Code No: R1631023 **R16** SET - 1

III B. Tech I Semester Regular Examinations, October/November - 2018

SIGNALS AND SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1\. a) What is the condition for orthonormality? [2M]

b) If $x(t) \overset{F}{\leftrightarrow} X(f)$, then find FT of $g(t) = x(2t)$. [2M]

c) What is the minimum sampling rate required to sample the signal $x(t) = 5\cos(\pi 500t) + 15\sin(\pi 1000t)$ [2M]

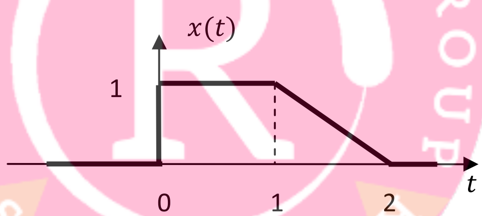
d) Draw the magnitude response of ideal band stop filter. [3M]

e) What is the relation between Laplace transform and Fourier transform of a signal? [3M]

f) Find the z-transform of $x[n] = \left(\frac{1}{4}\right)^n u(-n-1)$? [2M]

PART -B

2\. a) Find the even and odd parts of the signal shown in Figure. [7M]



b) Show that the unit impulse function is the derivative of unit step function. [7M]

3\. a) State and prove the time-convolution property of Fourier transform. [7M]

b) A periodic signal is defined over one period as [7M]

$$x_p(t) = \sin(\pi t)\,; 0 < t < 1$$

i) Plot $x_p(t)$

ii) Obtain Fourier series representation of $x_p(t)$

4 State and prove sampling theorem for band-limited signals. [14M]

5\. a) State and prove Parseval's theorem. [7M]

b) Find the convolution of two signals $x(t) = u(t-1) - u(t+1)$ and $h(t) = e^{-at}u(t), a > 0$. [7M]

6\. a) Find the Laplace transform of $x(t) = e^{-at}u(t), a > 0$ and plot its ROC. [7M]

b) State and prove the convolution property of Laplace transform. [7M]

7\. a) State and prove the final-value theorem of z-transform. [7M]

b) Find the inverse z-transform of $X(z) = \frac{1}{1+z}$ with ROC $|z| < 1$. [7M]

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Code No: R1631023 **R16** SET - 2

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PART –A

1. a) If it is periodic, what is the fundamental period of $x(t) = Acos(2\pi 1000t) + Bsin(2\pi 500t)$? [2M]
b) Find the FT of unit ramp function. [2M]
c) What is aliasing effect? [2M]
d) Define cross-correlation function. [3M]
e) Find the initial value of $x(t)$ with $X(s) = \frac{1}{s+1}$. [3M]
f) State final-value theorem of z-transform. [2M]

PART -B

2. a) Define the following: [7M]
i) Energy-type signals ii) Power-type signals
b) If $x(t) = u(t) - u(t-1)$. Plot $y(t) = x(2t + 3)$. [7M]

3. a) State and prove the time-scaling property of Fourier transform. [7M]
b) Explain how the Fourier transform of a periodic signal can be obtained. [7M]

4. a) Define the following: [7M]
i) Sampling rate ii) Under Sampling iii) Nyquist interval
b) Determine the conditions on sampling interval T_s, so that the signal $x(t) = cos(2\pi t) + \sin(6\pi t)$ is uniquely represented by a discrete-time sequence $x[n] = x(nT_s)$. [7M]

5. a) Explain about stability and causality of an LTI system. [7M]
b) What do you understand by distortedness transmission? Explain. [7M]

6. a) State and prove the initial-value theorem of Laplace transform. [7M]
b) Determine the Laplace transform of the following signals: [7M]
i) $x_1(t) = \cos(\omega_o t)$ ii) $x_2(t) = te^{-t}u(t)$

7. a) State and prove time convolution property of Z-transform. [7M]
b) Determine z-transform, ROC and pole-zero locations of $x[n] = e^{j\Omega_o n}u[n]$. [7M]

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PART –A

1. a) Evaluate the integral: $\int_{-\infty}^{\infty} \cos(200t)\delta(t-t_o)dt$ [2M]
   b) State the time-integration property of FT. [2M]
   c) Define Nyquist interval. [2M]
   d) What is the relation between rise time and bandwidth of a linear system? [3M]
   e) Find the final value of $f(t)$ with $F(s) = \frac{10}{s+10}$. [3M]
   f) Draw the ROC of $X(z)$ if $x[n] = \left(\frac{1}{8}\right)^n u[n]$. [2M]

PART -B

2. a) Define the following and give one example for each: [7M]
   i) Random signal ii) Deterministic signal iii)Multi channel signal
   b) Determine whether the signal $x(t) = (\cos(2\pi t))^2$ is periodic. If it is periodic, find the fundamental period. [7M]

3. a) Use differentiation-in-time and differentiation-in-frequency properties to find the Fourier transform of the Gaussian pulse, $(t) = \left(\frac{1}{\sqrt{2\pi}}\right) e^{-\frac{t^2}{2}}$. [7M]
   b) Find the Hilbert transform of the signal $x(t) = \cos(2\pi t)$. [7M]

4. a) Define the following: [7M]
   i) Under sampling ii) Over sampling iii) Critical sampling
   b) Compare natural sampling and flat top sampling. [7M]

5. a) A signal is given by $x(t) = u(t) - u(t-1)$. Convolve $x(t)$ with itself and plot the result. [7M]
   b) Draw the ideal filter characteristics. What is the condition for realizability of these filters? [7M]

6. a) Find the inverse Laplace transform of [7M]
   i) $X(s) = \frac{1}{s+2} \, with \, ROC \, Re(s) > -2$
   ii) $X(s) = \frac{1}{(s+2)(s+3)} \, with \, ROC \, Re(s) > -2$
   b) List the properties of ROC for Laplace transforms [7M]

7. a) State and prove the convolution property of z-transform. [7M]
   b) State and prove time-advance property of z-transform. [7M]

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PART –A

1. a) Plot the signal $x(t) = 5u(2t-1)$, where $u(t)$ is unit step function. [2M]
b) Define Fourier complex spectrum [2M]
c) Define band-limited signal. [2M]
d) What is the relation between convolution and correlation? [3M]
e) State differentiation property of Laplace transforms. [3M]
f) Draw the pole-zero plot of $H(z) = \frac{z}{1+z}$ [2M]

PART -B

2. a) Find the energy and power of the signal $x(t) = 5\cos(\pi t) + \sin(5\pi t)$. [7M]
b) Explain how signals can be approximated using orthogonal functions. [7M]

3. a) Find the Fourier transform of signum function and plot its spectrum. [7M]
b) Derive the relation between exponential Fourier coefficients and trigonometric Fourier coefficients. [7M]

4. a) Explain how a band-limited signal can be reconstructed from its samples. [7M]
b) Write notes on flat-top sampling. [7M]

5. a) Define the following: [7M]
i) Signal bandwidth ii) System bandwidth iii) Causality of a filter
b) State all the properties of Auto correlation function. [7M]

6. a) State and prove the final-value theorem of Laplace transform. [7M]
b) Find the Laplace transform and ROC of $x(t) = sgn(t) + e^{-2t}u(t) + u(t)$. [7M]

7. a) Find the inverse z-transform of $X(z) = \frac{1}{1-az^{-1}}$ with ROC $|z| < |a|$ [7M]
b) State and prove the differentiation in z property of z-transform. [7M]

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