“ TABLE-TOP ”

BOYA

EDC + Comm

unacademy

Comprehensive Course on Communication System

Random Variable - Part I

→ LIVE (NOV)

→ Comm^n → 10
→ EMFT → 10
→ EDC → 10 → 35
→ D.E. → 10
→ Mathe + GA → 35

60

(70)

November

60

85/100

70/100

Dec + Jan

✓ Sig ×
✓ Control ×
✓ N/W ×
✓ Analog ×

Lesson 1 • July 27, 2020 • Vishal Soni

ESE + GATE

SYLLABUS

1. Random Variable : 22 Hours
2. Random Process : 18 Hours
3. Noise As Random Process : 9 Hours

45

- ✓ Amplitude Modulation : 18 Hours
- ✓ Angle Modulation : 14 Hours
- ✓ Transmission & Reception Of Analog Signal : 9 Hours
- ✓ Sampling Theorem & Pulse Modulation Technique : 18 Hours
- ✓ Digital Receiver : 18 Hours
- ✓ Bandpass Digital Signalling : 18 Hours
- ✓ Information Theory : 15 Hours

SUBJECTS	GATE 2012	GATE 2013	GATE 2014	GATE 2015	GATE 2016	GATE 2017	GATE 2018	GATE 2019	GATE 2020
Engineering Mathematics*	14%	10%	11%	13%	**12%**	14%	14%	13%	13%
Network Theory*	11%	15%	11%	9%	**8.3%**	5.5%	7%	5%	5%
✓ Electronics Devices & Circuits	11%	3%	9%	10%	**9.5%**	11%	12%	13%	10%
✓ Analog Electronics*	9%	15%	9%	8%	**9%**	9%	8%	11%	13%
Digital Circuits	4%	6%	9%	9%	**8.3%**	10%	11%	6%	9%
Signals & Systems*	8%	11%	11%	9%	**9%**	9.5%	7%	8%	8%
Control Systems*	7%	11%	8%	10%	**8%**	9%	7%	10%	10%
✓ Communication	9%	9%	10%	8%	**9%**	9%	11%	10%	9%
✓ Electromagnetic Theory	12%	5%	7%	9%	**11.3%**	8%	8%	9%	8%
General Aptitude*	15%	15%	15%	15%	**15%**	15%	15%	15%	15%

2hours ✓

Antenna ✓

RESOURCES:

1) CLASS NOTES < along with / download → printout ✓

2) Questions: My side

3) Books: → Analog Commⁿ < Proakis / B P LATHI

\+

→ R. V. + R. P. → Simon Haykin, Oliver, populis.

\+

→ Digital commⁿ < BP Lathi / Simon Haykin / Proakis.

P. Ramakrishna Rao → Analog + Digital commⁿ

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4) TEST SERIES → 15 August: 15 Question →

↳ 1 Test series

5) DOUBT CLEARING: → # "Facebook Group"

\# weekly: 2 hour → ✓

\# 4th class doubt → 30 minutes

\# Quizz discussion → + DPP discuss

saturday: 10pm → 11 pm

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6) Revision: → daily of all previous classes.

special: 12pm-1pm

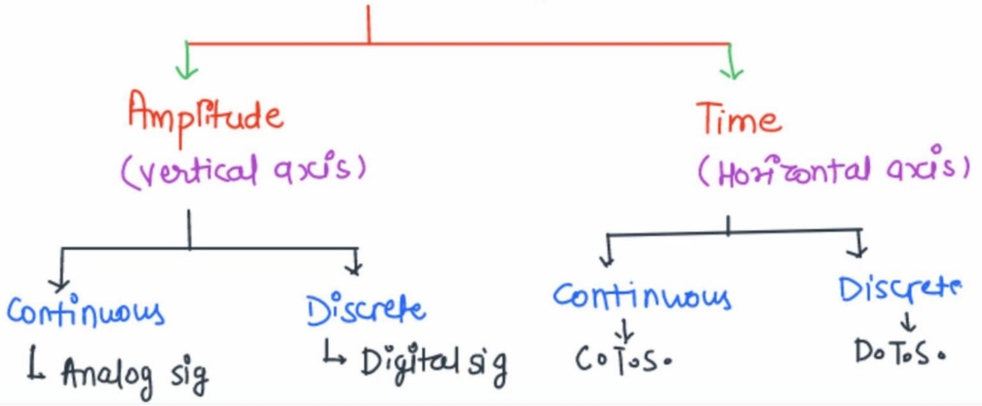
PREREQ:

1) Basics of signal System upto F. T.
2) ✓ Functions and Limits.
3) ✓ Diff and Integrations of signal
4) BASICS of probability → "Your end."

