Code No: R1621043 | **R16** | SET - 1

II B. Tech I Semester Regular Examinations, October/November - 2017
SIGNALS & SYSTEMS
(Com to ECE, EIE and ECC)

Time: 3 hours   Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
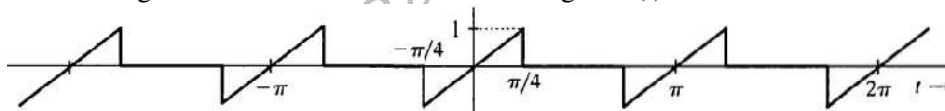2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**
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PART –A
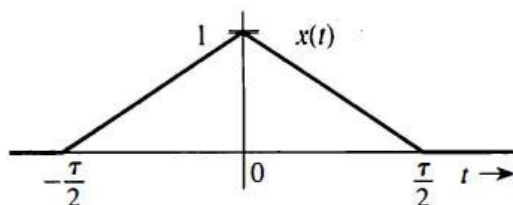
1. a) Define an impulse function and plot $\delta(t+2) - \delta(t-3)$. (2M)

   b) Define Hilbert transform of a signal x(t). (2M)

   c) Write short notes on band pass sampling. (3M)

   d) Write the conditions for distortion less transmission. (3M)

   e) Write time scaling property of Laplace transform. (2M)

   f) Find the Z transform of $\delta(n-2)$ (2M)

PART –B

2. a) Find the even and odd components of the signal $x(t) = \cos(\omega_o t + \pi/3)$. (7M)

   b) A function $f(t) = \begin{cases} 1 & 0 < t \le 0.5 \\ -1 & 0.5 < t \le 1 \end{cases}$ using $f(t) = c_1 \sin t + c_2 \sin 3t$. Compute the coefficients c_1, c_2. (5M)

   c) Discuss orthogonality in complex functions. (2M)

3. a) Find the trigonometric Fourier series for the signal x(t) shown below. (7M)

   b) Compute the Fourier transform of the signal x(t) applying differentiation in time property of Fourier transform. (7M)

4. State and prove sampling theorem for band limited signals. (14M)

5. a) A system represented by y(t) = 2x(t-2) + 2x(t+2). (7M)
   i) Is the system time invariant? Justify your answer.
   ii) Is the system causal? Justify your answer.

   b) Explain detection of signal in the presence of noise using correlation. (7M)

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6. a) Find the inverse Laplace transform of   (7M)

$$G(s) = \frac{4s}{(s+3)(s+8)}, \quad \sigma > -3$$

   b)   (7M)

Find the Laplace transform of $\quad e^{-\alpha|t|}$

7. a) Using the z-domain differentiation property find the Z transform of   (7M)

$$x[n] = n(5/8)^n \, u[n]$$

   b) Find the inverse of   (7M)

$$X(z) - \frac{z-1}{3z^2 - 2z + 2}, \quad |z| < 0.8165$$

Code No: R1621043   (**R16**)   (SET - 2)

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PART –A

1. a) Define a unit step function and plot u(t-2)   (2M)

   b) Write Direchlet's conditions.   (3M)

   c) Discuss the effects of under sampling on recovery of signal.   (2M)

   d) Explain the characteristics of ideal LPF.   (2M)

   e) Write the constraints on ROC for different signals.   (3M)

   f) Find the Z transform of $\delta(n+2)$ (2M)

PART –B

2. a) Find the even and odd components of the signal x(t) =sin2t + sin2t.cos2t + cos2t   (7M)

   b) Discuss orthogonality in signals using relevant expressions. Explain the term complete set. Give examples of complete sets.   (4M)

   c) Compute the energy of the signal x(t) shown below   (3M)
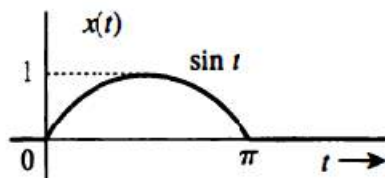
3. a) Find the complex exponential Fourier series for the signal x(t) shown below   (10M)
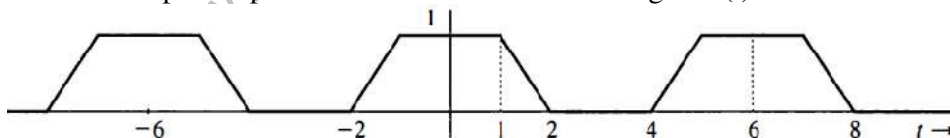
   b) State and prove differentiation in time domain property of Fourier transform.   (4M)

4. a) Explain natural sampling with relevant waveforms and expressions.   (7M)

   b) Explain reconstruction of signals from samples using relevant expressions.   (7M)

5. a) A system is given by y(t) = $\frac{d}{dt}x(t-1)$,   (7M)
   i) Check whether the system is BIBO stable. (Let x(t) be a square wave.)
   ii) Is the system causal? Justify your answer.

   b) Write the properties of autocorrelation function and prove two of them.   (7M)

6. a) Find the inverse Laplace transform of   (7M)

$$G(s) = \frac{4}{(s+3)(s+8)}, \quad \sigma > -3$$

b) Find the Laplace transform of $e^{-\sigma t} \sin(\omega_0 t) u(t)$ (7M)

