EC36

NEW SCHEME

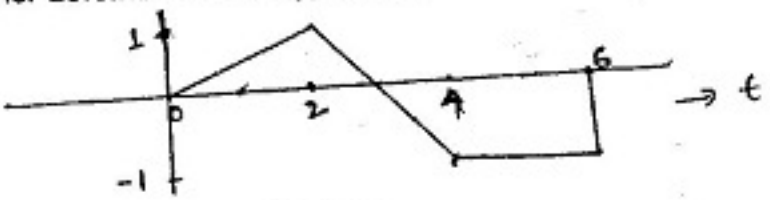
Reg. No. | | | | | | | | | | |

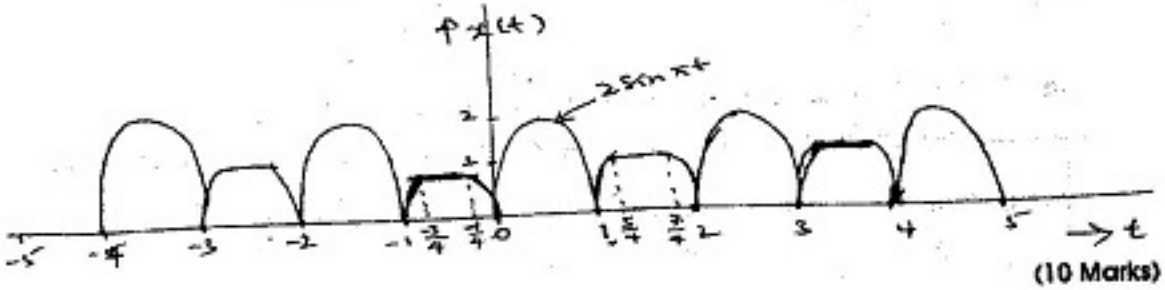
Third Semester B.E. Degree Examination, January/February 2006
EC / TE / ML / IT / BM / EE
Signals and Systems

Time: 3 hrs.) (Max.Marks : 100

Note: *1. Answer any FIVE full questions.*
2. Missing data may be suitably assumed with proper justification.

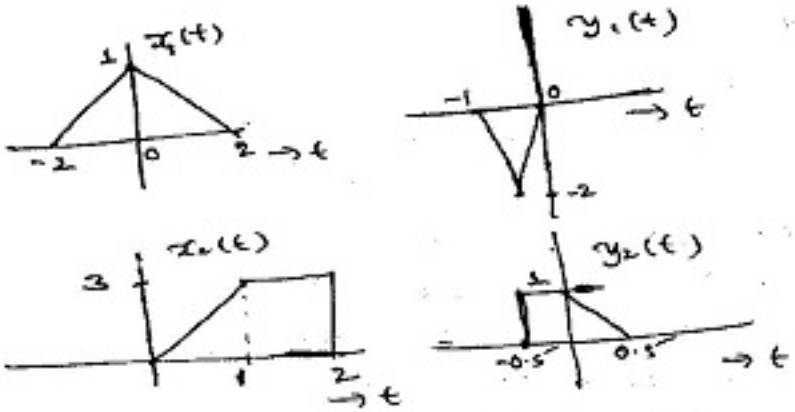
1. (a) Is the signal shown in fig 1a is power or energy signal? Give reasons for your answers and further determine its energy/power.





(10 Marks)

(b) Explain the significance of time compression and expansion. Determine the relationship between the signals $x_1(t)$ & $y_1(t)$ and $x_2(t)$ & $y_2(t)$ shown in fig 1b.



(10 Marks)

2. (a) Determine whether the following signals are periodic. If periodic determine the fundamental period.

i) $x(t) = cos2t + sin3t$ ii) $x(n) = cos(\frac{1}{5}\pi n)sin(\frac{1}{3}\pi n)$ **(6 Marks)**

(b) Determine whether the system shown below is memoryless, stable, causal, linear and time invariant.

i) $y(n) = x(n) \sum_{k=-\infty}^{\infty} \delta(n-2k)$ ii) $y(t) = \frac{d}{dt}\{e^{-t}x(t)\}$ **(14 Marks)**

