Alva's Institute of Engineering & Technology
Shobhavana Campus, Miljar, Moodbidri, D.K – 574225
Phone: 08258-262725, Fax: 08258-262726
Department of Electronics and Communication Engineering
EM SEMINAR 5th SEM A SECTION -2023-24

BATCH.No	USN	NAME	TOPIC
B1	4AL21EC031	Hemanth R	Torque in electric and magnetic field
	4AL21EC039	Keerthan S	
	4AL21EC046	Mahantesh ShidarayTanvashi	
B2	4AL21EC015	Bhavana.B	Lorentenz Transformation
	4AL21EC025	Deeksha S	
	4AL21EC030	Harshitha B S	
	4AL21EC033	HuriyaSanadi	
B3	4AL21EC007	Anchita	Antenna design and optimization for wireless communication
	4AL21EC024	Darshana Basavaraj Bandi.	
	4AL21EC034	Inchara S Shetty	
	4AL21EC043	Lakshmi Keerthana B	
B4	4AL21EC002	Abhishek S	Gama rays on wireless communication
	4AL21EC003	Akash A H	
	4AL21EC036	Jeevan V	
	4AL21EC053	Nagabhushan H K	
B5	4AL21EC032	Hemashri H N	Doppler Effect
	4AL21EC049	Manupriya Y	
	4AL21EC068	Ramya R	
B6	4AL21EC014	Bhaskar T	EM Properties of Conductors, semi conductors and insulators
	4AL21EC018	Charan Raj R V	
	4AL21EC045	Madugonde Sandeep	

	4AL21EC054	Naveen Kumar H S	
	4AL21EC026	Deekshith D Shetty	
	4AL21EC029	Gowtham M A	
B7	4AL21EC040	Kiran Kashyap M	**Histroy of Maxwell Equations**
	4AL21EC042	Lakshan	
	4AL21EC001	A. S. Pavithra	
	4AL21EC009	B.Vennela	
B8	4AL21EC050	Meghana L	**EM waves in Radar**
	4AL21EC104	Vaishnavi S	
	4AL22EC400	Abhishek P T	
	4AL21EC013	Bharath N	
B9	4AL22EC402	Chetan G Kur Gouda	**Electromagnetic spectrum**
	4AL22EC406	Shamshuddin	
	4AL22EC401	Chethana A B	
B10	4AL22EC405	Pallavi B	**Intensity of an EM waves**
	4AL22EC407	Suhani R J	
	4AL21EC016	ChakravarthyJaipalTeredal	
	4AL21EC023	Darshan T S	**Magnetic field for different current configurations**
B11	4AL21EC018	Charan Raj R V	
	4AL22EC408	Veeresh S V	
	4AL21EC028	Gagan H S	**Properties of electric Material**
B12	4AL21EC062	Prajwal S Das	

Alva's Institute of Engineering & Technology

Shobhavana Campus, Mijar, Moodbidri, D.K – 574225

Phone: 08258-262725, Fax: 08258-262726

Department of Electronics and Communication Engineering
EM SEMINAR 5thSEM A SECTION -2023-24

	4AL21EC020	Chethan K.M	
	4AL21EC035	Jeevan K G	
	4AL21EC005	Akshay Kumar H	
	4AL21EC021	Chiranjeevi U B	
13	4AL21EC041	Kishor U	Electric diploe
	4AL21EC044	Lekhan T	
	4AL21EC037	Kalmesh G Galigoudra	Remote Sensing
	4AL21EC038	KaluvaChandrashekar	
14	4AL21EC047	Mailaragouda N P	
	4AL21EC006	Amaresha M	
15	4AL21EC008	Anush S Amargol	Applications of Gauss Law in Communication
	4AL21EC010	Basangouda Patil	
	4AL21EC011	Basavakiran	

