Innovations by the Faculty in Teaching and Learning (10)

A. Statement of clear goals, use of appropriate methods, significance of results, effective presentation

Academic year	SCP	CD	SP	MM	Z to A	Role play	BB	NMC	DM	Quiz	PBL	VBB	TPS	Total
2023-24	1	-	3	-	-	-	-	1	-	2	3	-	1	**11**
2022-23	3	-	1	-	-	-	-	3	-	2	2	2	1	**14**
2021-22	3	-	-	-	-	-	-	1	-	1	2	-	1	**8**

SCP - Socio constructivist perspective

CD – Classroom Discussion

SP – Short Presentation

MM – Mind Map

Z to A - Z to A Approach

BB – Brown Bag Approach

DM – Demonstration Model

TPS – Think Pair Share

NMC – Never Miss a Class

PBL – Project Based Learning

VBB – Virtual Black Board

1 .Socio constructivist perspective

Social constructivist perspectives focus on the interdependence of students in the co-construction of knowledge.

IDEA: To play a video related to a topic and make students answer a few questions related to it.

IMPLEMENTATION: Playing a video on how a klystron works?

OUTCOME: Better understanding of a topic by students.

2. **Classroom Discussion**

IDEA: To make students discuss a given topic.

IMPLEMENTATION: Explained different configurations of transistor.

Students are divided into three groups. Each group is assigned a name based on configuration of transistor (i.e. CE, CB,CC).

Students are asked to give their views on the concept.

OUTCOME: Active participation of students. Remembering the topic for a longer time.

3. **Short presentation**

IDEA: To make students give a presentation on a given topic

IMPLEMENTATION: The following topics are given to some students.

1. Positive clipper circuit
2. Negative clamper circuit
3. Clamping with dc bias
4. Comparator circuit

They are asked to prepare and give seminars on the given topics.

OUTCOME: Improved presentation skills of student and better analyzing of a topic.

4. **Group Projects**

IDEA: To make students understand IEEE papers and implement a part of it.

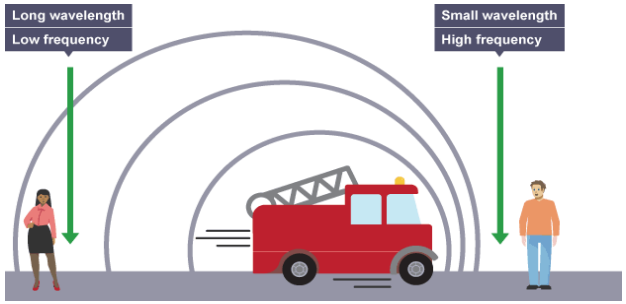
IMPLEMENTATION: Students have implemented a few IEEE projects.

OUTCOME: Bringing out the creative thoughts of students.

5. **Mind map**

IDEA: Mind Maps can be used in class to brainstorm and generate discussions. This involves use of notes with keywords and images in classroom teaching.

IMPLEMENTATION: Following image is shown to students and they are asked to discuss it among themselves.



OUTCOME: This will encourage students not only to participate but also to fully understand a topic and its nuances by creating connections between ideas. This makes students remember the topic for a longer time.

6. **Z to A approach**

IDEA: Attempt to explain the application for a particular concept first and then the concept

IMPLEMENTATION:

Listing different peripherals (like keyboard, mouse, LEDs and switches) used for better operation of 8086 microprocessor. Discussion of interfacing them with 8086. Drawing the need of using 8255 for interfacing 8086 with peripherals by increasing the number of I/O ports then discusses the 8255 architecture.

OUTCOME: Creating interest among the students in knowing the topic.

7. **Role play**

IDEA: Students are given a scenario and other options to solve a particular issue, then the students are exposed to decision making in a given environment.

IMPLEMENTATION: Some students are selected randomly. Each student is assigned a particular frequency. One students is selected to act as a low pass filter with particular cutoff frequency. He is made to stand at the door of classroom. Students come one by one. The student with frequency less than cutoff frequency is only allowed to enter the classroom. The other students are blocked at door.

OUTCOME: This helps in understanding of topic quickly.

8. **Brown bag approach**

IDEA: A bag is filled with papers having different topics of the subject written on them. Each student is asked to pick a paper of his/her choice. And they are given an opportunity to explain it.

IMPLEMENTATION: The following topics are written on paper, and kept in bag.

- Inverting amplifier

- Non inverting amplifier
- Integrator
- Differentiator
- Difference amplifier
- Instrumentation amplifier
- Students are asked to pick papers and explain them.

OUTCOME: This allows students to experience a real time exchange of knowledge.

9. Think pair share

IDEA: Think-pair-share (TPS) is a collaborative learning strategy where students work together to solve a problem or answer a question about an assigned reading**.**

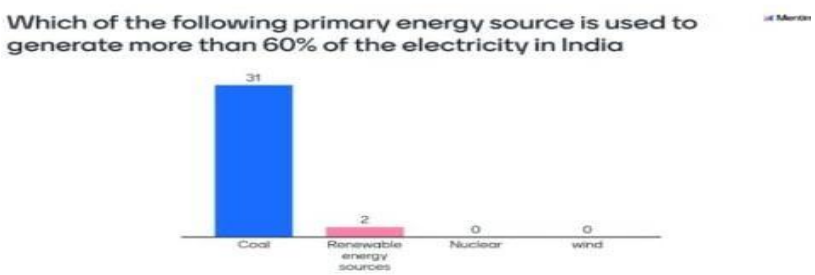
IMPLEMENTATION: In the classroom faculty has to give one question to the student and each student has to solve the question individually and after completion of solving the question student has to pair with one of his/her classmate and discuss each answer. Then one of the students in the class shares his/her thoughts with total class. This strategy requires students to think individually about a topic or answer to a question and share ideas with classmates.

Outcome: This strategy improves collaborative thinking enhances collective skills.

10. Menthimeter:

IDEA: Mentimeter is easy-to-use presentation software; we can create fun and interactive presentations by asking polling type questions.

IMPLEMENTATION: By using menthimeter, we can create no of questions in the form of polling type to easily answer and to enhance student's interest so that teaching becomes more interactive by letting the students actively participate in lectures throughusing Mentimeter as a formative assessment tool. Students have to open the link and submit the answer.



OUTCOME: Active participation of students and can identify how many students answered correctly.

11. Canvas:

IDEA: With learning tools that support instructor innovation and student engagement, Canvas is more than higher education software. It's a platform for student success.

IMPLEMENTATION: we can give different permissions to different users so that you can have the teacher with the top-level permission and students can follow. Different roles can even assign projects, other roles, and assignments. All users can access our class virtually. Canvas sends alerts about upcoming projects, assignments, feedback, and questions. Canvas helps both teachers andstudents stay organized.

Key features and benefits:

- Content management (files, links, library integration)
- Interactive assessments
- Discussion forums
- Blogs
- Speed Grader

- Learning analytics

OUTCOME: Active participation of students and can identify how many students answered correctly.

12. Never Miss a Class:

IDEA: By this concept student will be able to learn the topics which he/she might have missed during the course.

IMPLEMENTATION: In order to implement the same faculty will be recording their class work regularly and update the same insocial media like YouTube and provide the same link in their constrained class group.

OUTCOME: students will never miss a topic in their course work.

13. Quiz by Google form and Google Spread Sheet: IDEA:

For continuous evaluation and student performance.

IMPLEMENTATION: After completion of each unit faculty will create a Google form which contains the questions and simple Problems related to topics from unit share the link in the student group.

OUTCOME: Student will be able to revise each particular unit.

14. Project Based Learning:

IDEA: To enhance collaborative, critical and creative skills.

IMPLEMENTATION: To involve students in mini projects and hobby projects and also through conduct a workshop.

OUTCOME: Students will be able to learn core subjects in an elaborative and practical way.

15.Virtual Black board:

IDEA: To recreate classroom environment in online teaching by using latest virtual aids.

IMPLEMENTATION: Virtual Blackboard is very easy-to-use. It has a very friendly User Interface. In a few applications, there is a needto learn how to operate those applications. Using this application, one can make quick notes for any lectures, Discussions or one can use this application for step by step drawing. While creating media (video) files, audio also gets recorded. While playing the created media (audio) file, video as well as audio can be seen and heard.

OUTCOME: Students will be benefited through these aids to expose classroom teaching.

16. Kahoot:

IDEA: The idea is to transform the classroom, where the teacher acted as the game show host and the students were contenders using their own mobile devices.

Kahoot is a game-based learning platform that makes it easy to create, share and play learning games or trivia quizzes in minutes. Unleash the fun in classrooms..Kahoot can be used to review students' knowledge, for formative assessment, or as a break from traditional classroom activities.

IMPLEMENTATION: We create multiple-choice quiz for the corresponding course,

Input questions and answer choices are entered by students using their mobiles/laptops.

Now students are awarded points based on the number of correct answers and time of submitting the answers.

Finally, the rankings will be displayed.

OUTCOME: The main conclusion is that Kahoot! has a positive effect on learning performance, classroom dynamics, and anxiety in students. Studies Kahoothas statistical significant improvement in learning performance compared to traditional teaching and other tools, a statistically significant improvement on students' and teachers' perception of lectures, statistically significant improvement in classroom dynamics.

