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RAMAIAH
Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – MARCH 2022

Program	:	**B.E.: Electrical and Electronics Engineering**
Course Name	:	**Signals and Systems**
Course Code	:	**EE51**

Semester : **V**

Max. Marks : **100**

Duration : **3 Hrs**

Instructions to the Candidates:
- Answer one full question from each unit
- Suitably assume any missing data.

UNIT- I

1. a) Let $x(n) = 2^n [u(n+1) - u(n-3)]$, sketch the following signals.   CO1   (10)
   - i) $Y_1(n) = x(n-1)$,
   - ii) $Y_2(n) = x(n+1)$
   - iii) $Y_3(n) = x(-n+3)$
   - iv) $Y_4(n) = x(-n-2)$.
   - v) $Y_5(n) = x(n/2-1)$

   b) Consider an LTI system with $h(n) = (-1/4)^n u(n-1)$,   CO1   (05)
   - i) Is the system Causal?
   - ii) Is the system stable?
   - iii) Is the system memoryless?

   c) Sketch $x(t)$ and its odd and even parts $x(t) = e^{-t} u(t)$.   CO1   (05)

2. a) Determine whether each of the following signals is periodic. If a signal is periodic, find its fundamental period.   CO1   (10)
   - i) $x(n) = 5 \sin(0.2\pi n)$
   - ii) $x(n) = \cos(2n)$.

   b) A trapezoidal pulse, $x(t)$ denoted by: CO1   (05)

   $$x(t) = \begin{cases} 5-t, & 4 \le t \le 5 \\ 1, & -4 \le t \le 4 \\ t+5, & -5 \le t \le -4 \\ 0, & \text{otherwise,} \end{cases}$$

   is the signal power or energy? Find power or energy?

   c) Find the even and odd part of the following signals: CO1   (05)
   $x(n) = u(n)$

UNIT – II

3. a) Compute $y(n) = h(n) * x(n)$ for $h(n) = (1/2)^n u[n]$ and $x(n) = 2^n u[-n]$.   CO2   (10)

   b) Derive the expression of convolution integral.   CO2   (10)

4. a) Convolute the two continuous time signals $x(t) = u(t)$ and $h(t) = t\, u(-t)$ CO2   (10)

   b) Compute the convolution of two sequences $x_1(n)$ and $x_2(n)$, given below $x_1(n) = \{ 1,2,3 \}$ and $x_2(n) = \{ 1,2,3,4 \}$ CO2   (10)

UNIT – III

5. a) State and bring out the importance of sampling theorem. CO3 (08)
   b) Find the forced response for the following differential equation: CO3 (06)

$$\frac{d^2y}{dt^2} + 9y = \cos 4t$$

   c) Draw direct form I and direct form II realization of the following systems: CO3 (06)

$$\frac{d^2y}{dt^2} + y = 3\frac{dx}{dt}$$

6. a) Find the complete response for the following differential equation: CO3 (10)

$$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = 2x \ .$$

   Given y(0) = -1, $y^1(0)$ = 1 and x(t) = cost u(t).
   b) Draw direct form I and direct form II realization of the following systems:y(n) – 1/9 y(n-2) = 2x(n) + x(n-1). CO3 (05)
   c) What is quantization? Explain the significance of quantization. CO3 (05)

UNIT – IV

7. a) Determine the Fourier series representation of the wave form shown in Fig Q7(a). CO4 (10)

Fig Q7(a)
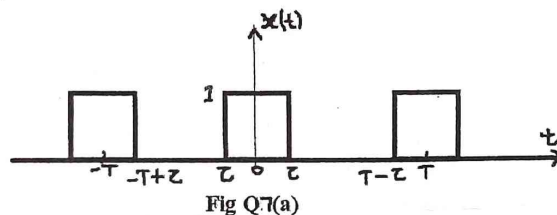
   b) Determine the DTFT of the following signals: CO4 (10)

   (i) $x(n) = \left(\frac{1}{2}\right)^n [u(n+3) - u(n-2)]$ (ii) $x(n) = n\left(\frac{1}{2}\right)^n u(n)$

8. a) State and prove the following properties of DTFS: CO4 (10)
   (i) Modulation (ii) Parseval's theorem.
   b) Find the FT of the following signals: CO4 (10)

   (i) x(t) = e^{-3t} cosπt u(t)   (ii) $x(t) = \begin{vmatrix} 1 + \cos \pi t; & |t| < 1 \\ 0; & |t| > 1 \end{vmatrix}$.

UNIT – V

9. a) Determine the z transform of the following and sketch the ROC: CO5 (10)

   i) $x(n) = \left(\frac{3}{4}\right)^n u(n) + 2^n u(-n-1)$ ii) $x(n) = [3(4)^n + 3(5)^n]u(n)$.

   b) Find the total response of the system defined by the difference equation CO5 (10)
   y(n) – 0.25 y(n – 1) – 0.125 y(n – 2) = x(n) + x(n – 1) with x(n) = u(n) and y(0) = 0 and y(-2) = 1.

10. a) Find the inverse z- transform given: CO5 (10)

$$X(z) = \frac{2z^3 + 2z^2 + 3z + 1}{2z^4 + 3z^3 + z^2} \quad \text{with } |z| > 1$$

    b) List the important properties of ROC. Also explain the time reversal and time shifting properties of z- transform CO5 (10)

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