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

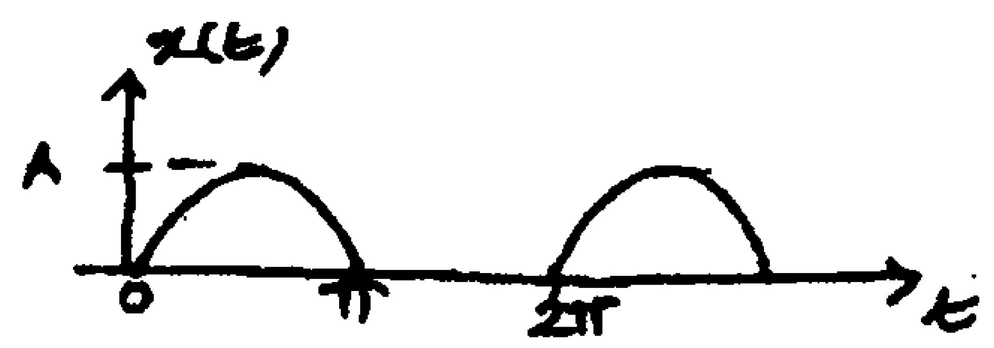
(b) A Discrete time system is given as $y(n) = y^2 (n - 1) = x(n)$. A bounded input of $x(n) = 2\delta(n)$ is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable. **(16)**

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

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

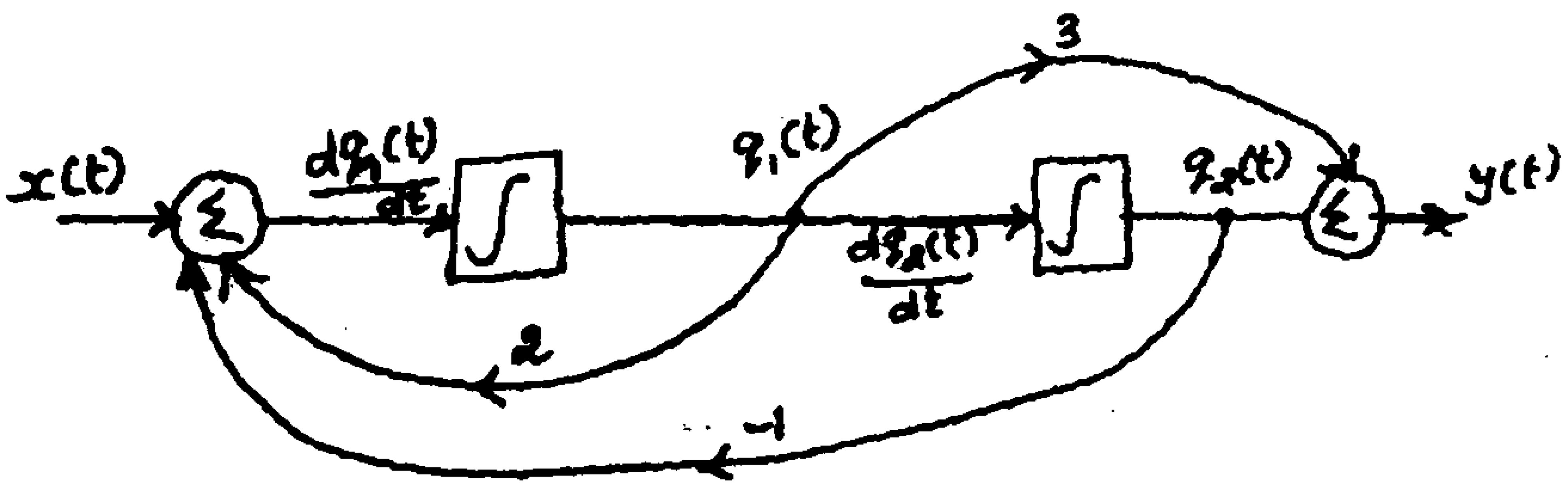
Find the frequency response and impulse response using Fourier transform. (8)

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)**

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