Department of Physics
Course Structure (w.e.f. 2021)

Semester –I

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	21ULTA11 21ULFA11	பொதுத்தமிழ் தாள் - 1 இக்கால இலக்கியம் (செய்யுள், இலக்கணம், இலக்கிய வரலாறு, உரைநடை, சிறுகதை) Introductory French Course	6	3	40	60	100
II	General English	21UGEN11	Poetry, Prose, Extensive Reading and Communicative English-I	6	3	40	60	100
III	Core I	21UPHC11	Mechanics and Properties of Matter	6	5	40	60	100
	Core practical I	21UPHCR1	Practical I	2				
	Allied I	21UCHA11	Allied Chemistry	4	3	40	60	100
	Allied Practical I	21UCHAR1		2				
IV	Skill Enhancement Course – I	21UPHPE1	Professional English for Physics – I	2	2	20	30	50
	Ability Enhancement Course – I	21UAVE11	Value Education	2	2	20	30	50
Total				**30**	**18**			

Semester II

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	21ULTA21	பொதுத்தமிழ் தாள் 2 சமய இலக்கியங்களும் நீதி இலக்கியங்களும் (செய்யுள், இலக்கணம், இலக்கிய வரலாறு, உரைநடை, வாழ்க்கை வரலாறு)	6	3	40	60	100
	French	21ULFA21	Intermediate French Course					
II	General English	21UGEN21	Poetry, Prose, Extensive Reading and Communicative English –II	6	3	40	60	100
III	Core II	21UPHC21	Thermal Physics and Optics	6	5	40	60	100
	Core Practical I	21UPHCR1	Practical I	2	2			
	Allied I	21UCHA22	Allied Chemistry	4	3	40	60	100
	Allied Practical I	21UCHAR1		2	2			
IV	Skill Enhancement Course – II	21UPHPE2	Professional English for Physics – II	2	2	20	30	50
	Ability Enhancement Course	21UAEV21	Environmental Studies	2	2			
Total				**30**	**22**			

Semester III

Part	Components	Course Code	Course Title	Hrs/ Week	Credit	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	21ULTA31 21ULFA31	பொதுத்தமிழ் தாள் 3 : காப்பியங்களும் சிற்றிலக்கியங்களும் (செய்யுள், இலக்கணம், இலக்கிய வரலாறு, உரைநடை, புதினம்) Advanced French Language	6	4	40	60	100
II	General English	21UGEN31	Poetry, Prose, Extensive Reading and Communicative English- III	6	4	40	60	100
III	Core III	21UPHC31	Electricity and Electromagnetism	4	4	40	60	100
	Core Practical II	21UPHCR2	Practical II	2				
	Allied II	21UMAA31	Allied Mathematics	6	5	40	60	100
	Skill Based Elective	21UPHS31	Instrumentation Physics	2	2			
	NME I	21UPHN31	Applied Physics I	2	2	20	30	50
IV	Ability Enhancement Course	21UAWS31	Women's Synergy	2	2			
	Self Study Course / MOOC/ Internship (Compulsory)	21UPHSS1/ 21UPHO31/ 21UPHI31	Maintenance of Electronic Equipment and Photography		2		50	50
Total				**30**	**25**			

Semester IV

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil / French	21ULTA41 21ULFA41	பொதுத்தமிழ் தாள் 4: சங்க இலக்கியம்: (செய்யுள், இலக்கணம்,இலக்கிய வரலாறு, உரைநடை, நாடகம்) French Course and Literature	6	4	40	60	100
II	General English	21UGEN31	Poetry, Prose, Extensive Reading and Communicative English- IV	6	4	40	60	100
III	Core IV	21UPHC41	Electronics and Communication	4	4	40	60	100
	Core Practical II	21UPHCR2	Practical IV	2	2			
	Allied II	21UMAA41	Allied Mathematics	6	5	40	60	100
	Skill Based Elective	21UPHS41	Physics for Competitive Examinations	2	2	40	60	100
	NME II	21UPHN41	Applied Physics II	2	2	20	30	50
IV	Ability Enhancement Course	21UAYM1	Yoga & Meditation	2	2			
	Self study / Online Course / Internship (Optional)	21UPHSS2/ 21UPHO41/ 21UPHI41	Electrical Wiring and Appliances		+2		50	50
V	NCC, NSS & Sports				1			
	Extension Activities CDP				+1			
Total				**30**	**26+3**			

Semester V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core V (Common Core)	21UPCC51	Material Science	6	5	40	60	100
	Core VI	21UPHC51	Digital Electronics	5	5	40	60	100
	Core VII	21UPHC52	Computational Physics	5	5	40	60	100
	Core Elective	21UPHE51/ 21UPHE52	Renewable Energy Sources/ Mathematical Physics	4	4	40	60	100
	Core Practicals III, IV & V	21UPHCR3	Practical – V (Non electronics)	3				
		21UPHCR4	Practical - VI (Electronics)	3				
		21UPHCR5	Practical – VII (Programming in C++)	2				
IV	Common Skill Based	21UCSB51	Computers for Digital Era and Soft Skills	2	2	20	30	50
	Self study / MOOC / Internship (Optional)	21UPHSS3/ 21UPHO51/ 21UPHI51	Biophysics	--	+2		50	50
Total				**30**	**21+2**			

Semester VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core VIII	21UPHC61	Relativity and Quantum Mechanics	5	5	40	60	100
	Core IX	21UPHC62	Atomic and Nuclear Physics	4	4	40	60	100
	Core X	21UPHC63	Opto Electronics And Fibre Optics Communication	4	4	40	60	100
	Core XI	21UPHC64	Advanced Physics	4	4	40	60	100
	Core Practicals III, IV & V	21UPHCR3	Practical – V (Non electronics)	3	2			
		21UPHCR4	Practical - VI (Electronics)	3	2			
		21UPHCR5	Practical – VII (Programming in C++	2	2			
IV	Core XII / Project	21UPHC65	Microprocessor 8086 and Microcontroller	5	5	40	60	100
			Total	**30**	**28**			

Semester	Hours	Credits	Extra Credits
I	30	18	---
II	30	22	---
III	30	25	---
IV	30	26	3
V	30	21	2
VI	30	28	--
Total	**180**	**140**	**5**

