Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 11324

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Third Semester

Electronics and Communication Engineering

EC 2204/147303/EC 35/EC 1202 A/10144 EC 305/080290015 — SIGNALS AND SYSTEMS

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine whether the following signal is energy or power signal. And calculate its energy or power :

$$x(t) = e^{-2t}\,u(t)$$

2. Check whether the following system is static (or) dynamic and also causal (or) non-causal :

$$y(n) = x(2n)$$

3. Give synthesis and analysis equations of continuous time Fourier transform.

4. Define the region of convergence of the Laplace transform.

5. List and draw the basic elements for the block diagram representation of the continuous time system.

6. Check the causality of the system with impulse response $h(t) = e^{-t}\,u(t)$.

7. Define DTFT and inverse DTFT.

8. State the convolution property of the z-transform.

9. Convolve the following two sequences :

$$x(n) = \{1, 1, 1, 1\}$$

$$h(n) = \{3, 2\}$$

10. A causal LTI system has impulse response $h(n)$, for which the z-transform is $H(z) = \frac{1 + z^{-1}}{(1 - 0.5z^{-1})(1 + 0.25\,z^{-1})}$. Is the system stable? Explain.

PART B — (5 × 16 = 80 marks)

11. (a) (i) How are the signals classified? Explain. (8)

(ii) Determine whether the following signal is periodic. If periodic, determine the fundamental period : (4)

$$x(t) = 3\cos t + 4\cos\frac{t}{3}.$$

(iii) Give the equation and draw the waveforms of discrete time real and complex exponential signals. (4)

Or

(b) (i) Determine whether the following system is linear, time invariant, stable and invertible : (10)

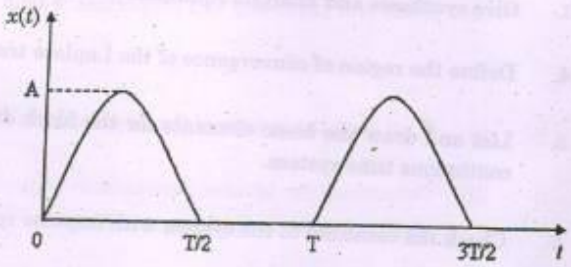
(1) $y(n) = x^2(n)$

(2) $y(n) = x(-n)$

(ii) Define LTI system. List the properties of LTI system and explain. (6)

12. (a) (i) State Dirichlet's conditions. Also state its importance. (4)

(ii) Obtain the trigonometric Fourier series for the half wave rectified sine wave given below. (12)



Or

(b) (i) Determine the Fourier transform for double exponential pulse whose function is given by $x(t) = e^{-2|t|}$. Also draw its amplitude and phase spectra. (8)

(ii) Obtain the inverse Laplace transform of the function $X(s) = \frac{1}{s^2 + 3s + 2}$, ROC : $-2 < \text{Re}\{s\} < -1$. (8)

13. (a) (i) What is impulse response? Show that the response of an LTI system is convolution integral of its impulse response with input signal? (6)

(ii) Obtain the convolution of the following two signals : (10)

$$x(t) = e^{2t}\, u(-t)$$
$$h(t) = u(t-3)$$

Or

(b) The input $x(t)$ and output $y(t)$ for a system satisfy the differential equation $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$.

(i) Compute the transfer function and impulse response. (8)

(ii) Draw direct form, cascade form and parallel form representations. (8)

14. (a) (i) State and prove sampling theorem for low pass band limited signal and explain the process of reconstruction of the signal from its samples. (10)

(ii) State and prove any two properties of DTFT. (6)

Or

(b) (i) Find the z-transform of the sequence $x(n) = \cos(n\theta)\, u(n)$. (8)

(ii) Determine the inverse z-transform of the following expression using partial fraction expansion : (8)

$$X(z) = \frac{1}{\left(1 - \frac{1}{3}z^{-1}\right)\left(1 - \frac{1}{6}z^{-1}\right)}, \quad \text{ROC} : |z| > \frac{1}{3}.$$

15. (a) (i) Find the system function and the impulse response $h(n)$ for a system described by the following input-output relationship

$$y(n) = \frac{1}{3}y(n-1) + 3x(n). \qquad (6)$$

(ii) A linear time-invariant system is characterized by the system function

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}.$$

Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions :

(1) The system is stable

(2) The system is causal

(3) The system is anti-causal. (10)

Or

(b) (i) Derive the necessary and sufficient condition for BIBO stability of an LSI system. (6)

(ii) Draw the direct form, cascade form and parallel form block diagrams of the following system function : (10)

$$H(z) = \frac{1}{\left(1 + \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}.$$

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Question Paper Code : 27190

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the value of the integral $\int_{-\infty}^{\infty} e^{-2t} f(t+2)dt$.

2. Give the relation between continuous time unit impulse function $f(t)$, step function $u(t)$ and ramp function $r(t)$.

3. State Dirichlets conditions.

4. Give the relation between Fourier transform and laplace transform.

5. What is $u(t-2) * f(t-1)$? Where * represents convolution.

6. Given the differential equation representation of a system, $\frac{d^2}{dt^2}y(t) + 2\frac{d}{dt}y(t) - 3y(t) = 2x(t)$. Find the frequency response $H(jr)$.

