

- (b) Define sampling theorem. What is the procedure to avoid aliasing ? 7½

(Compulsory Question)

9. (a) What are invertible and non-invertible system ?
(b) Define initial and final value theorem of Laplace transform.
(c) Define time scaling, time shifting and time reversing with examples.
(d) If $y(t) = x(t) * h(t)$, where $*$ is convolution and $g(t) = x(3t) * h(3t)$. Show that $g(t)$ has the form $g(t) = Ay(Bt)$. Determine the values of A and B.
(e) Determine whether the signal is energy or power $x(t) = A[u(t + a) - u(t - a)]$ for $a > 0$.
5×3=15

Roll No.

Total Pages : 04

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B. Tech. EXAMINATION, 2021

Semester III (CBCS)

SIGNALS AND SYSTEMS

EC-304

Time : 2 Hours

Maximum Marks : 60

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from any of the Sections A, B, C and D.
Q. No. **9** is compulsory.

Section A

1. (a) Define the following terms : 7½
Energy and Power signal, Continuous and Discrete time signal.

- (b) Let $x(n)$ be a signal with $x(n) = 0$ for $|n| > 2$. For each signal given below, find the value of n for which it is guaranteed to be zero :
- (i) $x(n - 2)$
- (ii) $x(-n + 4)$. 7½

2. (a) Define periodic signal and non-periodic signal. Determine whether the signal is periodic or not, if periodic find the time period of signal :
- (i) $x(n) = 5 \cos(6n)$
- (ii) $x(n) = \cos(2n) \cos(4n)$. 7½
- (b) Let $x_1(t)$ and $x_2(t)$ be periodic signals with fundamental periods T_1 and T_2 . Under what condition is the sum $x(t) = x_1(t) + x_2(t)$ periodic, and what is the fundamental period of $x(t)$ if it is periodic. 7½

Section B

3. (a) Define System. Explain linear and non-linear system and write the properties of LTI system. 7½
- (b) Find the convolution of $x(t) = 5.u(t - 2) - 5.u(t - 4)$ and $h(t) = 10.u(t) - 10.u(t - 2)$. 7½

4. (a) A continuous time periodic signal $x(t)$ is real valued and has a fundamental period $T = 10$. The non-zero Fourier coefficients for $x(t)$ are ; $a_1 = a_{-1} = 4$, $a_3^* = 6j$. Express $x(t)$ in the form of : 7½

$$x(t) = \sum_{k=0}^{\infty} A_k \cos(\omega_k t + \phi_k).$$

- (b) State and prove Parseval's theorem. 7½

Section C

5. (a) State and prove multiplication properties of Fourier transform. 7½
- (b) Find the Fourier transform of $x(t) = \cos(t) u(t)$. 7½
6. Write the properties of Laplace transform. 15

Section D

7. (a) State and prove multiplication property of z-transform. 7½
- (b) Find z-transform of $x[n] = -n^2 a^n u(-n - 2)$. 7½
8. (a) Find Nyquist time interval of $x(t) = \sin c(t) \otimes \sin c^4(2t)$. 7½