LESSON PLAN

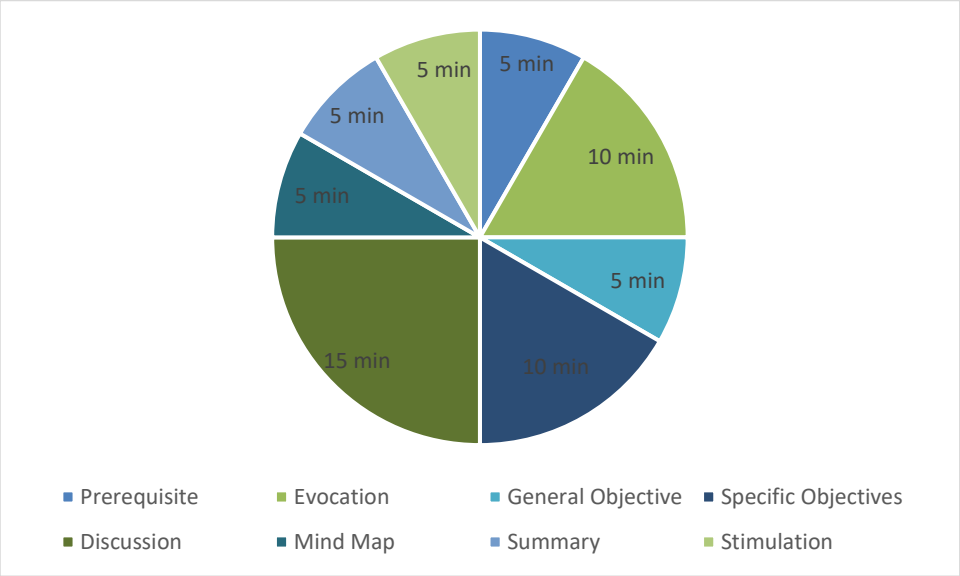
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	I
Subject Title	Core I: Mechanics and Properties of Matter
Code	21UPHC11
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	UnitII- Elastic and Inelastic collision
Name of the Faculty	Ms. Lucas Rexceline
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of Newton's laws of motion, law of conservation of momentum, kinetic energy, basic concepts of mechanics, and familiarity with the terms collision, impulse, and impact force.

Micro-Planning



1. **Topic for Learning through Evocation:**

Imagine two balls colliding on a frictionless surface. In an **elastic collision**, the balls bounce off each other, retaining both their total momentum and kinetic energy, just as if they were perfectly springy, with no energy lost to deformation or heat. On the other hand, in an **inelastic collision**, some of the kinetic energy is converted into other forms of energy, such as sound or heat, and the objects may stick together or deform upon impact. These types of collisions are often observed in everyday life, from car accidents to the bouncing of a rubber ball. By understanding these fundamental types of collisions, students can appreciate the conservation of momentum and the transformation of energy in various physical systems. Reflecting on real-world examples helps students recognise the practical significance of these concepts in physics.

2. Topic Introduction:

Elastic and inelastic collisions are fundamental concepts in physics that describe how objects interact when they collide. In an elastic collision, both momentum and kinetic energy are conserved, meaning the objects bounce off each other without any energy loss to heat or deformation. This can be seen in phenomena like bouncing balls or molecular collisions in gases. In contrast, an inelastic collision conserves momentum but not kinetic energy, as some of the energy is transformed into other forms, such as heat or deformation. A common example of this is a car crash, where the vehicles crumple upon impact. Understanding these types of collisions helps explain energy transfer and conservation in various real-world scenarios.

3.1. General Objective:

To understand the principles of elastic and inelastic collisions, including the conservation of momentum and energy. Recognize the differences between the two types of collisions and their real-world applications, such as in sports, vehicle accidents, and particle physics.

3.2. Specific Objectives:

Students will be able to

1. Explain the basic principles of elastic and inelastic collisions and the conservation of momentum in each type of collision.
2. Identify the differences between elastic and inelastic collisions, including the conservation of kinetic energy and how energy is dissipated.
3. Analyze real-life examples of elastic and inelastic collisions, such as billiard balls (elastic) and car crashes (inelastic).
4. Evaluate the role of elastic and inelastic collisions in various fields, including physics, engineering, and sports, and understand their implications for energy transfer and material behavior.
5. Investigate how elastic and inelastic collisions can be modeled mathematically using equations and principles from Newtonian mechanics.

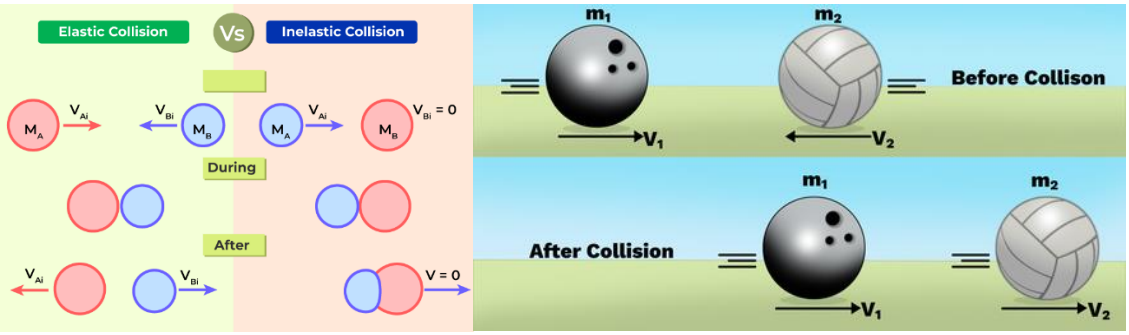
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		2,5	2,5			
C. Procedural Knowledge			5	3,4		
D. Meta Cognitive Knowledge			5	3,4,5	4	4