7. State the need for sampling.

8. Find the z–transform and its associated ROC for $x[n] = \{1, -1, 2, 3, 4\}$.

9. Distinguish between recursive and non-recursive systems.

10. Convolve the following signals, $x[n] = \{1, 1, 3\}$ and $h[n] = \{1, 4, -1\}$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Given $x[n] = \{1, 4, 3, -1, 2\}$. Plot the following signals.

(i) $x[-n-1]$

(ii) $x\left[-\frac{n}{2}\right]$

(iii) $x[-2n+1]$

(iv) $x\left[-\frac{n}{2}+2\right]$.

Or

(b) Given the input-output relationship of a continuous time system $y(t) = tx(-t)$. Determine whether the system is causal, stable, linear and time invariant.

12. (a) State and prove any four properties of Fourier transform.

Or

(b) Find the Laplace transform and its associated ROC for the signa $x(t) = te^{-2|t|}$.

13. (a) Convolve the following signals :

$x(t) = e^{-2t}u(t-2)$

$h(t) = e^{-3t}u(t)$

Or

(b) The input-output of a causal LTI system are related by the differe equation $\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = 2x(t)$.

(i) Find the impulse response $h(t)$

(ii) Find the response $y(t)$ of this system if $x(t) = u(t)$.

Hint : Use Fourier transform.

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14. (a) State and explain sampling theorem both in time and frequency domains with necessary quantitative analysis and illustrations.

Or

(b) State and prove any two properties of DTFT and any two properties of Z-transform.

15. (a) Convolve the following signals :

$$x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-2]$$

$$h[n] = u[n+2]$$

Or

(b) Consider an LTI system with impulse response $h[n] = \alpha^n u[n]$ and the input to this system is $x(n) = \beta^n u(n)$ with $|\alpha|$ & $|\beta| < 1$. Determine the response $y[n]$.

(i) When $\alpha = \beta$

(ii) When $\alpha \neq \beta$

Using DTFT.

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Question Paper Code : 91398

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Third Semester

Electronics and Communication Engineering

EC 2204/EC 35/EC 1202 A/080290015/10144 EC 305 — SIGNALS AND SYSTEMS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define discrete time unit step and unit impulse functions.
2. Define energy and power signals.
3. What is the relationship between Fourier transform and Laplace transform?
4. State Drichlet's conditions.
5. List the properties of convolution integral.
6. State the significance of impulse response.
7. What is aliasing?
8. Write a note on ROC.
9. Write the n^{th} order difference equation.
10. Write the state variable equations of a DT-LTI system.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the even and odd components of the signal $x(n) = \{1, 0, -1, 2, 3\}$. (8)

(ii) Find the fundamental period of the signal $x(t) = e^{j\frac{7\pi}{3}n}$. (8)

Or

(b) (i) Check the system $y(n) = \log_{10}|x(n)|$ is linear, time invariant, causal and static. (10)

(ii) Find the summation $\sum_{n=0}^{5} \delta(n+1)2^n$. (6)

12. (a) (i) Find the Fourier transform of $x(t) = \sum_{n=-\infty}^{\infty} x(t - nT)$. (6)

(ii) Prove the time scaling property of Fourier transform and hence find the Fourier transform of $x(t) = e^{-0.5t}u(t)$. (6)

(iii) Derive the relation between trignometric Fourier series and exponential Fourier series. (4)

Or

(b) (i) Find the Laplace transform of $\left[4e^{-2t}\cos 5t - 3e^{-2t}\sin 5t\right]u(t)$. (8)

(ii) Find the inverse Laplace transform of $X(S) = \frac{1 + e^{-2s}}{3s^2 + 2s}$. (8)

13. (a) Find the block diagram representation and state space representation of the system given by

$$\frac{d^3y(t)}{dt^3} + \frac{3d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{d^2x(t)}{dt^2} + \frac{6dx(t)}{dt} + 5x(t). \quad (16)$$

Or

(b) (i) Solve : $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} + x(t)$ with $y(0) = \frac{9}{4}$, $y'(0) = 5$ and $x(t) = e^{-3t}u(t)$. (10)

(ii) The frequency response of continuous LTI system is $H(j\Omega) = \frac{a - j\Omega}{a + j\Omega}$ with $a > 0$. Find the impulse response of the system. (6)

14. (a) (i) State and prove sampling theorem.

(ii) Using Z-transform, find the convolution of two seque $x_1(n)=\{1,2,-1,0,3\}$ and $x_2(n)=\{1,2,-1\}$.

(iii) Find the $X(Z)$ if $x(n)=n^2u(n)$.

Or

(b) (i) Find inverse Z transform of $X(Z)=\dfrac{Z(Z-1)}{(Z+2)^3(Z+1)}$ $Roc|Z|>2$. (8)

(ii) The Nyquist rate of a signal $x(t)$ is Ω_0. What is the nyquist rate of the following signals? (8)

(1) $x(t)-x(t-1)$

(2) $x(t)\cos\Omega_0 t$.

