**RGM COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)**
**01st March 2023**
**II B.Tech. I Sem. (R20) End Examinations (Regular)**
**SIGNALS AND SYSTEMS**
**ECE**

**Time: 3 Hrs**                                                  **Total Marks: 70**

*Note 1: Answer Question No.1 (Compulsory) and 4 from the remaining*
   *2: All Questions Carry Equal Marks*

1a   Define causal and non-causal system with example.

b   Define ROC in Z-transform.

c   State differentiation in time property of DTFT.

d   What is the effect of Hilbert transform

e   Find inverse DTFT of the signal $X(e^{j\omega}) = 2e^{j\omega} + 1 - 3e^{-j\omega} + 4e^{-2j\omega} - 2e^{-3j\omega}$?

f   Find the convolution between u(t) and u(t)?

g   Define the deterministic and random signals.

2   a) State and prove time reversal and time shifting properties of Z transform.     (7)
     b) Find the Z-transform of the following signals                                (7)
     i) $x(n) = a^n u(n)$ ii) $x(n) = \left(\frac{1}{2}\right)^n u(n) + \left(-\frac{1}{3}\right)^n u(n)$

3   a) State and prove differentiation in time property of Fourier transform.     (7)
     b) Find the Fourier transform of $x(t) = e^{-at}u(t)$.                           (7)

4   a) Prove that a signal x(t) and its Hilbert transform $\widehat{x(t)}$ are orthogonal    (4)
     b) Find the pre-envelope and natural envelope of x(t)=$A_c$ sin($\omega_c$t)       (5)
     c) Write a short notes on band pass signals?                               (5)

5   Find the frequency response of the following causal systems
     a) $y(n) - y(n-1) + \frac{3}{16}y(n-2) = x(n) - \frac{1}{2}x(n-1)$             (7)
     b) $y(n) - \frac{1}{4}y(n-1) - \frac{3}{4}y(n-2) = x(n) + x(n-1)$           (7)

6   a) Verify the following systems for time invariance                      (7)
     i) y(n)=x(-n)
     ii )y(n)= x(2n+1)
     b) Verify the following LTI systems for stability and causality         (7)
     i) $h(n) = \left(\frac{1}{2}\right)^n u(n)$
     ii) h(n)= u(n)-u(n-10)

7   a) Find the auto correlation of x(t)=sin(wot).                       (7)
     b) Derive the relationship between autocorrelation and energy spectral density of an energy signal.                                                 (7)

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