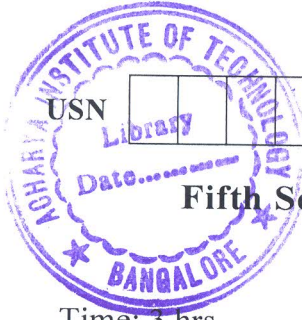


# CBCS SCHEME



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15EE54

**Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020**

## Signals & Systems

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. Categorize the following signal as energy signal or power signal. Find out corresponding value:

$$x(t) = \begin{cases} t & 0 \leq t \leq 1 \\ 2-t & 1 \leq t \leq 2 \\ 0 & \text{Otherwise} \end{cases} \quad (04 \text{ Marks})$$

- b. What are different elementary signals? Explain them with neat sketch. (04 Marks)

- c. Sketch and label for each of the following for given signal  $x(t)$  shown in Fig. Q1 (c):

(i)  $x(2t+1)$     (ii)  $x(-2t+3)$     (iii)  $x\left(2\left(\frac{t}{3}-2\right)\right)$

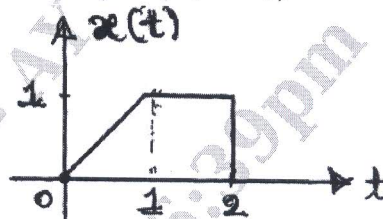


Fig. Q1 (c)

(08 Marks)

OR

- 2 a. Explain different classification of signals. (05 Marks)

- b. Given discrete time system  $y(n) = 2x(2^n)$ . Determine whether the system is,  
 (i) Linear    (ii) Time variant    (iii) Memoryless    (iv) Stable. (05 Marks)

- c. Find the even and odd part of the following signal,  
 (i)  $x(t) = e^{-2t} \cos(t)$     (ii)  $x(t) = e^{jt}$  (06 Marks)

### Module-2

- 3 a. Find the following convolution sum  $y(n) = \left(\frac{3}{4}\right)^n u(n) * u(n-2)$  and evaluate the value for  $n = \pm 5$ . (06 Marks)

- b. Find out the total response of the system given by,

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

with  $y(0) = -1$ ,  $\left. \frac{dy(t)}{dt} \right|_{t=0} = 1$  and  $x(t) = \cos(t)u(t)$  (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. The impulse response of an LTI system is given by  $h(t) = u(t) - u(t - 2)$ . Find the output of the system for a given input  $x(t) = u(t) - u(t - 3)$ . Draw the output response. (10 Marks)
- b. Draw the direct form I and direct form II implementations for the following difference equation.
- $$y[n] + \frac{1}{2}y[n-1] - y[n-3] = 3x[n-1] + 2x[n-2] \quad (06 \text{ Marks})$$

**Module-3**

- 5 a. Find the Fourier Transform (FT) of the following signals:
- (i)  $x(t) = e^{-a|t|}$       (ii)  $x(t) = \frac{1}{a^2 + t^2}$       (iii)  $x(t) = \cos \omega_0 t$  (10 Marks)
- b. State and prove the following properties in Fourier Transforms:
- (i) Differentiation property (Time)
- (ii) Time shift property (06 Marks)

OR

- 6 a. Find the frequency response of the system and impulse response if differential equation of the system is given by,
- $$\frac{d^2}{dt^2}y(t) + 5\frac{d}{dt}y(t) + 6y(t) = -\frac{d}{dt}x(t) \quad (08 \text{ Marks})$$
- b. The RC filter is characterized by following impulse response find out corresponding frequency response:
- $$h(t) = \frac{1}{RC}e^{-t/RC}u(t)$$
- For the above LTI system plot the magnitude curve. (08 Marks)

**Module-4**

- 7 a. Find the Discrete Time Fourier Transform (DTFT), of a rectangular pulse sequence given by  $x[n] = u[n] - u[n - N]$  (08 Marks)
- b. A causal discrete LTI system is described by,
- $$y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n]$$
- (i) Determine frequency response of the system  $H(\Omega)$ .
- (ii) Find the impulse response  $h[n]$  of the system. (08 Marks)

OR

- 8 a. Use appropriate properties to find DTFT of the following signal:
- (i)  $x[n] = \left[\frac{1}{2}\right]^n u[n-2]$ .
- (ii)  $x[n] = n\left[\frac{1}{2}\right]^{-|n|}$  (08 Marks)
- b. A discrete LTI first order system is given by,
- $$y[n] = x[n] + x[n-1]$$
- Find out the frequency response of the system and impulse response. (08 Marks)

**Module-5**

- 9 a. Determine the z-transform, ROC and the location of poles and zeros of  $X(z)$  for the given  $x(n)$ ,

$$x(n) = -\left(\frac{1}{2}\right)^n u(-n-1) - \left(-\frac{1}{3}\right)^n u(-n-1). \quad (08 \text{ Marks})$$

- b. Use the method of partial fractions to obtain time domain signal corresponding to the given  $X(z)$ .

$$X(z) = \frac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1} \quad \text{ROC } \frac{1}{2} < |z| < 2 \quad (08 \text{ Marks})$$

**OR**

- 10 a. What are the properties of Region Of Convergence (ROC) in z-transform? (04 Marks)  
 b. Find the inverse - z transform of  $X(z) = \ln(1 + z^{-1})$  using power series expansion. (04 Marks)  
 c. Solve the following difference equation using unilateral z-transform:

$$y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n) \quad \text{for } n \geq 0$$

$$y(-1) = 4, \quad y(-2) = 10 \quad \text{and } x(n) = \left(\frac{1}{4}\right)^n u(n) \quad (08 \text{ Marks})$$

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