

Code: 15A04303

B.Tech II Year I Semester (R15) Supplementary Examinations June 2018

SIGNALS & SYSTEMS

(Common to ECE & EIE)

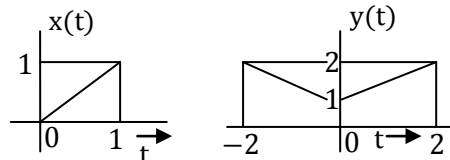
Time: 3 hours

Max. Marks: 70

PART – A
 (Compulsory Question)

1 Answer the following: (10 X 02 = 20 Marks)

- Distinguish between energy and power signal.
- State the conditions for the convergence of Fourier transform.
- A pair of sinusoidal signals with a common angular frequency is defined by $x_1[n] = \sin[5\pi n]$ and $x_2[n] = \sqrt{3} \cos[5\pi n]$. Specify the condition, that the period N of both $x_1[n]$ and $x_2[n]$ must satisfy for them to be periodic.
- Express the signal $y(t)$ in terms of $x(t)$.



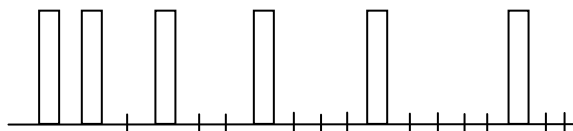
- Compute $y[n] = x[n] * h[n]$, where $x[n] = \alpha^n u[n]$, $h[n] = \beta^n u[n]$.
- Define the conditions for a system to be causal.
- Define system bandwidth.
- Is Fourier transform of a discrete time signal continuous or discrete? Justify your answer.
- Deduce the relationship between bandwidth and rise time.
- Give the relationship between Fourier transform and Z-transform.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- A binary signal $x(t) = 0$ for $t < 0$. For positive time, $x(t)$ toggles between one and zero as follows: One for 1 second, zero for 1 second, one for 1 second, zero for 2 seconds, one for 1 second, zero for 3 seconds, and so forth. That is, the “on” time is always one second but the “off” time successively increases by one second between each toggle. A portion of $x(t)$ is shown below. Determine the energy and power of $x(t)$.



- Determine whether the following signals are periodic or not. If periodic, deduce the period of the same:
 - $x(n) = \cos\left(\frac{1}{4}n\right)$
 - $x(n) = \cos^2\left(\frac{\pi}{8}n\right)$

OR

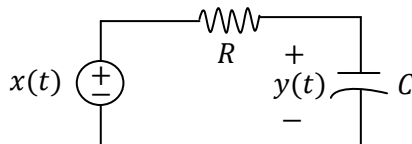
- Consider a continuous-time LTI system described by $y(t) = T\{x(t)\} = \frac{1}{T} \int_{t-\frac{T}{2}}^{t+\frac{T}{2}} x(\tau) d\tau$. Find and sketch the impulse response $h(t)$ of the system. Is the system causal?
 - Prove that the complex sinusoids with frequencies separated by an integer multiple of the fundamental frequency are ORTHOGONAL and hence derive expressions for DTFS.

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UNIT – II

- 4 (a) Find the Fourier series representation for output $y(t)$ of the RC circuit shown in response to the square wave input. Assume $T_s/T = 1/4$, $T = 1s$, $RC = 0.1s$.



- (b) State and prove sampling theorem for low pass signals.

OR

- 5 (a) State and prove convolution property.
 (b) Let the input to a system with impulse response $h(t) = 2e^{-t} u(t)$ be $x(t) = 3e^{-t} u(t)$. Use the convolution property to find the output of the system, $y(t)$.

UNIT – III

- 6 Deduce the conditions for distortion less transmission through a system.

OR

- 7 (a) Deduce the Poly Wiener criterion for physical realization of the systems.
 (b) Deduce the relationship between power spectral density and autocorrelation function.

UNIT – IV

- 8 (a) Consider the DFT $\{2, 1+j, 0, 1-j\}$. Evaluate the IDFT.
 (b) State and prove circular convolution property.

OR

- 9 Deduce the circular convolution of the sequences $[2 \ 2 \ 2 \ 2]$ and $[2 \ 2 \ 2 \ 2]$. Explain the relationship between circular and linear convolutions.

UNIT – V

- 10 (a) State and prove differentiation property in Laplace transforms.
 (b) Deduce the Laplace transform of the following signal:

$$X(t) = (e^{-t} \cos 2t - 5 e^{-2t}) u(t) + 0.5 e^{2t} u(-t)$$

OR

- 11 (a) Find the inverse Laplace transform of the following:

$$X(s) = \frac{1}{s(s+1)^2} \quad \text{Re}(s) > -1$$

- (b) Find the z-transform and the associated ROC for the following sequence:

$$x[n] = a^{n+1} u[n+1]$$
