The Punjab State Board of Technical Education and Industrial Training

Plot No. 1-A,Sector 36-A , Chandigarh PH: 0172-2615385, 2622584-85

No. PSBTE&IT/DA/2026/5284

Dated: 16-07-2026

Circular

Subject: Commencement of Physics Bridge Course Classes.

All the institutes affiliated with PSBTE&IT are hereby informed that the detailed content and curriculum for the Physics Bridge Course has been finalized and attached herewith. All affiliated institutes are requested to share it among the concerned faculty members for effective planning and implementation.

Kindly ensure that the Bridge Course is conducted in accordance with the prescribed content and schedule and as per Board's circular No.PSBTE&IT/DA/2026/5279 dated 16-07-2026.

For Compliance Please.

Director Academics,
For Secretary
PSBTE&IT, Chandigarh

Bridge Course Physics (10 days)

Complete Course Structure

Day 1: What is Physics, Physics in daily life & importance of Physics? (1 hour)
Day 2: Basic Physical Quantities and Their Importance (1hour)
Day 3: Measurement of physical quantities and Measuring Instruments (1 hour)
Day 4: Units, its applications and conversions (1 hour)
Day 5: Dimensions (1 hour)
Day 6: Scientific terminology & language barrier (1 hour)
Day 7: Symbols, Greek symbols (1 hour)
Day 8: Formulas - The Universal Language (1 hour)
Day 9: Mathematics for Physics – Confidence Building Workshop (1 hour)
Day 10: Physics Laboratory Skills: Measurements, Mean, Errors and Graphs (1 hour)

Day 1

Topic: What is Physics, Physics in daily life & importance of Physics? (1 hour)

Objectives: By the end of this lesson, students will be able to:

1. Identify at least three everyday phenomena that are governed by the laws of physics.
2. Explain the importance of physics in technological advancements and human survival.
3. Define physics in their own words as the study of matter, energy, and their interactions.

Meaning of Physics (10 Minutes)

Activity 1:

Materials: Tennis ball, a sheet of paper,

Drop a tennis ball and a crumpled piece of paper at the same time. They hit the ground together. Now, drop a flat sheet of paper and a tennis ball. The ball wins.

- Ask the class: Why? Is the flat paper inherently lazier?
- Transition: "We live in a world governed by invisible rules.
- When you don't know the rules, it looks like magic. When you do, its Physics.

Narrative: What is Physics?

The word *physics* comes from the Ancient Greek word *physis*, meaning "nature." At its core, physics is the ultimate user manual for the universe and explains all physical phenomenon around us. It is the branch of science concerned with the nature and properties of matter and energy.
Physics doesn't just look at *stuff* (matter); it looks at how stuff *moves* through space and time, and how forces shape everything from the smallest subatomic particles to the largest galaxies.

Physics in daily life:

A. Moving Around/walking (Mechanics)
B. Seeing and Hearing (Waves & Optics)
C. Sweating: Thermodynamics (Heat and Energy)

A. Moving Around/walking (Mechanics)

Narrative/Discussion: 5 min

When you walk, you aren't just moving—you are interacting with Sir Isaac Newton's Third Law of Motion: For every action, there is an equal and opposite reaction. Your foot pushes backward against the ground, and the ground pushes you forward. Without friction (a force that resists relative motion), you would just slide in place forever, like walking on smooth ice.Mechanics explains how and why things move. It governs everything from a car braking to why you don't slip when you walk.

• **The Phenomenon (Friction):** When you walk, your shoes push backward against the ground, and an invisible force called friction pushes forward, preventing you from slipping. On ice, friction is greatly reduced, which is why it's hard to stay upright.

• **The Phenomenon (Inertia):** When a moving car suddenly brakes, your body jolts forward. This is due to inertia (Newton's First Law)—your body was moving at the same speed as the car and wants to keep moving even when the car stops.

Activity 2: The Coin Drop (Testing Inertia) 5 min

Materials: A drinking glass, an index card (or playing card), and a coin.

• **What to do:** Place the card over the mouth of the glass, and set the coin on top of the card. With a quick, sharp flick of your finger, snap the card horizontally out from under the coin.

• **What happens:** The card flies away, but the coin drops straight down into the glass.

• **The Physics:** Because of inertia, the coin wants to stay exactly where it is. Since the force of your flick only acted on the card, the coin stayed still for a split second until gravity pulled it down.

Activity 3: Concept: Friction and Force. 5 min

Materials: A heavy book, a smooth desk surface, a piece of sandpaper, and a few round pencils or straws.

Action: 1. Ask a student to push a heavy book across a bare desk.

2. Place the book on a sheet of sandpaper and try to push it again (notice the increased resistance).
3. Place 3–4 round pencils under the book and push it (sliding friction turns into rolling friction, making it incredibly easy).

Discussion: How does this apply to car tires on a rainy day versus a dry day?

B. Seeing and Hearing (Waves & Optics)
Narrative/Discussion: 5 min

You see your friends because light waves reflect off them and hit your eyes. You hear music because a speaker mechanically pushes air molecules, creating a chain reaction of pressure waves that travel into your eardrum.Sound and Light Waves are disturbances that transfer energy from one place to another without transferring matter.

• **The Phenomenon (Sound Waves):** When you speak, your vocal cords vibrate. These vibrations push against air molecules, creating a chain reaction of collisions (a longitudinal wave) that travels to someone else's eardrum.

• **The Phenomenon (Light Refraction):** Have you ever noticed that a straw in a glass of water looks bent or broken? This happens because light travels slower in water than it does in air. As the light changes speed, it bends, tricking your eyes.

Activity 4: The Broken Pencil Trick (Light Refraction) 5 min

Material: glass, water, pencil

What to do: Fill a clear glass halfway with water. Place a straight pencil into the glass at an angle and look at it from the side.

What's happening: The pencil will look broken or bent at the water line.

The Physics: This is because light travels faster through air than it does through denser water.

C. Sweating: Thermodynamics (Heat and Energy) 5 min

Sweating: When you get hot, your body produces sweat. As the liquid evaporates from your skin, it absorbs and carries away heat energy, cooling you down. This is a real-life example of "evaporative cooling".

Refrigerators: They don't actually "create" cold; they use physics to pump heat energy *out* of the fridge and release it into your kitchen.

The heat from your morning stove moving into your frying pan is thermodynamics in action—heat energy moving from a hot object to a cooler one until equilibrium is reached.

The Importance of Physics: Shaping the Future (10 Minutes)

If the *need* for physics is about understanding our current world, the *importance* of physics is about building our future. Physics is the foundational bedrock for almost every other modern science and engineering discipline.

Industry	How Physics Formed It
Medicine	X-rays, MRIs, and cancer radiation therapies are entirely designed by medical physicists.
Energy	Solving the climate crisis depends on physics—from optimizing solar panels to mastering nuclear fusion.
Computing	The silicon microchips powering AI today exist because of quantum mechanics discoveries made decades ago.

Summary and Assessment (10 min)

Physics isn't just a collection of terrifying equations to memorize for an exam. It is a lens that changes how you view everything around you. When you look at a rainbow, a smart phone, or a skyscraper, you aren't just looking at objects—you are looking at physics in action. It is the fundamental toolkit we use to survive, innovate, and explore the cosmos.