RANDOM VARIABLE:

x(t)

1) Function / Signal



- Amplitude (vertical axis)
  - Continuous ↳ Analog sig
  - Discrete ↳ Digital sig
- Time (Horizontal axis)
  - Continuous → C. T. S.
  - Discrete → D. T. S.

2) Limit of a function at a point.

$$\lim_{t \to a} f(t) = l$$

$$\boxed{\underbrace{\lim_{t \to a^-} f(t)}_{L.H.L.} = \underbrace{\lim_{t \to a^+} f(t)}_{R.H.L.} = l}$$

3) Continuity of a function: {Continuity of Amplitude of a f^n}.

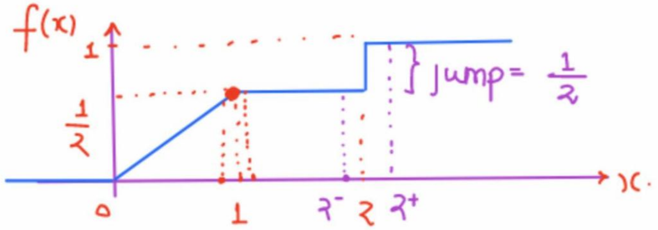
Continuity of a function at a point.

$$\boxed{\lim_{t \to a^-} f(t) = \lim_{t \to a} f(t) = f(a)}$$

$$\boxed{LHL = RHL = \text{functional value}}$$

continuity of complete function.

Function should be continuous at every point.



1) Continuity of amplitude at $x = 1 \Rightarrow$

$$\boxed{\lim_{x \to 1^-} f(x) = \lim_{x \to 1^+} f(x) = f(1) = 1/2}$$

$$\boxed{f(1^+) - f(1^-) = 0}$$

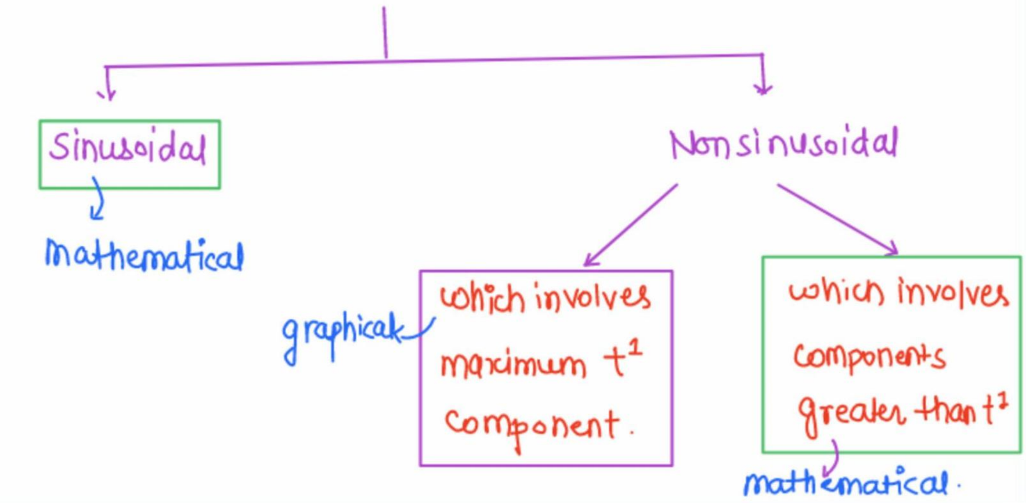
2) Continuity of amplitude at $x = 2$

$$\boxed{\lim_{x \to 2^-} f(x) \neq \lim_{x \to 2^+} f(x)} \rightarrow \text{jump at } x = 2$$

$$\boxed{f(2^+) - f(2^-) = \frac{1}{2} = \text{size of jump}}$$

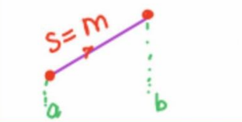
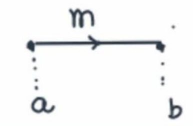
3) $\boxed{f(x) \longrightarrow \text{discontinuous as a whole.}}$

