Code No: A109210402 **R09** **Set No. 2**

**II B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010**

SIGNALS AND SYSTEMS
Common to BME, ICE, ETM, EIE, ECE

Time: 3 hours Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Write short notes on "Ideal BPF".
   (b) In the following network, determine the relationship between R's and C's in order to have a distortion less attenuation while signal is transmitted through the network shown in figure 1b. [8+7]

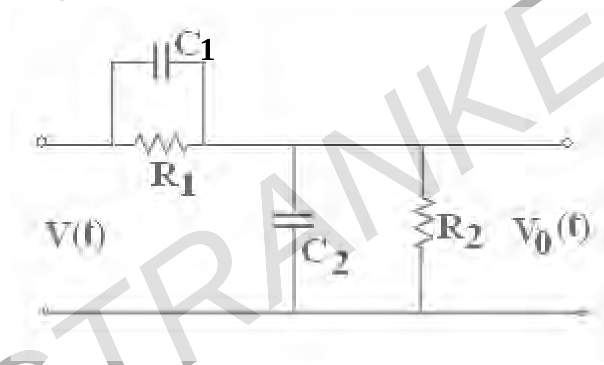



Figure 1b

2. (a) State the three important spectral properties of periodic power signals.
   (b) Determine the Fourier series of the function shown in figure 2b. [5+10]

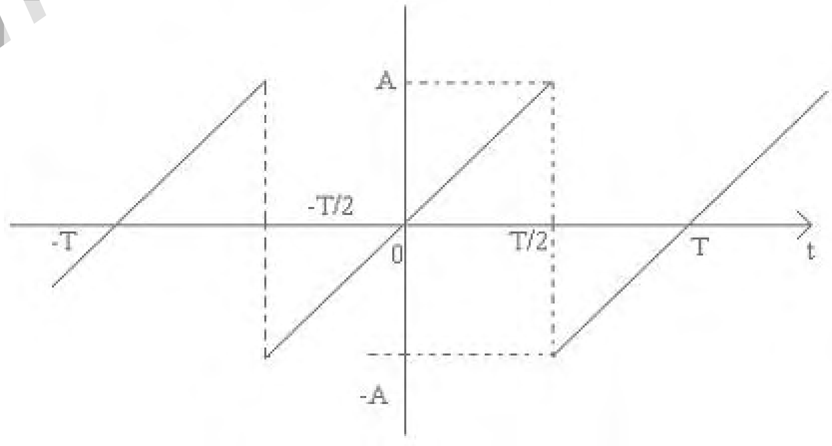



Figure 2b

3. (a) With the help of graphical example explain sampling theorem for Band limited signals.
   (b) Explain briefly Band pass sampling. [8+7]

4. (a) Find the Z-transform and ROC of the signal
   $x(n) = [4(5^n) - 3(4^n)]\, u(n)$

(b) Find the Z-transform as well as ROC for the following sequences: [7+8]

i. $\left(\frac{1}{3}\right)^n u(-n)$

ii. $\left(\frac{1}{3}\right)^n [u(-n) - u(n-8)]$

5. (a) State the properties of the ROC of Laplace transforms.

(b) Determine the function of time x(t) for each of the following laplace transforms and their associated regions of convergence. [7+8]

i. $(s+1)^2/\ s^2$-s+1 Re $\{S\} > 1/2$

ii. $s^2$- s+1/ $(s+1)^2$ Re $\{S\} >$ -1

6. (a) The rectangular function f(t) in figure 6a is approximated by the signal $4\pi$Sin t.

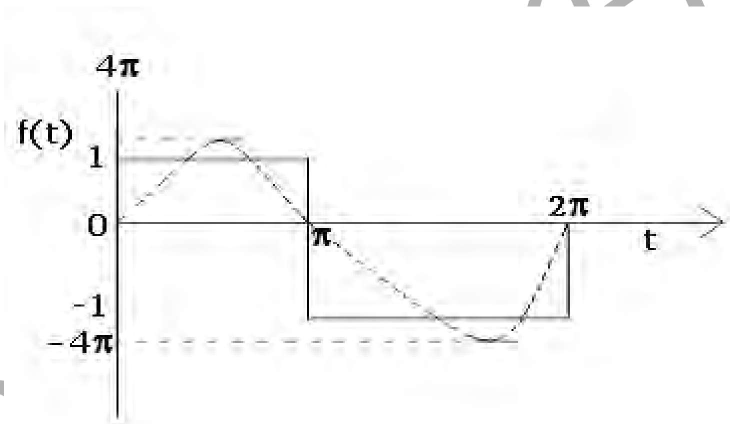



Figure 6a

show that the error function $f_e(t)$ = f(t)-4/$\pi$ Sin t is orthogonal to the function Sin t over the interval (0,2$\pi$).