17. Demonstration Model:

IDEA: EM Wave Representation on 3 – Dimensional coordinate systems

IMPLEMENTATION: 3 – Dimensional coordinate systems Model is prepared to explain Electromagnetic concepts

OUTCOME: Demonstration method is very good approach for clear understanding of concepts

The innovative teaching methodologies are introduced by senior faculty members (10 years experience) in front of Program Assessment committee (PAC) and Department Advisory Board (DAB). In turn the methodologies where amended based on their merits by the DAC member. Later the methodology is briefed to the faculty members to follow the same. The use of appropriate methods, significant results, effective presentation and reflective critique where periodically checked by DAB.

List of Faculty employing innovative teaching practices

ACADEMIC YEAR 2023-24

S. No.	Faculty	Topic	Subject	Approach used
1	A.Jaya Lakshmi	Fourier transform	SS	Project Based Learning
2	Mr.Md.Akram Ahmed	Antenna parameters	AP	Quiz in Google Form
3	Dr.Krishnaiah	VLSI Design process	VLSI	Think pair share
4	E.Kavitha	Transistor Hybrid model	AC	Never miss a Class
5	Mr.G.Sreenivasa Rao	555 Timer	LICA	Short Presentation
6	Mr.Ch.Sandeep		VLSI	Socio Constructivist Perspective
7	Mr.G.Parameswar	RTL	Computer Architecture	Project Based Learning
8	Mr.Subhanvali shaik	Loading,types of loading	NATL	Short Presentation

9	J.Sudha Rani	Reflection coefficient	EMTL	Project Based Learning
10	Mr.Satheesh.A	RC Phase shift oscillator	LICA	Short Presentation
11	Ms.S.Santhi Priya	Signal flow graph	Introduction to MATLAB	Quiz by using Google form and Google Spread Sheet

ACADEMIC YEAR 2022-23

S. No.	Faculty	Topic	Subject	Approach used
1	A.Jaya Lakshmi	PLL	SS	Project Based Learning
2	Dr.Krishnaiah	VLSI Design process	VLSI	Think pair share
3	E.Kavitha	Schmitt trigger	LDICA	Never miss a Class
4	Dr K.Vasanth	Fourier series	Signals and Systems	Socio Constructivist Perspective
5	Dr.S.Tulasi Prasad	Diode formation	EDC	Socio Constructivist Perspective
6	Mr.G.Parameswar	RTL	Computer Architecture	Project Based Learning
7	A.Jaya Lakshmi	Types of Signals and Systems	Signals and Systems	Quiz by using Google form and GoogleSpread Sheet
8	E.Supraja	Strowger Switching Systems	TSSN	Never miss a Class
9	S.SanthiPriya	Combinational Circuits	DLD	Never miss a Class

10	Dr K.Vasanth	Discrete Fourier Transform	Signal & Systems	Virtual Black Board
11	Mr.G.Someswara Rao	Formation of Diode	EDC	Socio Constructivist Perspective
12	Dr.S.Tulasi Prasad	Schmitt trigger	LDICA	Virtual Black Board
13	Mr.G.Parameswar	RTL	Computer Architecture	Assignments and Quiz's using canvas
14	Mrs.E.Kalpana	Faraday's law	EMTL	Short presentation

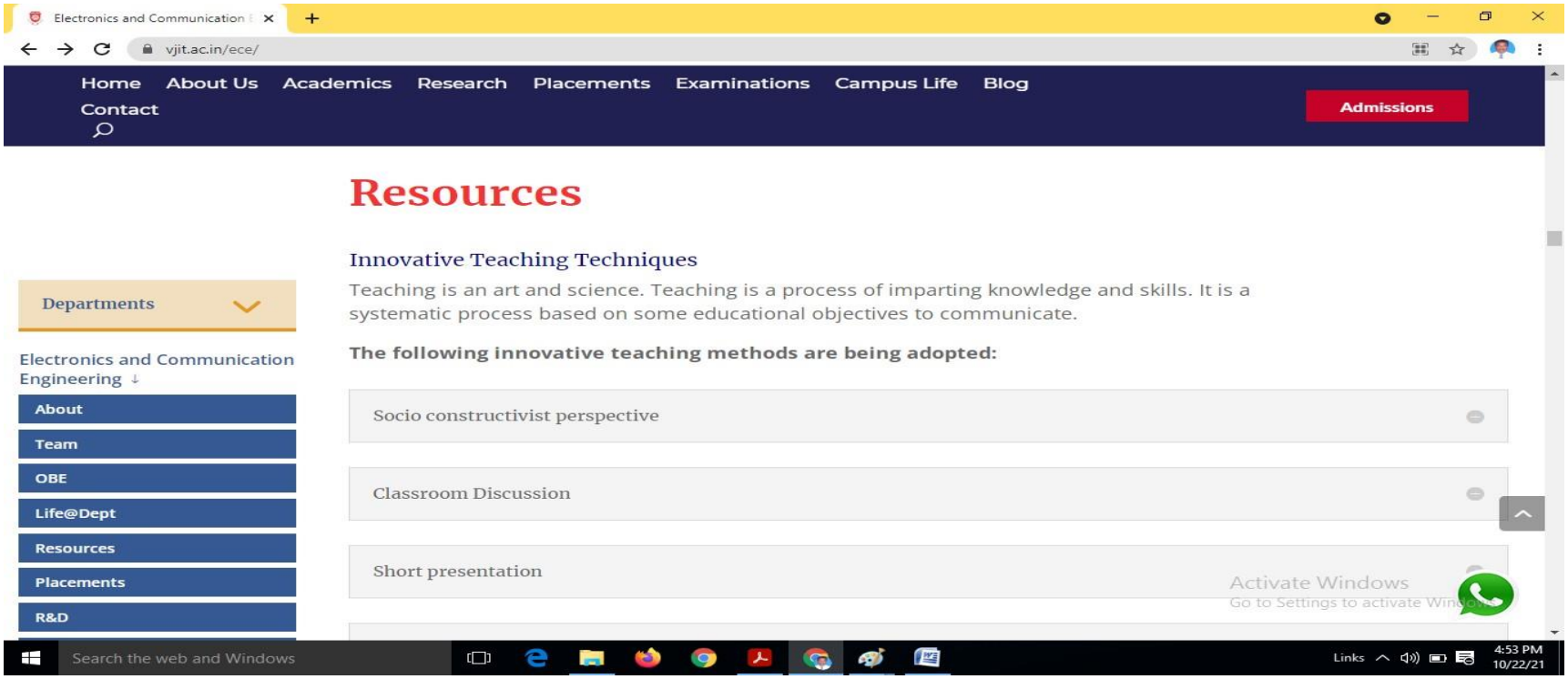
ACADEMIC YEAR 2021-22

S. No.	**Faculty**	**Topic**	**Subject**	**Approach used**
1	A.Jaya Lakshmi	Sampling	SS	Project Based Learning
2	Mr.G.Someswara Rao	Formation of Diode	EDC	Socio Constructivist Perspective
3	Dr.Krishnaiah	VLSI Design process	VLSI	Think pair share
4	E.Kavitha	Schmitt trigger	LDICA	Never miss a Class
5	Dr K.Vasanth	Fourier series	Signals and Systems	Socio Constructivist Perspective
6	Dr.S.Tulasi Prasad	Diode formation	EDC	Socio Constructivist Perspective
7	Mr.G.Parameswar	RTL	Computer Architecture	Project Based Learning

8	Mrs.C.H.S.N Sireesha Devi	Types of Signals and Systems	Signals and Systems	Quiz by using Google form and Google SpreadSheet

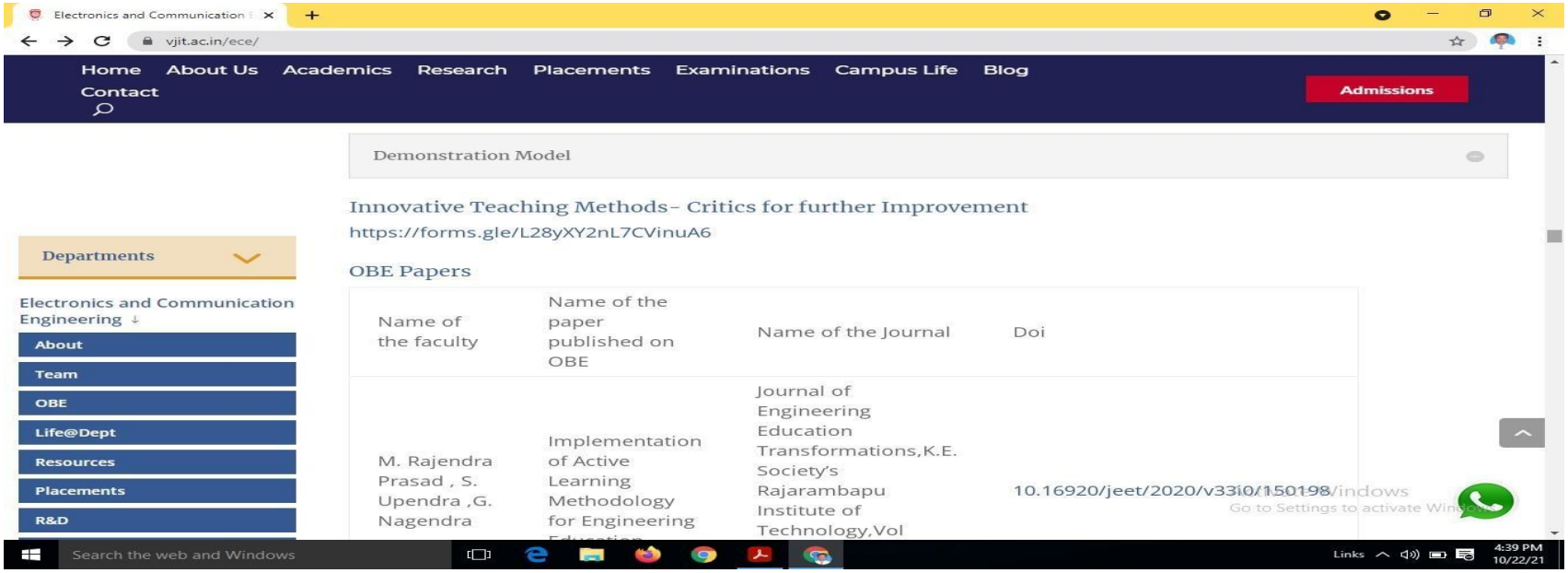
B. Availability of work on the Institute Website

