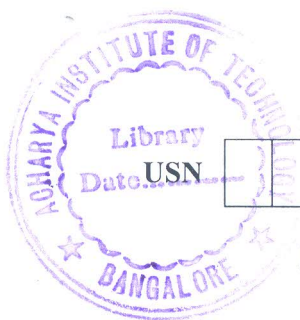


CBCS SCHEME



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 $y(t) = \frac{d}{dt} [e^{-t} x(t)]$. 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 $x(3t) + x(3t + 2)$.

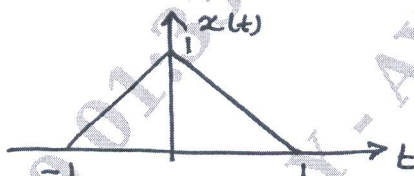


Fig. Q2(a)

(04 Marks)

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

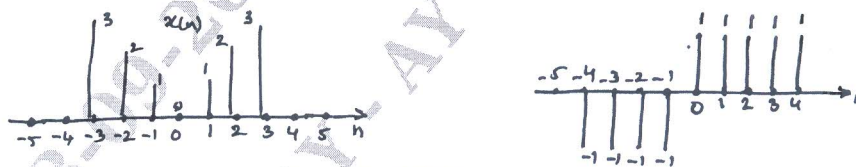


Fig. Q2(b)

(04 Marks)

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

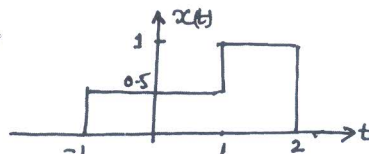


Fig. Q2(c)

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

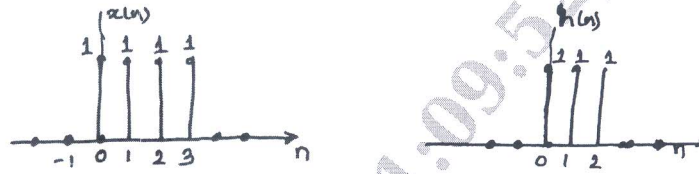


Fig.Q3(a)

(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 form – I and direct form – II realizations for the system with input – output

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

(06 Marks)

OR

- 4 a. For a system the input $x(t) = e^{-3t}[u(t)-u(t-2)]$ and the impulse 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 :

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

- 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).

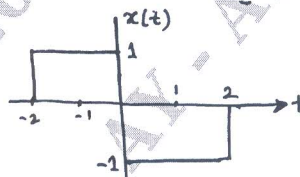


Fig.Q6(a)

(05 Marks)

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

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

(05 Marks)

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

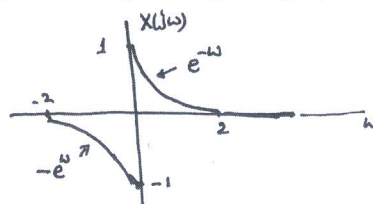


Fig.Q6(c)

(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
 $x(n) = \cos(\frac{\pi}{4}n)(\frac{1}{2})^n u(n-2)$ (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.

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

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 :

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

OR

- 10 a. Determine the Z-transform of the signal

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

Give the region of convergence. (05 Marks)

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

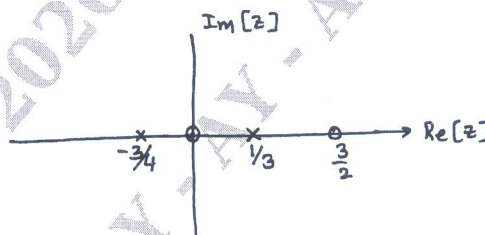


Fig.Q10(b)

(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)