3.4. Keywords:

Momentum Conservation, Kinetic Energy, Deformation, Elasticity, Energy Loss

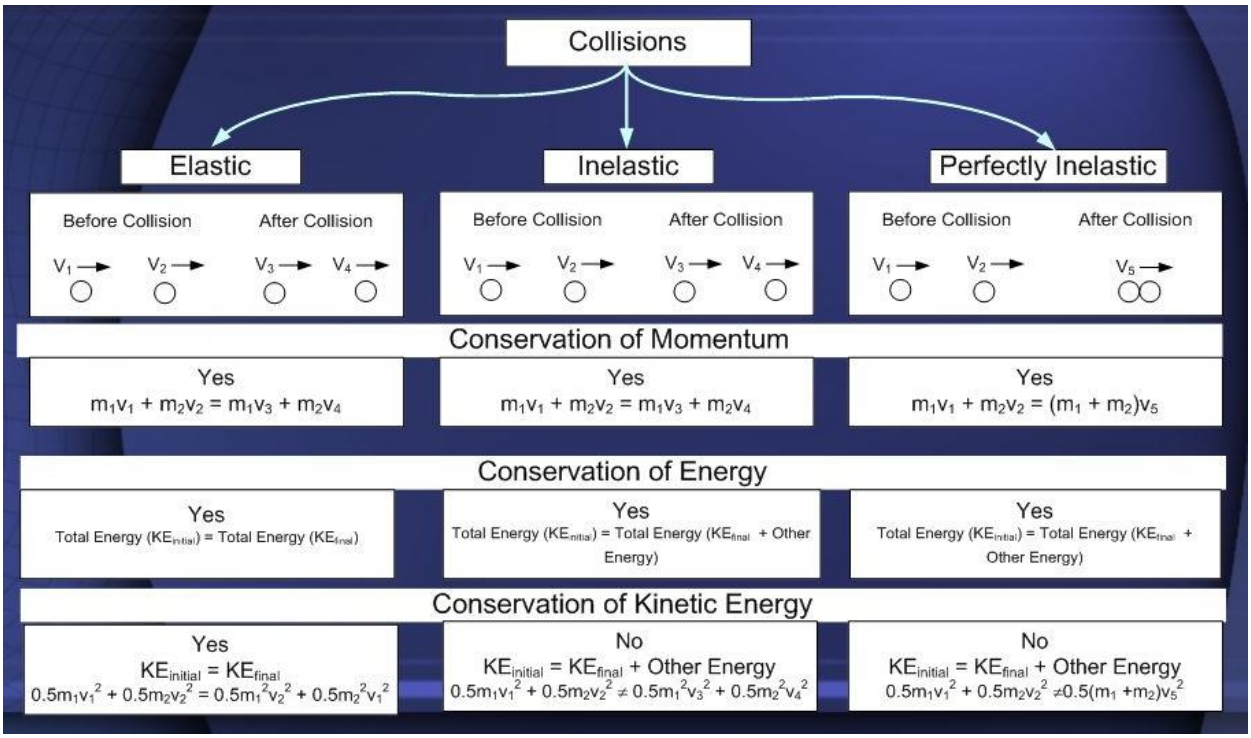
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding elastic and inelastic collisions. One of the students will be asked to draw a diagram illustrating the difference between an elastic and an inelastic collision, highlighting the key factors like conservation of kinetic energy and momentum. The students will then discuss real-life examples of each type of collision, such as a bouncing ball (elastic) versus a car crash (inelastic), to reinforce their understanding of the concepts.

4. Mind Map:



5. Summary:

Students will be asked to identify how the principles of elastic and inelastic collisions differ and how they are applied in various real-world scenarios. They will use a mind map to visually organise key concepts such as:

- Elastic Collision: Momentum and kinetic energy are conserved; objects bounce off each other without deformation or heat generation.
- Inelastic Collision: Momentum is conserved, but kinetic energy is not; some energy is transformed into heat or deformation.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Students will be given examples of real-life collisions (e.g., a ball bouncing on the floor and a car crash) and asked to identify if they are elastic or inelastic based on the behavior of energy and momentum. They will also analyse the effects of the collisions on objects and categorise them accordingly.
2. Students will be tasked with creating an e-content module demonstrating the key principles of elastic and inelastic collisions. This could include animations or simulations showing how kinetic energy is conserved in elastic collisions and how it is lost in inelastic ones.
3. Students will be asked to imagine a situation where two cars collide—one with a soft bumper (inelastic collision) and one with a hard bumper (elastic collision). They should generate mental images of how energy and momentum behave in each scenario.

7. FAQs:

1. What is the difference between an elastic and an inelastic collision?
2. Are there real-world examples of elastic collisions?
3. What happens to kinetic energy in an inelastic collision?
4. Can a collision be perfectly inelastic?
5. How are elastic and inelastic collisions used in physics?

8. References:

1. Murugeshan R. *Properties of matter*. S. Chand & Company Ltd. Revised edition 2008.
2. Ubald Raj A. and Jose Robin G. *Mechanics and Thermal Physics*. Marthandam: Indira publication 2003.
3. Ubald Raj A. and Jose Robin G. *Mechanics and relativity*. Marthandam: Indira Publications. 2008.
4. Mathur D. S. *Mechanics*. S. Chand & Co. Ltd. 1984.
5. Mathur D. S. *Properties of matter*. Ram Nagar: Shyamlal Charitable trust. 1992.
6. Brijlal and Subramanyam N. *Mechanics*. Himalaya Publishing House. ISO 9001:2015 certified.
7. Dr. Upadhyaya J.C. *Classical Mechanics*. Himalaya Publishing House. ISO 9001:2015 certified.

A. Lucas Rexline

Verified by Subject Expert

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LESSON PLAN

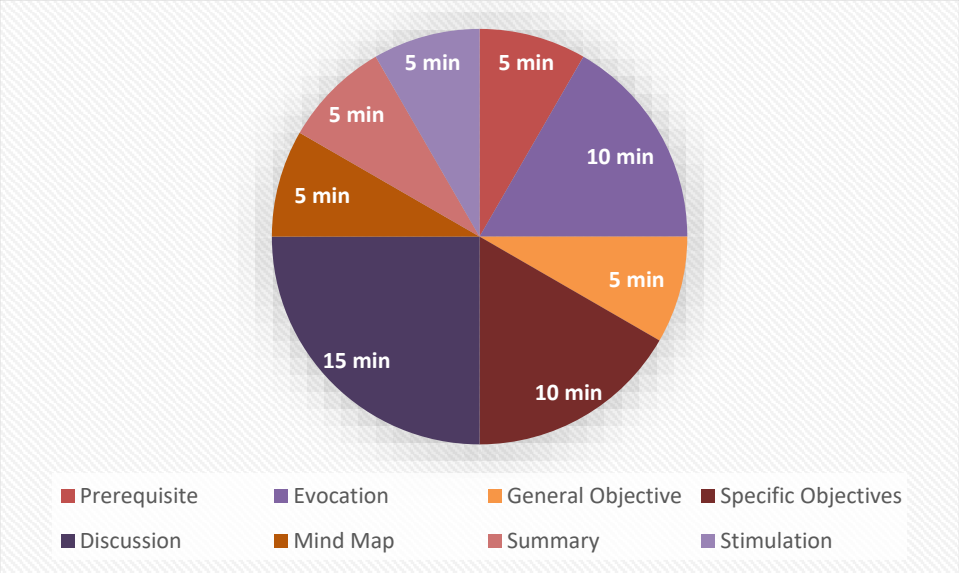
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	I/III
Subject Title	Allied: Allied Physics – Paper I
Code	21UPHA11 / 21UPHA31
Hours	4
Total Hours	60
Credits	3
Max Marks	100
Unit & Title	Unit V- SONAR
Name of the Faculty	Ms. A. Lucas Rexceline
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding sound waves, their propagation, and interaction with mediums.

