Code No: RT21044 **R13** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
SIGNALS AND SYSTEMS
(Com. to ECE, EIE, ECC)

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 **THREE** Questions from **Part-B**

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PART –A

1. a) Define Signal and System. What are the major classifications of the signal? (4M)
   b) Find the Fourier transform of x (t) = $e^{j2\pi ft}$ (3M)
   c) Define LTI CT systems .What is the condition of LTI system to be stable? (3M)
   d) List and state the properties of convolution Integral (3M)
   e) Define ROC of the Laplace Transform (4M)
   f) A discrete time causal system has a transfer function H(Z)= $(1-Z^{-1}) / (1-0.2Z^{-1}-0.15Z^{-2})$, Determine the difference equation of the system (5M)

PART -B

2. a) Define the error function 'f_e (t)' while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ & $f_2(t)$. (8M)
   b) Find the trigonometric fourier series representation of a periodic square wave (8M)
   x(t) = 1, for the interval (0 , π).
   = 0,for the interval (π , 2π)

3. a) Explain the differences between various sampling techniques (8M)
   b) Determine the Fourier Transform for double exponential pulse whose function is given by (8M)
   y $(t) = e^{-2|t|}$ Also draw its magnitude and phase spectra

4. a) State and prove the relationship between rise time and bandwidth. (8M)
   b) Explain the Filter characteristics of linear systems (8M)

5. a) Prove that auto correlation function and energy/power spectral density function forms Fourier Transform pair. (8M)
   b) With an example explain the Graphical representation of convolution. (8M)

6. a) State and prove time convolution property of Laplace Transform. (8M)
   b) Determine the initial value and final value of signal x(t) whose Laplace Transform is, (8M)

$$X(s) = \frac{2s+5}{s(s+3)}$$

7. a) State and prove the following properties of Z transform (8M)
   i) Linearity ii) Time shifting iii) Differentiation
   b) Find inverse Z-transform (8M)

$X(Z)=1 / (1-1/3z^{-1})(1-1/6z^{-1})$ ROC: $|Z|>1/3$
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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define continuous time unit step and unit impulse (4M)
   b) Define Fourier Transform. Write short notes on dirichlets conditions. (3M)
   c) What is the impulse response of two LTI systems connected in parallel? (3M)
   d) List and state the properties of Autocorrelation function (3M)
   e) State Initial and Final value Theorem of Laplace Transforms (4M)
   f) The system function of the LTI system is given as (5M)
   $H(Z)= (3-4(Z^{-1})) / (1-3.5Z+1.5Z^{2})$
   Specify the ROC of H(Z) and determine h(n)

PART -B

2. a) Write the Derichlet's conditions to obtain Fourier series representation of any signal. Find the trigonometric fourier series for half wave rectified sine wave. (8M)
   b) Find the power and rms value of signal $x(t)=20\cos 2\pi t$. (8M)

3. a) Determine the Fourier Transform for double exponential pulse whose function is given by (8M)
   $y(t) = e^{-2|t|}$ Also draw its magnitude and phase spectra
   b) State and prove any four properties of Fourier Transform (8M)

4. a) What is the impulse response of two LTI systems connected in parallel? (8M)
   State the convolution Integral for CT LTI systems?
   b) Differentiate LII system with LTV system. (8M)

5. a) Determine the convolution sum of two sequences x(n) = {3,2,1,2}, h(n) = {1,2,1,2} (8M)
   b) Explain the relation between convolution and correlation. (8M)

6. a) Find the Laplace Transform of the following: (8M)
   i) $t\, e^{-at}\, u(t)$ ii) $\cos \omega_0 t\, u(t)$
   b) Explain the constraints on ROC for various classes of signals (8M)

7. a) State and prove the following properties of z-transform. (8M)
   i) Time shifting ii) Time reversal iii) Differentiation iv) Scaling in z-domain
   b) Find the inverse z-transform of $x(z) = (z^2+z) / (z-1)(z-3)$, ROC: $z > 3$. Using (i) Partial fraction method, (ii) Residue method (8M)
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Code No: RT21044 **R13** SET - 3

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define orthogonal vector space. (4M)
   b) State modulation theorem (3M)
   c) Find the transfer function of an ideal differentiator (3M)
   d) List and state the properties of Cross correlation function. (3M)
   e) Find the Laplace Transform of the signal x(t) = $e-atu(t)$. (4M)
   f) What is the Z-transform of sequence x(n)=a^nu(n)? (5M)

