

Q.P. Code :11967

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:**
1. **Question No.1 is compulsory.**
 2. **Attempt any three questions out of remaining five.**
 3. Assume suitable data if required.

Q.1 Answer the following

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- a) Determine whether the following signals are energy signals or power signals and calculate their energy or power.

(1) $x(t) = e^{-2t} u(t)$

(2) $x[n] = \left(\frac{1}{2}\right)^n u[n]$

- b) Determine if following system is memoryless, casual, linear, time invariant.

$y(t) = 10x(t) + 5$

- c) Determine Fourier transform of $x(t)$ using time shifting property

$x(t) = e^{-3|t-t_0|} + e^{3|t+t_0|}$

- d) Find out even and odd components of the following signals:

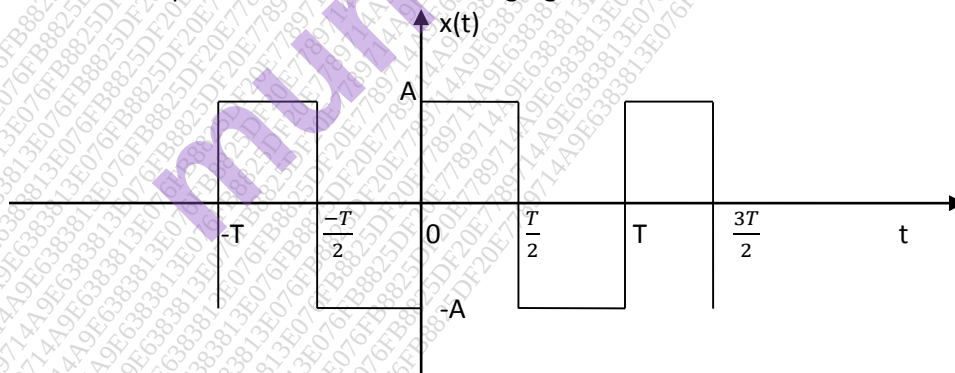
(i) $x[n] = u[n] - u[n-5]$

(ii) $x(t) = 3 + 2t + 5t^2$

- e) Determine relation between continuous time Fourier Transform and Laplace Transform.

Q.2 a) Determine Fourier Series representation of the following signal:

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Q.2 b) Find impulse response of continuous time systems governed by following transfer function.

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(i) $H(s) = \frac{1}{s^2(s-2)}$

(ii) $H(s) = \frac{1}{s(s+1)(s-2)}$

Q.3 a) A continuous time signals is defined as,

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$x(t) = t; \quad 0 \leq t \leq 3$

$x(t) = 0; \quad t > 3$

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Sketch waveforms of following signals:

- (i) $x(-t)$ (ii) $x(2-t)$ (iii) $x(3t)$ (iv) $x(0.5t+1)$

Q.3 b) Determine inverse z-transform of the following function:

$$X[Z] = \log(1+az^{-1}); |z| > |a|$$

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Q.3 c) Compute DTFT of sequence $x[n] = \{0, 1, 2, 3\}$. Also Sketch magnitude and phase spectrum.

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Q.4 a) Using Laplace Transform determine complete response of system described by following equation.

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$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 4 y(t) = \frac{dx(t)}{dt} \text{ where } y(0) = 0; \left. \frac{dy(t)}{dt} \right|_{t=0} = 1, \text{ for input } x(t) = e^{-2t} u(t)$$

Q.4 b) Find impulse response of system described by following difference equation

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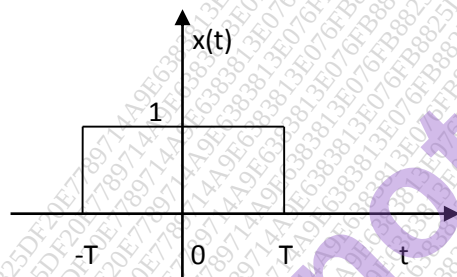
$$y[n] - 3y[n-1] - 4y[n-2] = x[n] + 2x[n-1] \text{ where all initial conditions are zero.}$$

Q.5 a) For the following continuous time signals, determine Fourier Transform.

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(i) $x(t) = e^{-at} \sin \omega_0 t u(t)$

(ii)

Q.5 b) Determine Fourier series representation of $x[n] = 4 \cos \left[\frac{\pi n}{2} \right]$

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Q.5 c) Determine cross correlation of sequence $x[n] = \{1, 1, 2, 2\}$ and $y[n] = \{1, 3, 1\}$

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Q.6 a) The input signal $x(t)$ and impulse response $h(t)$ of a continuous-time system are described as follows

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$$x(t) = e^{-3t} u(t) \text{ and } h(t) = u(t-1). \text{ Find output of system using convolution integral.}$$

b) Determine Z Transform and ROC of

(i) $x[n] = a^n u[n-1]$

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(ii) $x[n] = a^n \cos \omega_0 n u[n]$

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