Micro-Planning



1. **Topic for Learning through Evocation:**

SONAR, or Sound Navigation and Ranging, is like the "eyes" of the underwater world, allowing us to explore the depths of oceans and discover what lies beneath. Much like how bats use echolocation to navigate and find prey, SONAR sends out sound waves that travel through water, bouncing back when they hit an object. This technology has been vital in mapping the ocean floor, detecting submarines, and tracking marine life. Students can draw parallels between SONARs principles and the way sound travels through different mediums, reflecting on its components and how they work together to provide valuable data.

2. Topic Introduction:

1. The term SONAR is an acronym for Sound Navigation and Ranging.
2. SONAR technology was developed to detect objects underwater using sound waves.
3. The basic principle of SONAR is based on the emission of sound pulses, which travel through water, reflect off objects, and return to the source, helping to determine the distance, shape, and nature of submerged objects.

3.1. General Objective:

Enables the students to understand the principles, functioning, and applications of SONAR technology.

3.2. Specific Objectives:

To enable the students to:

1. Describe the basic working principle of SONAR.
2. Explain the types of SONAR systems used for different purposes.
3. Analyze the role of sound waves in detecting objects underwater.
4. Compare active and passive SONAR systems.
5. Identify the applications of SONAR in marine exploration, navigation, and scientific research.

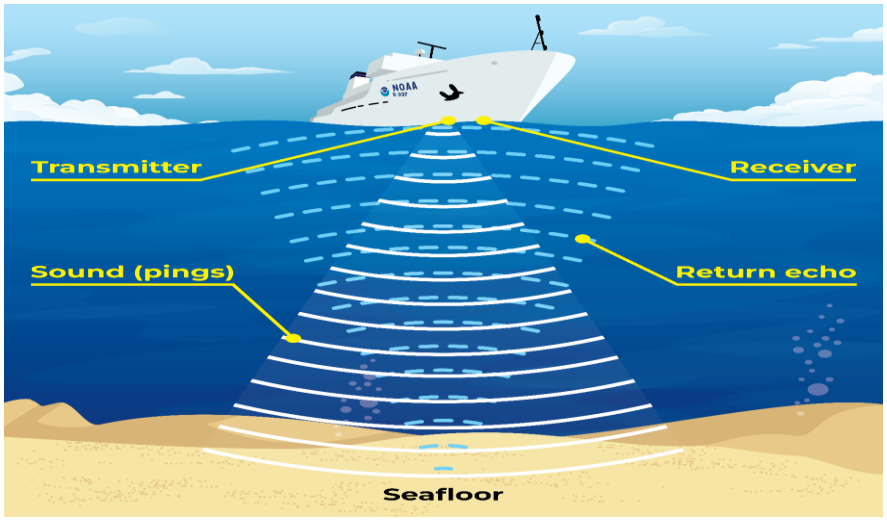
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2,5	1,2,5				
B. Conceptual Knowledge		2,5	2,5			
C. Procedural Knowledge			4	3		
D. Meta Cognitive Knowledge				3,4		

3.4. Keywords:

SONAR, Sound Waves, Reflection, Underwater Detection, Acoustic Signals

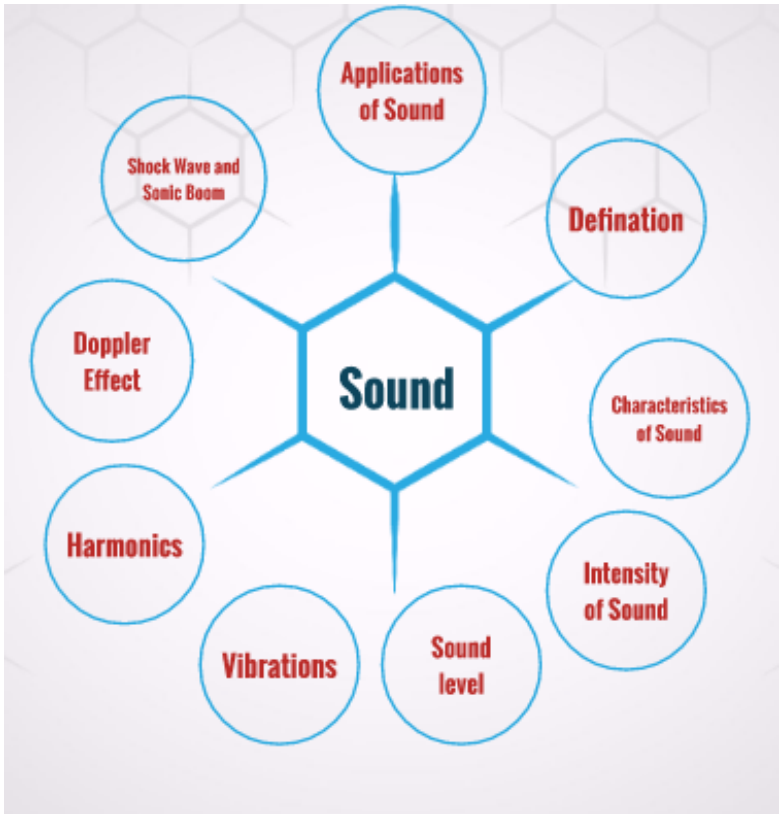
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the working principle of SONAR. One of the students will be asked to explain how SONAR is used for detecting objects underwater, followed by a demonstration using examples from real-life applications like submarine navigation and fish finding.

4. Mind Map:



5. Summary:

Students will be asked to identify how SONAR technology works and explain its evolution over time, illustrating the principle of sound wave reflection and navigation through a mind map.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generating a mental idea about how SONAR can be used in other fields, such as medical imaging (e.g., ultrasound).
2. Discussing the limitations of SONAR in terms of its accuracy and range.
3. Analysing different types of SONAR systems used in submarines and oceanography and their applications.

7. FAQs:

1. What is the principle of SONAR?
   (a) Reflection of sound waves (b)Absorption of sound waves
   (c) Transmission of light waves (d) Reflection of light waves
2. What is the main function of SONAR?
   (a) To detect objects on land (b) To navigate airways
   (c) To detect objects underwater (d) To monitor temperature
3. In SONAR, what happens when sound waves are reflected back to the source?
   (a) The object is detected (b) The signal is lost
   (c) The waves are absorbed (d) The waves break apart
4. Which type of SONAR is used for measuring the distance to an object underwater?
   (a) Active SONAR (b)Passive SONAR
   (c) Reflective SONAR (d) Echolocation SONAR
5. What is a common limitation of SONAR technology?
   (a) It's inability to detect underwater objects
   (b) It's dependence on high frequencies only
   (c) It's limited range in deep waters
   (d) It's requirement for direct line of sight.