(b) Determine the given functions are periodic or non periodic.

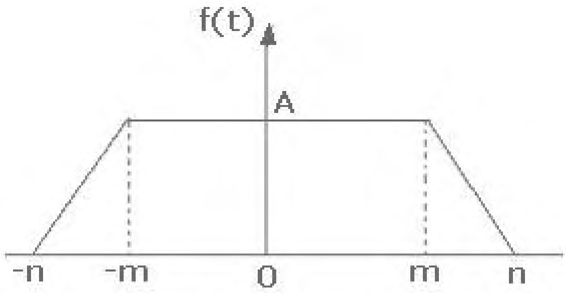
i. a Sin 5t + b cos 8t

ii. a Sin (3t/2) + b cos (16t/15) + c Sin (t/29)

iii. a cos t + b Sin $\sqrt{2t}$

Where a, b, c are real integers. [10+5]

7. (a) Determine the Fourier Transform of a trapezoidal function and triangular RF pulse f(t) shown in figure 7a. Draw its spectrum.



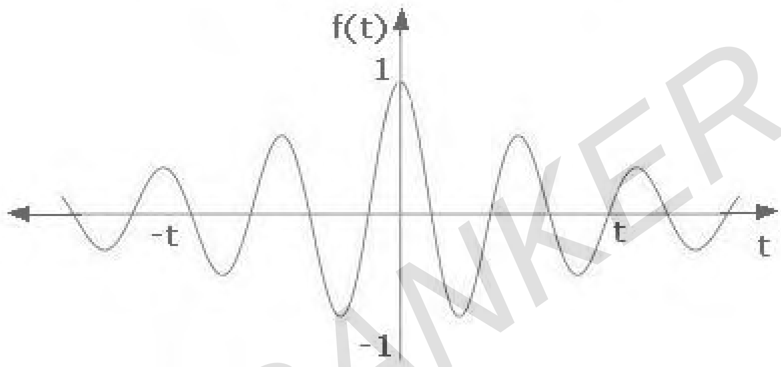




Figure 7a

(b) Using Parsevals theorem for power signals, Evaluate $\int_{-\alpha}^{\alpha} e^{-2t}u(t)dt$. [10+5]

8. (a) Consider an input x[n] and an impulse response h[n] given by
$x[n] = \left(\frac{1}{2}\right)^{n-2} u[n-2]$,
$h[n] = u[n+2]$.

Determine and plot the output $y[n] = x[n] * h[n]$.

(b) Bring out the relation between Correlation and Convolution.

(c) Explain the properties of Correlation function. [7+4+4]

⋆⋆⋆⋆⋆

Code No: A109210402 **R09** **Set No. 4**

**II B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010**

**SIGNALS AND SYSTEMS**
**Common to BME, ICE, ETM, EIE, ECE**

**Time: 3 hours** **Max Marks: 75**

**Answer any FIVE Questions**
**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State the properties of the ROC of Laplace Transforms.
   (b) Determine the function of time x(t) for each of the following Laplace transforms and their associated regions of convergence. [7+8]
      i. $\frac{(s+1)^2}{s^2-s+1}$ $\quad \mathrm{Re}\{S\} > 1/2$
      ii. $\frac{s^2-s+1}{(s+1)^2}$ $\quad \mathrm{Re}\{S\} > -1$

2. (a) Explain the conditions under which any periodic waveform can be expressed using the Fourier series.
   (b) Find the Trigonometric Fourier series for a periodic square form shown in figure 2b, which is Symmetrical with respect to the vertical axis? [5+10]