BATCH.No	USN	NAME	TOPIC
B1	4AL21EC066	Raksha	Modren Communication System Using Maxwell's Equation
	4AL21EC063	Prakruthi K P	
	4AL21EC070	Sahana	
	4AL21EC091	Sindhu S Patil	
B2	4AL22EC404	Navaneeth	Evolution of Biot savarts Law
	4AL21EC099	Thejas J Kotian	
	4AL21EC067	Rakshith	
B3	4AL21EC074	Santhosha A S	EM In Defense
	4AL21EC098	Tej Ashok	
	4AL21EC083	Shreyas S Naik	
	4AL21EC069	Ravi Kovi	
B4	4AL21EC059	Pooja Venkatesh Naik	Wave Behavior of EM
	4AL21EC092	Sonali	
	4AL21EC093	Srishti S Shetty	
	4AL21EC106	Varshini Shetty	
B5	4AL21EC061	Prajwal Malabagi	Permittivity and permeability in different media
	4AL21EC079	Shivakumar K V	
	4AL21EC095	Sumith N	
B7	4AL21EC084	Shruthi	Uniform Plane Waves & Helmholtz Wave equation
	4AL21EC088	Sinchana RD	

	4AL21EC090	Sindhu KS	
	4AL21EC102	Usha Rani.N	
B8	4AL21EC082	Shreya K R	**Applications of Laplace equations**
	4AL21EC086	Sinchana C K	
	4AL21EC109	Veena Basavaraj Rachappanavar	
	4AL21EC113	Yashaswini T R	
B9	4AL20EC009	C. Navajeevan	**Applications of Gauss law in communication**
	4AL21EC071	Saikumar	
	4AL21EC085	Siddharoodh B Durgipujeri	
	4AL21EC103	V Venkta Sainihith Mullapudi	
B10	4AL21EC101	Thrisha P Hegde	**Poisson's Distribution**
	4AL21EC081	Shreya Chandrahasa Shetty	
	4AL21EC097	Tanishka	
	4AL21EC089	Sinchana.S.D	
B11	4AL21EC056	Nivedita T Patil	**Wireless Power Transmission**
	4AL21EC073	Sanjana Shrikant Havanoor	
	4AL21EC087	Sinchana R	
	4AL21EC096	Sushrutha N	
B12	4AL21EC080	Shravya Shetty	**Television Radio Waves**
	4AL21EC094	Suma K G	
	4AL21EC100	Thejashwi P Acharya	

USN	Name	Topic
4AL21EC065	Rakesh	Satellite Communication
4AL21EC058	Pavan	
4AL21EC110	Videesh D Shetty	
4AL21EC111	Vishal	
4AL21EC076	Shashank C Soppannavar	Biot Savarts Law in communication
4AL21EC077	Shashank Swami	
4AL21EC078	Shashank Viresh Shetti	
4AL21EC108	Varun Devaramani	
4AL21EC060	Prajwal L R	Electric dipole
4AL21EC064	Prasanna Kumar B I	
4AL21EC107	Varun Kumar R	
4AL21EC057	Prajyot Rajgonda Patil	EM in Space
4AL21EC112	Vishwanath HB	

ALVA`S INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

SEMINAR REPORT IN ELECTROMAGNETIC WAVES

TOPIC: LORENTZ TRANSFORMATION

ACADEMIC YEAR :	2023-24
SUBJECT CODE:	21EC54
SUBJECT:	ELECTROMAGNETIC WAVES
CLASS:	III YEAR
SEMESTER:	5TH SEM
SECTION:	A

SUBMITTED BY:

USN	NAME
4AL21EC015	BHAVANA B
4AL21EC025	DEEKSHA S
4AL21EC030	HARSHITHA B S
4AL21EC033	HURIYA SANADI

CERTIFICATION OF EVALUATION

COLLEGE NAME	ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY
DEGREE	B. E
BRANCH	ELECTRONICS AND COMMUNICATION ENGINEERING
CLASS	III YEAR
SEMESTER	V
SECTION	A
USN & NAME OF STUDENTS	4AL21EC015 — BHAVANA B
	4AL21EC025 — DEEKSHA S
	4AL21EC030 — HARSHITHA B S
	4AL21EC033 — HURIYA SANADI
SEMINAR TOPIC	LORENTZ TRANSFORMATION
FACULTY NAME	PROF. VIJETHA T S
DESIGNATION	ASSISTANT PROFESSOR
DATE OF SUBMISSION	24-01-2024 7/2/24
TOTAL MARKS	10
MARKS SCORED	

