

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

[Total No. of Questions: 09]

13/3/21LE)

[Total No. of Pages: 02]

Uni. Roll No.

Program: B.Tech. (Batch 2018 onward)

Semester: 3rd

Name of Subject: Signals and Systems

Subject Code: PCEC-103

Paper ID: - 16033

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately
- 4) Scientific Calculator is allowed.

Part – A

[Marks: 02 each]

Q1.

- a) State one property of LTI System.
- b) Differentiate between Joint Probability and Conditional Probability.
- c) Define Signal-to-Noise Ratio in any system.
- d) Under what conditions a random process is said to be ergodic?
- e) Check whether $x(t) = e^{j2t}$ is periodic or not. If yes, find its time period.
- f) Sketch signals: $\text{sgn}(t)$ and $u(t)$. Also, derive relation between both.

Part – B

[Marks: 04 each]

- Q2. Explain different types of noises in electronic circuits.
- Q3. State and prove Parseval's theorem.
- Q4. List any four properties of Fourier series and prove any one.
- Q5. Calculate the Fourier Transform of continuous-time signal $x(t) = e^{-2t} \cdot u(t)$.
- Q6. Determine the energy and power of signal $x(t) = u(t) - u(t-3)$ and check whether it is an energy signal or power signal.
- Q7. Given that LTI system has input $x(t) = u(t)$ and impulse response $h(t) = t \cdot u(t)$. Determine its output.

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Part – C

[Marks: 12 each]

Q8. (a) Draw the following signals:

- (i) $u(-t+2)$ (ii) $r(t)$ (iii) $\text{rect}(t)$ (iv) $\delta(n-3)$
(v) 3^n (vi) $u(n)-u(n-2)$ (vii) $u(t)+u(t-1)$ (viii) e^{-t}

(b) Explain the analysis and synthesis equations of Exponential Fourier Series.

OR

Discuss various operations like scaling, shifting, folding, addition, multiplication and subtraction of signals with the help of examples.

Q9. Let X be a continuous random variable with pdf

$$f_X(x) = 3 \cdot x^{-4}, \text{ for } x > 1 \text{ and pdf is zero for other values of } x.$$

- Evaluate: (i) Mean of X, (ii) $E[X^2]$, (iii) Variance of X.
(iv) Standard Deviation of X. (v) $E[2X+3]$, (vi) $E[3X^2+2X]$

OR

- (a) A continuous-time signal $x(t) = 2 \cos(200\pi t) + \cos(600\pi t) + \cos(50\pi t)$ is to be sampled. Calculate the Nyquist rate and Nyquist Interval. What can be the negative effects, if sampling rate is not chosen properly?
- (b) Calculate step response of LTI system whose impulse response is given as $h(t) = \delta(t) - \delta(t-3)$.