Q: Ask students examples of some principles of physics like this:

Principle Where We See It Daily

Newton's Laws of Motion	Walking, driving, sports
Law of Gravitation	Falling objects, tides, orbits
Thermodynamics	Cooking, AC, refrigerators
Optics	Eyes, glasses, cameras, mirrors
Electromagnetism	All electrical appliances
Wave Motion	Sound, light, communication
Archimedes' Principle	Swimming, ships, balloons
Bernoulli's Principle	Flying, spraying, ventilation

Q: Why Physics Matters in Daily Life?
- Safety — Understanding force and pressure prevents accidents
- Efficiency — Physics helps design energy-saving devices
- Innovation — Every new technology is rooted in physics
- Decision Making — Basic physics knowledge helps us make smarter choices
-Understanding the World — Physics answers the "why" and "how" of everything around us.

As per availability of materials teachers may choose these alternative activities.

Additional activity 1: The Singing Balloon (Sound Waves)

• Materials: A balloon, a small hex nut (from a hardware store).

• Action: Drop the hex nut inside the balloon, inflate it, and tie it off. Swirl the balloon in a circular motion so the nut rolls inside. It will make a loud, screaming sound.
• The Physics: The flat edges of the hex nut bounce against the balloon's rubber walls, forcing the plastic to vibrate and create distinct sound waves.

Additional Activity 2: The Human Wave Gauge

Concept: Wave motion, frequency, and medium.

Materials: A long, brightly colored slinky or a heavy jump rope.

Action: 1. Have two students hold opposite ends of the rope on the floor or a long table.
2. Have one student move their hand side-to-side to create a **transverse wave** (looks like a snake).
3. Have them push and pull the rope forward and backward to demonstrate a **longitudinal wave** (compression and expansion).

Discussion: Explain that the slinky itself isn't traveling across the room; it is just the *medium* moving back and forth to transfer the *energy* of the wave. This is exactly how sound travels to our ears.

Additional Activity: The Dancing Rice grains(energy transfer)

What to do: Stretch a piece of plastic wrap tightly over a large bowl and secure it with a rubber band. Sprinkle a few grains of uncooked rice on top. Now, hold a metal baking pan close to the bowl and hit it hard with a spoon to make a loud noise.

What's happening: The loud noise vibrates the air molecules, creating sound waves. When these waves hit the plastic wrap, they transfer their energy to it, causing the plastic—and the rice—to dance.

DAY 2

Topic: Basic Physical Quantities and Their Importance

Learning Objectives

Students will be able to:
1. Define physical quantity.
2. Explain why measurement is necessary.
3. Identify measurable and non-measurable quantities.
4. Recognize physical quantities in daily life.

1. Introduction Story (10 min)

"The Invisible Symphony of Your Day"

Ask students to imagine their morning.
Alarm rings → Time
Hot tea feels hot → Temperature
School bag feels heavy → Mass
Distance from home to college → Length
Mobile works because of → Electric Current

Conclusion
Every activity around us depends on measurable quantities.

Question to students
"Name one physical quantity present in this classroom."
(Expected answers: temperature, length, time, mass, light, electricity.)

2. Physical Quantity (10 min)

Definition
A Physical Quantity is any quantity that can be measured and expressed with a number and a unit.

Daily-life Examples

Situation	**Physical Quantity**
Cooking	Temperature, Time
Construction	Length, Area
Sports	Speed
Electricity Bill	Energy
Purchasing Petrol	Volume

3. Activity 1 – Measurable or Not? (10 min)

Write on board:

1. Happiness
2. Height
3. Love
4. Temperature
5. Distance
6. Anger
7. Mass

Ask students to classify them.

Result:

Measurable	**Not measurable**
Height	Love
Distance	Happiness
Temperature	Anger
Mass	

Conclusion

Only measurable quantities are called physical quantities.

4. Activity 2 – Paint the Room (15 min)

Situation:

Your family wants to paint a room.

Ask:

"What should we measure before buying paint?"

Students answer:

Length
Width
Area

Explain that paint is purchased according to area.
Learning: Correct measurement saves money and materials.

5. Discussion (10 min)

Ask: Why are physical quantities important?

Guide students to conclude:

Building houses
Manufacturing machines
Medicines
Sports
Agriculture
Engineering
Without measurement, accurate work is impossible.

Summary (5 min)

-Physical quantities are measurable.
-Measurement is essential in daily life.
-Science begins with measurement.
-Engineers depend on accurate measurements.

Closing Thought

"What cannot be measured cannot be improved."

DAY 3

Topic: Measurement of physical quantities and Measuring Instruments (1 Hour)

Learning Objectives

Students will be able to:

1. Define measurement.
2. Explain the importance of measurement.
3. Identify common measuring instruments.
4. Measure basic physical quantities correctly.

1. Recap (5 min)

Quick questions: What is a physical quantity?
Give two examples.
Name one non-measurable quantity.

2. What is Measurement? (10 min)

Definition: Measurement is the process of comparing an unknown quantity with a standard unit.

Examples
Table → metre scale
Milk → litre
Rice → kilogram
Time → clock

3. Importance of Measurement (5 min)

Measurement is essential in:
Construction
Manufacturing
Healthcare
Agriculture
Transportation
Scientific research
Sports

4. SI Units and Measuring Instruments (10 min)

Quantity	SI Unit	Instrument
Length	metre (m)	Scale/ Measuring Tape
Mass	kilogram (kg)	Weighing Balance
Time	second (s)	Stopwatch
Temperature	kelvin (K)	Thermometer
Volume	litre (m^3)	Measuring Cylinder

Ask: Why can't we use one instrument for everything?

Students conclude that different quantities require different instruments.

5. Activity 1 – Measure the Classroom Desk (10 min)

Students:
Estimate desk length.
Measure using tape.
Compare estimate with actual value.

Learning
Measurement is more reliable than guessing.

6. Activity 2 – Measure Mass (10 min)

Materials: Digital balance, Book, Water bottle
Students measure mass.

Learning
Different objects have different masses, measured accurately using a weighing balance.

7. Activity 3 – Measure Speed (5 min)

Mark a 20–30 m path.
One student walks.
Record time.
Calculate:
Speed = Distance ÷ Time
Explain that speed is a derived quantity obtained from measurements.

Summary (5 min)

Key Takeaways
-Measurement compares an unknown quantity with a standard unit.

-SI units provide uniform measurements.
-Different instruments measure different quantities.
-Accurate measurement is essential in science, engineering, and everyday life.

Closing Thought

"Measurement is the language of engineering. Every successful machine, building, and invention begins with accurate measurement.”

Day 4

Topic: Units, its applications and conversions (1hour)

Learning Objectives

1. Understand the need for unit conversion in daily life and engineering.
2. Applications of units
3. Convert units of length, mass, time, area, volume, and speed accurately.
4. Use conversion factors correctly while solving numerical problems.
5. Appreciate the importance of unit conversion in engineering, manufacturing, construction, and trade.

1. Narrative / Story (Confusion in Cloth Market) (5 min)

A cloth merchant sells fabric. Customer asks for 2 meters cloth. Suppose the shopkeeper uses his own arm length instead of meter. Different people would receive different amounts. This creates confusion. Hence standard units are necessary.

2. Activity: Non-Standard Measurement (10 min)

Materials Required: Desk, Students' hands
Procedure: Measure desk length using hand spans.
Different students obtain:
6 spans
7 spans
8 spans

Now measure using a meter scale.
Everyone gets same value.
Observation
Hand spans vary.
Meter scale gives uniform results.
Conclusion
Standard units ensure accuracy.

