CBCS SCHEME

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17EC42

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

Time: 3 hrs. Max. Marks: 100

Note: ***1. Answer any FIVE full questions, choosing ONE full question from each module.***
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. Explain the following with an example each :
i) Even and odd signal
ii) Aperiodic and periodic signal
iii) Energy and power signal. **(06 Marks)**

b. Sketch the following signal :
i) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$
ii) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$ **(06 Marks)**

c. Verify the following properties of system :
memoryless, casual, stable and some invariant $y(n) = n\,x(n)$. **(08 Marks)**

OR

2 a. Sketch the even and odd parts of the signal shown in the Fig.Q2(a).

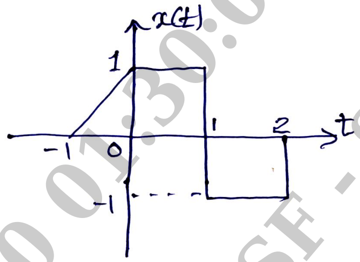

Fig.Q2(a) **(06 Marks)**

b. Classify the following the following as an energy or power signal
i) $y(t) = r(t) - r(t-2)$
ii) $x(t) = (1 + e^{-5t})u(t)$. **(08 Marks)**

c. Determine whether the following signals are periodic or not. If periodic find its fundamental time period.
i) $x[n] = 5\sin\left(\frac{7\pi n}{12}\right) + 8\cos\left(\frac{14\pi n}{8}\right)$
ii) $x(t) = \cos t + \sin\sqrt{2}t$. **(06 Marks)**

Module-2

3 a. Prove the following properties of convolution :
i) Commutative ii) Distributive. **(06 Marks)**

b. Determine the convolution of the following two signals $x(t) = e^{-3t}u(t)$ and $h(t) = u(t+2)$. **(07 Marks)**

c. Find the convolution of the following sequences
$x(n) = \beta^n u(n)$ with $|\beta| < 1$ and $h(n) = u(n-3)$. **(07 Marks)**

OR

4 a. Determine the convolution sum of the given sequence $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ and $h(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$ sketch output. **(06 Marks)**

b. The impulse response of the system is given by h(t) = u(t). Determine the output of the system for an input $x(t) = e^{-\alpha t}u(t)$. **(08 Marks)**

c. Prove the associative property of convolution. **(06 Marks)**

Module-3

5 a. Find the step response for the impulse response $h(t) = u(t+1) - u(t-1)$. **(06 Marks)**

b. Find the overall impulse response of a cascade of two systems having identical impulse responses $h(t) = 2[u(t) - u(t-1)]$. **(06 Marks)**

c. Find the Fourier series coefficients X(k) for the signal $x(t) = \sum_{m=-\infty}^{\infty}[\delta(t - \tfrac{1}{2}m)]$. Sketch the magnitude and phase spectra. **(08 Marks)**

OR

6 a. Determine whether following system with the given impulse response is memoryless, causal and stable $h[n] = \left[\frac{1}{2}\right]^n u[n]$. **(06 Marks)**

b. Evaluate the DTFS representation for the signal x(n) shown in Fig.6(b) and sketch its spectra.

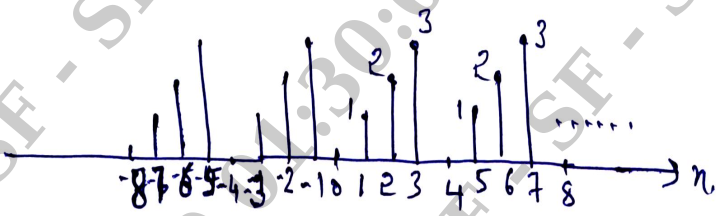

Fig.Q6(b) **(08 Marks)**

c. Find the Fourier series representation for the signal $x(t) = \sin(2\pi t) + \cos(3\pi t)$. Sketch the magnitude and phase spectra. **(06 Marks)**

Module-4

7 a. Prove the following properties of Fourier transform :

i) Time shifting

ii) Time domain convolution. **(08 Marks)**

b. Find the Fourier transform of the signal. **(06 Marks)**

c. Find the DTFT of the signal shown in the Fig.Q7(c).

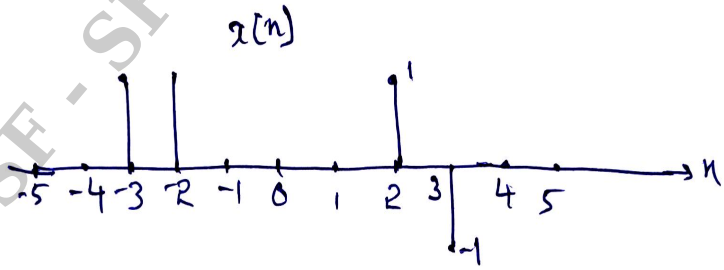

Fig.Q7(c) **(06 Marks)**

OR

8 a. Explain the concept of sampling theorem and reconstruction of signals. **(06 Marks)**

b. Find the DTFT of the sequence $x(n) = -a^n u[-n-1]$. **(08 Marks)**

c. Find the Fourier transform of the signal $x(t) = e^{-3t} u(t-1)$. **(06 Marks)**

Module-5

9 a. Explain the properties of ROC. **(05 Marks)**

b. Find the Z-transform and the ROC of the discrete sinusoid signal.
$x[n] = [\sin(\Omega n)]u[n]$. **(07 Marks)**

c. Find the transfer function and difference equation if the impulse response is

$$h[n] = \left[\frac{1}{3}\right]^n u[n] + \left[\frac{1}{2}\right]^n u[n-1].$$ **(08 Marks)**

OR

10 a. Using power series expansion technique or long division method find the inverse z-transform of the following X(z).

i) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| < \frac{1}{2}$

ii) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| > 1$. **(08 Marks)**

b. Determine the z-transform of the following signal $x[n] = 2^n u[n]$.
Also obtain ROC and locations of poles and zeroes of X(z). **(06 Marks)**

c. Using z-transform find the convolution of the following two sequences

$h[n] = \left\{\underset{\uparrow}{1}, \frac{1}{2}, \frac{1}{4}\right\}$ and

$x[n] = \delta[n] + \delta[n-1] + 4\delta(n-2)$. **(06 Marks)**

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