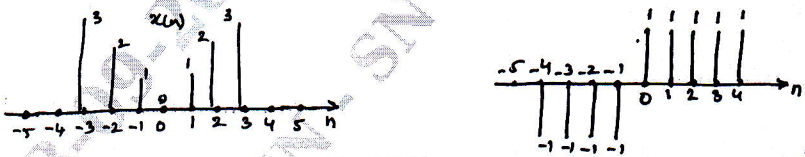

Fig.Q2(b) **(04 Marks)**

c. Find the even and odd components of the signal shown in Fig.Q2(c).

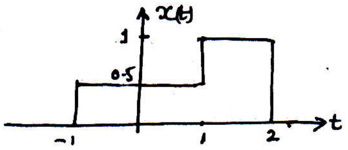

Fig. Q2(c) **(05 Marks)**

d. The input – output relationship of a discrete time system is $y[n] = \sum_{k=-\infty}^{n} x(k+2)$. Check whether the system is : i) memory-less ii) causal. **(03 Marks)**

Module-2

3 a. Evaluate $y(n) = x(n) * n(n)$ where x(n) and h(n) are shown in Fig.Q3(a).

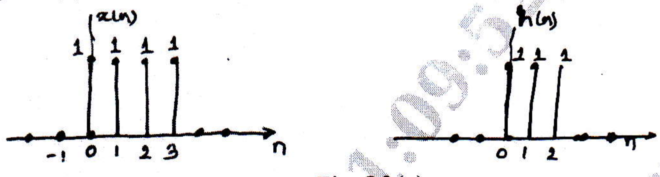

Fig.Q3(a) **(06 Marks)**

b. Show that linear time invariant systems is BIBO stable if and only if :

$\sum_{k=-\infty}^{\infty} |h(k)| < \infty$. **(04 Marks)**

c. Draw the direct from – I and direct form – II realizations for the system with input – output relationship $4\frac{d^3y(t)}{dt^3} - 3\frac{dy(t)}{dt} + y(t) = x(t) + \frac{dx(t)}{dt}$. **(06 Marks)**

OR

4 a. For a system the input $x(t) = e^{-3t}[u(t)-u(t-2)]$ and the inpulse response $h(t) = e^{-t}u(t)$. Determine the output y(t) using convolution integral. **(06 Marks)**

b. Determine the homogeneous solution for the system described by the difference equation :

$y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1]$ with $y(-y) = 0$ and $y(-2) = 1$. **(06 Marks)**

c. Evaluate the step response of the system : $n(t) = e^{-2t}u(t-1)$. **(04 Marks)**

Module-3

5 a. State and prove convolution property of Fourier transform. **(05 Marks)**

b. Use the defining equation for continuous time Fourier transform to evaluate the frequency domain representation of $x(t) = e^{-4|t|}$. **(05 Marks)**

c. Find the frequency response and impulse response of the system having input $x(t) = e^{-t}u(t)$ and output $y(t) = e^{-2t}u(t) + e^{-3t}u(t)$. **(06 Marks)**

OR

6 a. Evaluate the Fourier transform of the continuous time signal x(t) shown in Fig.Q6(a).

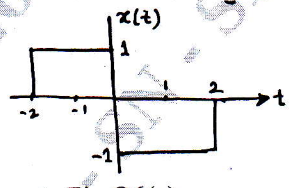

Fig.Q6(a) **(05 Marks)**

b. Determine the frequency response and impulse response for system described by the differential equation :

$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{-d}{dt}x(t)$. **(05 Marks)**

c. Determine the time domain signal corresponding to $x(j\omega)$ shown in Fig.Q6(c).

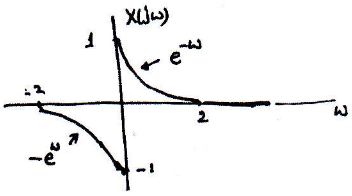

Fig.Q6(c) **(06 Marks)**

Module-4

7 a. State and prove Parsevals theorem for discrete domain. **(05 Marks)**

b. Determine the frequency response and impulse response for system described by the difference equations : $y[n] + \frac{1}{2}y(n-1] = x[n] - 2x[n-1]$. **(06 Marks)**

c. Evaluate discrete time Fourier transform of the signal $x[n] = [\frac{1}{3}]^n u(n+2)$. **(05 Marks)**

OR

8 a. Evaluate the Fourier transform of the signal

$x(n) = \cos\left(\frac{\pi}{4}n\right)\left(\frac{1}{2}\right)^n u(n-2)$ **(06 Marks)**

b. Find the frequency response and impulse response of the system having input $x[n] = (\frac{1}{2})^n u(n)$ and output $y[n] = \frac{1}{4}(\frac{1}{2})^n u(n) + (\frac{1}{4})^n u(n)$. **(06 Marks)**

c. Determine the difference equation description for the system with frequency response.

$$H(e^{j\Omega}) = 1 + \frac{e^{-j\Omega}}{(1-\frac{1}{2}e^{-j\Omega})(1+\frac{1}{4}e^{-j\Omega})}.$$ **(04 Marks)**

Module-5

9 a. Define RoC. List the properties of RoC. **(05 Marks)**

b. Determine the Z-transform of the signal $x[n] = (\frac{1}{4})^n [u(n) - u(n-5)]$. **(05 Marks)**

c. Determine the transfer function and impulse response representations of the system represented by the difference equations :

$$y[n] - \frac{4}{5}y[n-1] - \frac{16}{25}y[n-2] = 2x[n] + x[n-1].$$ **(06 Marks)**

OR

10 a. Determine the Z-transform of the signal

$$x(n) = \begin{cases} (1/3)^n; & n \geq 0 \\ (1/2)^{-n}; & n < 0 \end{cases}$$

Give the region of convergence. **(05 Marks)**

b. The pole zero plot for x(z) is an shown in Fig.Q10(b). Find the transfer function and identify all the ROCs.

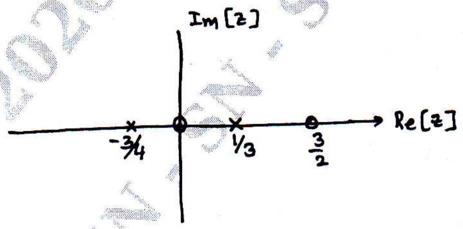

Fig.Q10(b) **(06 Marks)**

c. Determine whether the system with transfer function :

$$H(z) = \frac{2z+3}{z^2 + z - \frac{5}{16}}$$

is : i) causal and stable
ii) minimum phase. **(05 Marks)**

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