3. Narrative / Story (The Wrong Cement Order) (10 min)

A contractor in a nearby town was asked to construct a small room. The engineer instructed him to purchase 2 cubic meters (m^3) of sand. The contractor misunderstood the unit and ordered 2 cubic feet (ft^3) instead.

When the material arrived, it was far less than required. Construction stopped, workers remained idle, and additional transportation costs were incurred. The engineer explained:

"In engineering, knowing the correct unit is not enough. You must also know how to convert one unit into another."

Learning Point
Incorrect unit conversion can lead to financial loss, delays, and engineering failures.

Discussion
Ask students:
Have you ever purchased cloth in meters? Why are road distances written in kilometers?
Why do we buy milk in liters and medicines in milliliters?
Why do online maps sometimes show distance in kilometers and sometimes in miles?

Guide students to conclude that different situations use different units, and conversion helps us compare and communicate measurements accurately.

4. Understanding Unit Conversion (10 Minutes)

What is Unit Conversion?
Unit conversion is the process of changing the value of a physical quantity from one unit to another without changing its actual value. Example:
1 meter = 100 centimeters
Both represent the same length.
Common Conversion Factors

Length

Unit	**Equivalent**
1 km	1000 m
1 m	100 cm
1 cm	10 mm

Mass

Unit	**Equivalent**
1 kg	1000 g
1 g	1000 mg

Time

Unit	Equivalent
1 hour	60 minutes
1 minute	60 seconds
1 day	24 hours

Area

Unit	Equivalent
1 m^2	10,000 cm^2

Explain:

Since 1 m = 100 cm,
Area = (100 cm × 100 cm) = 10,000 cm^2

Volume

Unit	Equivalent
1 m^3	1,000,000 cm^3
1 L	1000 mL

Speed

Unit	Equivalent
1 m/s	3.6 km/h

Simple Trick
When converting to a smaller unit → Multiply

Example:
3 m = 300 cm

When converting to a larger unit → Divide

Example:
300 cm = 3 m

5. Activity Unit Conversion Relay (10 Minutes)

Objective: To reinforce unit conversion through teamwork.
Materials Required:

Flashcards with conversion questions
Whiteboard
Marker
Calculator (optional)

Procedure:

1. Divide students into small groups.
2. Give each group one conversion problem.
3. One student solves it on the board.
4. The next student solves the next problem.
5. Continue until all questions are completed.

Sample Questions:

1. Convert 5 km into meters.
2. Convert 2500 g into kilograms.
3. Convert 2 hours into minutes.
4. Convert 750 mL into litres.
5. Convert 72 km/h into m/s.

Observations
Students notice:
Multiplication is used for smaller units.
Division is used for larger units.
Units must always be written correctly.

Expected Answers
5 km = 5000 m
2500 g = 2.5 kg
2 hours = 120 minutes
750 mL = 0.75 L
72 km/h = 20 m/s

6. Practical Applications & Discussion (10 Minutes)

Narrative / Story (The Bike Mechanic)
A mechanic ordered a replacement bolt with a diameter of 8 mm. The supplier accidentally sent an 8 cm bolt. Although both numbers were “8”, the units were different. The bolt was ten times larger and could not be used.

Learning Point
Numbers alone are meaningless without the correct units.

Real-Life Examples

Situation	Unit Conversion Used
Buying milk	L ↔ mL
Cooking recipes	g ↔ kg
Petrol filling	L ↔ mL
Speedometer	km/h ↔ m/s
Construction	cm ↔ m
Water tanks	L ↔ m^3
Medical dosage	mg ↔ g
Gold sold	mg ↔ g

Electricity billed J into kWh
Road distance km into m

Discussion Questions
Ask students:

1. Why are highways marked in kilometers instead of meters?
2. Why do doctors prescribe medicine in milligrams?
3. Why do engineers convert centimeters into meters before calculations?
4. What problems arise if units are not converted properly?

Expected responses:
Easier calculations
Standardization
Accurate engineering work
Prevention of costly mistakes

7. Quiz & Summary (5 Minutes)

Multiple Choice Questions:
Q1 1kilometre equals:

A.10 m
B 100 m
C .1000 m
D.10000 m
Answer: C

Q2 5000 g equals:

A. 0.5 kg
B. 5 kg
C. 50 kg
D. 500 kg
Answer: B

Q3 1 litre equals:

A. 10 mL
B. 100 mL
C. 1000 mL
D. 10,000 mL
Answer: C

Q4 2 hours equals:

A. 60 minutes
B. 90 minutes
C. 120 minutes
D. 240 minutes
Answer: C

Q5 72 km/h is equal to:

A. 10 m/s
B. 20 m/s
C. 30 m/s
D. 40 m/s
Answer: B

Short Answer Questions

1. What is unit conversion?
2. Why is unit conversion necessary in engineering?
3. Convert
   a. 5mg ↔ g
   b. 9 kg into grams.
   c. 350 cm into metres.
   d. 2.5 litres into millilitres.
4. State the conversion factor between m/s and km/h.
5. Explain why incorrect unit conversion can lead to engineering failures.

Summary

-Unit conversion changes the unit, not the physical quantity.
-Always use the correct conversion factor.
-Multiply when converting to smaller units and divide when converting to larger units.
-Correct unit conversion is essential in engineering, healthcare, manufacturing, trade, and daily life.
-Always write the unit along with the numerical value.
-Units are the language of measurement, and unit conversion is the translator. An engineer who understands unit conversion avoids costly mistakes and ensures accuracy in every design, calculation, and project.”

DAY 5

Topic: Dimensions (1 hour)

Objective

To help students realize that Dimensions are a part of everyday life and the foundation of engineering.

The Narrative: “The Blueprint of the Universe” (10 min)

Imagine you are a master chef, and you want to open a restaurant. Before you cook anything, you have to stock your pantry with absolute basic ingredients—things that cannot be broken down any further. Let’s say your basic ingredients are Flour, Sugar, and Water.
With just those three things, you can bake a lot of different items: For example;

If you bake a cake, your recipe might look like: Flour X Sugar X Water

If you make dough, your recipe might just be: Flour X Water

If you want to make a sugary drink, your recipe might be: Sugar X Water

Now, let’s step out of the kitchen and look at the entire universe.
The universe is full of incredibly complicated things: roaring engines, speeding planets, scorching stars, and lightning bolts. But just like our master chef, nature builds all of these complex phenomena using a tiny, elite pantry of just seven Base Ingredients. In physics, we call these Base Quantities.

For a long time, physicists got by using just the first three “mechanical” ingredients in the pantry:
Mass (M) – How much “stuff” is there.
Length (L) – How much space it takes up.
Time (T) – How long a process lasts.

Every single concept in physics—whether it is the crushing weight of a black hole’s gravity or the speed of a Ferrari—is just a recipe made from these three basic ingredients.

The Hook (5 min)

When we look at a complex physics recipe, we need a shorthand way to see exactly how much of each base ingredient is inside it. We need to know: Are we multiplying lengths? Are we dividing by time?

This is where Dimensions come in. Like for any complex recipe that can be broken into a simple ingredient list, which in turn gives an idea about the nature of the dish, similarly, the dimensions of a physical quantity are ingredients in terms of fundamental quantities: Mass (M), Length (L) and Time (T) that give us an idea about the nature of a physical quantity.

Thus “dimensions” of a physical quantity are simply the exponents—the powers—that tell us exactly how many times a base ingredient is multiplied or divided to create that quantity. It is the ultimate genetic code, or the secret blueprint, of any physical concept.

