## GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **IN303U - Signals and Systems**

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

**1)**    Solve any three questions from A,B,C and D.

A) a. Sketch the discrete-time signal given by equation, $x[n] = \begin{cases} 1 & for\ n = 1,\ 2 \\ -1 & for\ n = -1, -2 \\ 0 & otherwise \end{cases}$    [3]

    Also, sketch the signal $y[n] = x[n+3]$

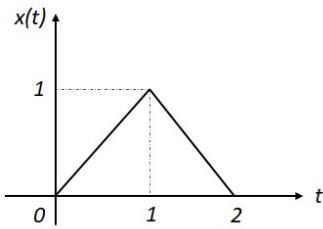   b. Sketch the even and odd part of continuous-time signal shown in Figure-1 below.    [3]



Figure-1

B)   Compute the convolution integral using graphical method for,    [6]
$x(t) = e^{-t}u(t)$
$h(t) = u(t)$

C) a. Check whether the following system is linear, time invariant, causal.    [3]
$y(t) = \cos(x(t))$

   b. Check whether the following signals are energy, power or neither energy nor power.    [3]
$i.\ x(t) = e^{-a.t}.\,u(t)\ ii.\ x[n] = u[n] - u[n-4]\ iii.\ y[n] = \cos(\pi n)$

D)   Find the convolution sum of following two discrete-time sequences and sketch the result.    [6]
$x[n] = \begin{cases} n+1 & for\ 0 \le n \le 2 \\ 5-n & for\ 2 \le n \le 4 \\ 0 & otherwise \end{cases}$

$h[n] = \begin{cases} \frac{-n}{2} & for\ 2 \le n \le 4 \\ 0 & otherwise \end{cases}$

**2)**    Solve any three questions from A,B,C and D.

A)   State any four properties of Laplace Transform and prove convolution property of Laplace Transform.    [6]

B)   State any four properties of Fourier Transform and prove time scaling property.    [6]

C)   State any four properties of Z-Transform and prove differentiation property.    [6]

D)   Find the initial and final value of $x(t)$    [6]
$X(s) = \frac{2s+3}{s^2+5s-7}$

**3)**    Solve any three questions from A,B,C and D.

A)   Determine the inverse Laplace Transform of    [6]
$X(s) = \frac{s^2+2s-2}{s(s+2)(s-3)},\ \ ROC : Re(s) > 3$

B)   Determine the impulse response $h(t)$ of given transfer function $H(j\omega)$ using inverse Fourier Transform.    [6]
$H(j\omega) = \frac{j\omega+1}{(j\omega+2)(j\omega+3)}$

C)   Using Z-transform, determine the impulse response of the causal system described by second order difference equation,    [6]
$y[n] - y[n-1] - 0.5y[n-2] = x[n] + x[n-1]$

D)   Determine all possible signals that have the Z-Transform,    [6]
$H(z) = \frac{1}{1-1.5\,z^{-1}+0.5z^{-2}}$

**4)**    State any four properties of auto-correlation function of continuous-time energy signal. Determine the cross-correlation between two signals given by,    [6]
$x[n] = \{1, 2, 3, 4\}$
$h[n] = \{3, 2, 1, 0\}$

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