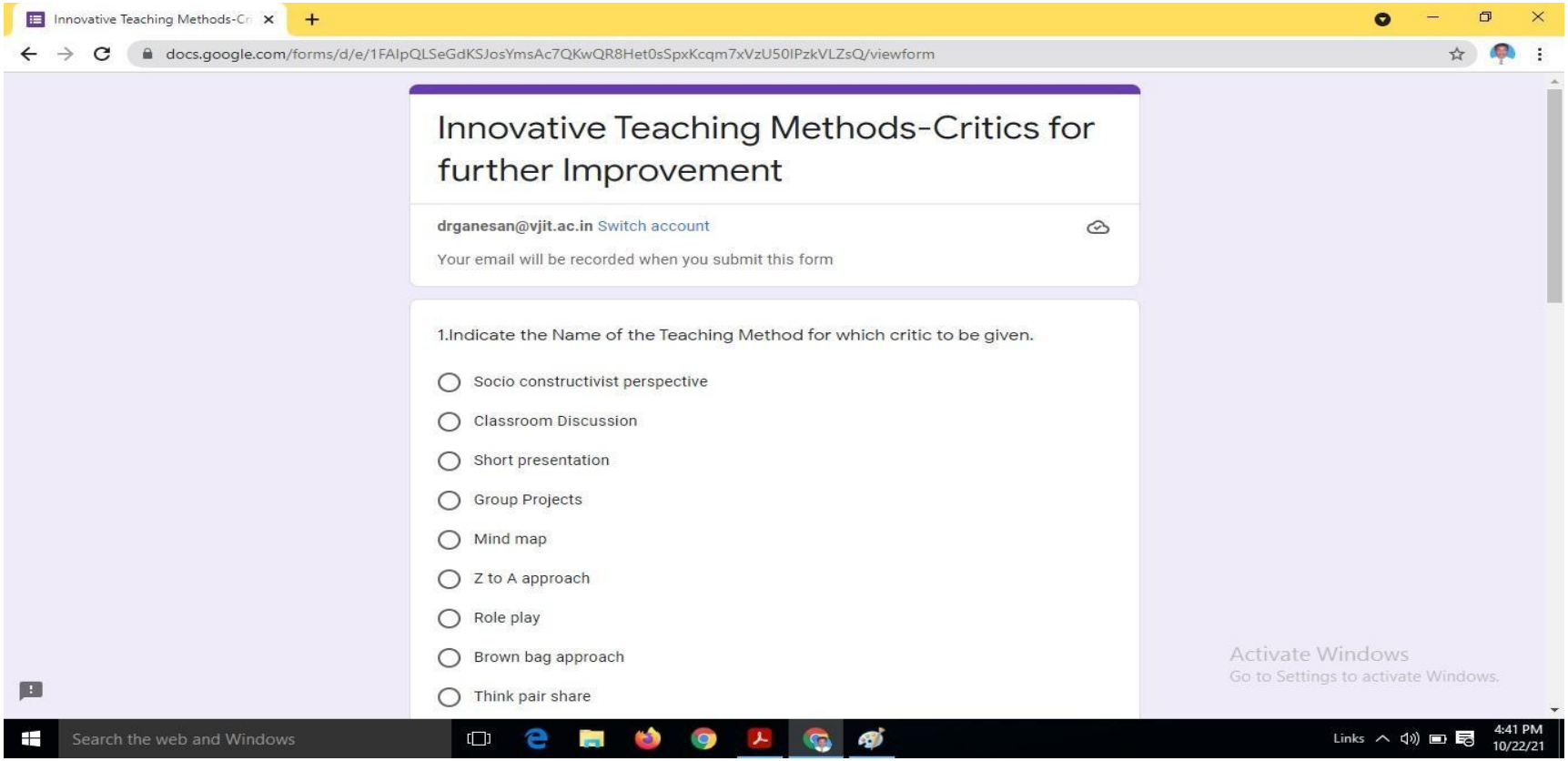
All the Innovations adopted in the Teaching methodology is available at the Institute website https://vjit.ac.in/ece/ under resources tab.



C. Availability of work for peer review and critique

The Innovations adopted in the department are disseminated in the institute website. A Google form is floated in resource tab https://forms.gle/L28yXY2nL7CVinuA6 for Peer review and Critique. Faculty who wish to adopt the methodology can fill up the form.




Innovative Teaching Methods-Cr
docs.google.com/forms/d/e/1FAIpQLSeGdKSJosYmsAc7QKwQR8Het0sSpxKcqm7xVzU50IPzkVLZsQ/viewform
Innovative Teaching Methods-Critics for further Improvement
drganesan@vjit.ac.in Switch account
Your email will be recorded when you submit this form
1.Indicate the Name of the Teaching Method for which critic to be given.
Socio constructivist perspective
Classroom Discussion
Short presentation
Group Projects
Mind map
Z to A approach
Role play
Brown bag approach
Think pair share
Activate Windows
Go to Settings to activate Windows.
Search the web and Windows
Links
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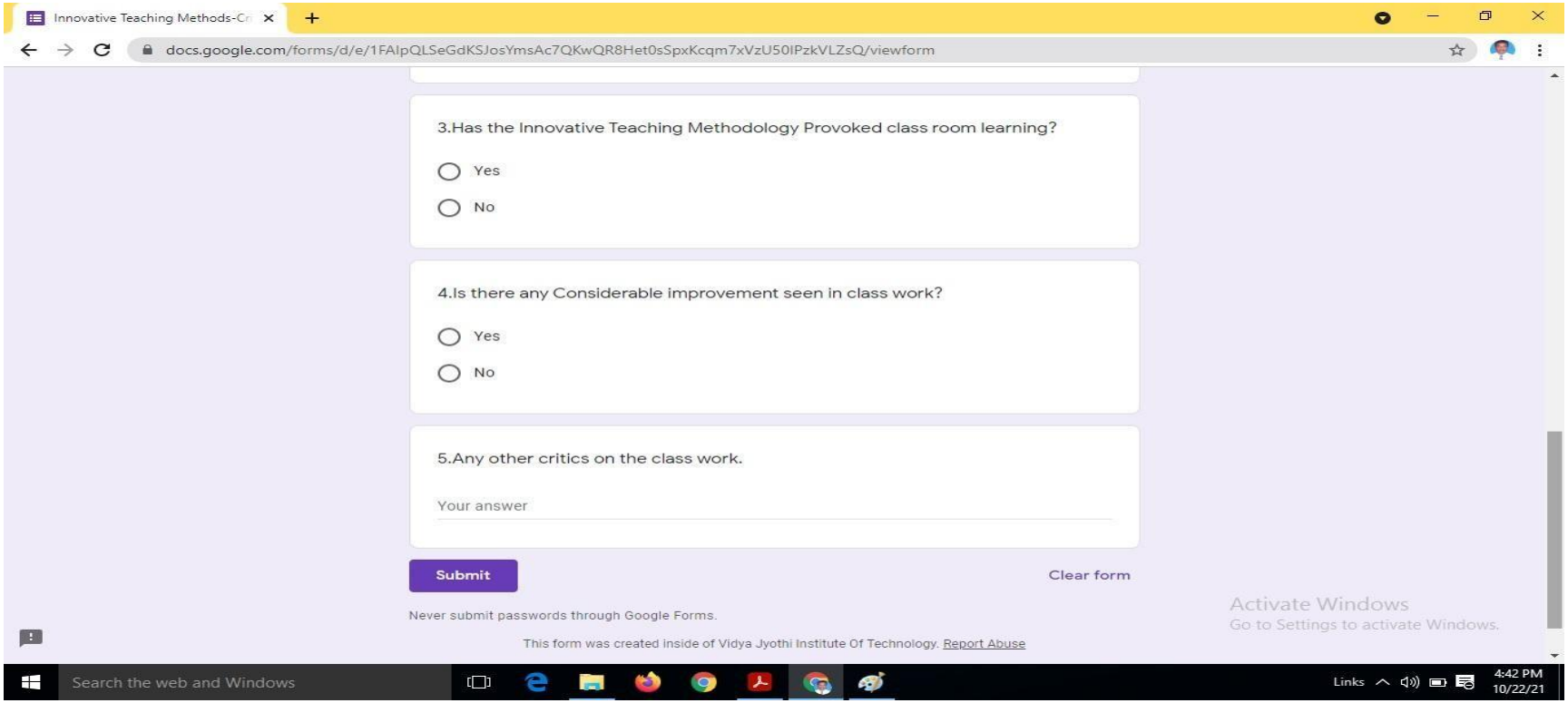
10/22/21