Unit → Measurement

Physical quantity |

Dimension→Nature

Teacher’s Tip for Transitioning: (5 min)

Right after delivering this narrative, you can turn to the board and say:
“So, let’s look at the blueprint for ‘Area’. To get Area, we take the ingredient ‘Length’ and multiply it by ‘Length’. That’s Length squared $[L^2]$. The dimension is 2. Let’s see what happens when we look at Speed, we take two ingredients Distance and time and write it as
Speed = $[L^1 T^{-1}]$

The New Aisles in the Pantry (10 min)

But then, physics grew up. We started studying fire, heat, and electricity, and we realized our three basic ingredients weren’t enough to describe the whole picture. We couldn’t explain a lightning bolt using just meters and kilograms. So, nature opened up two more crucial aisles in our pantry:
Temperature (K) – The ingredient for heat and thermal energy.
Electric Current (A or I) – The ingredient for the flow of electricity.
Now, our pantry is fully stocked. Every single concept in physics—whether it is the heat radiating from a dying star or the electrical current powering your smart phone—is just a recipe made from these basic ingredients.

How to Pivot to the Lesson

Right after delivering this story, you can turn to your students and show them how the new ingredients change the recipes:

The Mechanical Recipe (Charge): “Class, how do we get Electric Charge? It’s just Electric Current multiplied by Time. So its blueprint is [I x T]. The dimensions are 1 for current and 1 for time.”

Teacher’s Note: By framing the symbols (M, L, T, K, I) as the “letters” and the dimensions as the “count” of those letters, students usually stop viewing dimensional formulas as scary equations and start viewing them as simple ingredient labels.

Classroom Activity: The Physics Bakery (15 min)

Objective: Understand how complex physical quantities (recipes) are built from base quantities (ingredients) using powers/exponents (the count of ingredients).
Setup: Divide the class into small groups of 3–4 students.

Materials Needed (Easy to Find)
You don’t need fancy lab equipment. Just gather these common items (one set per group):
A Ruler or Measuring Tape (Represents the Length [L] ingredient)
A Stopwatch or smart phone timer (Represents the Time [T] ingredient)
A Notebook or Textbook (The object they will test)
“Recipe Cards” (Index cards or scraps of paper)

Step-by-Step Activity Guide

Step 1: Label the Ingredients
Have the students write down their two “Base Ingredients” on the board or on a piece of paper in big letters:
L = Length (measured using the ruler)
T = Time (measured using the stopwatch)

Step 2: Baking “Area”
Tell the students, “Your first order at the bakery is to make Area. Look at your textbook. How do we calculate the area of the cover?”
They will use the ruler to measure the length (Ingredient L).
They will use the ruler again to measure the width (which is just another Ingredient L).
The Math: Length x Width = L x L = L2
The Dimensional Recipe: Have them write on their Recipe Card: Area = [L^2]. Explain that the power 2 means they had to use the Length ingredient twice to “bake” an Area.

Step 3: Baking “Speed”

Now, change the order. “The next customer wants Speed. Slide your textbook across the desk. How do we measure how fast it moved?”
They will use the ruler to measure the distance it slid (Ingredient L).
They will use the stopwatch to time how long the slide took (Ingredient T).
The Math: Distance / Time = L / T = $L^1 T^{-1}$
The Dimensional Recipe: Have them write on a new Recipe Card: Speed = [$L^1 T^{-1}$]. Explain that the negative power (-1) just means that the Time ingredient is being divided (put in the denominator), not multiplied.

Step 4: The Lightning Round Challenge
To challenge them, introduce a third ingredient: Mass (M) (represented by the heavy textbook itself).
Ask them: “If Density is Mass (M) divided by Volume (Length x Length x Length), what is the secret recipe card for Density?”
Let them huddle for a minute. The winning groups will hold up a card that says: Density = [$M^1 L^{-3}$].

Why This Works?
Instead of looking at abstract formulas on a chalkboard, students physically hold the ruler (L) and click the stopwatch (T). They visually see that to get “Speed,” they literally have to combine the ruler action and the stopwatch action. The exponents stop being scary math and start acting as a simple headcount of how many tools they used!

Examples	**Dimensional formulas (5 min)**
Velocity	[$L T^{-1}$]
Acceleration	[$L T^{-2}$]
Force	[$M L T^{-2}$]
Momentum	[$M L T^{-1}$]
Work	[$M L^2 T^{-2}$]
Power	[$M L^2 T^{-3}$]
Pressure	[$M L^{-1} T^{-2}$]
Density	[$M L^{-3}$]

Assessment Activity: Find Dimensions (10 min)

Materials Required
Worksheet
Calculator
Procedure

Students find dimensions of:

1. Velocity
2. Momentum
3. Acceleration
4. Force

Teacher guides.
Observation
Velocity = Displacement / Time = $[L]/[T] = [L^1T^{-1}]$
Momentum = Mass x Velocity = $[M^1][L^1T^{-1}] = [M^1L^1T^{-1}]$

Acceleration = Velocity / Time = $[L^1T^{-1}]/ [T^1] = [L^1\ T^{-2}]$

Force = Mass × Acceleration = $[M^1]\ [L^1\ T^{-2}] = [M^1L^1T^{-2}]$

Few Quantities with the same dimensions

- Work and Energy $[M^1\ L^2\ T^{-2}]$
- Frequency and Angular velocity $[T^{-1}]$
- Stress and Pressure $[M^1\ L^{-1}\ T^{-2}]$

Think: If these quantities have the same dimensions, do they have the same nature?

Conclusion
Complex quantities can be expressed through fundamental dimensions.

Day 6

Topic: Scientific terminology & language barrier (1 hour)

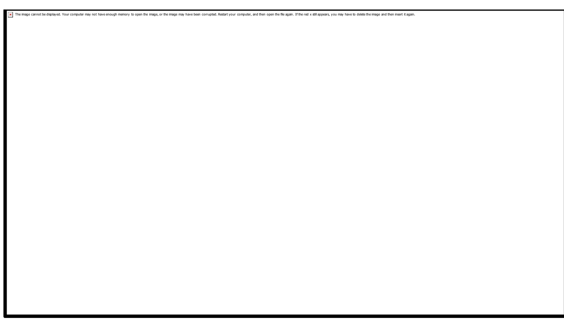
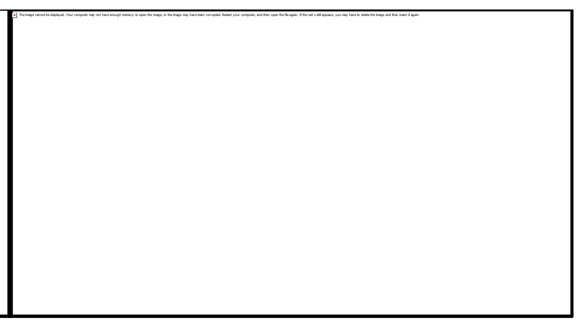
This is 60 minute lecture plan is designed to dismantle the fear of English technical terminology by framing physics not as a foreign language, but as a universal system of symbols and logical roots.

Objective

To remove language fear among diploma students by showing that scientific terminology is highly logical, and that physics ultimately relies on a universal language of symbols and formulas rather than complex English grammar.

Materials Required

- Whiteboard and colored markers (to distinguish symbols, numbers, and units).
- Flashcards with English terms on one side and their Punjabi/Urdu etymological roots on the other.
- A physical textbook written in a non-English language (like Russian, German, or Japanese) that contains recognizable physics equations.(Or Show images given below)

BREAKING THE LANGUAGE BARRIER IN PHYSICS

Setting the Stage, Real-World Connection (10 minutes)

Narrative/Story: In Punjab, three neighboring villages—Bhadaur, Rampura, and Kotli—decided to buy a new tractor together for farming.