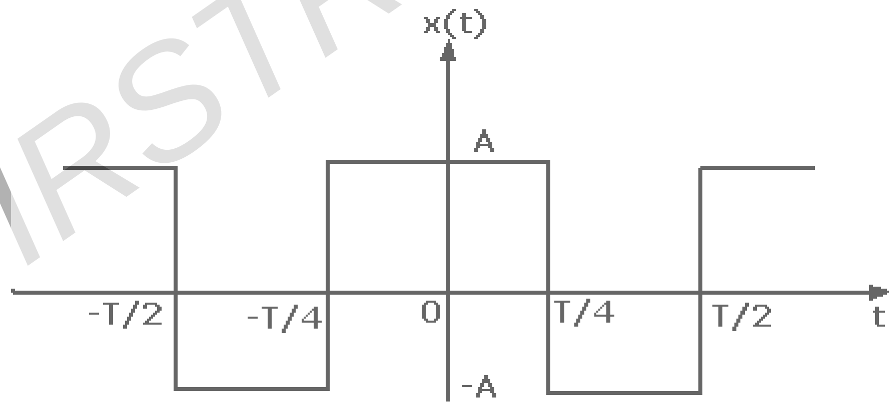



Figure 2b

3. (a) What is an LTI system? Derive an expression for the transfer function of an LTI system.
   (b) The signal v(t) = cos $\omega_0$t + 3 Sin 3$\omega_0$t + 0.5 Sin 4$\omega_0$t is filtered by an RC low pass filter with a 3dB frequency $f_c = 2f_0$. Find the output power $S_0$.[8+7]

4. (a) Impulse train sampling of x[n] is used to obtain
   $g[n] \ = \ \sum\limits_{k=-\infty}^{\infty} x[n]\,\delta[n \ - \ kn]$
   if $X(e^{j\omega})$ for $3\pi/7 \leq |\omega| \leq \pi$ , determine the largest value for the sampling interval N which ensures that no aliasing takes place.
   (b) Explain the Sampling theorem for Band Limited Signals with Graphical proof. [7+8]

5. Find the power of periodic signal g(t) shown in figure5. Find also the powers of

   (a) -g(t)

   (b) 2g(t)

   (c) g(-t)

   (d) g(t)/2. [15]

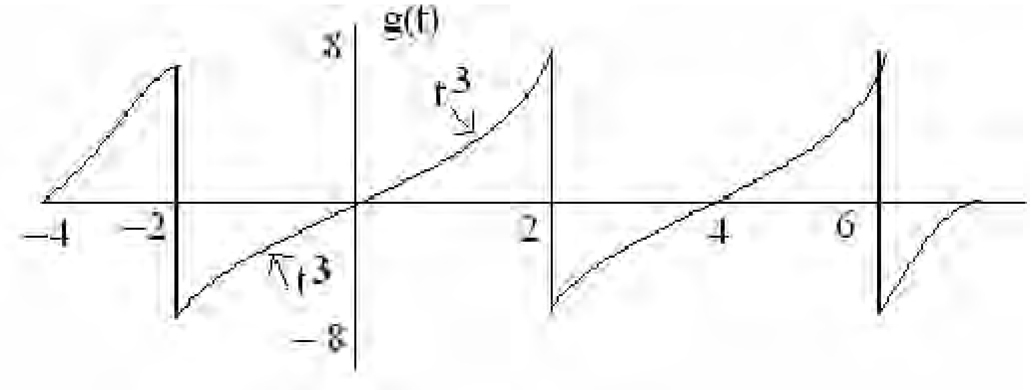



Figure 5

6. (a) An AM signal is given by
   f(t) = 15 Sin $(2\pi 10^6 t)$ + [5 Cos $2\pi 10^3$t + 3 Sin$2\pi$ $10^2$t] Sin $2\pi 10^{\mathbf{6}}$t
   Find the Fourier Transform and draw its spectrum.

