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

Question Paper Code : 51445

B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Electronics and Communication Engineering

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

(Common to Biomedical Engineering)

(Regulations 2008/2010)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Check whether the discrete time signal Sin3n is periodic.

2. Define a random signal.

3. What is the relationship between Fourier transform and Laplace transform ?

4. State Drichlet's conditions.

5. Determine the Laplace transform of the signal $\delta(t-5)$ and $u(t-5)$.

6. Determine the convolution of the signals $x[n] = \{2, -1, 3, 2\}$ and $h[n] = \{1, -1, 1, 1\}$.

7. What is aliasing ?

8. Define unilateral and bilateral 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 respnse h(n), for which the z-transform is $H(z) = \frac{1 + z^{-1}}{(1 - 0.5\, z^{-1})\,(1 + 0.25\, z^{-1})}$. Is the system stable ? Explain.

PART – B (5 × 16 = 80 Marks)

11. (a) Determine whether the systems described by the following input-output equations are linear, dynamic, casual and time variant. **(16)**

(i) $y_1(t) = x(t-3) + (3-t)$

(ii) $y_2(t) = dx(t)/dt$

(iii) $y_1[n] = n\,x[n] + bx^2[n]$

(iv) Even $\{x[n-1]\}$

OR

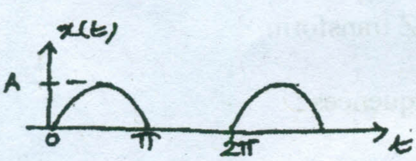
(b) A Discrete time system is given as $y(n) = y^2(n-1) = x(n)$. A bounded input of $x(n) = 2\delta(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable. **(16)**

12. (a) (i) Compute the Laplace transform of $x(t) = e^{-b|t|}$ for the cases of $b < 0$ and $b > 0$. **(10)**

(ii) State and prove Parseval's theorem of Fourier transform. **(6)**

OR

(b) (i) Determine the Fourier series representation of the half wave rectifier output shown in figure below. **(8)**



(ii) Write the properties of ROC of laplace transform. **(8)**

13. (a) (i) Define convolution integral and derive its equation. **(8)**

(ii) A stable LTI system is characterized by the differential equation

$$\frac{d^2 y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$$

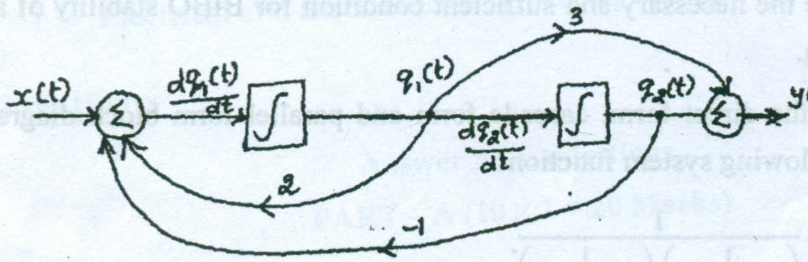
Find the frequency response and impulse response using Fourier transform. **(8)**

OR

(b) (i) Draw direct form, cascade form and parallel form of a system with system function.

$$H(s) = \frac{1}{(s+1)(s+2)}.$$ **(8)**

(ii) Determine the state variable description corresponding to the block diagram given below. **(8)**



14. (a) (i) State and prove sampling theorem. **(8)**

(ii) Using Z-transform, find the convolution of two sequences $x_1(n) = \{1, 2, -1, 0, 3\}$ and $x_2(n) = \{1, 2, -1)$. **(4)**

(iii) Find the X(Z) if $x(n) = n^2 u(n)$. **(4)**

OR

(b) (i) Find inverse Z transform of $X(Z) = \frac{Z(Z-1)}{(Z+2)^3 (Z+1)}$ 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) Find the system function and the impulse response h(n) for a system described by the following input-output relationship.

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

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