GOVERNMENT COLLEGE OF ENGINEERING, JALGAON
(An Autonomous Institute of Government of Maharashtra)
National Highway No.6, JALGAON – 425 002

Phone No.: 0257-2281522   Fax No.: 0257-2281319
Website : www.gcoej.ac.in   E-mail : princoej@redifmail.com

Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **EE204U - Signals and Systems**

Generated At : **19-04-2022 14:58:30**

Maximum Marks : **60**   Duration : **3 Hrs**

Edit   Print   View Answer Key   Close   **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. *All questions are compulsory.*
2. *Illustrate your answer with suitable figures/sketches wherever necessary.*
3. *Assume suitable additional data; if required.*
4. *Use of logarithmic table, drawing instruments and non programmable calculators is allowed.*
5. *Figures to the right indicate full marks.*

1)   Attempt any three sub-questions.

a) Consider a DTLTI system represented by the impulse response $h(n) = \left(\frac{1}{4}\right)^n u(n)$ [6]
   Determine whether this system is causal, stable, and memoryless. Justify your answer.

b) Consider a system represented by the following equation   [6]
   $y(t) = mx(t) + 2$.
   The input signal of the system is x(t) and the output signal of the system is y(t).
   Determine whether this system is linear, time-invariant, stable, and causal.

c) Calculate the total energy of the signal, which is defined as follows   [6]

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

   Determine whether this signal is an energy signal or a power signal.

d) Derive the expression to determine the response of the DTLTI system. Hence determine the response of the DTLTI system having impulse response h[n] and signal x[n], that   [6]
   is given below.
   $x[n] = \{1, 2, 3, 4\}$ and $h[n] = \{1, -1\}$

2)   Attempt any three sub-questions.

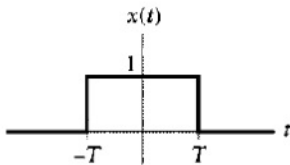a) Find the Fourier transform of the signal shown in figure 1. Also, sketch its magnitude spectrum.   [6]

Figure 1

b) State and prove the following properties of Z transform.   [6]
   i) Shifting in time domain
   ii) Convolution in time domain

c) Consider a CTLTI system characterized by impulse response $h(t) = 2e^{-t}u(t)$.   [6]
   calculate and sketch the output of the system for input signal $x(t) = u(t)$.

d) Find the Fourier series representation of the signal shown in figure 2.   [6]
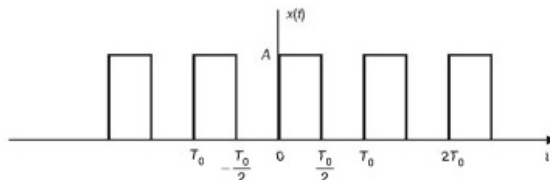
3)   Attempt any three sub-questions.

a) Consider a continuous-time LTI system for which the input x(t) and output y(t) are related by following differential equation   [6]
   $y''(t) + y'(t) - 2y(t) = x(t)$

   1. Find the system function H(s)
   2. Determine the impulse response of the system h(t), for the causal system.

b) Determine the z-transform of the signal $x(n) = 3^n u(n)$.   [6]

Hence determine the z-transform of the signal $y(n) = 3^{n-2} u(n-2)$.

Sketch the region of convergence for X(Z) and Y(Z).

c) Determine the inverse Laplace transform of the following X(s).   [6]

$X(s) = \frac{2s+4}{s^2+4s+3}, \; Re(s) > -1.$

What will be the inverse Laplace transform, if the region of convergence is modified to $-3 < Re(s) < -1$.

d) Using Z-transform, calculate the response y[n] of the DTLTI system, described by the following difference equation.   [6]

$y[n] = -3y[n-1] + x[n].$

The input signal applied to this system is $x[n] = u[n]$.

Assume initial condition $y[-1] = 1$.

4) State and explain any two properties of the autocorrelation function. Calculate autocorrelation function for the signal $x(n) = \{1, 2, 2, 1\}$.   [6]

Auto Generated by SsOES v6.2