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**S.E. (Information Technology) Semester- IV (Revised Course 2007-08)**  
**EXAMINATION Aug/Sept 2019**  
**Signals & Systems**

[Duration : Three Hours]

[Max. Marks 100]

**Instructions:**

- 1) Answer any five questions by selecting at least one question from each module.
- 2) Draw neat labeled diagrams wherever necessary in pencil.
- 3) Assume data if required.

**MODULE 1****QUESTION 1**

- a) Explain the properties of system and determine if the system is linear, fixed, causal, BIBO stable. 12 mks
- i)  $x(t)=x(t-2)$
  - ii)  $x(t)=t^2x(t/2)$
  - iii)  $x(t)=x(t-2)x(t+3)$
- b) A system defined by Impulse response. 8 mks  
 $h(t)=(1/2)^n u[n-2]$  is subjected to input  $x(t)=(u[n+10]-2u[n+5])$ . Plot  $x(t)$ ,  $h(t)$  and the output  $y(t)$  of the system computed using convolution.

**QUESTION 2**

- a) Find Impulse Response of the system modeled by differential equation 8 mks  
 $2d(y)/d(t) + 4y(t) = x(t), -\infty < t < \infty$  where  $y(t)$  is output of the system and  $x(t)$  is input to the system.
- b) Sketch the single sided and double sided amplitude and phase spectrum for the following signal 8 mks
- $$x(t) = \sin(3\pi t) + \cos(5\pi t)$$
- c) Write a short note on Singularity functions. 4 mks

**MODULE 2****QUESTION 3**

- a) Consider the square wave defined by 12 mks
- $$x(t) = \begin{cases} -A, & -T_0/2 < t < -T_0/4 \\ A, & -T_0/4 < t < T_0/4 \\ -A, & T_0/4 < t < T_0/2 \end{cases}$$
- Find  $a_0, a_m, b_m$
- b) State using mathematical expressions properties of Fourier Transform. 8 mks

**QUESTION 4**

- a) Write a short note on Rate of Convergence of Fourier Spectra 5 mks
- b) State and prove Parseval's theorem. 10 mks  
 & Compute the average power of the Sine wave  $x(t) = 4 \sin 50\pi t$  5 mks
- c) Compute the Fourier transform of  $x(t) = e^{-t}u(t)$  5 mks

**MODULE 3**

**QUESTION 5**

- a) State and prove Complex Frequency shift theorem 5 mks
- b) A discrete time system is described by the differential equation  $y[n] + 3y[n - 1] + 12y[n - 2] = x[n] + 2x[n - 1]$  10 mks  
 Determine   
 i) The system transfer function   
 ii) Impulse response  $h[n]$
- c) Using block diagram explain Analog to Digital Conversion. 5 mks

**QUESTION 6**

- a) Find Inverse Laplace transform 10 mks  
 a)  $X(s) = (5s + 4)/(s^3 + 3s^2 + 2s)$   
 b)  $X(s) = -s - 4/s^2 + 3s + 2$
- b) State using mathematical expressions the properties of Laplace Transform. 5 mks
- c) Write short note on Ideal Reconstruction filter. 5 mks

**MODULE- IV**

**QUESTION 7**

- a) Explain Initial value theorem 4 mks
- b) Find Inverse Z transform of  $X(z) = (2z + 1)/(z^2 + 6z + 8)$  8 mks
- c) Obtain cascade and parallel realization of  $H(z) = (1/4z^{-1} - 1)^2/(1 - \frac{1}{2}z^{-1})$  8 mks  
 $(1 - 1/4z^{-1})$

**QUESTION 8**

- a) Design step invariant digital filter for analog prototype

$$H_a(s) = 0.3(s + 3)/(s + 2)(s + 2)$$

**8 mks**

- b) Use a long division method to determine
- $x(0), x(1), x(2), x(3)$
- for the following function of
- $z$

**5 mks**

$$X(z) = 2 + z^{-1}/(1 - 1/4z^{-1})^2$$

- c) Derive an equation for pulse transfer function encountered in discrete time Trapezoidal integration and draw a schematic of its implementation.

**7 mks**