Contd.... 2

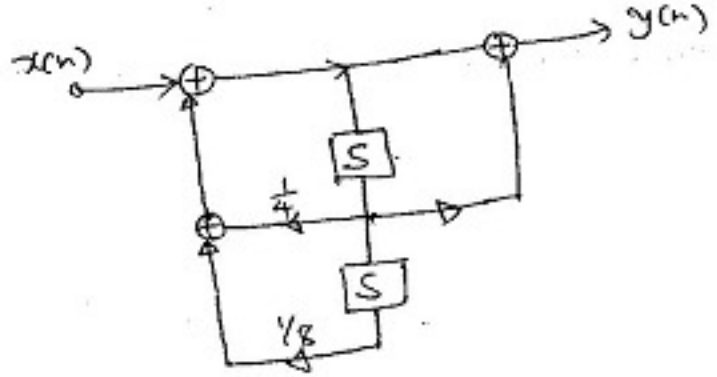
3. **(a)** A LTI system has impulse response $h(t) = tu(t) + (10-2t)u(t-5) - (10-t)u(t-10)$ determine the output for each of the following inputs:

i) $x_1(t) = \delta(t+2) + \delta(t-5)$ ii) $x_2(t) = 2\delta(t) + \delta(t-5)$ **(14 Marks)**

(b) Draw the direct form I and direct form II implementation if the following system:

$$\frac{d^3}{dt^3}y(t) + 2\frac{d^2}{dt}y(t) + 3y(t) = x(t) + 3\frac{d^2}{dt^2}x(t)$$ **(6 Marks)**

4. **(a)** Determine the output response of the following system given the input and initial condition as $x(n) = 2^n u(n)$ $y(-1) = 2$ $y(-2) = -1$



(12 Marks)

(b) Explain the characteristics of systems described by differential equations. **(6 Marks)**

(c) Obtain an expression for impulse response of a LSI system in terms of its step response. **(2 Marks)**

5. **(a)** Determine the time domain expression given the following:

i) $X(e^{j\Omega}) = \frac{6 - \frac{2}{3}e^{-j\Omega} - \frac{1}{6}e^{-j2\Omega}}{-\frac{1}{6}e^{-j2\Omega} + \frac{1}{6}e^{-j\Omega} + 1}$

ii) $X(j\omega) = \frac{2j\omega + 1}{(j\omega + 2)^2}$

iii) $X(j\omega) = 4\frac{Sin^2(\omega)}{\omega^2}$ **(12 Marks)**

(b) Evaluate the following quantities

i) $\int_{-\infty}^{\infty} \frac{4}{(\omega^2+1)^2} d\omega$ ii) $\int_{-\infty}^{\infty} \frac{sin^2(\pi t)}{\pi t^2} dt$ **(8 Marks)**

6. **(a)** Prove the following properties:

i) Convolution property of periodic discrete time sequences.

ii) Time shift property of discrete time aperiodic sequences.

iii) Parseval relationship for the FS. **(10 Marks)**

(b) A LTI system has impulse response $h(t) = 2\frac{sin\pi t}{\pi t}cos(4\pi t)$. Use the FT to determine the system output if the input is given by fig 6b. **(10 Marks)**

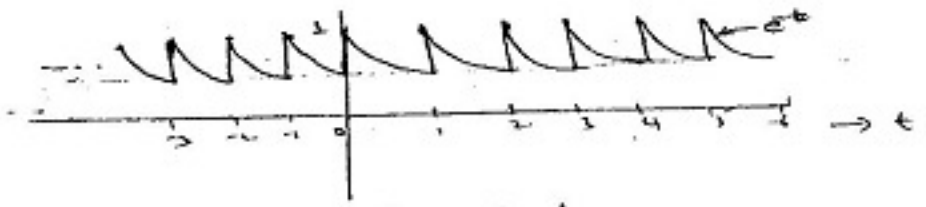


Fig 6.b

Contd.... 3

7. (a) Describe the reconstruction scheme used in reconstructing CT signal from its discrete counter part using zero-order hold with necessary equations and sketches. **(8 Marks)**

   (b) Describe the properties of Region-of-Convergence and specifically sketch the ROC of a two sided sequence. **(6 Marks)**

   (c) Prove the convolution property of a LSI system in z-domain. **(6 Marks)**

8. (a) Determine the 'all possible impulse responses for the system described by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = 2x(n)$. Also determine the output $y(n)$ if the input $x(n) = 2^n u(n)$ **(12 Marks)**

   (b) Determine the z-transform the signal $x(n) = 2(n-1)^2(\frac{1}{2})^n u(n-1)$. Sketch its ROC and pole-zero plot. **(8 Marks)**

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