DIFFERENTIATION OF A SIGNAL :

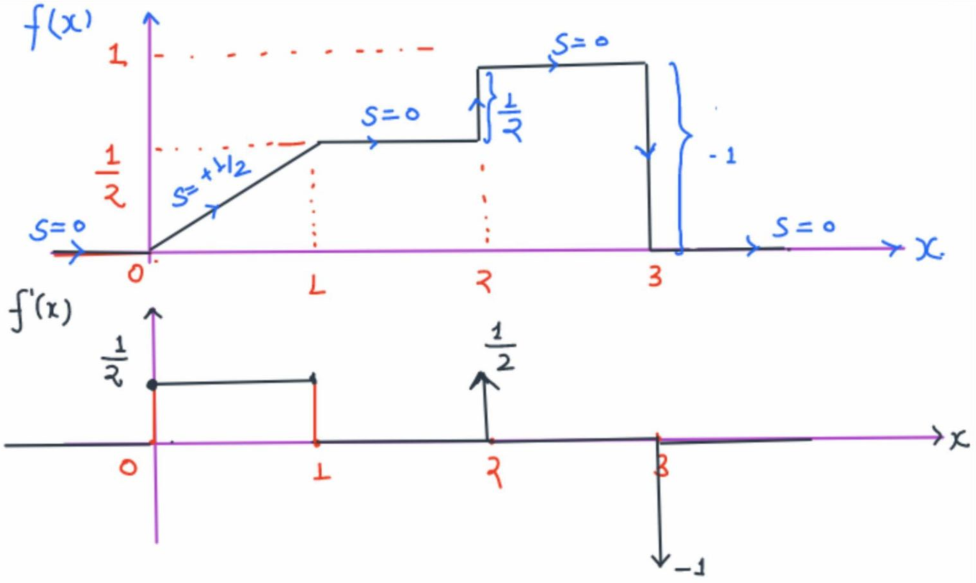


Sinusoidal
→ Mathematical

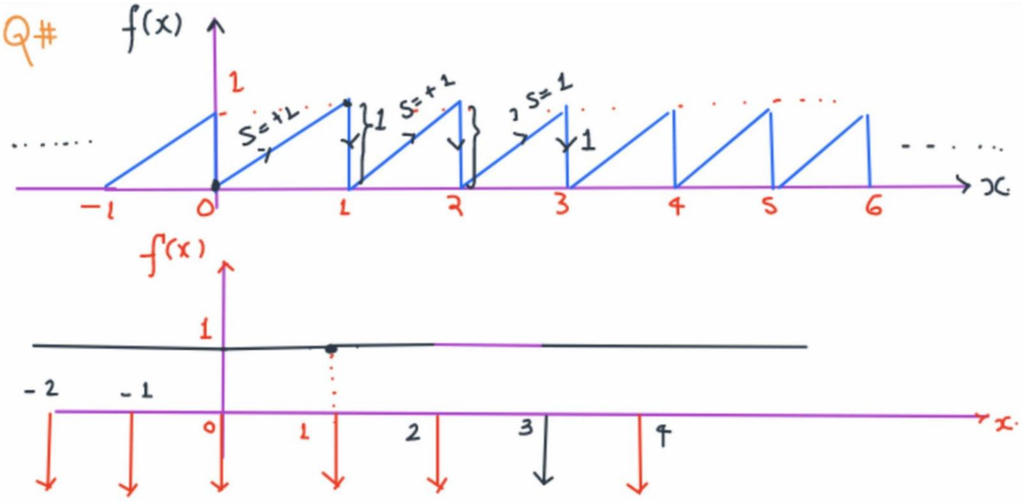
Nonsinusoidal
- which involves maximum t^1 component. → graphical
- which involves components greater than t^1 → mathematical.