8. References:

1. A. Ubald Raj & G. Jose Robin, Allied Physics I, Indra Publications, Marthandam, 2016.
2. A. Ubald Raj & G. Jose Robin, Allied Physics, Indra Publications, Marthandam, 2004.
3. Dr. G. Natarajan, Engineering Physics – I, Sri Krishna publications, Chennai, 2004.
4. R. Murugesan, Properties of matter, S. Chand & Co. Ltd., New Delhi, 2008.
5. D. S. Mathur, Properties of matter, Shyamalal charitable trust, New Delhi, 1992.
6. Brijlal& Subramanian, A text book of Optics, S. Chand & Co. Eurasia Publishing House (Pvt.) LTD, New Delhi, 2014.

A. Lucas Rexeline.
Verified by Subject Expert

Approved by HOD

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LESSON PLAN

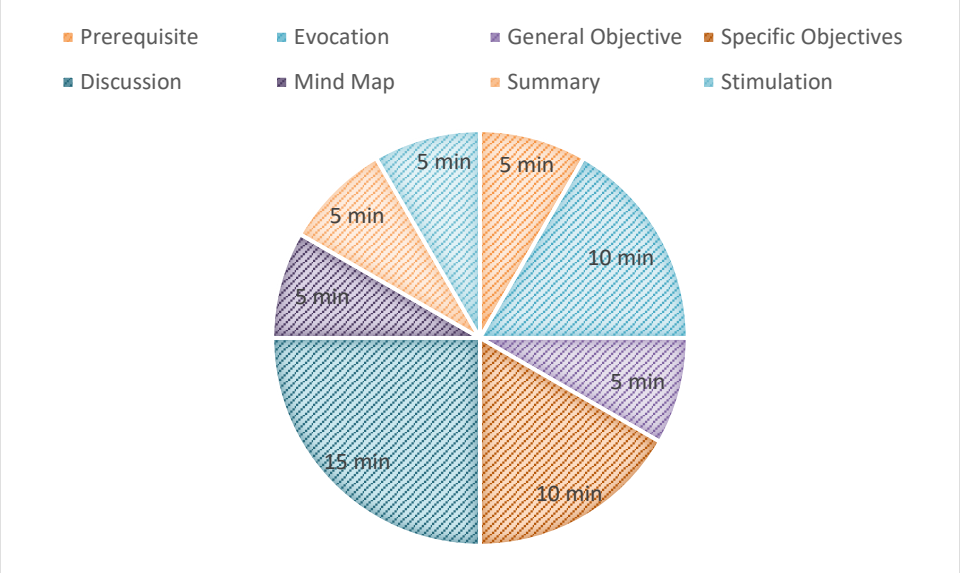
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	I
Subject Title	Skill Enhancement Course – I: Professional English for Physics – I
Code	21UPHPE1
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit V - Creative writing
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding the structure and function of a thesis statement in academic writing.

Micro-Planning



1. **Topic for Learning through Evocation:**

Creative writing serves as a bridge that connects the boundless realm of imagination to the structured world of expression. Just as ancient explorers charted unknown territories, writers navigate the depths of their thoughts and emotions to craft stories, poems, and essays that resonate with readers. This topic invites students to embark on a journey of self-discovery and artistic exploration, encouraging them to experiment with language, form, and style to create compelling narratives that leave a lasting impact. Through evocation, students will learn to breathe life into their ideas, transforming abstract visions into vivid, tangible creations.

2. Topic Introduction:

Creative writing is the art of weaving imagination into words, creating worlds that captivate, inform, and inspire. It is a form of self-expression that goes beyond the mundane, giving life to thoughts, emotions, and ideas in a way that resonates deeply with readers. Just as pteridophytes adapted to their environment, creative writing evolves with the writer's experiences, shaping and reshaping narratives to connect with diverse audiences.

3.1. General Objective:

To enable students to develop skills in crafting compelling, imaginative, and impactful creative content that aligns with professional standards.

3.2. Specific Objectives:

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

1. Analyse the components of a compelling narrative structure.
2. Differentiate between various forms of creative writing (e.g., storytelling, poetry, essays).
3. Apply techniques to enhance creativity and maintain professional tone in writing.
4. Develop original content with clarity, coherence, and sophistication.

3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1, 2	1, 2				
B. Conceptual Knowledge		1, 2	3			
C. Procedural Knowledge			3	1, 4	2	4
D. Meta Cognitive Knowledge				1, 4	2	4

3.4. Keywords:

Creative Writing, Narrative Structure, Storytelling, Poetry, Essays, Professional Tone, Original Content

Discussion:

Students will be asked to reflect on various elements that contribute to a well-crafted essay or creative writing piece. Key questions might include:

- How do you balance creativity and structure in writing?
- What role do sensory details play in bringing a narrative to life?
- How can creative writing techniques enhance the overall message of an essay?

One student will be selected to write a brief essay or passage using one creative writing technique (e.g., vivid imagery, dialogue, or emotional appeal). This will allow the class to examine how different techniques shape storytelling and essay writing.

4. Mind Map:

5. Summary:

Students will summarise key concepts discussed during the lesson, focusing on how creative writing can be integrated into essays. They will practice refining their writing by identifying a central theme, using relevant techniques (like metaphors or descriptive language), and summarizing their essays with clarity and impact.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generating Mental Ideas: Students will be tasked with imagining an essay or creative writing scenario and how they would use storytelling techniques to craft an engaging narrative.

2. Producing the E-content: In groups, students will write and share a short creative essay, using their understanding of structure, style, and creativity.
3. Practical Application: Students will be given a topic and asked to incorporate storytelling elements such as setting, characterisation, or symbolism, then assess the overall impact of their piece.

7. FAQs:

1. Which of the following is most important when writing a creative essay?
   (a) Strict adherence to facts
   (b) The use of complex language
   (c) Creativity and emotional engagement
   (d) Length of the essay
2. What is the role of a metaphor in creative writing?
   (a) To confuse the reader
   (b) To provide deeper meaning and insight
   (c) To reduce clarity
   (d) To shorten the narrative
3. How do you ensure your creative writing flows effectively?
   (a) Use long paragraphs without breaks
   (b) Focus on strong transitions and pacing
   (c) Avoid any variation in sentence structure
   (d) Use no descriptive language
4. Which of these is a key feature of effective creative writing?
   (a) Repetition of words
   (b) Vivid sensory descriptions and strong emotional appeal
   (c) Sticking strictly to one theme
   (d) Avoidance of personal reflection

