

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four out of remaining six.
 (3) Assume suitable data wherever necessary.
 (4) Each question is of 20 marks.

1. Attempt any five :-

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- (a) Explain Energy and Power Signals with examples.
- (b) Explain Linear and Non-linear System with examples.
- (c) Explain the relationship between Laplace Transform and Fourier Transform.
- (d) Plot the line spectrum (single sided as well as double sided) of the signal.
 $x(t) = 7 - 10 \cos(40\pi t - 60^\circ) + 14 \sin(120\pi t)$
- (e) Derive the Transfer function of a closed loop system.
- (f) Determine z-transform of the following signals :-
 - (i) $x_1(n) = \{ 1, 2, 3, 4, 5, 0, 6 \}$
 - (ii) $x_2(n) = \{ -1, -2, -3, 0, 4, 5 \}$

2. (a) Perform convolution of the given two signals. Draw output waveform.

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$x(t) = e^{-3t} \{ u(t) - u(t - 2) \}$
 $h(t) = e^{-t} u(t)$

(b) Perform Discret convolution using graphical technique to get the output response.

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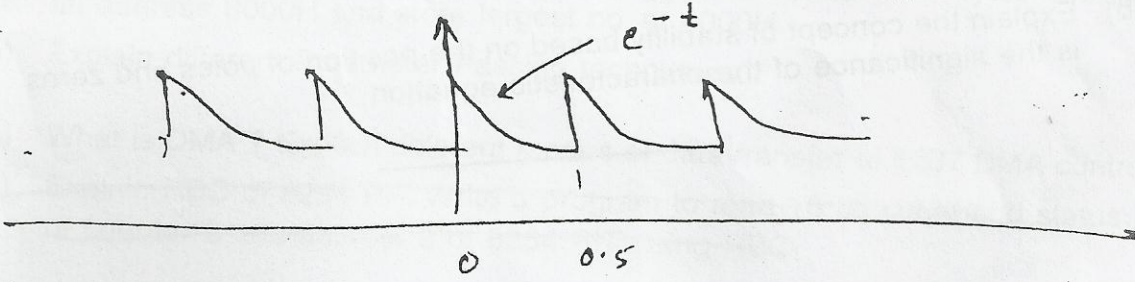
$x(n) = \{ 1, 2, 3, 4 \}$
 $h(n) = \{ -1, -2, 0, 1, -2 \}$

3. (a) Derive the formula for Trigonometric Fourier Series.

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(b) Find the Trigonometric Fourier Series for the given periodic signal.

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4. (a) Find the Laplace transform of the following signals :-

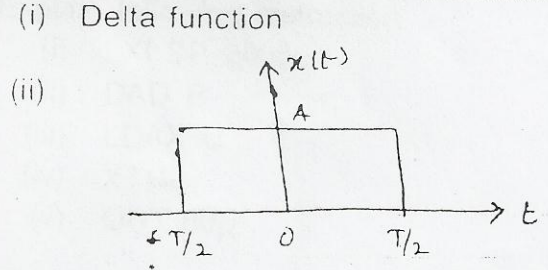
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- (i) $x(t) = (t - 3)^2$
- (ii) $x(t) = \cos\left(t - \frac{2\pi}{9}\right)$

Prove the property used in the above examples.

(b) Obtain the Fourier transform of the following signals :-

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5. (a) Prove the differentiation property of the z-transform and hence find out the z-transform of : 10

$$x(n) = n a^n u(n)$$

- (b) (i) Compute the z-transform of : 10

$$x(n) = a^n \cos(\omega n) u(n)$$

- (ii) For a causal system, find the impulse response. The system function of :

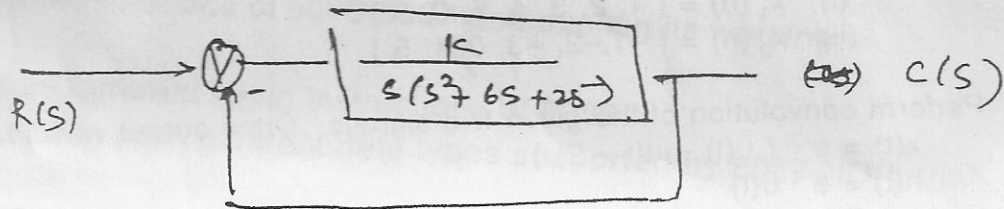
$$H(z) = \frac{z^2}{z^2 + \frac{5}{4}z + \frac{3}{8}}$$

6. (a) For a system with characteristic equation :

$$F(s) = s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$$

Examine the stability. 10

- (b) Draw the Root Locus of the given system and comment on the stability. 10



7. (a) Draw the Bode Plot of the given system and comment on the stability. 10

$$G(s)H(s) = \frac{80}{s(s+2)(s+20)}$$

Also determine, W_{gc} and W_{pc} .

- (b) Explain the concept of stability based on the position of poles and zeros. What is the significance of the characteristic equation ? 10