m(t)	slope	dm(t)/dt.
A $\xrightarrow{S=0}$	S = 0	part of Time axis.
1 { ↑ S = ∞	S = +∞	Impulse of Area = Size of Jump
m { ↓ S = -∞	S = -∞	Impulse of Area = Size of Jump.
 S = m, a, b	S = m $0<m<\infty$ $-\infty<m<0$	→  m, a, b

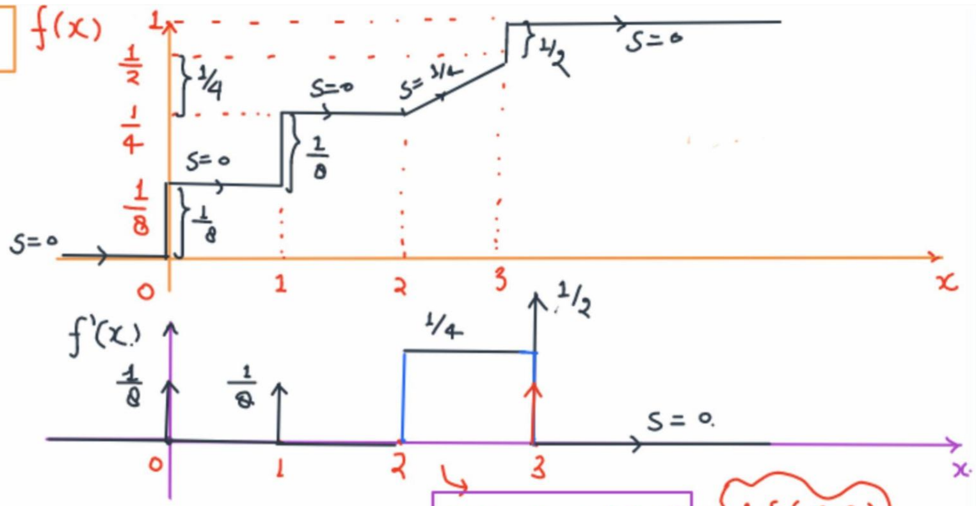
Q#



Q#

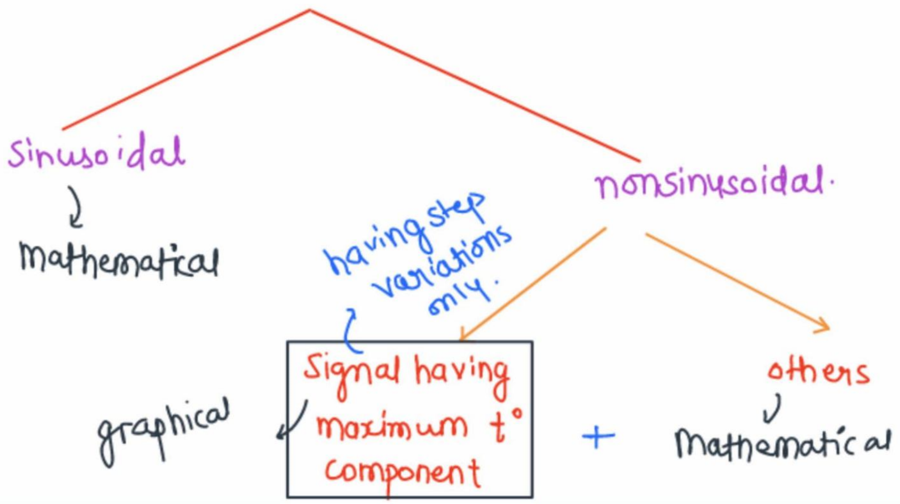


Q#



$u(x-2)-u(x-3)+\frac{1}{8}\delta(x-3)$

Integration of signals:



Sinusoidal
↓
Mathematical

nonsinusoidal.

having step variations only.
↓
Signal having maximum t° component
↓
graphical

\+

others
↓
Mathematical

Case 1: When signal is having only step variations.