8. References:

Material from the Department of Physics

Dhanalakshmi. P.
Verified by Subject Expert

Approved by HOD

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LESSON PLAN

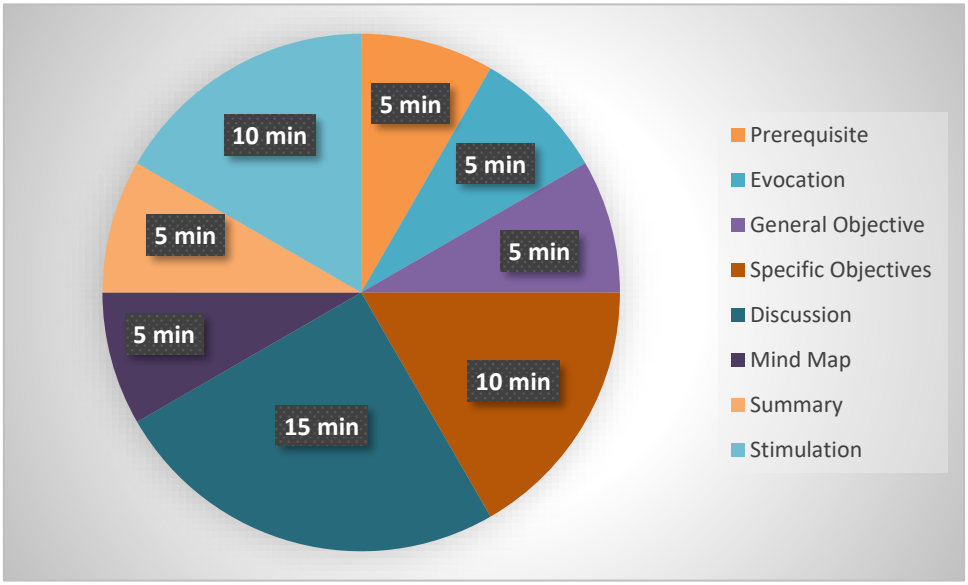
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	II
Subject Title	Core II: Thermal Physics and optics
Code	21UPHC21
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit III- Dispersive power
Name of the Faculty	Dr. Sr. Jessie Fernando
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Knowledge of refraction, refractive index, and the dependence of refractive index on wavelength.

Micro-Planning



1. Topic for Learning through Evocation:

Dispersive power describes how a material splits white light into its constituent colours due to varying refractive indices for different wavelengths. This phenomenon can be observed in prisms and rainbows. It helps understand why shorter wavelengths, like violet, bend more than longer wavelengths, like red. Isaac Newton's experiments with light revealed the dispersion of white light. Dispersive power is mathematically related to the refractive indices of specific wavelengths. Materials with high dispersive power, like flint glass, are used in optics. Students can relate this to everyday observations, such as colour

fringes in lenses. This concept is foundational in studying chromatic aberration and designing optical instruments.

2. Topic Introduction:

Dispersive power is the ability of a medium to separate white light into its constituent colours based on wavelength. It arises because the refractive index of a material varies for different wavelengths of light. This property explains the formation of rainbows and the splitting of light by a prism. Dispersive power is crucial in understanding optical phenomena and designing instruments like spectroscopes. Its study connects physics principles with practical applications in optics.

3.1. General Objective:

To enable students to understand the concept of dispersive power and its role in the separation of light into its constituent colours, as well as its applications in optical systems.

3.2. Specific Objectives:

1. To explain the concept of dispersive power and its mathematical expression.
2. To describe how dispersive power varies for different materials.
3. To illustrate the phenomenon of dispersion using examples like prisms and rainbows.
4. To analyse the relationship between refractive index and wavelength in dispersion.
5. To demonstrate the practical applications of dispersive power in optical instruments.

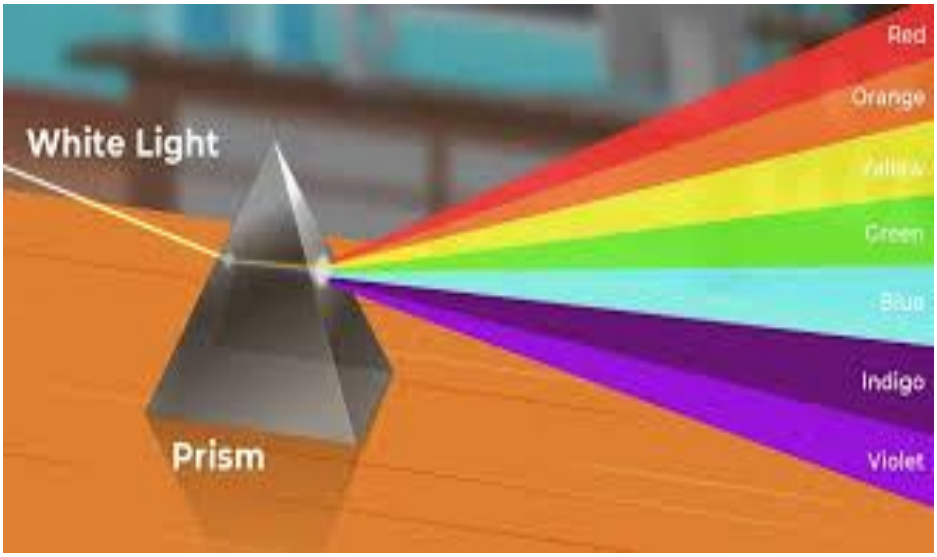
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1,2				
B. Conceptual Knowledge	1	1	3	4		
C. Procedural Knowledge			3	4	5	5
D. Meta Cognitive Knowledge		2			5	5

3.4. Keywords:

Dispersion, Dispersive Power, Refractive Index, Wavelength, Prism

3.5. Key Diagram:

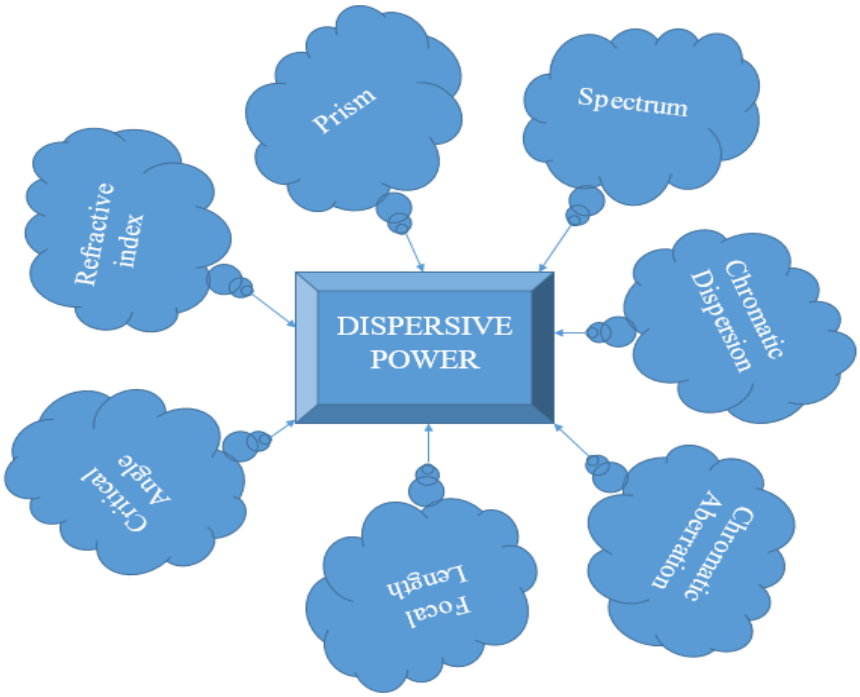


Discussion:

The students will be asked questions regarding the dispersive power of materials. One of the students will be asked to explain the formula for dispersive power and demonstrate its application in a practical scenario, such as calculating the dispersive power for a prism.

