

- N.B. 1. Question No. 1 is compulsory.
 2. Attempt any three questions out of remaining five.
 3. All questions carry equal marks
 4. Assume Suitable data, if required and state it clearly.

- 1 a) Perform the convolution of $h(t)=3e^{-0.5t} u(t)$ and $x(t)=1 \quad 0 \leq t \leq 2$, otherwise $x(t)=0$. 20
 b) Find the Z-transform of $x[n]=a^n u[-n-1]$.
 c) Find the initial and final value of Laplace transform:
 $X(s) = 2(s^2+1)/[(s)(s+2)(s+5)]$
 d) Explain whether the system $y(t)=x(t^2)$ is a static, causal, time-invariant and linear system or not?
 e) Determine whether the following signals are energy or power signals:
 I. $x(t) = 3\cos 5\Omega t$
 II. $x[n] = \sin(3\pi n/4)$
- 2 a) Obtain the Fourier transform of a periodic rectangular pulse train with a period $T_0=1$ and width $\tau = 0.1$ symmetrically placed around the origin. 20
 b) Determine the response of discrete time LTI system governed by the difference equation $y(n)-2y(n-1)-3y(n-2) = x(n)+4x(n-1)$, when the input is $x(n)=2^n u(n)$ and initial condition, a) $y(-2) = 0$ and b) $y(-1) = 5$.
- 3 a) Find the inverse Laplace transform of $X(s)=(-3)/[(s+2)(s-1)]$ for all possible ROCs 20
 b) Determine the Laplace transform of $x(t)=3e^{-2t} \cos(4t)-5e^{-3t} \sin(2t) +2$
- 4 a) Determine the inverse Z-transform of $X(z) = 1/(1-0.8z^{-1}+0.12z^{-2})$ 20
 i. If ROC is, $|z| > 0.6$
 ii. If ROC is, $|z| < 0.2$
 iii. If ROC is, $0.2 < |z| < 0.6$
 b) If Fourier transform of $e^{-t} u(t)$ is $1/(1+j\Omega)$ then find the Fourier transform of $1/(1+t)$ using duality property.
- 5 a) Determine the impulse response for the cascade of two LTI systems having impulse responses: 20
 $h_1(n) = (1/2)^n u(n)$ and $h_2(n) = (1/4)^n u(n)$
 b) Using Laplace transform, determine the forced response of the system represented by the following equation:
 $d^2y(t)/dt^2 + 9 dy(t)/dt + 20 y(t) = 0.2 dx(t)/dt + 2 x(t)$,
 Input $x(t) = 6 u(t)$
- 6 a) Realize the given IIR system using direct form-I and direct form-II 20
 structure and sketch the signal flow diagram.
 $H[z] = [8z^3 - 4z^2 + 11z - 2] / [(z - 0.25)(z^2 - z + 0.5)]$
 b) Explain the following (any two):
 i. Two properties of Fourier transform.
 ii. BIBO stability and the condition for stability.
 iii. Explain in brief the relation between Laplace transform and Fourier transform