$f(x) \longrightarrow \boxed{\text{Integrator}} \longrightarrow \int_{\boxed{-\infty}}^{\boxed{x}} f(\lambda)\, d\lambda$

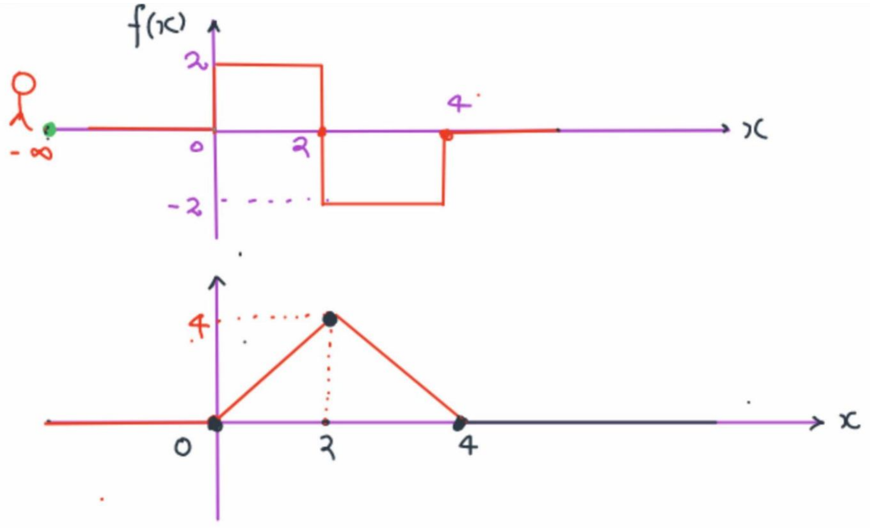
dummy

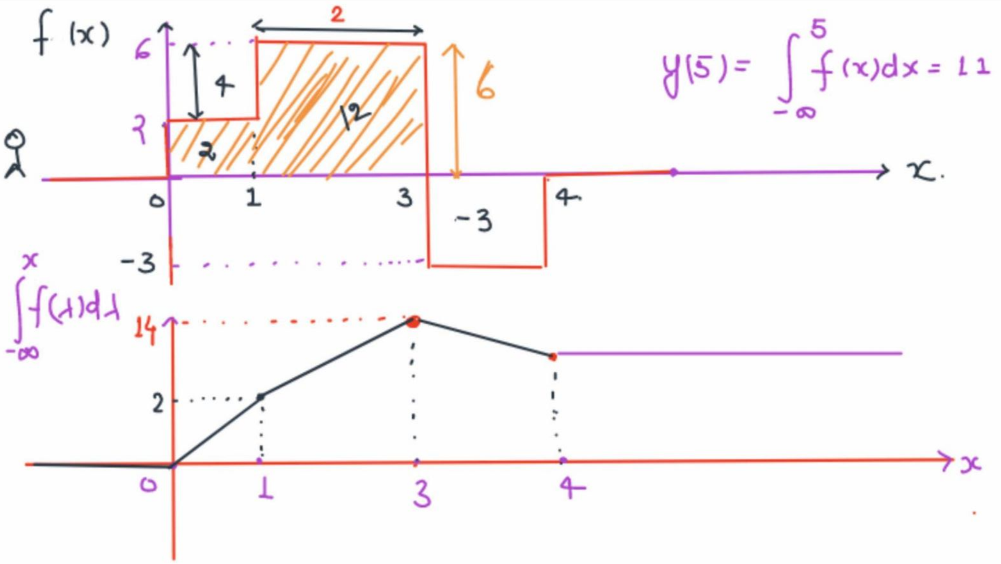
$$\boxed{\int_{-\infty}^{x} f(\lambda)\, d\lambda \longrightarrow \text{Area from } (-\infty) \text{ to } x \text{ of } f(x)}$$