FACULTY INCHARGE
PROF VIJETHA T S

ECE HOD
DR SIDDESH G K

LORENTZ TRANSFORMATION

Table of Contents:

<u>LORENTZ TRANSFORMATION</u>

<u>Introduction:</u>

The Lorentz transformation is a fundamental concept in physics, particularly in the theory of special relativity. It describes how coordinates of events in spacetime change under a change of inertial frame. This transformation was first introduced by the Dutch physicist Hendrik Lorentz in 1904 and later independently by Albert Einstein in 1905 as part of his theory of special relativity. The Lorentz transformation is crucial in understanding phenomena such as time dilation, length contraction, and the relativistic addition of velocities.

What is Lorentz Transformation?

Lorentz transformation refers to the relationship between two coordinate frames that move at a constant speed and are relative to one another. It is named after a Dutch physicist, Hendrik Lorentz.

The Lorentz transformation is a mathematical description of how space and time coordinates are transformed between different inertial frames of reference that are moving relative to each other with constant velocity. It was developed to make the equations of electromagnetism compatible with the theory of relativity. Lorentz proposed "contracting" lengths in the direction of motion in order to explain the <u>Michelson-Morley experiment</u>.

It involves scaling space and time coordinates by a factor that depends on velocity, known as the Lorentz factor. This results in <u>length contraction and time dilation</u> between frames. Lorentz transformations are related to only the inertial <u>frame of reference</u> and coordinate a relationship between two frames in linear motion that move at a constant velocity with respect to each other, in the context of <u>special theory of relativity</u>.

Each coordinate in one frame is a linear function to the other frame and each parameter describes the direction, speed and orientation of the equations.

We can divide reference frames into two categories:

Department of Electronics and Communication Engineering

CONCLUSION:

To sum up, the Lorentz Transformation is a fundamental concept in contemporary physics, especially in the field of special relativity. Its foundation is in Hendrik Lorentz's work bringing the equations of electromagnetism and the laws of relativity together. Since then, it has grown to be essential to comprehending phenomena like relativistic kinematics, time dilation, and length contraction. The Lorentz Transformation gracefully explains how space and time coordinates alter between various inertial frames moving at constant velocities relative to one another through its mathematical framework. The concept of the speed of light as a universal constant offers a framework for comprehending spacetime's composition and the interactions between time and space. Beyond theoretical physics, Lorentz Transformation has far-reaching ramifications. Applications include the behavior of subatomic particles in particle accelerators and the accurate synchronization of global positioning systems. Its theoretical elegance and practical utility, which allow us to make precise forecasts and improve technology, are equally important. The Lorentz Transformation continues to be a reliable guide as we explore farther into the secrets of the universe. It serves as a constant reminder of the interconnectivity of space and time as well as the underlying ideas that shape our reality.

LORENTZ TRANSFORMATION

Introduction:

The Lorentz transformation is a fundamental concept in physics, particularly in the theory of special relativity. It describes how coordinates of events in spacetime change under a change of inertial frame. This transformation was first introduced by the Dutch physicist Hendrik Lorentz in 1904 and later independently by Albert Einstein in 1905 as part of his theory of special relativity. The Lorentz transformation is crucial in understanding phenomena such as time dilation, length contraction, and the relativistic addition of velocities.

➤ What is Lorentz Transformation?

Lorentz transformation refers to the relationship between two coordinate frames that move at a constant speed and are relative to one another. It is named after a Dutch physicist, Hendrik Lorentz.

The Lorentz transformation is a mathematical description of how space and time coordinates are transformed between different inertial frames of reference that are moving relative to each other with constant velocity. It was developed to make the equations of electromagnetism compatible with the theory of relativity. Lorentz proposed &"contracting" lengths in the direction of motion in order to explain the Michelson-Morley experiment.

➢ Lorentz Transformation in Inertial Frame:

A Lorentz transformation can only be used in the context of inertial frames, so it is usually a special relativity transformation. During the linear transformation, a mapping occurs between 2 modules that include vector spaces. The multiplication and addition operations on scalars are preserved when using a linear transformation. As a result of this transformation, the observer who is moving at different speeds will be able to measure different elapsed times, different distances, and order of events, but it is important to follow the condition that the speed of light should be equivalent across all frames of reference.