   (b) Signal x(t) has Fourier Transform $x(f) = \frac{j2\pi f}{3+j/10}$.

   i. What is total net area under the signal x(t).

   ii. Let y(t) = $\int_{-\alpha}^{t} x(\lambda)d\lambda$ what is the total net area under y(t). [8+7]

7. (a) Find the inverse Z-transform of the following X(z).

   i. X(Z) = log ( 1 / (1-a$z^{-1}$)), |z| > |a|

   ii. X(Z) = log ( 1 / (1-$a^{-1}$z)), |z| < |a|

   (b) Find the Z-transform X(n), x[n] = $(1/2)^n$ u[n] + $(1/3)^n$ u[-n-1] [8+7]

8. (a) Which of the following signals or functions are periodic and if what is its fundamental period.

   i. g(t) = $e^{-j60\pi t}$

   ii. g(t) = 10 Sin $(12\pi t)$ + 4 Cos $(18\pi t)$

   (b) Let two functions be defined by:
   $x_1$(t) = 1 , Sin $(20\pi t) \geq 0$
   -1 , Sin $(20\pi t) < 0$
   $X_2$(t) = t, Sin $(2\pi t) \geq 0$
   -t Sin $(2\pi t) < 0$
   Graph the product of these two functions vs time over the time interval
   -2 $< t <$ 2. [8+7]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: A109210402 **R09** **Set No. 1**

**II B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010**

**SIGNALS AND SYSTEMS**

**Common to BME, ICE, ETM, EIE, ECE**

**Time: 3 hours** **Max Marks: 75**

**Answer any FIVE Questions**

**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Evaluate the following integrals:
   i. $\int_{-1}^{8} [u(t+3) - 2\delta(t).u(t)]dt$
   ii. $\int_{\frac{1}{2}}^{\frac{5}{2}} \delta(3t)dt$

   (b) A even function g(t) is described by

   $$g(t) = \begin{cases} 2t & 0 \le t < 3 \\ 15 - 3t & 3 \le t < 7 \\ -2 & 7 \le t < 10 \end{cases}$$

   i. What is the value of g(t) at time t = 5
   ii. What is the value of $1^{st}$ derivative of g(t) at time t = 6. [8+7]

2. (a) Distinguish between Energy and Power signals.

   (b) Derive the expression for Energy density spectrum function of a energy signal f(t) from fundamentals and interpret why it is called Energy density spectrum. [5+10]

3. (a) Explain the concept of generalized Fourier series representation of signal f(t).

   (b) State the properties of Fourier series. [8+7]

4. (a) Explain the properties of the ROC of Z transforms.

   (b) Z transform of a signal x(n) if $X(z) = \frac{1+z^{-1}}{1+\frac{1}{3}z^{-1}}$.
   Use long division method to determine the values of

   i. x[0], x[1], and x[2], assuming the ROC to be $|z| > \frac{1}{3}$
   ii. x[0], x[-1], and x[-2] , assuming the ROC to be $|z| < \frac{1}{3}$. [7+8]

5. (a) A signal y(t) given by $y(t) = C_0 + \sum_{n=1}^{\infty} C_n Cos(n\omega_0 t + \theta_n)$. Find the auto-correlation and PSD of y(t).

   (b) Explain the Graphical representation of convolution with an example. [8+7]

6. (a) Consider an LTI system with input and output related through the equation. $y(t) = \int_{-\alpha}^{t} e^{-(t-\tau)}x(\tau - 2)d\tau$What is the impulse response h(t) for this system.

(b) Determine the response of this system when the input x(t) is as shown in figure 6b.

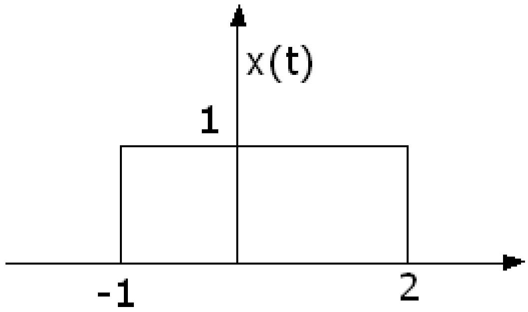



Figure 6b

(c) Consider the inter connection of LTI system depicted in figure 6c.