PART -B

2. a) Test Whether the signal x(n) = (½) n u(n) energy or power signal (8M)
   b) Determine whether the following system are time invariant or not (8M)
   (i) $y(t) = tx(t)$ (ii) y(n) = ($2n$)

3. a) State and prove time shifting and time scaling properties of Fourier Transform. (8M)
   b) Find the Fourier Transform of (8M)
   (i) Triangular pulse with period T = 8Sec and amplitude A = 10V.
   (ii) One cycle of sine wave

4. a) A stable LTI system is characterized by the differential equation (8M)
   $d^2y(t)/dt^2+6dy(t)/dt+8y(t)=2x(t)$
   Find the frequency response & Impulse response using Fourier transform.
   b) Find the input x(n) of the system, if the impulse response h(n) and the output y(n) (8M)
   as shown below. h(n) = {1,2,3,2} y(n) = {1,3,7,10,10,7,2}

5. a) Compute & plot the convolution y(t) of the given signals. (8M)
   i) X(t)=u(t-3) – u(t-5) ,h(t)=e^{-3t}u(t) ii) X(t)=u(t) ,h(t)= e^{-t}u(t)
   b) State and prove any four properties of Auto correlation function (8M)

6. a) Find the laplace transform of the signal (8M)
   $x(t) = e^{-at}u(t) + e^{-bt}u(-t)$
   b) Concept of region of convergence (ROC) for Laplace transforms (8M)

7. a) Find the z-Transform of (8M)
   i) X(z) = 1/(1-0.5z^{-1}+0.5^{-2}) for ROC $|Z| > 1$ ii) 1/(z^2-1.2z+0.2)
   b) Find the inverse z-transform of x(z) = (z2+z) / (z-1)(z-3), ROC: z > 3. Using (i) (8M)
   Partial fraction
   i) Method (ii) Residue method and (iii) Convolution method.
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PART –A

1. a) Any function f(t) can be expressed as a sum of its components along mutually orthogonal functions. Write the condition on the function (4M)
   b) Write sampling property of impulse function (3M)
   c) The output response (t) of a continuous time LTI system is $2e{-}3t$ (t) when the input x(t) is u(t). Find the Transfer function. (3M)
   d) What is the relationship between correlation and Convolution (3M)
   e) Give the Relationship between Laplace Transform and Fourier Transform (4M)
   f) Define one sided Z- transform and two sided Z-transform? (5M)

PART -B

2. a) Test Whether the signal x(t) = e-2t u(t).) energy or power signal (8M)
   b) Determine the power and RMS value of the following signals. (8M)
   i) y(t) = 5cos (50t + π/3) ii) y(t) = 10$cos5tcos10t$

3. a) State and prove sampling theorem. (8M)
   b) Explain the differences between various sampling techniques (8M)

4. a) The input and output of a causal LTI system are related by the differentia equation, (8M)
   $d^2y(t)/dt^2+6dy(t)/dt+8y(t)=2x(t)$
   i) Find the impulse response of the system.
   ii) What is the response of this system if $x(t) = t\,e^{-2t}\,u(t)$
   b) What is Impulse Response? Show that the Response of an LTI system is convolution Integral of its impulse Response with input signal? (8M)

5. a) Find the convolution of the two signals (8M)
   x(n) = 3nu(-n); h(n) = (1/3)nu(n-2)
   x(n) = (1/3) –nu(-n-1); h(n) = u(n-1)
   x(n) = u(n) –u(n-5); h(n) = 2[u(n) – u(n-3)]
   b) State and prove Parseval's theorem (8M)

6. a) Find the Laplace Transform of the following (8M)
   i) $t\,e^{-at}\,u(t)$ ii) Cos $\omega_0 t\,u(t)$
   b) What is the relation between L.T, and F.T. of a signal (8M)

7. a) Determine the Z Transform of the Signal (8M)
   (i)x(n)={1,2,0,2} (ii)x(n)={1,2,-1,2,9} (iii)x(n)= u(n)-u(n-5)
   b) State and prove the following properties of Z transform (8M)
   i) Time shifting ii) Correlation iii)Convolution
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