

(3 Hours)



[ Total Marks : 80 ]

- N.B. :** (1) Questions No. 1 is compulsory.  
 (2) Solve any **three** questions from question no. 2 to question no. 6.  
 (3) Assume suitable data if required.

1. Solve any **four** questions :-

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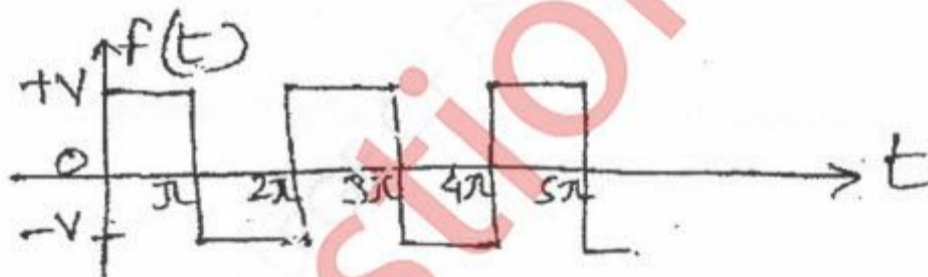
- (a) State the properties of Laplace transform and derive convolution property of Laplace transform.  
 (b) Compare energy and power signals.  
 (c) Prove that  $\int_{-\infty}^{\infty} x(t) dt = 0$  if  $x(t)$  is odd  
 (d) Determine initial and final values of  $x(n)$  if

$$x(z) = \frac{z}{2z^2 - 3z + 1} \quad |z| > 1$$

- (e) State and prove parseval's theorem.

2. (a) Find trigonometric Fourier series of the following signal :-

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(b) A system transfer function is given by

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$$H(S) = \frac{1}{(s^2 - 16)(s^2 - 9)}$$

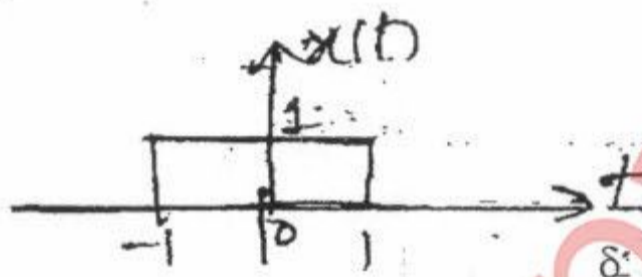
Determine  $h(t)$  if (i) System is stable (ii) System is causal  
 (iii) System is neither stable nor causal.

3. (a) Perform linear convolution using circular convolution for the following

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$$x(n) = \{ \underset{\uparrow}{1}, 2, 3 \}, \quad h(n) = \{ \underset{\uparrow}{1}, 1 \}$$

3. (b) Determine whether the following systems are memoryless, linear, causal time - variant and stable, 10
- (i)  $y(n) = n x(n)$
- (ii)  $y(t) = (t-2) e^{x(t)}$
4. (a) Determine whether the following signals are energy signals, power signals or neither and find values of energy and power 6
- (i)  $x(n) = A e^{j\omega n}$
- (ii)  $x(t) = A \sin \omega t$
- (b) Check whether the following signals are periodic or not? If periodic find its fundamental period. 4
- (i)  $x(n) = \cos 0.01 \pi n$
- (ii)  $x(t) = 10 \sin 12 \pi t + 4 \sin 18 \pi t$
- (c) Sketch the following signals if  $x(t)$  is given as follows :- 10



- (i)  $x(2t)$
- (ii)  $x(-2+t)$
- (iii)  $x(t) \delta(t)$
- (iv)  $x(t+1) u(t)$

- 5 (a) Find the inverse Laplace transform for all possible Rocs. 10

(i)  $x(s) = \frac{3s+7}{s^2-2s-3}$

(ii)  $x(s) = \frac{5s-10}{9s^2-16}$

- (b) The differential equation of a system is given by 10

$$y''(t) - y'(t) - 6y(t) = x(t)$$

Find (i)  $H(s)$  (ii)  $h(t)$  (iii) Step response of the system

6. (a) Find odd and even part of given signal  $r(t) = 3t^3 + 2t^2 + 4t + 9$  4
- (b) Find the fourier transform of signum function. 6
- (c) Find Z - inverse of the following signal 10

$$x(z) = \frac{1}{(1+z^{-1})(1-2z^{-1})^2}$$