Lorentz Boost:

It is also possible to apply the Lorentz transform to rotate space. A rotation free of this transformation is called Lorentz boost. This transformation preserves the space-time interval between two events.

The Statement of the Principle:
The transformation equations of Hendrik Lorentz relate two different coordinate systems in an inertial reference frame. There are two laws behind Lorentz transformations:

->Relativity Principle
->Light's constant speed

➢ Space-Time:

The concept of Lorentz transformation requires us to first understand spacetime and its coordinate system.

As opposed to three-dimensional coordinate systems having x, y, and z axes, space-time coordinates specify both space and time (four-dimensional coordinate system). The coordinates of each point in four-dimensional spacetime consist of three spatial and one temporal characteristic.

Need of a Spacetime Coordinate System:

Earlier, time was viewed as an absolute quantity. Since space is not an absolute quantity, observers would disagree about the distance (thus, the observers would not agree about the speed of the light) even though they agree on the time it takes for the light to travel. Consequently, time is no longer considered an absolute quantity due to the Theory of Relativity.

As a result, the distance between events can now be calculated as a function of time.
$$d = (1/2)c$$

Where,
-> d-distance of the event
->t-time was taken by a pulse to reach the event and reflect back
-> c-speed of light

➢ Application of Lorentz Transformation;

The following are the applications of Lorentz transformation:

>Helps us to understand the concept of space-time and its required coordinates.
>To understand the space-time diagrams and world lines.
>The speed of light is invariant in Lorentz transformations under inertial frames.
>Can observe muons on the surface of the Earth which originate from cosmic rays, proved by Lorentz transformation.

Lorentz's Transformation has two consequences:
>Length Contraction
> Time Dilation

Lorentz-Fitzgerald proposed for the first time that when a body moves at a rate comparable to the velocity of light relative to a stationary observer, the length of the body decreases along the direction of velocity. This reduction in length in the direction of motion is known as 'Length Contraction.'

Time dilation is the elongation of the time gap between two occurrences for an observer in an inertial frame moving relative to the events' rest frame.

➢ Significance of Lorentz Transformation:

The Lorentz transformation has been created in order to make predictions that could be confirmed by emprical mathematics. The Lorentz transformation is applicable to all physics events. Because of its left-fixed origin, a Lorentz transformation is also known as a hyperbolic rotation.

In the Lorentz transformation's relative time formula, c represents the velocity of light, as well as the relativistic invariant. The Lorentz boost has no effect on the velocity of light c, which remains constant regardless of the velocity linked to the Lorentz boost. Lorentz boost is essentially a Lorentz transformation without rotation. That explains why c is identical in all frames of reference.

The Lorentz transformation embodies the fundamental truth of the Universe. Every event is determined by the observer's reference frame. As a result, the Lorentz transform has an effect on every possible event. Because of its hyperbolic rotation, the Lorentz transformation is simply another arithmetical application in special relativity theory.

➤ CONCLUSION:

To sum up, the Lorentz Transformation is a fundamental concept in contemporary physics, especially in the field of special relativity. Its foundation is in Hendrik Lorent's work bringing the equations of electromagnetism and the laws of relativity together. Since then, it has grown to be essential to comprehending phenomena like relativistic kinematics, time dilation, and length contraction. The Lorentz Transformation gracefully explains how space and time coordinates alter between various inertial frames moving at constant velocities relative to one another through its mathematical framework. The concept of the speed of light as a universal constant offers a framework for comprehending spacetime's composition and the interactions between time and space. Beyond theoretical physics, Lorentz Transformation has far-reaching ramifications. Applications include the behavior of subatomic particles in particle accelerators and the accurate synchronization of global positioning systems. Its theoretical elegance and practical utility, which allow us to make precise forecasts and improve technology, are equally important. The Lorentz Transformation continues to be a reliable guide as we explore farther into the secrets of the universe. It serves as a constant reminder of the interconnectivity of space and time as well as the underlying ideas that shape our reality.