Innovative Teaching Methods-Cr
docs.google.com/forms/d/e/1FAIpQLSeGdKSJosYmsAc7QKwQR8Het0sSpxKcqm7xVzU50IPzkVLZsQ/viewform
3.Has the Innovative Teaching Methodology Provoked class room learning?
Yes
No
4.Is there any Considerable improvement seen in class work?
Yes
No
5.Any other critics on the class work.
Your answer
Submit
Clear form
Never submit passwords through Google Forms.
This form was created inside of Vidya Jyothi Institute Of Technology. Report Abuse
Activate Windows
Go to Settings to activate Windows.
Search the web and Windows
Links
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D. Reproducibility and Reusability by other scholars for further development

The Faculty of the department had adopted different innovative practices and inferred the result as a research paper. On clicking the Digitalobject identifier link (DOI) anyone can access the paper for reuse or reproduce the proposed technique and enhance it further.

S. No.	Name of the faculty	Name of the paper published on OBE	Name of the Journal	DOI
1	M. Rajendra Prasad , S. Upendra ,G. Nagendra	Implementation of Active Learning Methodology for Engineering Education	Journal of Engineering Education Transformations, K.E. Society's Rajarambapu Institute of Technology, Vol 33/pp 354-360/2020 2394-1707	10.16920/jeet/2020/v33i0/150198
2	K.Vasanth, C.N.Ravi, A.Padmaja, M. Rajendra Prasad	A Novel Methodology for Improving Teaching Learning Process and Its Outcomes on 2K Students for Engineering Education	Journal of Engineering Education Transformations, K.E. Society's Rajarambapu Institute of Technology, Vol 33/pp 323-328/2020, 2394-1707	10.16920/jeet/2020/v33i0/150179

Control systems Engineering
Quiz-1 /open loop and closed loop system

Untitled Section

ANSWER ALL THE QUESTIONS

A traffic light system is *

- closed loop system
- open loop system
- oscillator
- none of the above

In an open loop control system *

- Only system parameters have effect on the control output
- Output is dependent on control input
- Output is independent of control input
- None of the above

A closed loop system is distinguished from open loop system by *

- Servomechanism
- Input pattern
- Output pattern
- Feedback

Regenerative feedback means *

- oscillations
- step input feedback
- positive feedback
- negative feedback

With feedback _____ increases. *

- system stability
- sensitivity
- gain
- effects of disturbing signals

elements of mechanical translational system are *

- mass,moment of inertia of mass,spring
- moment of inertia of mass ,damper,torque
- mass,damper,spring
- moment of inertia of mass ,damper,spring

gain decreses in closed loop system *

- true
- False
- Other...

The output of comparator/errorelement is given to *

- control element
- sensor
- comparator
- amplifier

disadvantages of closed-loop control systems. *

- not stable
- gain decreases

Short presentation:

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Loss Tangent With Derivation

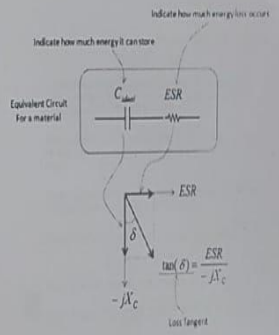
Name. : K.Sahithi
Roll no. : 22911A04F8
Class. : ECE-C

1
Introduction to Loss Tangent

Loss tangent is a key parameter in the characterization of dielectric materials.

It represents the ratio of the imaginary part to the real part of the complex permittivity of a material.

The loss tangent is a measure of the dissipation of energy in a dielectric material when an electric field is applied.

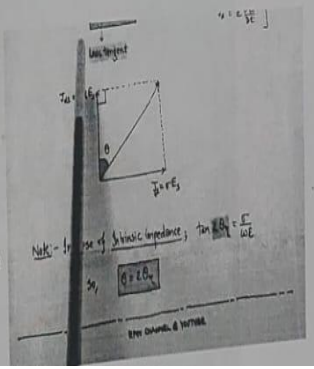


2
Definition of Loss Tangent

The loss tangent, denoted as tan δ, is defined defined as the ratio of the imaginary part (ε") (ε") to the real part (ε') of the complex permittivity, ε.

Mathematically, tan δ = ε"/ε'.

It quantifies the energy lost as heat in a dielectric material due to dielectric losses when an alternating electric field is applied.



3
Derivation of Loss Tangent

The complex permittivity, ε, can be expressed expressed as ε = ε' - jε", where j is the imaginary unit.

The loss tangent, tan δ, can then be written as tan δ = ε"/ε'.

By substituting the expression for ε in terms of its real and imaginary parts, the expression for tan δ can be derived.

4
Derivation Contd.

Let $\varepsilon = \varepsilon' - j\varepsilon''$, where ε' and ε'' are the real and and imaginary parts of the complex permittivity, respectively.

Substituting into the formula for tan δ, $\tan\delta = \varepsilon''/\varepsilon'$, we get $\tan\delta = (\varepsilon''/\varepsilon') = (\varepsilon''/(\varepsilon' - j\varepsilon''))$.

Simplifying further, $\tan\delta = (\varepsilon''/\varepsilon') = (\varepsilon''/(\varepsilon' - j\varepsilon'')) = (\varepsilon''/\varepsilon')/(1 - j(\varepsilon''/\varepsilon'))$.

SOME DERIVATION, contd. 2

We have $\int_0^a y^n[\exp(-ay)]dy = \frac{n!}{a^{n+1}}$

$$\therefore E_b = \frac{C_1 T^4}{C_2^4}\left[\frac{3!}{1^4} + \frac{3!}{2^4} + \frac{3!}{3^4} + \ldots\ldots\ldots\right]$$

$$= \frac{C_1 T^4}{C_2^4} \times 6.48 = \frac{3.742\times10^{-16}}{(1.4389\times10^{-2})^4} \times 6.48 \times T^4$$

or, $E_b = \sigma_b T^4$

where $\sigma_b = 5.67\times10^{-8}$ W/m^{2}K^2, Stefan-Boltzman constant

If there are two bodies, the net radiant heat flux is given by $Q_{net} = \sigma_b\left(T_1^4 - T_2^4\right)$

5
Conclusion

Loss tangent is a crucial parameter in understanding the dielectric properties of materials.

It quantifies the energy dissipation in a dielectric material when subjected to an alternating electric field.

The derivation of the loss tangent formula involves expressing the complex permittivity in terms of its real and imaginary components.

Dielectric Loss

- ε_s is static dielectric constant (result of polarization under dc conditions). Under ac conditions, the dielectric constant is different from the above as energy losses have to be taken into account.
- Thermal agitation tries to randomize the dipole orientations. Hence dipole moments cannot react instantaneously to changes in the applied field → losses.
- The absorption of electrical energy by a dielectric material that is subjected to an alternating electric field is termed dielectric loss.
- In general, the dielectric constant ε_r is a complex number given by

$$\varepsilon_r = \varepsilon_r' - j\varepsilon_r''$$

where, ε_r' is the real part and ε_r'' is the imaginary part.

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Phase Velocity And Wavelength

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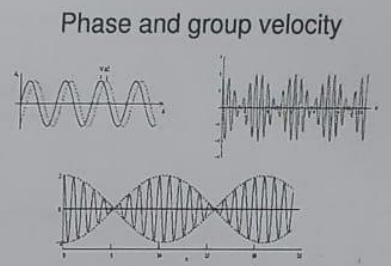
Introduction to Phase Velocity and Wavelength

Phase velocity is the speed at which the phase phase of a wave propagates in space.

Wavelength is the distance between two consecutive points in a wave that are in phase.

These two concepts are fundamental in understanding the behavior of waves in various mediums.



Phase Velocity

Phase velocity is the rate at which the phase of phase of a wave propagates through space. space.

It is different from the group velocity, which represents the speed at which the overall shape of the wave propagates.

In a homogeneous medium, the phase velocity can be calculated as the ratio of the frequency of the wave to its wavenumber.

Wave packet, phase velocity and group velocity

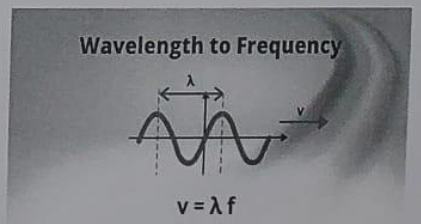
- The velocities of the individual waves which superpose to produce the wave packet representing the particle are different - the wave packet as a whole has a different velocity from the waves that comprise it
- Phase velocity: The rate at which the phase of the wave propagates in space
- Group velocity: The rate at which the envelope of the wave packet propagates

Relationship between Phase Velocity and Wavelength

The phase velocity of a wave is related to its its wavelength through the equation $v = \lambda f$, λf, where v is the phase velocity, λ is the wavelength, and f is the frequency.

