Sem V T.E. ETRX C. T. S. S. 02/06/06.

P May 06, 3 261

Con. 1868-06. TV-8295

(REVISED COURSE)

(3 Hours) [Total Marks : 100

N.B. (1) Question No. **1** is **compulsory** and answer any **four** questions out of remaining **six** questions.
(2) Assume suitable data, if **necessary** with proper justifications.
(3) **Figures** to the **right** indicate **full** marks.

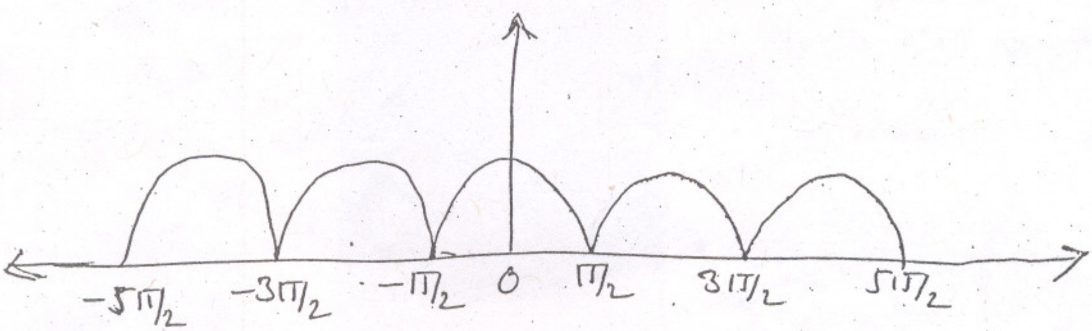
1. (a) In each of the following systems, x(t) is the input and y(t) is the o/p. Classify each system in terms of linearity, time invariance, memory and causality– **8**
(1) $y(t) = x^2(t) + x(t+1)$.
(2) $\ddot{y}(t) + 3\dot{y}(t) = 2\dot{x}(t) + x(t)$

(b) Determine whether the following signals can be classified as energy signals or power signals and hence find the its value. **6**
(i) $x(t) = A \sin wt$ (ii) $x(t) = te^{-t} u(t)$

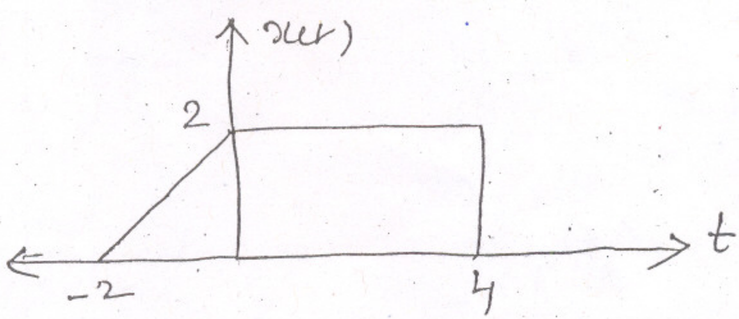
(c) Check whether the following signals are periodic or not ? If periodic find its fundamental period **6**
(i) $x(t) = \cos(2t) - \sqrt{2}\cos(2t - \pi/4)$
(ii) $x(t) = 4 - 3\sin^2(12\pi t)$

2. (a) (i) Show that the following signals are orthogonal over an interval [0, 1] **6**
$f(t) = x(t)$
$x(t) = \sqrt{3}(1 - 2t)$
(ii) Explain Gibb's phenomenon. **4**

(b) Find the Fourier series expansion and plot the corresponding frequency spectra for the full wave rectified cosine function shown below. **10**



3. (a) Find the Fourier transform of the following functions. **10**
(i) $x(t) = \sin w_0 t$ (ii) Signum function.



x(t) is given as shown in above **Figure.** Sketch and label the following signals–
(i) $y(t) = x(-t)$ (iii) $g(t) = x(t/2)$
(ii) $f(t) = x(2t - 2)$ (iv) $h(t) = x(2 - 2t)$.

4. (a) (i) Evaluate the following – 10

$$\text{(a)} \int_0^5 \sin 2t\, \delta(t-3)\, dt \qquad \text{(b)} \int_{-2}^{4} (t - t^2)\, \delta(t-3)\, dt$$

(ii) State and explain Parseval's theorem.

(b) Convolve the following two signals in time domain and sketch the o/p. 10

$x(t) = 2(t)\,[\,u(t+2) - u(t-2)\,]$, $h(t) = u(t) - u(t-4)$.

5. (a) If $X(s) = \dfrac{2s^2 + 5s + 5}{(s+2)(s+1)^2}$ find x (t) for all possible ROC conditions. 10

(b) A continuous time LTI system is described by following differential equation. 10

$$2\dddot{y}(t) + 3\ddot{y}(t) + 4\dot{y}(t) + 6y(t) - 2x(t)$$

Obtain the state variable model of this system.

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6. (a) Find the zero state response, zero input response and total response of the following system– **10**

$$\ddot{y}(t) + 4\dot{y}(t) + 3y(t) = 2\dot{x}(t) + x(t)$$

with initial conditions $y(0) = 1$, $\dot{y}(0) = 2$ and $x(t)\ e^{-2t}u(t)$.

(b) (i) Check whether the following systems are stable or unstable. **5**

(a) $H(s) = \dfrac{(s+1)^2}{s^2+1}$ (b) $H(s)\ \dfrac{s^2}{(s+2)(s^2+2s-3)}$

(ii) Derive the relation between Fourier transform and Laplace transform. **5**

7. (a) Find the state transition matrix for the system for which system matrix is given as– **10**

$$A = \begin{bmatrix} 3/4 & 0 \\ -1/2 & 1/2 \end{bmatrix}$$

(b) (i) Find the Laplace transform of following signal– **5**

$x(t) = te^{-at}u(-t)$.

(ii) State and prove the sampling theorem. **5**