7. a) Using convolution property find the Z transform of   (7M)

$$x[n] = (0.9)^n u[n] * (0.6)^n u[n]$$

b) Find the inverse Z transform of   (7M)

$$X(z) = \frac{z^2}{(z-1/2)(z-3/4)}, \quad |z| < 1/2$$

Code No: R1621043   **R16**   SET - 3

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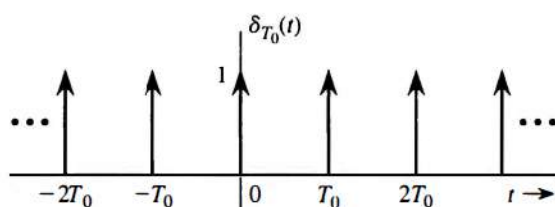2. Answer **ALL** the question in **Part-A**
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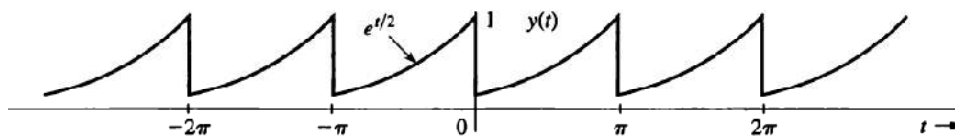~~~~~~

PART –A

1. a) Explain time reversal and draw time reversed unit step function. (2M)

    b) Express complex exponential Fourier coefficients in terms of trigonometric Fourier coefficients. (2M)

    c) State sampling theorem for band pass signals. (3M)

    d) Explain the characteristics of ideal HPF. (2M)

    e) Define region of convergence of Laplace transform. (2M)

    f) Compare Laplace, Fourier and z- transforms. (3M)

PART -B

2. a) Derive the expression for mean square error when a function is approximated by a set of orthogonal signals. (10M)

    b) Find the even and odd components of the signal x(t) = tu(t) (4M)

3. a) Compute the Fourier transform of the signal represented below (7M)

    b) Find the trigonometric Fourier series for the signal y(t) shown below (7M)

4. a) Explain flat top sampling with relevant expressions and waveforms. (7M)

    b) What is Nyquist rate of sampling? A signal x(t) = 10sinc(500t), find its Nyquist rate. Where $sinc(x) = \frac{\sin(\pi x)}{\pi x}$ (7M)

5. a) Derive the relationship between autocorrelation function and energy spectral density of an energy signal. (7M)

    b) Stating the properties and relevant mathematical expressions check whether the following systems are LTI or not? (7M)
    i) y(t) = 2x(t) + 3x(3t)
    ii) z(t) = (dw(t)/dt)²

1 of 2

6. a) Find the inverse Laplace transform of   (7M)

$$G(s) = \frac{s}{s^2 + 2s + 2}. \quad \sigma > -1$$

   b) Find the Laplace transform of $-te^{-\alpha t}\, u(-t)$ (7M)

7. a) Find the inverse Z transform of $X(z) = \ln(1 + az^{-1})$; ROC $|z| > a$ (7M)

   b) Find the Z transform and ROC of   (7M)

$$x[n] = (0.8)^n u[n] + (0.6)^n u[-(n+1)]$$

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Define an even signal and check whether signum function is even or not?.   (2M)
   b) Write duality property of Fourier transform.   (2M)
   c) A signal $x(t) = 5\sin(250t) + 6\sin(200\pi t)$, find the sampling rate to avoid aliasing.   (3M)
   d) Explain the characteristics of ideal BPF.   (2M)
   e) Write the relationship between Laplace transform and Fourier transform of a signal.   (2M)
   f) Find the Z transform of $n\delta(n)$.   (3M)

PART -B

2. a) Find the even and odd components of the signal $x(t) = (1+t^2+t^3)\cos^2 10t$.   (7M)
   b) Present the analogy between vectors and signals.   (7M)

3. a) Find the Fourier transform of the signum function.   (5M)
   b) Write the properties of Fourier series.   (5M)
   c) Find the Fourier transform of $x(t) = e^{-a|t|}$ (4M)

4. a) Compare impulse sampling, natural sampling and flat top sampling with relevant diagrams.   (7M)
   b) What is aliasing effect? Explain using relevant diagrams. Suggest the remedies to avoid aliasing.   (7M)

5. a) Define cross correlation function, write its properties and prove any two of them.   (7M)
   b) Derive the relationship between bandwidth and rise time.   (7M)

6. a) Find the inverse Laplace transform of   (7M)
$$G(s) = \frac{e^{-2s}}{s^2 + 2s + 2}, \quad \sigma > -1$$
   b) Find the Laplace transform of $-e^{-\alpha t}\sin(\omega_0 t)u(-t)$ (7M)

7. a) Find the inverse Z transform of $X[z] = \dfrac{-z(z+0.4)}{(z-0.8)(z-2)}$ ROC $0.8 < |z| < 2$ (7M)
   b) Find the Z transform and ROC of $x[n] = (1.2)^n u[n] + (3)^n u[-n-1]$ (7M)