As the wavelength of a wave decreases, the phase velocity typically increases.

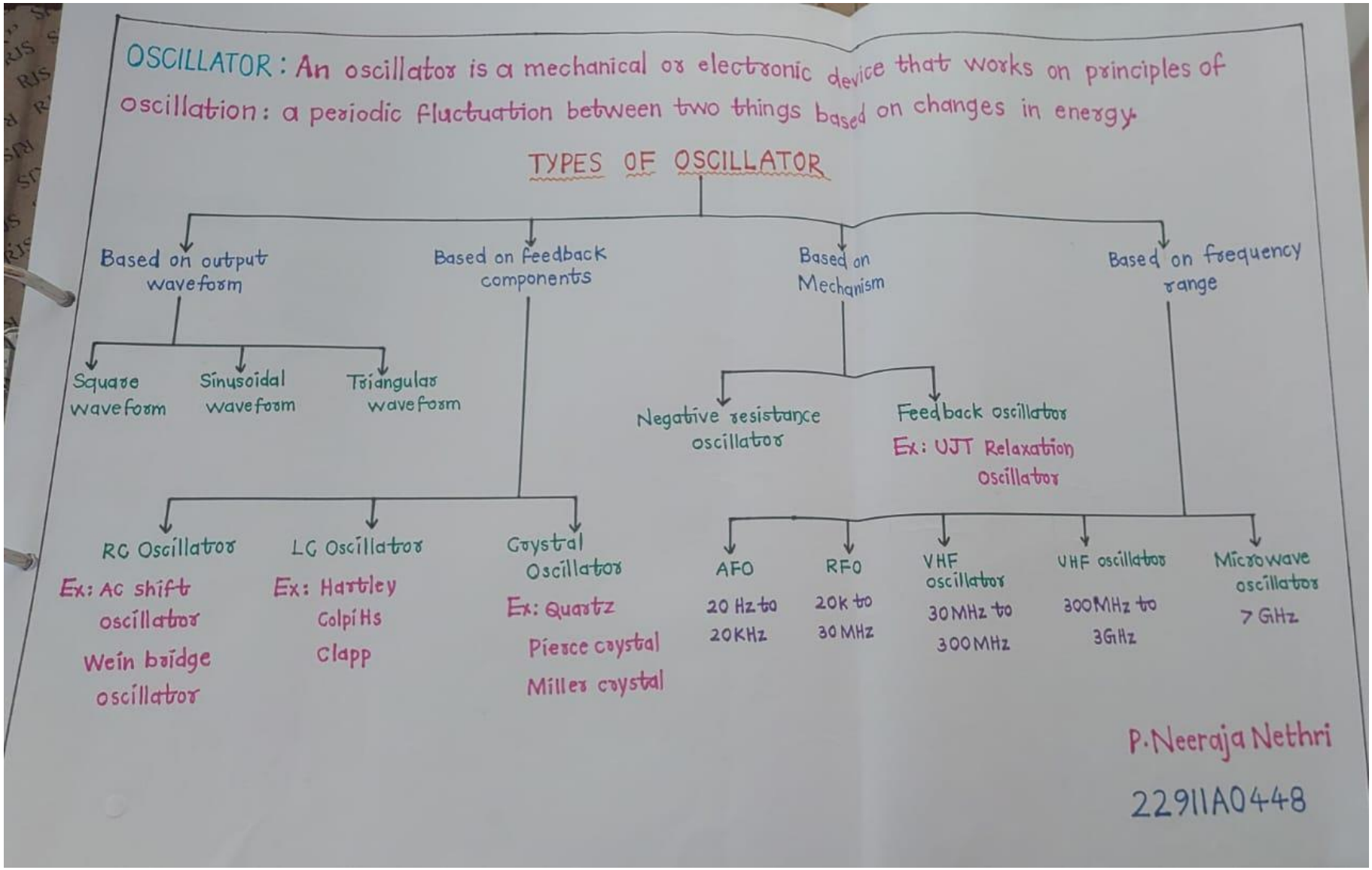
Conversely, if the wavelength increases, the phase velocity tends to decrease.



$$v = \lambda f$$

v = wave speed (c for light in a vacuum)
λ = wavelength
f = frequency

Demonstrational model:



MOSFET CONSTRUCTION

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A.DEEPIKA
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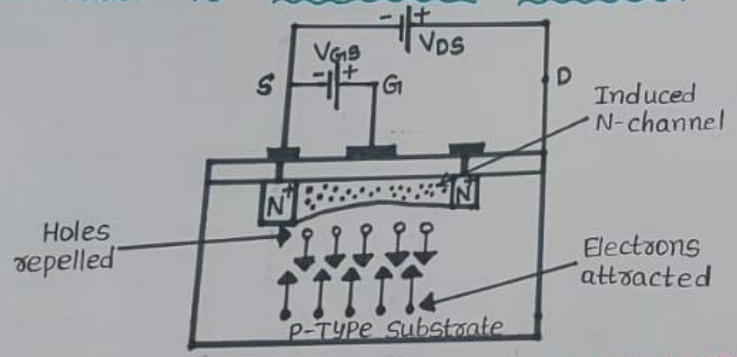
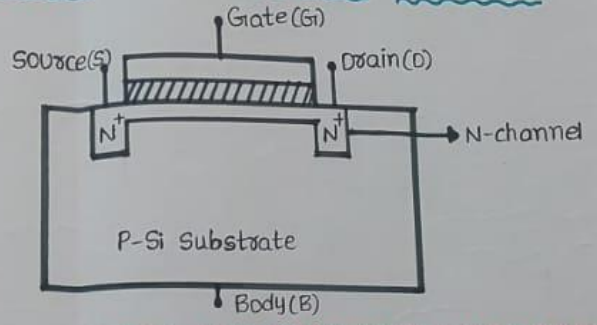
MOSFET: METAL OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTOR

- MOSFET
  - Enhancement mode
    - P-channel
    - N-channel
  - Depletion mode
    - P-channel
    - N-channel