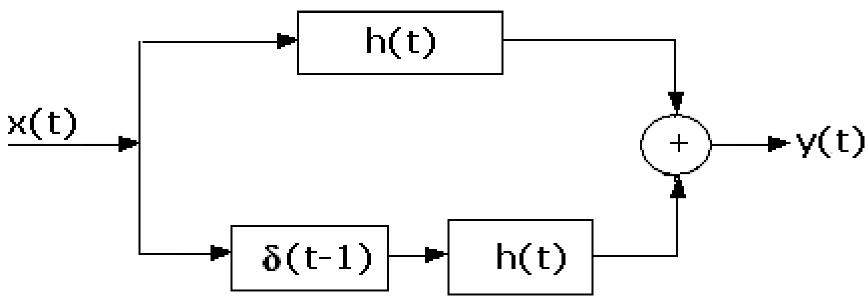



Figure 6c

Here h(t) is an in part (a). Determine the output y(t) when input x(t) is again given figure above, using the convolution integral. [5+5+5]

7. (a) Consider the signal x(t) = (sin 50 $\pi$t / $\pi$t)$^2$ which to be sampled with a sampling frequency of $\omega_s = 150\,\pi$ to obtain a signal g(t) with Fourier transform G(j$\omega$ ). Determine the maximum value of $\omega_0$ for which it is guaranteed that G(j$\omega$) = 75 X(j$\omega$) for $|\omega| < \omega_0$
where X(j$\omega$) is the Fourier transform of x(t).

(b) The signal x(t) = u(t + $T_0$) - u(t - $T_0$) can undergo impulse train sampling without aliasing, provided that the sampling period T< 2$T_0$. Justify. [7+8]

8. (a) Explain the method of determining the inverse Laplace transforms using Partial fraction method, for the following cases
   i. Simple and real roots
   ii. Complex roots
   iii. Multiple or repeated roots.

(b) Find the Laplace transform of the function
f(t) = A Sin $\omega_0$t for 0 < t < T/2. [3+3+4+5]

⋆⋆⋆⋆⋆

Code No: A109210402 **R09** **Set No. 3**

**II B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010**

SIGNALS AND SYSTEMS

Common to BME, ICE, ETM, EIE, ECE

Time: 3 hours Max Marks: 75

Answer any FIVE Questions

All Questions carry equal marks

⋆⋆⋆⋆⋆

1. (a) Derive polar Fourier series from the exponential Fourier series representation and hence prove that $D_n = 2|C_n|$.

   (b) Determine the trigonemetric and exponential Fourier series of the function shown in figure 1b. [5+10]

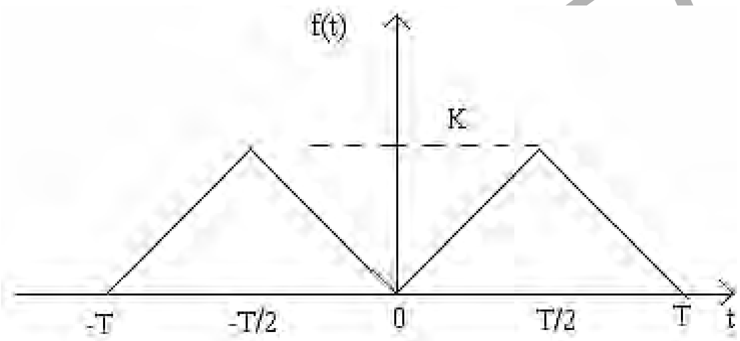



Figure 1b

2. (a) Write short notes on "orthogonal vector space".

   (b) A rectangular function f(t) is defined by:
   $$f(t) = \begin{cases} 1 & 0 < t < \Pi \\ -1 & \Pi \le t < 2\Pi \end{cases}$$
   Approximate above function by a finite series of Sinusoidal functions. [8+7]

3. (a) Using the Power Series expansion technique, find the inverse Z-transform of the following X(Z):

   i. $X(Z) = \frac{Z}{2Z^2 - 3Z + 1} \quad |Z| < \frac{1}{2}$

   ii. $X(Z) = \frac{Z}{2Z^2 - 3Z + 1} \quad |Z| > 1$

   (b) Find the inverse Z-transform of
   $X(Z) = \frac{(Z+1)}{Z(Z-1)(Z-2)} \quad |Z| > 2.$ [8+7]

4. (a) Determine the inverse Laplace transform for the following Laplace transform and their associated ROC.

   i. $\frac{s+1}{(s^2+5s+6)} \quad -3 < \mathrm{Re}\{s\} < -2$

   ii. $\frac{(s^2+5s+6)}{(s+1)^2} \quad \mathrm{Re}\{s\} > -1$

   (b) Explain the constraints on ROC for various classes of signals, with an example. [9+6]

5. (a) Find the Fourier Transform for the following functions shown in figure 5a.

