

- N.B. :** (1) Question No. 1 is **compulsory**.  
 (2) Attempt any **four** questions out of remaining **six** questions.  
 (3) Assume any **suitable** data if necessary and clearly state it.



1. Solve the following ;

(a) Compute the signal energy for  $x(t) = e^{-4t}u(t)$

(b) Find Z-transform of

$$x(n) = (n + 1)a^n u(n) \quad \text{Specify its ROC.}$$

(c) Explain relationship between Fourier transform and Laplace transform.

(d) Find odd and even component of the signal  $x(t) = \sin(\omega_0 t + \frac{\pi}{4})$

2. (a) Find the inverse Z- transform of

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$$X(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)(1 - 2z^{-1})(1 - z^{-1})}$$

With ROC  $1 < |z| < 2$

(b) Prove the convolution property of the Z-transform & find linear convolution of

$$h(n) = \{1, 2, 3, 4\} \quad \text{and} \quad x(n) = \{1, 0, -2, 3\} \quad \text{using Z- Transform.}$$

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3. (a) Examine the stability by Routh's criterion

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$$i) s^5 + 6s^4 + 3s^3 + 2s^2 + s + 1 = 0$$

$$ii) s^4 + 3s^2 + 7s^2 + 3s + 10 = 0$$

(b) Consider a linear feedback amplifier involving three transistor stages. The loop transfer function of amplifier is defined by

$$L(s) = \frac{6K}{(s + 1)(s + 2)(s + 3)}$$

Sketch the root locus of this feedback amplifier.

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4. (a) Sketch the waveform of the following signals

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$$i) x(t) = u(t) - u(t - 2) \quad ii) x(t) = u(t + 1) - 2u(t) + u(t - 1)$$

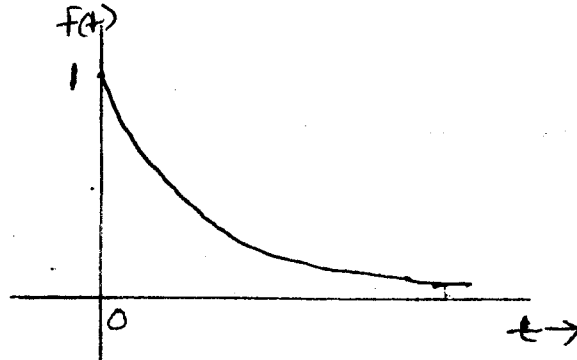
$$iii) x(t) = -u(t + 3) + 2u(t + 1) - 2u(t - 1) + u(t - 3)$$

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- (b) Find the Fourier Transform of exponential pulse shown in fig. whose function is given by  $f(t) = e^{-at}u(t)$



Draw the amplitude spectrum and phase spectrum.

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5. (a) Compute the Transfer function, Impulse response for the differential equation-

assuming initial condition are zero.

$$\frac{d^2}{dt^2}y(t) - \frac{d}{dt}y(t) - 6y(t) = x(t)$$

- (b) Find Laplace transform of the following signal

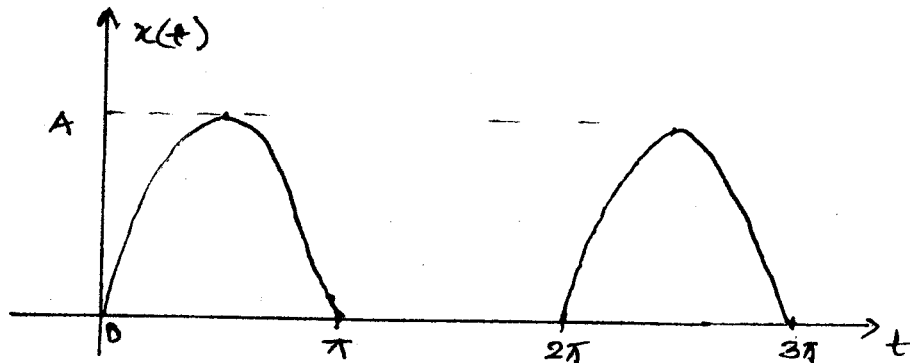
i)  $x(t) = A \cos \omega_0 t u(t)$

ii)  $x(t) = t^3 \cdot e^{-3t} u(t)$

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6. (a) Find the exponential Fourier series and plot its magnitude and phase spectrum of half wave rectified sine wave.