The farmers met in the village gurdwara to discuss the tractor's power and fuel efficiency.Farmer Gurpreet from Bhadaur said, "This tractor has 50 horsepower."
Farmer Harjit from Rampura said, "No, my dealer says it has 37 kilowatts."
Farmer Baldev from Kotli said, "My nephew from Canada says tractors are compared using kW,

not horsepower."

Soon everyone became confused.

The next day, an agricultural officer visited the village. He explained:

"Horsepower and kilowatts measure the same thing—power. Around the world, scientists and engineers use standard scientific terms and units so that everyone speaks the same language."

He wrote on a board:
1 horsepower ≈ 0.746 kilowatt

Discussion (5 minutes):

- Faculty asks: "How many of you feel nervous reading the English physics textbook?"
- Faculty asks: "If I say the word 'Acceleration', does it sound complicated?"
- Faculty Response Model: Validate their anxiety. "It is normal to feel overwhelmed. But today, you will see that these big English words are just simple labels for things you already know and experience every day in Punjab."

Decoding Terminology & Etymological Roots (15 minutes)

The Concept: Technical words are not random; they are highly descriptive. By looking at the linguistic roots of scientific words across languages—whether Latin, Punjabi, Urdu, or Farsi—we can see the shared logic behind them.

Discussion & Board Work: Faculty writes "Velocity" and "Mass" on the board. "Instead of memorizing the English word, let's look at what the words actually mean in our own languages. When you understand the root, the English word loses its power to scare you."
Vocabulary Translation & Root Table (Students copy into notebooks):

English Term	Punjabi (ਪੰਜਾਬੀਵਿੱਚ)	Etymological Logic / Meaning
Physics	ਭੌਤਿਕਵਿਗਿਆਨ	'ਭੌਤਿਕ'' relates to physical, worldly matter. So physics is essentially "The study of the physical world"

Mass	ਪੁੰਜ / ਦ੍ਰਵਿਮਾਨ	'ਪੁੰਜ'' means a collection or gathering. Mass is just the total collection of matter.
Volume	ਆਇਤਨ	From roots meaning 'to stretch or expand'. It is how much space an object stretches into (3D).
Acceleration	ਪ੍ਰਵੇਗ	'ਪ੍ਰ' (forward/increasing) + 'ਵੇਗ' (velocity). It literally means increasing velocity over time.
Gravity	ਗੁਰੂਤਾਕਰਸ਼ਣ	'ਗੁਰੂ'' (heavy/large) + 'ਆਕਰਸ਼ਣ' (pull). The logical pull of heavy objects.

Key Takeaway: "English scientists used Latin roots to name things. Our scientists used Sanskrit and Persian/Urdu roots. The logic is identical. Don't fear the English word; just connect it to the physical action." This small list will help students to understand the logic behind the names of quantities in English and well as in native language.

Activity: "The Etymology Flip & Teach" (15 minutes)

Step 1: Group Allotment:
Divide the class into small groups of 3-4 students. Hand each group 1 blank flashcard and assign them specific English terms from the core syllabus (e.g., Mass, Acceleration, Force, Displacement).

Step 2: Card Creation:
Front of the Card: Students write the assigned English Term in large, bold letters (e.g., ACCELERATION).

Back of the Card: Using the reference sheet, students write the translated Punjabi term (e.g., ਪ੍ਰਵੇਗ) and break down its logical etymology/meaning based on everyday language.

Step 3: Board Presentation:
One nominated member from each group comes to the front of the class. They hold up the English side of the card, flip it to the Punjabi side, and explain the logic of the word to the rest of the class.

Scientific Terminology Cheat sheet (15 minutes)

Teacher will give sheet of common and relevant scientific terms and discuss some of them in classroom

Sr. No.	English Term	Hindi	Punjabi	Description
1	Physics	भौतिकी	ਭੌਤਿਕਵਿਗਿਆਨ	Study of matter and energy
2	Engineering	अभियांत्रिकी	ਇੰਜੀਨੀਅਰਿੰਗ	Practical application of science
3	Physical Quantity	भौतिकराशि	ਭੌਤਿਕਰਾਸ਼ੀ	Measurable property
4	Measurement	मापन	ਮਾਪ	Comparison with a standard
5	Instrument	यंत्र	ਸੰਦ	Device used for measurement
6	Practical	प्रयोगात्मक	ਪ੍ਰਯੋਗਸ਼ੀਲ	Learning through experiments
7	Unit	इकाई	ਇਕਾਈ	Standard of measurement
8	SI Unit	SI मात्रक	SI ਇਕਾਈ	International system of units
9	Fundamental Units	मूलमात्रक	ਮੂਲਇਕਾਈਆਂ	Independent base units
10	Derived Units	व्युत्पन्नमात्रक	ਵਿਉਤਪੰਨਇਕਾਈ ਆਂ	Formed from base units
11	Meter Scale	मीटरस्केल	ਮੀਟਰਸਕੇਲ	Length measuring device
12	Scalar Quantity	अदिशराशि	ਅਦਿਸ਼ਰਾਸ਼ੀ	Quantity with Magnitude only
13	Vector Quantity	सदिशराशि	ਸਦਿਸ਼ਰਾਸ਼ੀ	Quantity with Magnitude and direction
14	Amount of Substance	पदार्थकीमात्रा	ਪਦਾਰਥਦੀਮਾਤਰਾ	Number of particles
15	Luminous Intensity	प्रकाशतीव्रता	ਪ੍ਰਕਾਸ਼ਤੀਬਰਤਾ	Brightness measure

Day 7

Symbols, Greek symbols (1 hour)

The "Emojis" of Engineering – Demystifying Symbols

Narrative/Story: "The Text Message Shortcut" (10 minutes)

Faculty addresses the class: "When you chat with your friends on WhatsApp, do you type out 'I am laughing out loud,' or do you just send a □ emoji? You send the emoji because it is a shortcut. It saves time, and everyone in the world knows what it means, no matter what language they speak.

Physics symbols are exactly the same thing. They are just 'emojis' for engineers. Instead of writing 'Change in Temperature' every single time, lazy but smart engineers just draw a little triangle and a T: Δ T. Today, we are going to learn the emojis of physics."