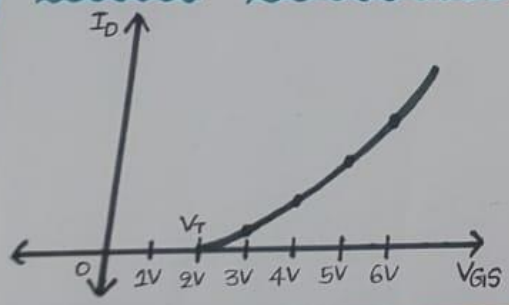
WORKING OF N-CHANNEL EMOSFET



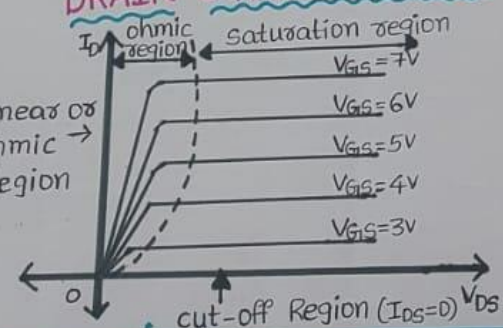
WORKING OF N-CHANNEL DMOSFET



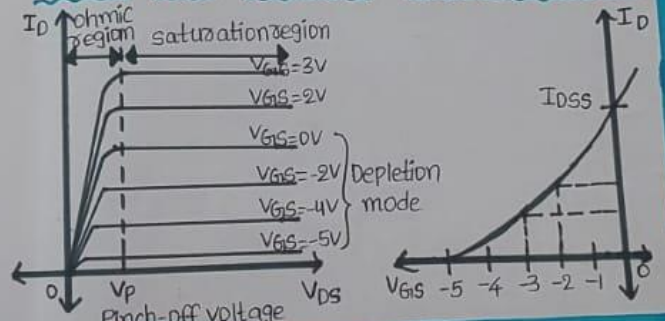
TRANSFER CHARACTERISTICS

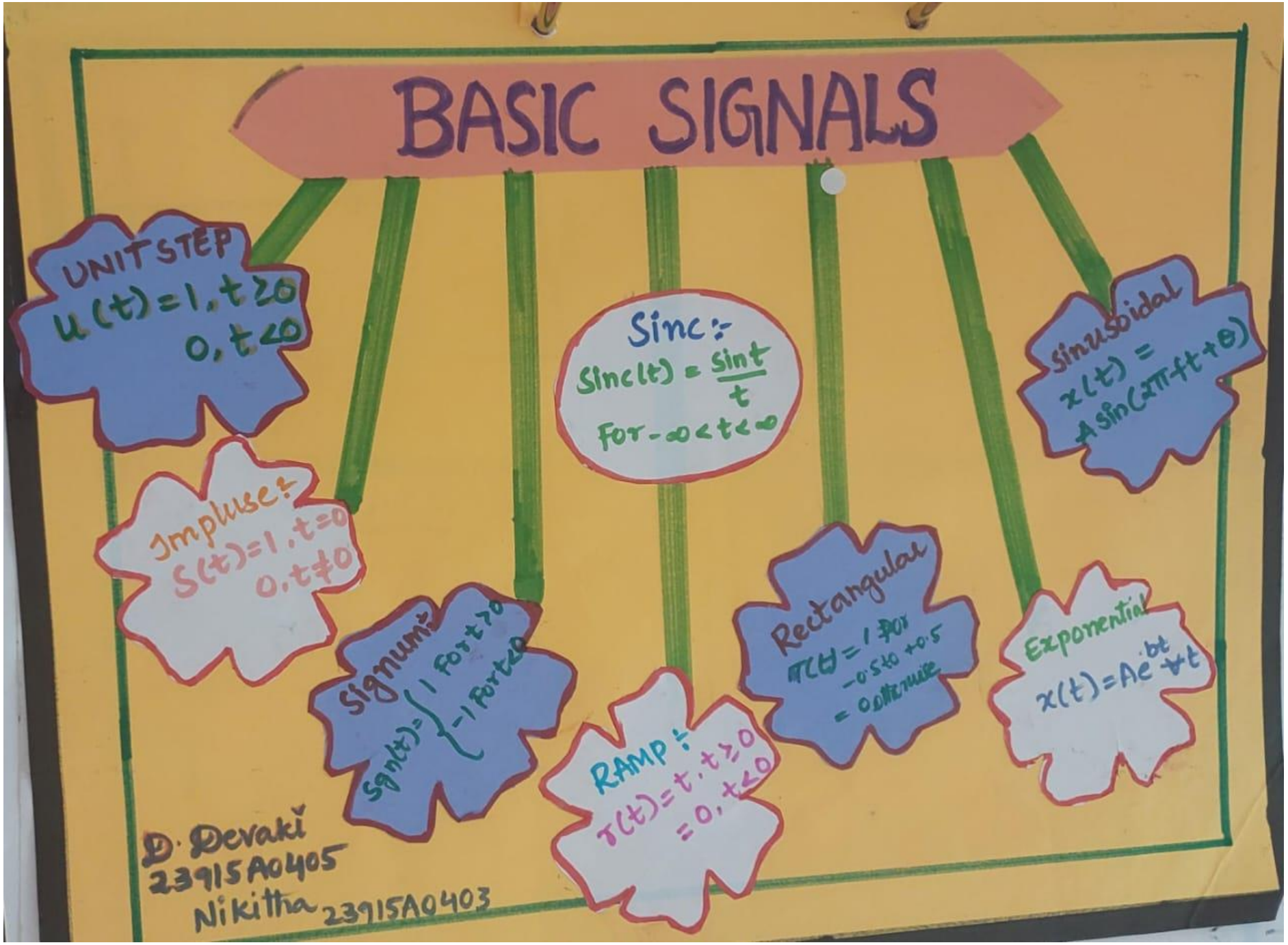


DRAIN CHARACTERISTICS



DRAIN AND TRANSFER CHARACTERISTICS




BASIC SIGNALS
UNIT STEP
u(t) = 1, t ≥ 0
0, t < 0
Sinc :-
Sinc(t) = sin t / t
For -∞ < t < ∞
Sinusoidal
x(t) = A sin(2πft + θ)
Impluse :
δ(t) = 1, t = 0
0, t ≠ 0
Signum :
sgn(t) = 1 for t > 0
-1 for t < 0
Rectangular
π(t) = 1 for
-0.5 to +0.5
= 0 otherwise
Exponential
x(t) = Ae^bt
RAMP :
r(t) = t, t ≥ 0
= 0, t < 0
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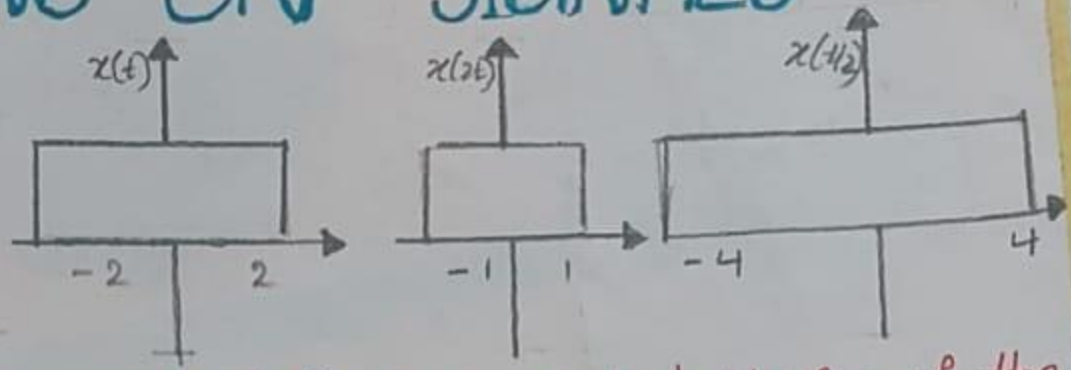
OPERATIONS ON SIGNALS

Time Scaling



$|A| > 1 \rightarrow$ Compression

$|A| < 1 \rightarrow$ Expansion

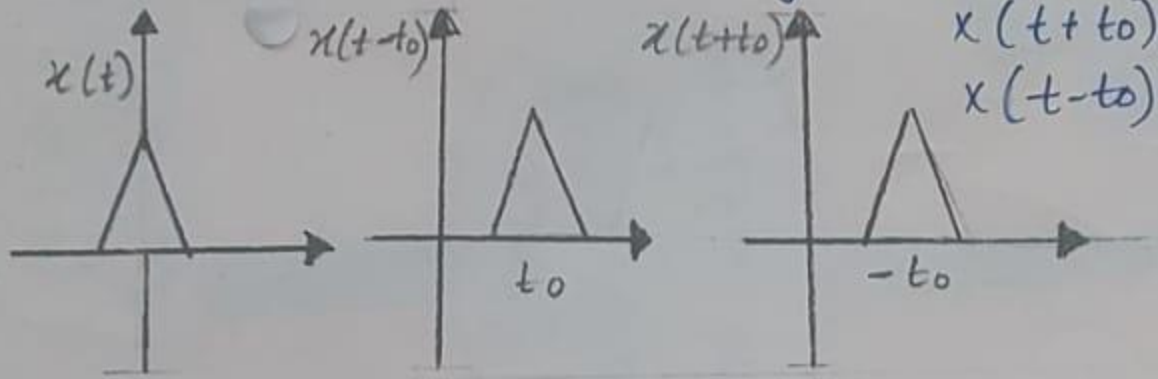
$x(At)$ is time scaled version of the signal $x(t)$. Where A is always positive

Time Shifting

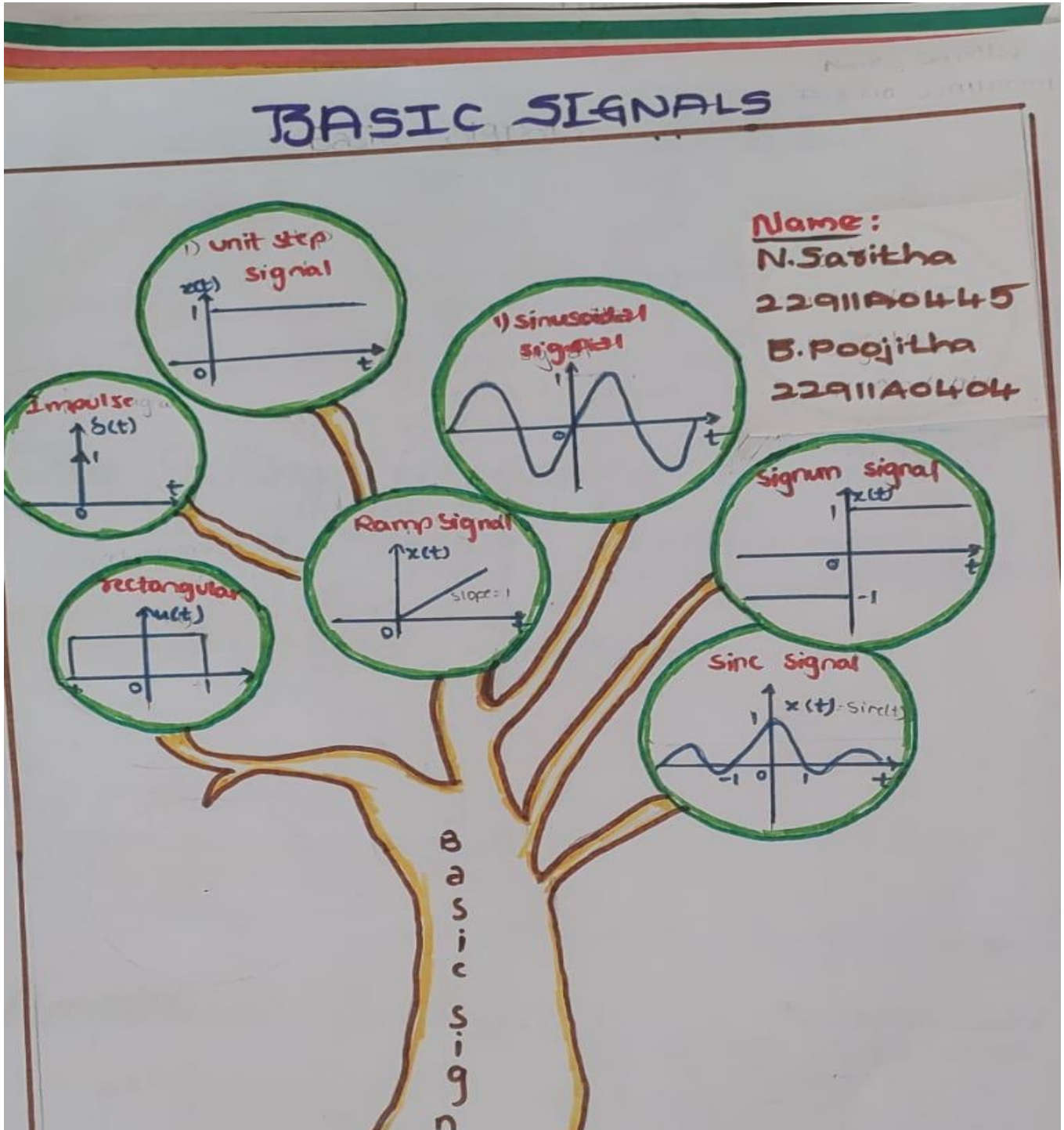
:- $x(t \pm t_0)$ is time shifted version of the signal $x(t)$.