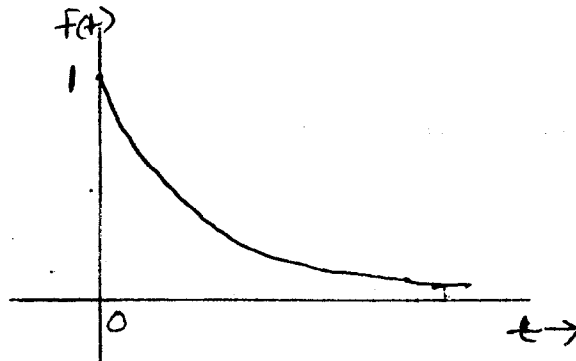
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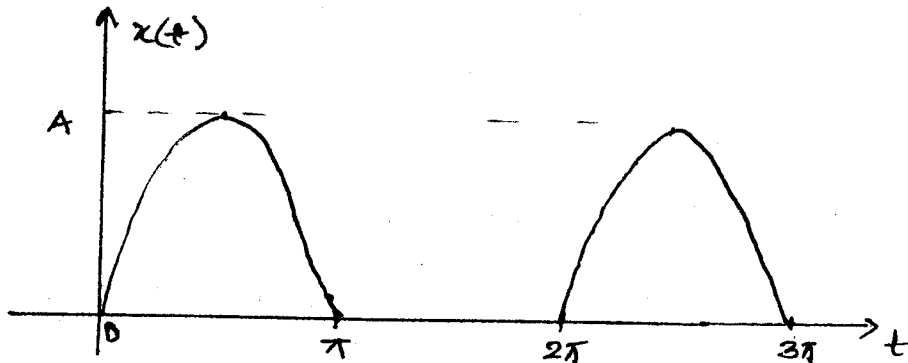
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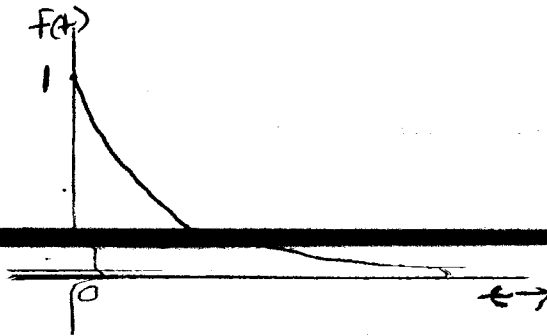
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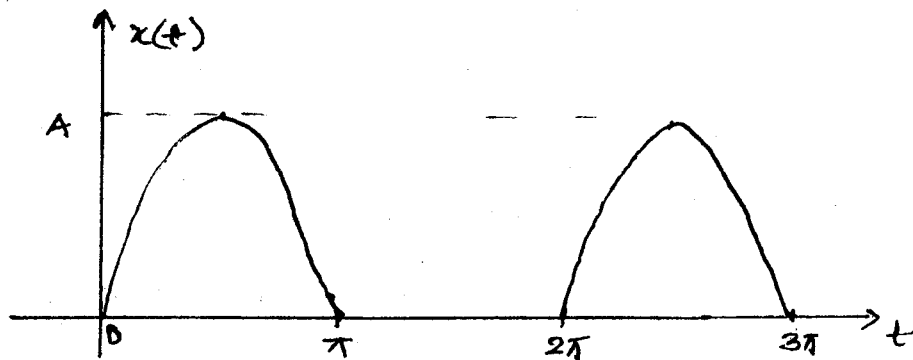
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(b) Determine whether the discrete time systems are Static / Dynamic, Linear / Nonlinear, Shift variant / invariant, Causal / Anticausal., stable / unstable 10

i)  $y(n) = (\cos \omega n) x(n)$

ii)  $y(n) = x(n) \cdot x(n-1)$

7. (a) Give classification of signals with examples 10  
(b) Give the relationship between z transform and the Fourier transform 05  
(c) Draw the pole-zero plot for the given system 05  
 $y(n] + 0.6y(n - 1) = x(n)$
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