15. (a) (i) It is given that the state matrices for a discrete time system are $A=\begin{bmatrix}0 & 1\\ 2 & 3\end{bmatrix}$, $B=\begin{bmatrix}0\\ 1\end{bmatrix}$, $C=[8\ \ 8]$, $D=[1]$. Find the system transfer function. (12)

(ii) Find DTFT of $x(n)=\underset{\uparrow}{[0,1,2,1,0]}$. (4)

Or

(b) (i) Given $H(Z)=\dfrac{0.2Z}{(Z+0.4)(Z-0.2)}$ $Roc|Z|>0.4$. Find the impulse response of the system. (8)

(ii) Find the step response of the system $y(n)+\dfrac{1}{3}y(n-1)=x(n)$. (8)

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Reg. No. :

Question Paper Code : 97060

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering and Medical Electronics Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State two properties of unit impulse function.
2. Draw the following signals :
   (a) $u(t)-u(t-10)$
   (b) $(1/2)^n u(n-1)$.
3. State the conditions for the convergence of Fourier series representation of continuous time periodic signals.
4. Find the ROC of the Laplace transform of $x(t)=u(t)$.
5. Draw the block diagram of the LTI system described by $\frac{dy(t)}{dt}+y(t)=0.1x(t)$.
6. Find $y(n)=x(n-1)*\delta(n+2)$.
7. Find the DTFT of $x(n)=\delta(n)+\delta(n-1)$.
8. State and prove the time folding property of z-transform.
9. Give the impulse response of a linear time invariant time as $h(n)=\sin \pi n$, check whether the system is stable or not.
10. In terms of ROC, state the condition for an LTI discrete time system to be causal and stable.

PART B — (5 × 16 = 80 marks)

11. (a) Check whether the following signals are periodic/aperiodic signals.

(i) $x(t) = \cos 2t + \sin t/5$.

(ii) $x(n) = 3 + \cos \pi/2n + \cos 2n$.

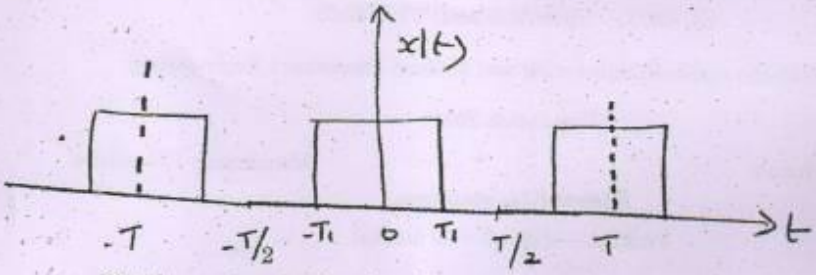
Or

(b) Check whether the following system is linear, causal time invariant and /or stable

(i) $y(n) = x(n) - x[n-1]$

(ii) $y(t) = \frac{d}{dt}x(t)$.

12. (a) Find the Fourier series coefficients of the following signal :

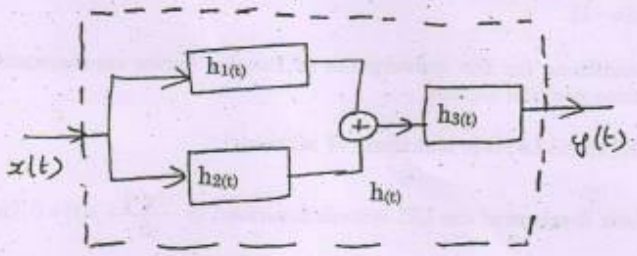


Plot the spectrum of the signal.

Or

(b) Find the spectrum of $x(t) = e^{-2|t|}$. Plot the spectrum of the signal.

13. (a) Find the overall impulse response of the following system.



Here $h_1(t) = e^{-2t}u(t)$

$h_2(t) = \delta(t) - \delta(t-1)$

$h_3(t) = \delta(t)$

Also find the output of the system for the input $x(t) = u(t)$ using convolution integral.

Or

(b) An LTI system is represented by $\frac{d^2}{dt^2}y(t)+4\frac{d}{dt}y(t)+4y(t)=x(t)$ with initial conditions $y(0)=0; y'(0)=1$; Find the output of the system, when the input is $x(t)=e^{-t}u(t)$.

14. (a) State and prove sampling theorem for a band limited signal.

Or

(b) Find inverse z-transform of $X(z)=\frac{z^{-1}}{1-0.25z^{-1}-0.375z^{-2}}$.

For (i) ROC $|z|>0.75$

(ii) ROC $|z|<0.5$

15. (a) Compute $y(n)=x(n)*h(n)$

where $x(n)=(1/2)^{-n}u(n-2)$

$h(n)=u(n-2)$.

Or

(b) LTI discrete time system $y(n)=3/2\,y(n-1)-1/2\,y(n-2)+x(n)+x(n-1)$ is given an input $x(n)=u(n)$

(i) Find the transfer function of the system.

(ii) Find the impulse response of the system.