$x(t+t_0) \rightarrow$ negative shift

$x(t-t_0) \rightarrow$ positive shift



BASIC SIGNALS



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TYPES OF SIGNALS

Energy & power signals

$E = \int_{-\infty}^{\infty} |x(t)|^2$ $P = \lim_{T\to\infty} \frac{\int_{-T}^{T} |x(t)|^2 dt}{2T}$

After finding

If Energy = finite } Energy signal
power = 0

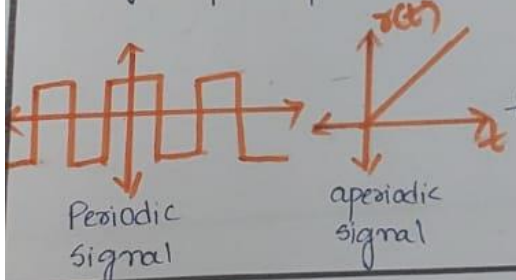
If Energy = infinite } power signal
power = finite

Periodic & aperiodic Signal

Repetation of signal called periodic signal eg:- sin, cos, square

No repetation of signal called aperiodic signal

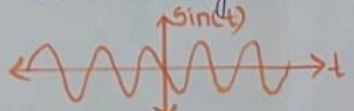
eg:- exp, ramp, step



Periodic signal aperiodic signal

Continuous Signal

For all values of time, if we define a signal called continuous signal



Deterministic & Random signal

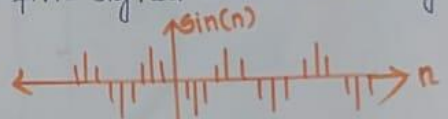
Any signal which can be represented as mathematical equation called Deterministic signal

eg:- sint, cost, t^2, t, t^3

Any signal which cannot be represented as mathematicl equation called random signal eg:- noise

Discrete Signal

for only particular values of time, if we define signal called Discrete signal



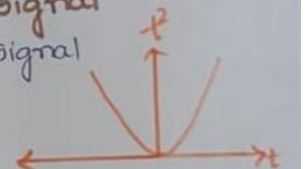
even signal & odd signal

If $x(t) = x(-t)$ is an even signal

eg:- $x(t) = t^2$

$x(-t) = -t^2 = t^2 = x(t)$

even signal

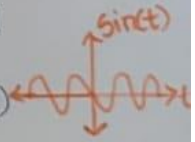


If $x(-t) = -x(t)$ is an odd signal

eg:- $x(t) = -x(-t) = \sin t$

$x(-t) = -\sin t = -x(t)$

odd signal



Done by:-
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Z-TRANSFORM OF BASIC SIGNALS AND IT'S PROPERTIES

Z - TRANSFORM

Sequence	Transform	ROC
$\delta[n]$	1	All z
$u[n]$	$\frac{1}{1-z^{-1}}$	$\lvert z\rvert > 1$
$-u[-n-1]$	$1/1-z^{-1}$	$\lvert z\rvert < 1$
$\delta[n-m]$	z^{-m}	All z except 0 & ∞
$a^n u[n]$	$1/1-az^{-1}$	$\lvert z\rvert > \lvert a\rvert$
$-a^n u[-n-1]$	$1/1-az^{-1}$	$\lvert z\rvert < \lvert a\rvert$
$na^n u[n]$	$az^{-1}/(1-az^{-1})^2$	$\lvert z\rvert > \lvert a\rvert$
$-na^n u[-n-1]$	$az^{-1}/(1-az^{-1})^2$	$\lvert z\rvert < \lvert a\rvert$
$0 \le n \le N-1$	$1-a^N z^{-N}/1-az^{-1}$	$\lvert z\rvert > 0$
otherwise		
$\cos(\omega_0 n)u[n]$	$1-\cos(\omega_0)z^{-1}/1-2\cos(\omega_0)z^{-1}+z^{-2}$	$\lvert z\rvert > 1$
$r^n \cos(\omega_0 n)u[n]$	$1-r\cos(\omega_0)z^{-1}/1-2r\cos(\omega_0)z^{-1}+r^2z^{-2}$	$\lvert z\rvert > r$

PROPERTIES OF Z-TRANSFORM

Property	Equation: Time-domain ⟷ z-domain
Linearity	$a_1x_1(n)+a_2x_2(n) \longleftrightarrow a_1X_1(z)+a_2X_2(z)$
Time Shifting	$x(n-k) \longleftrightarrow z^{-k}X(z)$
Scaling	$a^n x(n) \longleftrightarrow X(a^{-1}z)=X(\frac{z}{a})$
Time Reversal	$x(-n) \longleftrightarrow X(z^{-1})$
Differentiation in z-domain	$n\,x(n) \longleftrightarrow -z\frac{d}{dz}X(z)$
Convolution	$x_1(n) * x_2(n) \longleftrightarrow X_1(z).X_2(z)$
Initial Value Theorem	causal $x(n)$; $x(0)=\lim_{z\to\infty} X[z]$
Final Value Theorem	causal $x(n)$; $x(\infty)=\lim_{z\to 1}[(1-z^{-1})X(z)]$