Description & Board Work: English emojis (20 minutes)

Teachers will display/handout commonly used/relevant English symbol's list in the classroom and discuss some of them

Sr. No	Symbol	Physical Quantity/Unit	Hindi Name	Punjabi Name	Description
1	l	Length	लंबाई	ਲੰਬਾਈ	Distance between points
2	b	Width	चौड़ाई	ਚੌੜਾਈ	Breadth of an object
3	A	Area	क्षेत्रफल	ਖੇਤਰਫਲ	Two-dimensional extent
4	V	Volume	आयतन	ਆਇਤਨ	Three-dimensional space occupied
5	m	Mass	द्रव्यमान	ਪਿੰਡ	Amount of matter
6	t	Time	समय	ਸਮਾਂ	Measure of passage of time
7	W	Weight	भार	ਭਾਰ	Gravitational force
8	d	Distance	दूरी	ਦੂਰੀ	Total path covered
9	v	Speed	चाल	ਚਾਲ	Distance per unit time
10	T	Temperature	तापमान	ਤਾਪਮਾਨ	Measure of hotness/coldness

11	m	Meter	मीटर	ਮੀਟਰ	SI unit of length
12	cm	Centimeter	सेंटीमीटर	ਸੈਂਟੀਮੀਟਰ	1/100 of a meter
13	kg	Kilogram	किलोग्राम	ਕਿਲੋਗ੍ਰਾਮ	SI unit of mass
14	g	Gram	ग्राम	ਗ੍ਰਾਮ	1/1000 kilogram
15	A	Ampere	एम्पियर	ਐਂਪੀਅਰ	SI unit of electric current
16	K	Kelvin	केल्विन	ਕੈਲਵਿਨ	SI unit of temperature
17	mol	Mole	मोल	ਮੋਲ	SI unit of amount of substance
18	cd	Candela	कैंडेला	ਕੈਂਡੇਲਾ	SI unit of luminous intensity
19	ft	Foot	फुट	ਫੁੱਟ	FPS length unit
20	lb	Pound	पाउंड	ਪੌਂਡ	FPS weight unit
21	N	Newton	न्यूटन	ਨਿਊਟਨ	SI unit of force
22	J	Joule	जुल	ਜੂਲ	SI unit of Energy
23	W	Watt	वाट	ਵਾਟ	SI unit of power

Faculty writes three categories on the board:

The First Letter Rule: Most of the time, the symbol is just the first letter of the English word. Mass = m, Force = F, Velocity = v.
The Capital vs. Small Rule: Case matters in our emojis!
Small t = time (ਸਮਾਂ).

Capital T = Temperature (ਤਾਪਮਾਨ).

Discussion (5 minutes)

Faculty asks: "Why do you think it is so important not to mix up a small v and a capital V?"
Student Response: "Because one means speed and the other means size."
Faculty Guidance: "Exactly! If you write capital V when you mean small v, you are telling the mechanic about the size of the car's fuel tank instead of how fast the car is moving. In engineering, neat handwriting with symbols prevents disasters.”

The "Greek" Emojis: (15 minutes)

Faculty explains, "Because there are hundreds of things to measure in the universe, we ran out of the 26 English letters! So, scientists borrowed letters from an old language called Greek. They are not magic symbols; they are just extra alphabet letters."
Handout/display the cheatsheet of greek symbols to the students and discuss some of the more commonly used symbols

Sr. No.	Greek Symbol	Greek Name (Punjabi)	Common Description
1	α (small)	Alpha (ਅਲਫਾ)	Angular acceleration, temperature coefficient, alpha particles.
2	β (small)	Beta (ਬੀਟਾ)	Beta particles, sound intensity level, surface expansion coefficient
3	χ (small)	Chi (ਕਾਈ)	Magnetic susceptibility.
4	δ (small)	Delta (ਡੈਲਟਾ)	Small increment or difference in a quantity.
5	Δ (capital)		Change or macroscopic difference in a quantity.
6	ε (small)	Epsilon (ਐਪਸਿਲਨ)	Permittivity of free space, electromotive force (EMF), strain.
7	η (small)	Eta (ਈਟਾ)	Efficiency, coefficient of viscosity.
8	γ (small)	Gamma (ਗਾਮਾ)	Gamma rays, heat capacity ratio.
9	ι (small)	Iota (ਆਇਓਟਾ)	Rarely used in physics to avoid confusion with the letter 'i'.
10	κ (small)	Kappa (ਕੱਪਾ)	Thermal conductivity, dielectric constant.
11	λ (small)	Lambda (ਲੈਮਬਡਾ)	Wavelength, decay constant.
12	μ (small)	Mu (ਮਿਊ)	Coefficient of friction, magnetic permeability, "micro" prefix.
13	ν (small)	Nu (ਨਿਊ)	Frequency (especially in optics), kinematic viscosity.
14	ω (small)	Omega (ਓਮੇਗਾ)	Angular velocity, angular frequency.
15	Ω (capital)		Electrical resistance, solid angle.

16	ο (small)	Omicron (ਓਮੀਕਰੋਨ)	Rarely used to avoid confusion with zero or English 'o'.
17	φ (small)	Phi (ਫਾਈ)	Phase angle, work function.
18	Φ (capital)		Magnetic flux, electric flux.
19	π (small)	Pi (ਪਾਈ)	Ratio of a circle's circumference to its diameter.
20	ψ (small)	Psi (ਸਾਈ)	Wave function in quantum mechanics.
21	ρ (small)	Rho (ਰੋ)	Density, resistivity.
22	σ (small)	Sigma (ਸਿਗਮਾ)	Electrical conductivity, surface charge density, stress.
23	Σ (capital)		Summation operator.
24	τ (small)	Tau (ਟਾਊ)	Torque, time constant, shear stress.
25	θ (small)	Theta (ਥੀਟਾ)	Angle, angular displacement.
26	Θ (capital)		Temperature, thermodynamic temperature.
27	υ (small)	Upsilon (ਉਪਸਿਲੋਨ)	Rarely used in standard mechanics or electricity.
28	ξ (small)	Xi (ਜਾਈ)	Damping ratio, extent of a reaction.
29	ζ (small)	Zeta (ਜੀਟਾ)	Zeta potential in colloids, damping ratio.

Activity: "The Symbol Match & Draw" (10 minutes)

Materials Required: Blank sheets of paper and markers for each group.
Action: Faculty writes a list of most commonly used Greek symbols on the whiteboard. Each group must copy the symbol, draw it correctly, and match it to its jumbled up Punjabi/English names using a provided jumbled list.

Symbol to Draw	The Greek/English Name
Δ	Rho (ਰੋ)
θ	Pi (ਪਾਈ)
π	Theta (ਥੀਟਾ)
ρ	Delta (ਡੈਲਟਾ)

Day 8

Formulas - The Universal Language (1 hour)

The Concept: Formulas are simply short sentences that save us from writing long paragraphs in English.

Narrative/ Story(20 minutes)

The Arhtiya's Secret: Why Scientists Are Just Lazy Writers

Gurmukh was sitting on a manja in the courtyard, staring blankly at his physics textbook. To him, the formulas looked like an alien language—just a jumble of random English and Greek letters meant to make his life difficult.

His grandfather, Bapuji, walked in dusting off his kurta after a long morning at the mandi (grain market). He noticed Gurmukh's frustration.

"What is eating your head today, puttar?" Bapuji asked.

"These formulas, Bapuji," Gurmukh sighed. "I don't understand why physics can't just be written in plain Punjabi or English. Why do they have to hide everything behind these letters?"

Bapuji chuckled and sat down. "Let me show you something. Go get the notebook where we track our wheat harvest."

Gurmukh brought the thick, dog-eared register. Bapuji opened to a page from a few years ago when Gurmukh was first learning to help out.

Bapuji pointed to a paragraph Gurmukh had written:

"Today is Tuesday. We loaded a total of fifty sacks of kanak (wheat) onto the tractor trolley. Every single sack we filled weighs exactly fifty kilograms. So, the total weight of the wheat we are sending to the mandi is two thousand five hundred kilograms."

"You wrote this," Bapuji said. "It is perfectly correct. Now, look at the page from today, where the arhtiya (commission agent) at the market wrote down our account."

Gurmukh flipped to the newest page. The arhtiya had quickly scribbled:

$$T = N \times W$$

$$T = 50 \times 50 = 2500 \text{ Kg}$$

"Do you see what the arhtiya did?" Bapuji asked. "He is a busy man. Hundreds of tractor trolleys are waiting in line. He does not have the time to write a beautiful essay about Tuesday and the tractor trolley. He just created a shortcut."