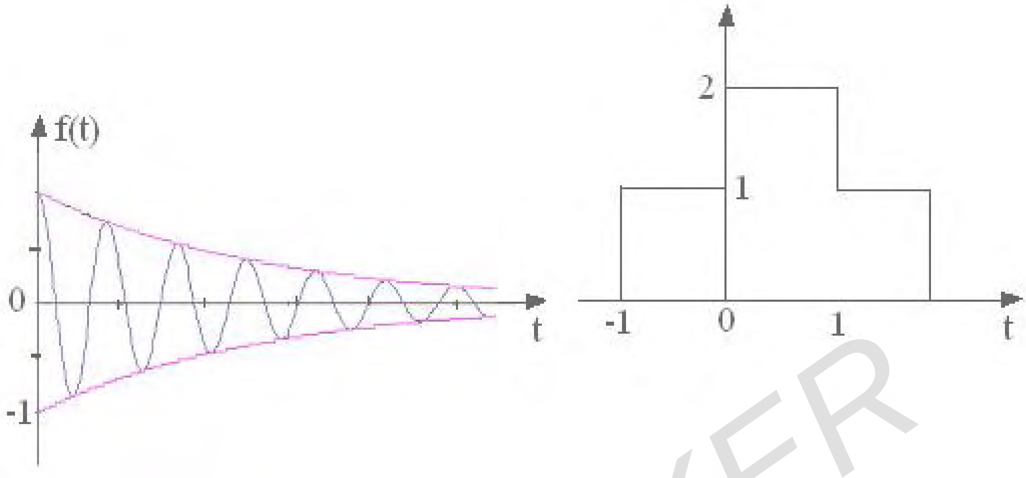



Figure 5a

(b) Find the total area under the function g(t) = 100 Sin c ((t-8)/30). [10+5]

6. (a) Explain briefly detection of periodic signals in the presence of noise by correlation.

(b) Explain briefly extraction of a signal from noise by filtering. [8+7]

7. (a) Find the transfer function of Lattice network shown in figure 7a.

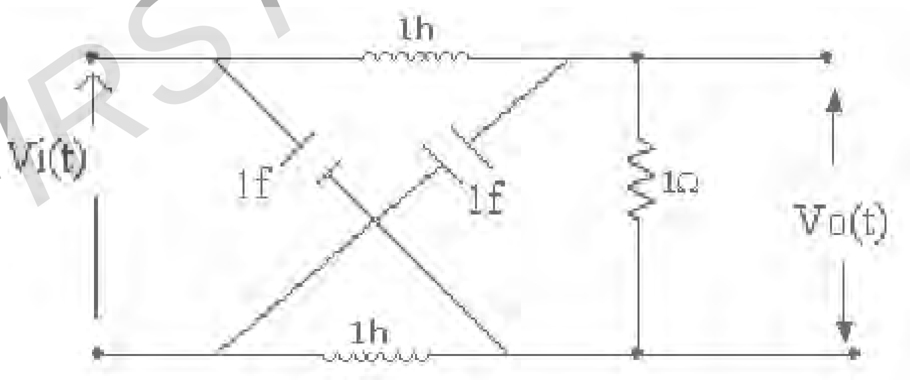



Figure 7a

(b) Sketch the magnitude and phase characteristic of H(j$\omega$). [8+7]

8. Determine the Nyquist sampling rate and Nyquist sampling interval for the signals.

(a) sinc(100$\pi$t).

(b) sinc$^2$(100$\pi$t).

(c) sinc(100$\pi$t) + sinc(50$\pi$t).

(d) sinc(100$\pi$t) + 3 sinc$^2$(60$\pi$t). [3+4+4+4]

⋆⋆⋆⋆⋆