Code: 15A04303 **R15**

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)

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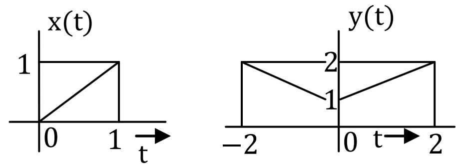
1 Answer the following: (10 X 02 = 20 Marks)

(a) Distinguish between energy and power signal.

(b) State the conditions for the convergence of Fourier transform.

(c) 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 and $x_2[n]$ must satisfy for them to be periodic.

(d) Express the signal y(t) in terms of x(t).



(e) Compute $y[n] = x[n] * h[n]$, whre $x[n] = \alpha^n\, u[n],\ h[n] = \beta^n u[n]$.

(f) Define the conditions for a system to be causal.

(g) Define system bandwidth.

(h) Is Fourier transform of a discrete time signal continuous or discrete? Justify your answer.

(i) Deduce the relationship between bandwidth and rise time.

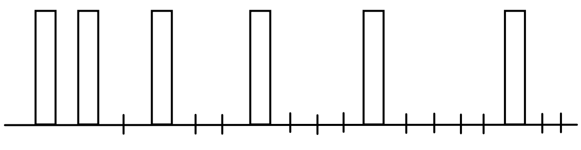
(j) Give the relationship between Fourier transform and Z-transform.

PART – B

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

UNIT – I

2 (a) 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 $x(t)$.



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

OR

3 (a) 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?

(b) 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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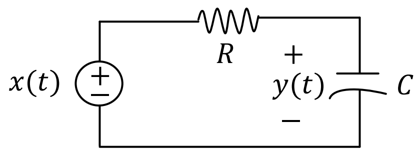
UNIT – II

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:

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

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

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

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