Bapuji pointed to the letters one by one.

- T just stands for the sentence: "The Total weight of the wheat."
- N just stands for: "The Number of sacks."

- W just stands for: "The Weight of one sack."

"The arhtiya's formula, $T = N \times W$, is not some magical mathematics," Bapuji explained gently. "It is just a shortcut for a long sentence. Scientists are exactly like busy arhtiyas. They don't want to spend all day writing,

'The force needed to move a body is equal to how heavy it is multiplied by how fast you want it to speed up.' They are too impatient for that!"
"So," Gurmukh realized, "they just write $F = m \cdot a$ instead?"

"Exactly," Bapuji smiled. "A formula is never a math problem first. It is always a sentence first. When you look at a formula, do not try to calculate it right away. Just ask yourself: What sentence is this lazy scientist trying to tell me?"

Important formula discussion and demonstration (20 minutes)

Display/handout the following list to the students and discuss some of the formulas

Topic	**The Long English Sentence**	**The Universal Symbol / Formula**
Vectors and Scalars	The magnitude of velocity is obtained by dividing displacement by time.	$v = s/t$
	The resultant of two perpendicular vectors is found using Pythagoras theorem.	$R = \sqrt{(A^2 + B^2)}$
Force and Motion	The force applied to an object is equal to its mass multiplied by acceleration.	$F = ma$
	Acceleration is calculated by change in velocity divided by time.	$a = (v-u)/t = \Delta v/t$
	Momentum is equal to mass multiplied by velocity.	$p = mv$
Work, Power and Energy	Work done is equal to force multiplied by displacement.	$W = Fs$
	Power is the rate of doing work.	$P = W/t$
	Kinetic energy equals half the mass multiplied by velocity squared.	$KE = \frac{1}{2}mv^2$

	Potential energy equals mass multiplied by gravity and height.	PE = mgh
Heat and Temperature	Heat gained or lost is equal to mass multiplied by specific heat capacity and temperature change.	$Q = mc\Delta T$
	Temperature in Kelvin is obtained by adding 273 to Celsius temperature.	K = °C + 273
Properties of Matter	Stress is equal to force divided by area.	Stress = F/A
	Strain is equal to change in length divided by original length.	Strain = $\Delta L/L$
	Modulus of elasticity is stress divided by strain.	Modulus of Elasticity= Stress/Strain
	Pressure is Force acting per unit area.	P=F/A

Activity: "Translating Sentences into Symbols" (15 minutes)

Faculty divides the class into small groups. "I am going to give you a long, complicated English sentence. I want your group to translate it into a simple formula using symbols."

Group Challenges:

Group	**The Long English Sentence**	**The Universal Symbol / Formula**
Group 1	"The total area is found by multiplying the length by the width."	$A = l\times b$
Group 2	"The speed of the vehicle is calculated by dividing the distance traveled by the time taken."	v = d/t
Group 3	"The force applied to an object is equal to its mass multiplied by its acceleration."	F = ma

Faculty Guide: After groups complete the task, emphasize how clean and simple the formulas are. "Look at Group 3. Instead of memorizing that long English sentence, you only need to remember F = ma. F is Force (ਬਲ), m is Mass (ਪੁੰਜ), and a is Acceleration (ਪ੍ਵੇਗ). The formula tells you exactly how they relate. It is a shortcut!"

Consolidation & Practical Demonstration(5 minutes)

Quick Interactive Drill: Faculty holds up objects and asks for the symbol and SI unit, avoiding the full English word to reinforce the universal language.

- Faculty holds up a Kilogram weight. "Symbol?" Class answers: "m". "SI Unit?" Class answers: "kg".
- Faculty holds up a Meter scale. "Symbol?" Class answers: "l". "SI Unit?" Class answers: "m".

Final Rule (Write in Box on Board):

PHYSICS IS NOT AN ENGLISH TEST. IT IS THE STUDY OF NATURE USING SYMBOLS.

Day 9
Mathematics for Physics – Confidence Building Workshop (1 hour)

Theme: "Don't Fear Mathematics... Use It!"
Learning Objectives
By the end of the session, students will be able to:
- Develop confidence in performing simple calculations required in Engineering Physics.
- Apply quick mental calculation techniques for estimation and verification.
- Identify the correct Physics formula for a given situation.
- Rearrange simple formulae to find unknown quantities.
- Solve basic Physics numericals using a systematic approach.
- Realize that Engineering Physics relies on logical thinking more than difficult mathematics.

Introduction (5 Minutes)

Narrative – **"The Student Who Was Afraid of Mathematics"**

Teacher says:
"When I ask first-year students, 'Who finds Physics difficult?' many raise their hands. But when I ask why, the answer is almost always the same..."

Students reply:
"Because of Mathematics."

Teacher continues:
"Last year, a diploma student named Aman joined the Engineering Physics laboratory. He knew the formulas but became nervous whenever he saw numbers. During his first practical, he whispered, 'Sir, I know the Physics, but I am weak in Mathematics.'"
The teacher smiled and gave him only one question.
A force of 20 N acts on a body of mass 5 kg. Find the acceleration.

Aman immediately wrote
$a=F/m=20/5=4\ m/s^2$

The teacher asked,
"Tell me honestly. Was this difficult Physics or just simple division?"

Aman smiled.

The teacher then said,
"Most Physics numerical are built from school mathematics—addition, subtraction, multiplication and division. What makes them look difficult is fear, not mathematics."
Teacher concludes:
"Today's class is about removing that fear."

Activity 1 (15 Minutes)

Math Confidence Challenge
Tell students,
"No calculators for the next five minutes. Just think."

Round 1 – Fast Calculations
25×48
99×36
50% of 640
25% of 800
$120 \div 20$
18×5
Students answer mentally.

Teach only three useful engineering shortcuts
Shortcut 1
For Multiply by 25
$\times 100$ then $\div 4$

Shortcut 2
Multiply by 99
$\times 100$ then subtract once

Shortcut 3
Estimate first.
Example
198×5
$\approx 200 \times 5$
≈ 1000

Teacher explains:
"Engineers estimate first and calculate second. Estimation tells us whether the final answer is reasonable."

Pair Activity

Each pair prepares one smart calculation question.
Exchange with another pair.

Activity 2 (20 Minutes)

Physics is Just Mathematics with Units

Teacher writes

Physics	Mathematics
Speed	Division
Force	Multiplication
Density	Division
Work	Multiplication
Power	Division

Ask
"What mathematical operation is hidden inside each Physics formula?"
Students answer.

Now solve three numerical.
Question 1
A cyclist covers 150 m in 30 s.
Find speed.

Teacher asks: "Which operation?"
Students: Division

Question 2
Mass = 6 kg
Acceleration = 3 m/s^2
Find force.
Students: Multiplication

Question 3
Voltage = 12 V
Current = 3 A
Find resistance.
Students rearrange
$R=V/I$
Teacher says
"Notice that there is no difficult mathematics—only choosing the correct formula."

Activity 3 (12 Minutes)
Engineering Escape Challenge

Narrative:
"You are trainee engineers. Before a machine can be started, your team must solve five quick calculations. Every correct answer brings the machine one step closer to working. The team who gives maximum correct answer will give bonus."

Procedure
1. Divide the class into 4–6 groups.
2. Display or write five questions on the board (or PPT) at the same time.
3. Each group discusses the answers together.
4. Ask one representative from each group to answer one question.
5. If the answer is incorrect, another group gets a chance to answer and explain the formula used.
6. Award 1 point for each correct answer. The team with the highest score wins.

