

(Following Paper ID and Roll No. to be filled in your Answer Books)

PAPER ID :**Roll No.**

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B.TECH.**Theory Examination (Semester-IV) 2015-16****SIGNALS & SYSTEMS****Time : 3 Hours****Max. Marks : 100****SECTION – A**

Q1. Attempt all parts

10 x 2=20

- Distinguish between Symmetric and Non-Symmetric signals with suitable example.
- Determine whether the following signal is periodic or not, if so find its period.

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

- Explain BIBO and Time Invariance properties of the system.
- Prove the frequency-shifting property of Fourier Transform.
- Find the Nyquist-rate for the following signal.

$$x(t) = [1 + 0.1 \sin(200\pi t)] \cos(2000\pi t)$$

- Sketch

$$Z(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$$

- What do you mean by Group Delay?
- Establish the relationship between convolution and correlation function for CT - system.
- Find the total energy and total-power contained in the unit-step signal $u(t)$.
- Find the impulse-response of the system having gain.

SECTION – B

Q2. Attempt any five parts

10 x 5 = 50

- An LTI system has impulse response $h(n) = [u(n) - u(n-4)]$. Find the output of the system if the input $x(n) = [u(n+10) - 2u(n+5) + u(n-6)]$. Sketch the output.

- Use the properties of the Fourier Transform to show by induction that the Fourier Transform of

$$x(t) = \frac{t^{n-1}}{(n-1)!} e^{-at} u(t), a > 0 \quad \text{is} \quad \frac{1}{(a+j\omega)^n}$$

- Show that the Fourier Transform of a train of impulses of unit height separated by T secs is also a train of impulses of height $\omega_0 = 2\pi/T$ separated by $\omega_0 = 2\pi/T$ sec.

- Determine the DTFT of the following signals

- $x(n) = a^{|n-2|}, |a| < 1$

- $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$

- $x(n) = 2^n [u(n) - u(n-6)]$

- Attempt the following

- Prove the time-shift property of uni-lateral Z-Transform.

- State and Prove initial value theorem for Z-Transform.

- Explain causal and anti-causal signals with suitable examples.

- Sketch $\delta[n] = u(n) - u(n-1)$

- Derive the expression for convolution integral.

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SECTION – C

Attempt any two parts

15 x 2 = 30

Q3. Attempt the following.

- a) Evaluate the continuous time convolution integral

$$y(t) = e^{-2t}u(t) * U(t + 2)$$

- b) Determine whether each of the systems given below is linear, time invariant, causal and memory.

- i. $y(t) = \cos(x(t))$
- ii. $y(n) = 2x(n)u(n)$
- iii. $y(t) = \frac{d}{dt}\{e^{-t}x(t)\}$

Q4. Attempt the following.

- a) Explain the following properties of the Laplace Transform

- i. Linearity.
- ii. Time – Shifting.
- iii. Time – Scaling.
- iv. Conjugation.

- b) Determine the unilateral Laplace Transform of each of the following signals, and specify the corresponding regions of convergence.

- i. $x(t) = e^{-2t}u(t + 1)$
- ii. $x(t) = \delta(t + 1) + \delta(t) + e^{-2(t+3)}u(t + 1)$
- iii. $x(t) = e^{-2t}u(t) + e^{-4t}u(t)$

Q5. Attempt any two of the following.

- a) Draw a block representation for the causal LTI system with system function

$$H(z) = \frac{1}{1 - \frac{1}{4}z^{-1}}$$

- b) Explain uni-lateral Z-Transform.
- c) Find the step-response of the RC – High Pass Filter.