Additionally, a student can be asked to draw a diagram illustrating the dispersion of white light through a prism, labelling the refracted and dispersed colours to reinforce their understanding visually.

4. Mind Map:



5. Summary:

Dispersive power is a key optical property that measures a material's ability to separate light into its constituent colours, determined by the variation of refractive index with wavelength. It plays a crucial role in optics, influencing the design of prisms, lenses, and instruments like spectrometers. Factors affecting dispersive power include the material's properties and the wavelength range of light.

By using stimulating questions, students can connect theoretical concepts with real-world phenomena, such as rainbows and chromatic aberrations. Analogies help simplify complex ideas, like comparing dispersion to separating a symphony into individual notes. Exploring advanced concepts like Abbe numbers or emerging technologies like photonic crystals provides depth and a futuristic perspective.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Why do we see a rainbow after rainfall? How does this relate to dispersive power?
2. Can two materials have the same refractive index but different dispersive powers? Why or why not?
3. Discuss the role of materials with controlled dispersive properties in emerging technologies like photonic crystals or metamaterials.
4. Explore how dispersion affects technologies like spectroscopy in chemistry or chromatic aberration in photography.
5. Imagine a prism made of a material with no dispersive power. What would happen to white light passing through it?

7. FAQs:

1. What is dispersive power?
2. How is dispersive power mathematically expressed?
3. What factors affect dispersive power?
4. What is the significance of dispersive power in optics?
5. How does dispersive power differ from refractive index?

8. References:

1. Ubald Raj A. and Jose Robin G. *Mechanics and Thermal Physics*. Marthandam: Indira publication.
2. Murugeshan R. *Thermal Physics and Geometrical Optics*.
3. MurugeshanKiruthigaSivaprasath R. *Optics and Spectroscopy*. S. Chand & Company Ltd. Revised edition 2014.
4. Gupta B. and Roy H.P. *Thermal Physics*. Books and Allied (P) Ltd., Second edition 2005.
5. Brijlal and Subramanyam N. *Heat and thermodynamics*, S. Chand & Co. Ltd. 2005.
6. Arunabhasen and Gupta A. B. *College Physics.* volume I. Books and Allied (P) Ltd. 2005.
7. Brijlal and Subramanyam N. *Optics*. S. Chand & Co. Revised by M.N. Avadhanulu. 23rd revised edition 2006.

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LESSON PLAN

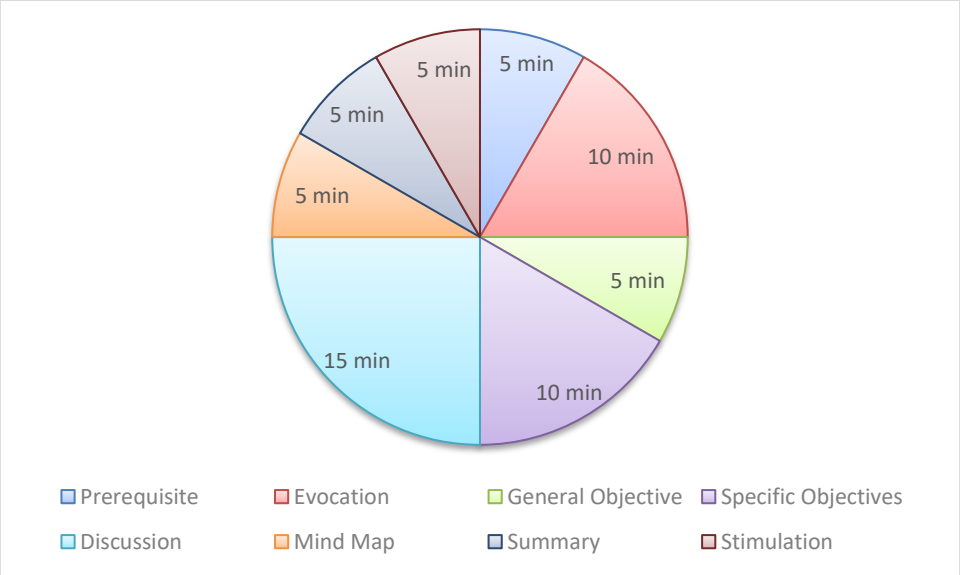
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	II/IV
Subject Title	Allied: Allied Physics – Paper II
Code	21UPHA21 / 21UPHA41
Hours	4
Total Hours	60
Credits	3
Max Marks	100
Unit & Title	Unit III-Natural radioactivity
Name of the Faculty	Ms. A. Lucas Rexceline
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of atomic structure, isotopes, and the concept of unstable nuclei.

Micro-Planning



1. Topic for Learning through Evocation:

Natural radioactivity is the spontaneous emission of particles or energy from the nucleus of unstable atoms, a phenomenon that has existed since the Earth's formation. It serves as a reminder of the dynamic forces within atoms that power natural processes. Radioactive elements like uranium and thorium are Earth's hidden storytellers, found deep within rocks and soil, slowly transforming over millennia. Their decay releases energy that has driven the heat of our planet's core and powered the creation of elements during stellar processes. Just as pteridophytes laid the groundwork for terrestrial ecosystems, natural radioactivity has shaped Earth's evolution, fueling geothermal activity and influencing the planet's chemical

composition. Students could explore how different types of radiation, alpha, beta, and gamma, interact with matter, akin to vascular bundles transporting nutrients, revealing the interconnected nature of the universe.

2. Topic Introduction:

1. Natural radioactivity refers to the spontaneous emission of radiation from the nuclei of certain elements without any external influence.
2. The phenomenon was first discovered by Henri Becquerel in 1896, when he observed the emission of radiation from uranium salts.
3. Natural radioactivity occurs in unstable isotopes of elements such as uranium, thorium, and radon, which undergo decay processes to become more stable by emitting alpha, beta, or gamma radiation. This process is a key aspect of nuclear physics and plays a significant role in understanding the age of geological formations and the behaviour of certain elements in nature.

