



Reg. No. : .....

Name : .....

**IV Semester B.Tech. (Regular/Supplementary/Improvement – Including Part Time) Degree Examination, May 2012  
(2007 Admn. Onwards)**

**PT 2K6/2K6EC/AEI 404 : SIGNALS AND SYSTEMS**

Time: 3 Hours

Max. Marks: 100

**Instruction :** Answer *all* questions.

**PART – A**

Answer **all** questions :

- I. a) Define an energy signal and check whether the following signal is an energy signal or not  $x(t) = t u(t)$ .
- b) What is BIBO stability ? Prove the condition on  $h(t)$  for a system to be stable.
- c) State and explain any 2 properties of CTFT.
- d) What is aliasing effect ? How it can be avoided in a signal ?
- e) Find the discrete Fourier series representation of a periodic sequence  $x(n) = \{1, 1, 0, 0\}$  with period  $N = 4$ .
- f) State and prove the convolution property of DTFT.
- g) Write any 4 properties of Region of convergence.
- h) State and prove the initial value theorem of z transform. **(8×5=40)**

**PART – B**

- II. a) If 'E' is the energy of the signal  $x(t)$  what is the energy of  $x(2t)$  and  $x(t/2)$ . **6**
- b) Find the natural and total response of the system described by the differential equation :

$$\frac{d^2y(t)}{dt^2} + \frac{6 dy(t)}{dt} + 8y(t) = \frac{dx(t)}{dt} + 2x(t) \quad x(t) = e^{-t}u(t). \text{ The initial conditions}$$

are  $y(0^+) = 2, \frac{d}{dt} y(0^+) = 3$ . **9**

OR

P.T.O.



- c) Test whether the following signals are periodic or not. If periodic find out the period :

$$x(t) = \cos\left(\frac{\pi}{3}\right) t + \sin\left(\frac{\pi}{5}\right) t$$

$$x(t) = \cos t + \sin \sqrt{2} t.$$

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$$d) \left. \begin{array}{l} x(t) = 1, \quad 0 \leq t < 1 \\ e^{-t} \quad t \geq 1 \\ 0 \quad \text{Otherwise} \end{array} \right\}$$

Plot :

i)  $x(2t - 3)$ ,

ii)  $x(1.5t - 0.5)$

iii)  $x(2 - 0.5t)$ .

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- III. a) State and prove any 2 properties of Hilbert transform.

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- b) Determine the impulse response  $h(t)$  and output response  $y(t)$  of the given differential equation with i/p  $x(t) = e^{-2t} u(t)$

$$\frac{dy(t)}{dt} + 3y(t) = x(t).$$

9

OR

- c) Find the energy spectral density of the signal  $x(t) = \begin{cases} e^{-2t} & t \geq 0 \\ 0 & t < 0 \end{cases}$ .

7

- d) Find the Fourier series coefficients of periodic signal  $x(t) = \begin{cases} 1 & |t| < T_1 \\ 0 & T_1 < |t| < T/2 \end{cases}$ .

8

- IV. a) Find the discrete time Fourier coefficients for

$$x(n) = 1 + \cos\left(\frac{2\pi}{N}\right) n + 2 \cos\left(\frac{4\pi n}{N} + \frac{\pi}{3}\right) + 4 \cos\left(\frac{6\pi n}{N} + \frac{\pi}{4}\right).$$

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b) Find the inverse DTFT of the system  $X(e^{j\Omega}) = \frac{\frac{2}{3}e^{-j\Omega} + 5}{1 + \frac{5}{6}e^{-j\Omega} + \frac{1}{6}e^{-2j\Omega}}$  . 8

OR

c) Find the DTFT of  $x(n) = a^{-n}u(-n)$ ,  $|a| > 1$ . 7

d) State and prove the difference in time property of DTFS. 8

V. a) A LSI system is described by  $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$

i) Determine the system function.

ii) Find the step response of the system. 15

OR

b) Find the inverse 2 transform of  $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$  using power series expansion method for  $|z| > 1$  and  $|z| < 1$ . 15

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