$$\boxed{y(x) = \int_{-\infty}^{x} f(\lambda)\, d\lambda}$$

$y(0) = \int_{-\infty}^{0} f(\lambda) d\lambda =$

$y(2) = \int_{-\infty}^{2} f(\lambda) d\lambda =$

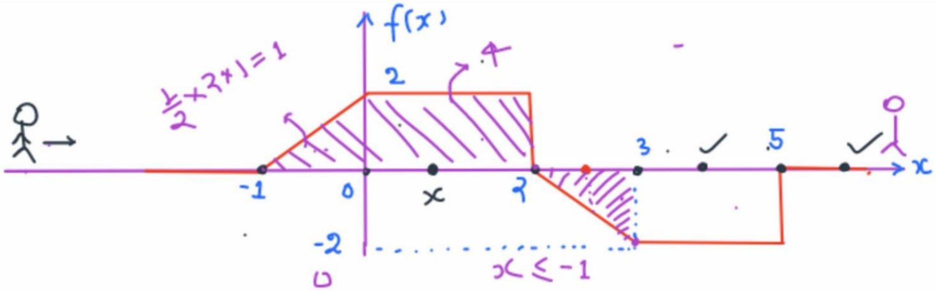




$y(5) = \int_{-\infty}^{5} f(x)dx = 11$

Case 2:

$\int_{-\infty}^{x} f(x)dx \rightarrow$ Integration from $\boxed{-\infty}$ to x.



$$f(x) = \begin{cases} 2(x+1) & -1 \leq x \leq 0 \\ 2 & 0 \leq x \leq 2 \\ -2x+4 & 2 \leq x \leq 3 \\ -2 & 3 \leq x \leq 5 \\ 0 & x \geq 5 \end{cases}$$

\# $x \leq -1$: $\int_{-\infty}^{x} f(x)dx = \int_{-\infty}^{x} 0\,dx = 0$

\# $-1 \leq x \leq 0$ $\int_{\boxed{-\infty}}^{\boxed{x}} f(x)dx = \int_{-\infty}^{-1} 0\,dx + \int_{-1}^{x} 2(x+1)dx = (x+1)^2$

\# $0 \leq x \leq 2$ $\int_{\boxed{-\infty}}^{x} f(x)dx = \int_{-\infty}^{-1} 0\,dx + \int_{-1}^{0} 2(x+1)dx + \int_{0}^{x} 2\,dx$

$= 2x+1$

$\boxed{2 \leq x \leq 3}$ $\int_{-\infty}^{x} f(x)dx = 5 + \int_{2}^{x}(2x+4)dx$

$= -x^2 + 4x + 1$

$\boxed{3 \leq x \leq 5}$ $\int_{-\infty}^{x} f(x).dx = 4 + \int_{3}^{x}(-2)dx = 4 - 2(x-3)$

$= (10 - 2x)$

$\boxed{x \geq 5}$ $\boxed{\int_{-\infty}^{x} f(x)dx = 0}$

$7 \rightarrow 8:30$

9 to 11 → pm

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Comprehensive Course on Communication System

Random Variable - Part II

Variable

Lesson 2 • July 27, 2020 • Vishal Soni

UPSC → Commn → Random. variable

$\frac{74}{200}$ → 2014 →

NIELIT : Commn + S/S + Control + N/W + Analog

c/b

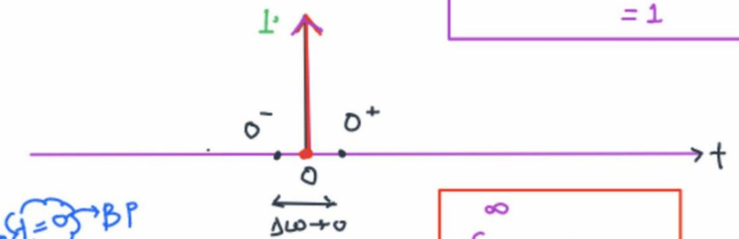
⑫

c/o

EE → mains

Continuous Time Impulse:

Area around Breakpoint = 1



1) : $\delta(t)$ ← t = 0 → BP

2) : $\delta(t) \rightarrow \infty \quad t = 0$

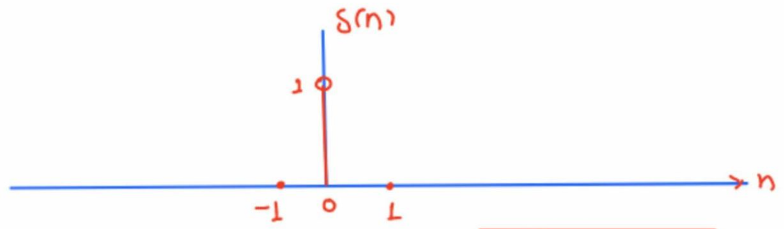
$\delta(t) = 0 \quad t \neq 0$

3) $\int_{-\infty}^{\infty} \delta(t)dt = 1$

$\int_{0^-}^{0^+} \delta(t)dt = 1$

DISCRETE TIME IMPULSE:

$x(n) = \delta(n)$



$$\boxed{\delta(n) = \begin{cases} 1 & n = 0 \\ 0 & n \neq 0 \end{cases}}$$

$$\boxed{\sum_{k=-\infty}^{\infty} \delta(k) = 1}$$

Experiment: Any process of observation is called as experiment.

Eg: Tossing of coin → faircoin / unbiased coin
→ unfair coin / Biased coin

Rolling of dice → unfair dice
→ fair dice

Outcome: Result of an experiment is called as outcome.

Exp.	OUTCOME	R. E.
Tossing of coin.	H, T	→ R. E. ✓
Tossing of unfair coin	$\boxed{H}$ $\boxed{T}$	→ R. E. ×
Rolling of a dice	1, 2, 3, 4, 5, 6	→ R. E. ✓

RANDOM Experiment:

→ outcomes: can not be predicted with certainity.

→ outcomes are uncertain.

→ outcomes are having associated Probability.

$$\boxed{0 < P < 1}$$

$P \neq 0$

$P \neq 1$

TERMS ASSOCIATED WITH Random Experiment:

1) Sample Space: "SET" of all the outcomes

Exp	outcomes	Sample Space
→ Tossing of coin	H, T	$S = \{H, T\}$
→ Rolling of dice	1, 2, 3, 4, 5, 6	$S = \{1, 2, 3, 4, 5, 6\}$

Que: 3 coins are tossed simultaneously form the sample space.

Soln: $S = \{TTT, TTH, THT, HTT, HHT, HTH, THH, HHH\}$

2) Sample point: Each element in sample space is called as sample point

OR

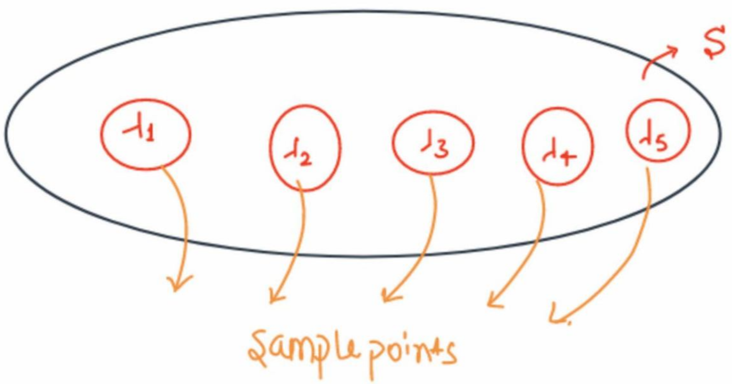
Each individual outcome represents a sample point

General Rep. of Sample Space:

$S = \{ \lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6 \}$

$$\boxed{S = \{\lambda_i\}_{i=1}^{m}}$$

* Venn diagram Rep of Sample space:



Event: Subset of sample space.

R.E.: 2 coins tossed simultaneously.

$S = \{TT, TH, HT, TT\}$

$S_1 = \{TT\} \prec \begin{matrix} \text{SP} \\ \text{Event.} \end{matrix}$

$S_2 = \{TH, HT\}$

$S_3 = \{\phi\} \rightarrow$ Null event

$S_4 = \{TT, TH, HT, HH\}$ → certain event

Note:

1) Every sample point represents an event but converse is not necessarily true.

2) $n \rightarrow$ sample points $\Longrightarrow$ Total 2^n events Including certain and Null event.