Questions
1. Mass = 5 kg, Acceleration = 4 m/s^2. Find Force.
2. Voltage = 24 V, Current = 6 A. Find Resistance.
3. Distance = 150 m, Time = 30 s. Find Speed.
4. Force = 20 N, Distance = 5 m. Find Work Done.
5. Work = 600 J, Time = 30 s. Find Power.

Reflection (5 Minutes)
Ask students to raise their hands.
"I used to think Physics numerical were difficult."
"I now feel more confident."
"What helped you most today?"
Discuss for two minutes.
Teacher says,
"Confidence grows through practice. Every engineer starts with simple calculations like today's."

Summary (3 Minutes)

Today's Takeaways

✔ Physics uses simple mathematics.

✔ Think before calculating.

✔ Estimate your answer first.

✔ Choose the correct formula.

✔ Rearrange if needed.

✔ Always write SI units.

Closing Thought

"The biggest obstacle in Engineering Physics is not mathematics—it is the fear of mathematics. Once you remove that fear, formulas become tools, numericals become puzzles, and Physics becomes enjoyable. Remember, every successful engineer began by solving simple problems with confidence."

Day 10

Physics Laboratory Skills: Measurements, Mean, Errors and Graphs (1 hour)

Learning Objectives

By the end of this session, students will be able to:

- Understand why measurements are repeated in a Physics laboratory.
- Calculate the mean (average) of repeated observations.
- Recognize common sources of experimental error.
- Draw and interpret simple graphs.
- Appreciate how graphs help engineers analyze experimental data.

Teaching Aids

- Ruler/Measuring tape
- Stopwatch or mobile timer
- A notebook/book
- Graph paper
- Whiteboard
- Marker

1. Motivation (5 minutes)

Story – "The Engineer Who Measured Only Once"

A newly recruited diploma trainee was asked to cut a steel rod exactly 50 cm long for a machine. He measured it only once and cut it.
When the machine was assembled, the rod was actually 49.6 cm, making the entire assembly misaligned. The machine vibrated and had to be dismantled.
His senior engineer smiled and said,
"In engineering, measure twice, cut once. In a laboratory, measure many times and take the average."
Ask students:

- Why wasn't one measurement enough?
- Could a small error affect a machine?

Lead to the idea that accuracy matters in engineering, and repeated measurements improve reliability.

Activity 1 – Measure, Compare & Discuss (10 minutes)

Materials

- One notebook (or any rectangular object)
- Ruler

Instructions

Each group measures the notebook only once.

Write all group readings on the board.

Example:

Group	Length (cm)
A	21.3
B	21.5
C	21.4
D	21.2
E	21.6

Ask:

- Why are all readings different?
- Is the notebook changing its size?

Students quickly realize that people measure differently.

Introduce the idea of measurement uncertainty.

Activity 2 – Finding the Mean (10 minutes)

Now ask one group to measure the notebook three times.

Example

Trial	Reading (cm)
1	21.3
2	21.5
3	21.4

Teacher asks:

Which value should we record in the observation table?

Introduce

Mean (Average)

Mean=Sum of observations / Number of observations

Mean = (21.3 + 21.5 + 21.4)/3 = 21.4 cm

Explain:

The mean gives the best estimate of the actual value.

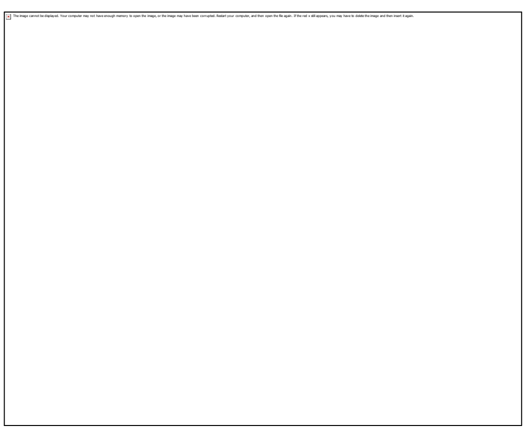
Activity 3 – Spot the Errors (10 minutes)

This is a fun demonstration.
Show a ruler.
Hold it correctly.
Ask a student to read.
Now deliberately tilt your head sideways while reading.
Ask
"Are both readings the same?"
Discuss
Sources of Error

- Parallax error
- Wrong zero mark
- Careless observation
- Faulty instrument
- Human reaction time

Quick Challenge
Display four pictures or act out four situations.
Students identify whether the measurement is

- Correct
- Incorrect



This usually creates lots of discussion.

Teacher concludes

- Errors are normal in science.
- The goal is to reduce them.

Activity 4 – Draw Your First Physics Graph (15 minutes)

Scenario: A cup of hot water cools with time.

Time (min)	Temperature (°C)
0	70
2	65
4	60
6	56
8	53
10	50

Students work in pairs.

Step 1

Draw axes.

X-axis → Time

Y-axis → Temperature

Step 2

Choose a suitable scale.

Step 3

Plot the points.

Step 4

Join the points.

Ask

- Is the temperature increasing or decreasing?
- Does cooling happen faster initially?
- Can you predict the temperature after 12 minutes?

Teacher explains

This is called a Cooling Curve, one of the simplest Physics graphs.

Mini Activity – Read the Graph (2–3 minutes)

Instead of drawing another graph, ask:

"If the graph shows 56°C at 6 minutes,

What was the temperature at 4 minutes?"

"What is the total temperature drop?"
Students learn that graphs help us answer questions quickly.

Physics Laboratory Connection (5 minutes)

Ask
"What do all these experiments have in common?"

Experiment	What is Measured?	Graph
Cooling of Water	Temperature	Temperature vs Time
Ohm's Law	Current & Voltage	V–I Graph
Simple Pendulum	Time	Time vs Oscillations
Hooke's Law	Load & Extension	Load vs Extension

Highlight the laboratory cycle:
Observe → Record → Repeat → Find Mean → Identify Errors → Plot Graph → Conclude

Assessment Quiz (5 minutes)

1. Why do scientists repeat measurements?

a) To waste time
b) To improve accuracy
c) To use more paper
d) To increase marks

Answer: b

2. What is the mean of 10 cm, 11 cm and 12 cm?

a) 10
b) 11
c) 12
d) 13

Answer:b

3. Reading a scale from an angle causes

a) Zero error
b) Parallax error
c) Instrument error
d) Random error

Answer:Parallax error

4. Which graph is best for showing temperature changing with time?

a) Bar graph
b) Line graph
c) Pie chart
d) Table

Answer:Line graph

5. Why are graphs useful?

a) They decorate reports.
b) They help us see patterns and trends.
c) They replace experiments.
d) They increase the number of observations.

Answer:b

Reflection (Exit Ticket – 2 minutes)

Before leaving, ask each student to write on a small slip of paper:

1. One new thing I learned today is...
2. One place where I will use graphs in engineering is...

Collect the responses as students leave. This gives the teacher quick feedback while encouraging students to connect today's lesson with their future diploma practicals.

Teacher's Closing Message

"Today you worked like young engineers. You measured, compared observations, calculated the average, identified possible errors, and transformed numbers into graphs. These are not just classroom skills—they are the foundation of every Physics laboratory experiment you will perform during your diploma. Remember: good engineers do not simply collect data; they analyze it carefully, minimize errors, and use graphs to communicate scientific results clearly.