Creating Colpitts Oscillator using Tina Software

Aim: To design Colpitts Oscillator circuit using Tina Software

Required

1. Tina Software (version 14)
2. Basic understanding of electronic circuits

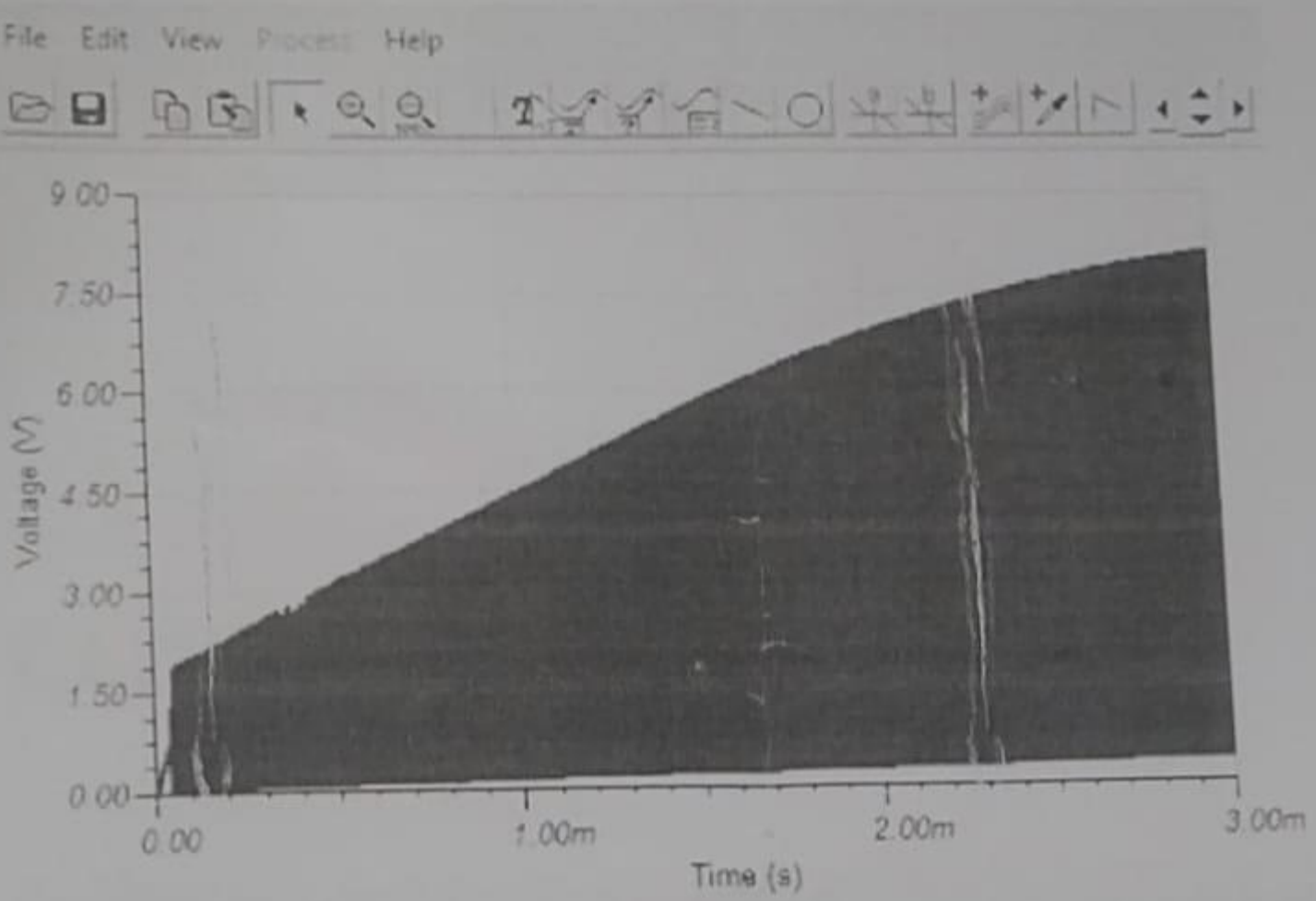
Theory

A Colpitts oscillator is an electronic signal generator that produces oscillating periods. It can be used as a high frequency sine wave generator, a temperature sensor, and a local oscillator in radio receivers. It falls under the category of voltage-controlled oscillators (VCOs) and is commonly used in radio frequency (RF) applications. The oscillator is named after its inventor, Edwin H. Colpitts. The colpitts oscillator consists of a transistor (usually a bipolar junction transistor or a field effect transistor) as the active device, along with the two capacitors (c1 and c2) and an inductor connected in a specific configuration . The capacitors and inductor form a tank circuit , which is responsible for generating the oscillations.

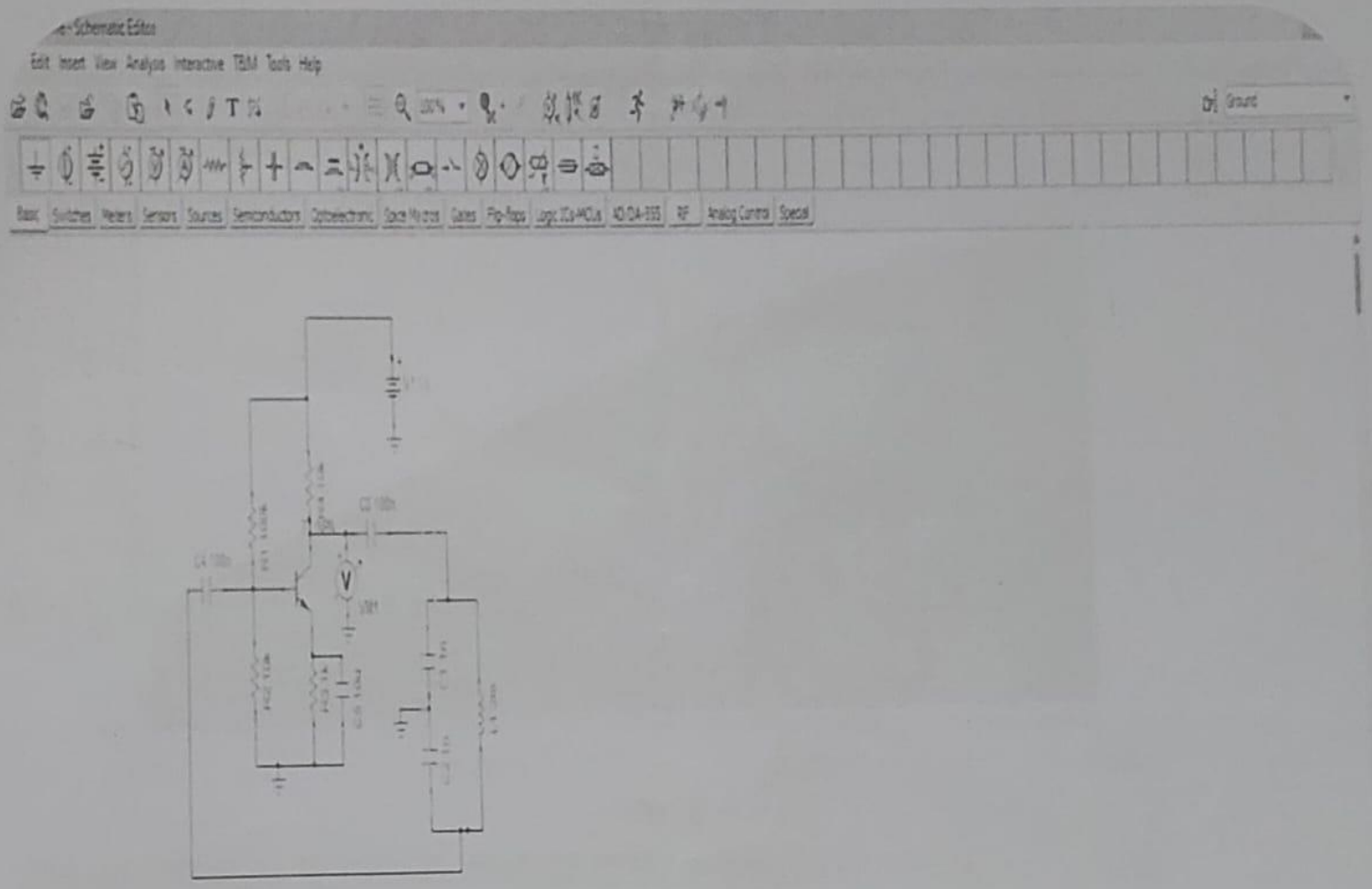
Procedure

- **Install TINA Software:** Make sure you have TINA installed on your computer. If you don't have it, you can download it from the official TINA website.

output


File Edit View Process Help
9.00
7.50
6.00
4.50
3.00
1.50
0.00
Voltage (V)
0.00
1.00m
2.00m
3.00m
Time (s)
TR result1
TR result2
TR result3
TR result4
TR result5
TR result6
File Edit View Process Help

Circuit diagram



LAPLACE TRANSFORM

3. unit step signal:

$u(t) = 1, \ t \geq 0$
$\quad\quad 0, \ t < 0$

$u(t) \xleftrightarrow{LT} \frac{1}{s}, \ \sigma > 0$

2. Impulse signal:

$\delta(t) = 1, \ t = 0$
$\quad\quad 0, \ t \neq 0$

$\delta(t) \xleftrightarrow{LT} 1$, Roc: entire s-Plane

1. Ramp Signal:-

$r(t) = t, \ t \geq 0$
$\quad\quad 0, \ t < 0$

$r(t) \xleftrightarrow{LT} \frac{1}{s^2}$ Roc: $\sigma > 0$

4. Coswot u(t):-

$LT\{\cos\omega_0 t \, u(t)\} = \frac{s}{s^2+\omega_0^2}, \ \sigma > 0$

5. Sinwot u(t):-

$LT\{\sin\omega_0 t \, u(t)\} = \frac{\omega_0}{s^2+\omega_0^2}$

$\sigma > 0$

PROPERTIES OF LAPLACE TRANSFORM

1. Linearity Property:-

if, $f_1(t) \xleftrightarrow{L.T} F_1(s)$, Roc: R_1 & $f_2(t) \xleftrightarrow{L.T} F_2(s)$, Roc: R_2

then, $af_1(t) + bf_2(t) \xleftrightarrow{L.T} a.F_1(s) + b.F_2(s)$, Roc: $R_1 \cap R_2$

if $f(t) \xleftrightarrow{L.T} F(s)$, Roc: R

then,

2. Time Shifting property:- $f(t-t_0) \xleftrightarrow{L.T} e^{-st_0}F(s)$, Roc: R

$f(t+t_0) \xleftrightarrow{L.T} e^{st_0}F(s)$, Roc: R

3. Frequency Shifting property:- $e^{s_0 t}.f(t) \xleftrightarrow{L.T} F(s-s_0)$, Roc: $R + Re\{s_0\}$

$e^{-s_0 t}f(t) \xleftrightarrow{LT} F(s+s_0)$, Roc: $R - Re\{s_0\}$

4. Time Scaling property:- $f(at) \xleftrightarrow{L.T} \frac{1}{|a|}.F\left(\frac{s}{a}\right)$, Roc: $\frac{R}{a}$

5. Time Reversal:- $f(-t) \xleftrightarrow{L.T} F(-s)$, Roc: $-R$

6. Time differentiation property:- $\frac{d}{dt}f(t) \xleftrightarrow{L.T} sF(s)$

7. Frequency differentiation property:- $f(-t)f(t) \xleftrightarrow{LT} \frac{d}{ds}F(s)$, Roc: R

8. Frequency Integration:- $\frac{f(t)}{t} \xleftarrow{L.T} \int_s^\infty F(s)\,ds$, Roc: R

9. Time Integration:- $\int_{-\infty}^{t} f(t)\,dt \xleftrightarrow{L.T} \frac{F(s)}{s}$, Roc: R