## Answer any TEN Questions (10 X 10 = 100 Marks)

Find and Sketch the Event and Odd Components of the following Signals:

Find and Skelch the 
$$a$$
 and  $a$  and

a) 
$$x(t) = 0$$
  
b)  $x(n) = 0^n, u(t-3); 0 < \alpha < 1$ 

2 Determine, if the following Signals are Periodic and If Yes, what is its Fundamental Period?

a) 
$$x(t) = e^{i\pi t}$$

b) 
$$x(t) = e^{(-j+j)t}$$

c) 
$$x(n) = LCos(3\pi n)$$

d) 
$$x(n) = Cos(2n)$$

Determine, whether the following Signals represented are Energy or Power Signals or Neither?

(a) 
$$x(t) = e^{-at}.u(t); a > 0$$

$$\text{(b) } x(t) = \frac{1}{2} [\cos(\omega t) + 1]; \ -\frac{\pi}{\omega} \le t \le \frac{\pi}{\omega};$$

$$x(t) = 0$$
; otherwise

$$(a) x(n) = A.\delta(n)$$

$$\emptyset \ x(n) = Cos(\pi n); \ -4 \le n \le 4$$

Determine, whether the following Systems, modelled by their respective and corresponding Input -Output Equations (given) are: (i) Static / Dynamic; (ii). Causal / Anti-Causal; (iii) Linear / Non-Linear; (iv) Time-Invariant / Time-Varying; (v) Stable / Unstable

$$a) x(t) = t^2 x(t-1)$$

b) 
$$x(n) = r^n : r > 1$$

Find the Fourier Transform of the following signals and draw its corresponding Magnitude and Phase Spectra.

$$a(x(t)) = e^{-at} \cdot u(t); a > 0$$

b) 
$$x(n) = \delta(6-3n)$$

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- a) Find the Frequency Response and the Impulse Response of the System described by the differentia equation, using Fourier Transform:  $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$
- (b) Obtain the Frequency Response and Impulse Response of the system described by the difference equation:  $y(n) + \frac{1}{2}y(n-1) = x(n) + 2x(n-1)$  using Fourier Transform.
- Find the Convolution of  $x_1(t) \& x_2(t)$  for the following signals:

a) 
$$x_1(t) = u(t) & x_2(t) = u(t)$$

a) 
$$x_1(t) = u(t) \otimes x_2(t) - u(t)$$
  
b)  $x_1(t) = tu(t) \otimes x_2(t) = u(t)$ 

c) 
$$x_1(t) = Sin(t).u(t) & x_2(t) = u(t)$$

d) 
$$x_1(t) = e^{-at}.u(t)$$
 [3] 
$$&x_2(t) = e^{-bt}.u(t)$$

- Find both the Cross-Correlations  $S_{xy}(t) \& S_{yx}(t)$  of the functions  $x(t) = e^{-t} \cdot u(t)$  and [10]  $y(t) = e^t \cdot u(-t).$
- 9. a) Find the Auto-Correlation of the signal  $x(t) = e^{-at}$ . u(t), with itself. [6]
  - b) Find the Energy Spectral Density (ESD) of the signal in the region [4]

$$x(t) = t; -1 < t < 1;$$

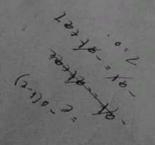
$$x(t) = 0$$
; other wise

- If the input to an LTI system is  $x(t) = e^{-3t}u(t)$  and output is  $y(t) = [e^{-t} e^{-2t}]u(t)$ . Find the impulse [10] response and the differential equation of the system using Laplace transform.
  - By using the properties, find the z-transform of the following, remembering to include the ROC for each one. Comment, if ROC does not exist.

a) 
$$x(n) = n\alpha^n u(-n)$$
 [5]

b) 
$$x(n) = 3^{n+1}u(n) - 2\left(\frac{1}{2}\right)^n u(-n-1)$$
 [5]







[2]

[2]

[3]