

Total No. of printed pages = 4.

CSE 181305

Roll No. of candidate

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2/2/2022 Mukherjee, K. K.
10/1/2022 10/1/22

B.Tech. 3rd Semester End-Semester Examination

CSE

BASICS OF SIGNAL AND SYSTEMS

(New Regulation & New Syllabus)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Question No. 1 is compulsory and answer any *four* questions from the rest.

1. Answer any *ten* questions : (10 × 1 = 10)
- (i) A lumped parameter system is described by
- (a) Ordinary differential equations
 - (b) Partial differential equations
 - (c) Both (a) and (b)
 - (d) None of above
- (ii) $y(n) = x(2n)$ is for a
- (a) Time invariant system
 - (b) Time-varying, dynamic system
 - (c) Linear, time-varying, dynamic system
 - (d) Linear, time invariant, static system
- (iii) Fourier Series applies to
- (a) Only periodic signal
 - (b) Only aperiodic signal
 - (c) Both periodic and aperiodic signal
 - (d) Only random signal

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- (iv) The net areas of sinusoids over complete periods are
- (a) Finite (b) Infinite
(c) Zero (d) None of these
- (v) If the frequency spectrum of a function is discrete, then the function is
- (a) Discrete (b) Aperiodic
(c) Periodic (d) Random
- (vi) The Fourier Transform of $e^{-at} u(t)$ is
- (a) $1/j\omega$ (b) $1/a - j\omega$
(c) $1/a + j\omega$ (d) $1/a^2 - \omega^2$
- (vii) The impulse response of a system is $h(t)$ when the input is $\delta(t)$. The output $y(t)$ will be
- (a) $y(t)$ (b) $\delta(t)$
(c) $h(t)$ (d) None of these
- (viii) The initial value of $L^{-1}\left[\frac{5}{s(s+2)}\right]$ is
- (a) 0 (b) 5
(c) Infinity (d) 5/2
- (ix) For the existence of Fourier series, Dirichlet's conditions are
- (a) Necessary (b) Sufficient
(c) Necessary and sufficient (d) None of these
- (x) $u(t-a) = 0$, if
- (a) $t-a = 0$ (b) $t-a < 0$
(c) $t-a > 0$ (d) $t > a$
- (xi) A deterministic signal has
- (a) No uncertainty (b) Uncertainty
(c) Partial uncertainty (d) None of above
- (xii) A signal is an energy signal if
- (a) $E = 0, P = 0$ (b) $E = \text{infinite}, P = \text{finite}$
(c) $E = \text{finite}, P = 0$ (d) $E = \text{finite}, P = \text{infinite}$

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2. (a) What are the types of representation of discrete-time signals? Represent a sequence in all types. (7)
- (b) (i) Find the even and odd components of the following signal: (2+2=4)
- (1) $1-2t+3t^3$
- (2) 2, 1, 4, 3, 5
- ↑
- (ii) Determine power and rms value of the signal: (2+2=4)
- (1) $x(t) = 5 \sin\left(10t + \frac{\pi}{2}\right)$
- (2) $e^{-5t} \cos 2t$.
3. (a) Show that the sum of two sinusoids is periodic provided that their frequencies are integral multiples of a fundamental frequency ω_0 . (7)
- (b) Find the Fourier Transform of: (4+4=8)
- (i) $x(t) = e^{-3t} \sin 4t u(t)$
- (ii) $x(t) = te^{-at} u(t)$.
4. (a) Find the inverse Laplace transform of: (5+5=10)
- (i) $X(S) = \frac{2s+1}{(s+1)(s^2+2s+2)}$
- (ii) $X(S) = \frac{3s^2+8s+6}{(s+2)(s^2+2s+1)}$
- (b) State and prove the sampling theorem. What is Nyquist rate? (4+1=5)
5. (a) Check whether the following systems are: (4+4=8)
- (i) Static or dynamic
- (ii) Linear or non linear
- (iii) Causal or non-causal
- (iv) Time variant or invariant:
- (1) $y(t) = \text{odd}\{x(t)\}$
- (2) $y(t) = atx(t) + bt^2 x(t-2)$
- (b) Define a system. How are systems classified? Define each one of them. (7)

6. (a) State and prove the Parseval's Theorem in Fourier Transform. (7)
(b) Discuss the advantages and limitations of Fourier Transform, Z- Transform and Laplace Transform. (8)
7. Write short notes on: (any three): (3 × 5 = 15)
- (a) Convolution
 - (b) ROC and its properties
 - (c) Sampling
 - (d) Aliasing
 - (e) Discrete time Fourier Transform.

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