3.1.General Objective:

To enable the students to understand the concept of natural radioactivity, its origins, and its significance in various scientific fields.

3.2. Specific Objectives:

Enables the students to:

1. Describe the process of natural radioactivity and its types (alpha, beta, and gamma decay).
2. Explain the sources of natural radioactivity, including isotopes like uranium, thorium, and radon.
3. Analyze the role of natural radioactivity in geological dating and environmental science.
4. Distinguish between natural and artificial radioactivity.
5. Demonstrate the safety measures and precautions involved in handling radioactive materials.

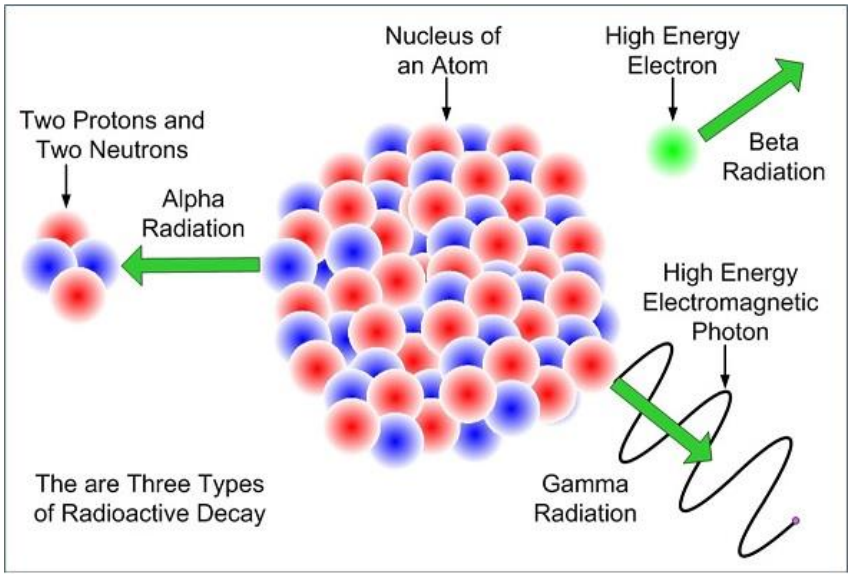
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1, 2	1, 2				
B. Conceptual Knowledge		2		3		
C. Procedural Knowledge				3,5	4	
D. Meta Cognitive Knowledge				3, 5	4	4, 5

3.4. Keywords:

Radioactivity, Alpha decay, Beta decay, Gamma radiation, Half-life

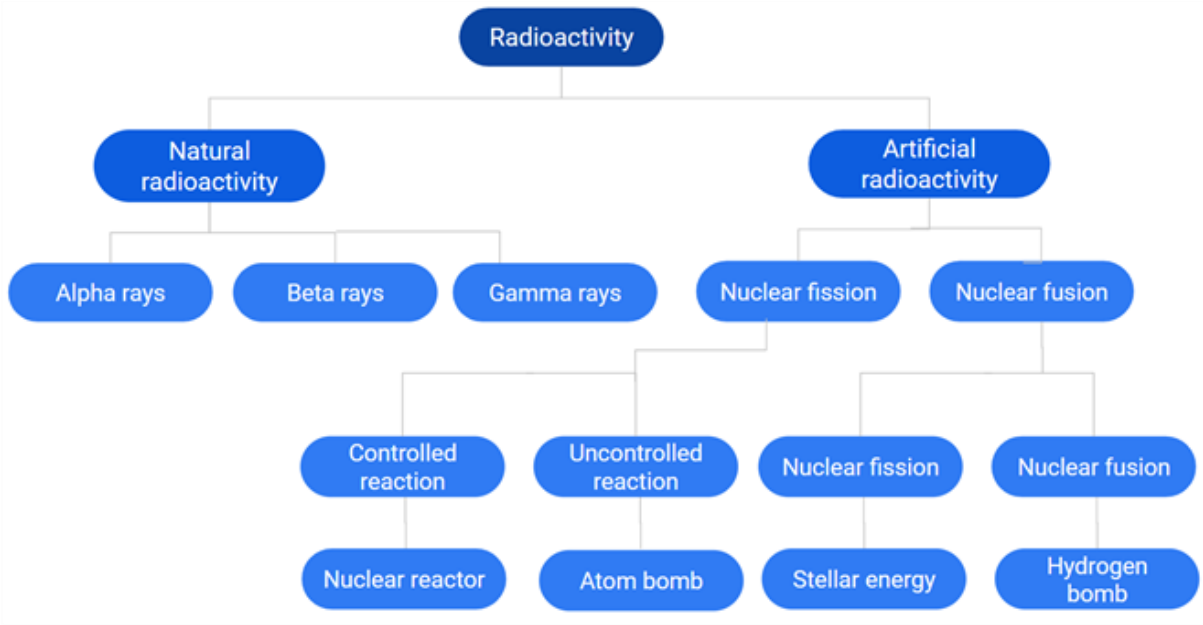
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the types of radiation (alpha, beta, and gamma) and the concept of half-life. One student will be asked to demonstrate the process of radioactive decay through a diagram or model.

4. Mind Map:



5. Summary:

Students will be asked to summarise the different types of natural radioactivity and how they occur in isotopes, using a mind map to identify the types of radiation and their characteristics.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Exploring the analogy of natural radioactivity with everyday phenomena like the decay of food or the transformation of energy in natural processes.
2. Generating mental ideas about creating an e-content on the process of radioactive decay.
3. Producing the e-content for educational purposes.
4. Given various isotopes, students will be asked to identify the type of radiation emitted by each based on its properties.

7. FAQs:

1. What is the primary type of radiation emitted during natural radioactivity?
2. What is the definition of half-life in the context of radioactivity?
3. Which type of radiation is most penetrating?
4. What happens to the mass number of an atom during beta decay?
5. Which type of radiation involves the emission of high-energy photons?

8. References:

1. A. Ubald Raj, Electromagnetism and Plasma Physics, Indra Publications, Marthandam, 1998.
2. A. Ubald Raj & G. Jose Robin, Allied Physics II, Indra Publications, Marthandam, 2016.
3. A. Ubald Raj & G. Jose Robin, Allied Physics, Indra Publications, Marthandam, 2004.
4. R. Murugesan, Electricity and Magnetism.S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
5. Brijlal& Subramanian, Electricity and Electromagnetism, S. Chand & Co. Eurasia Publishing House (Pvt. Ltd), Ram Nagar, New Delhi, 1985.
6. K.K. Tewari, Electricity and Magnetism, Sultan Chand & Co, New Delhi, Reprint-2nd edition ,1994

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LESSON PLAN

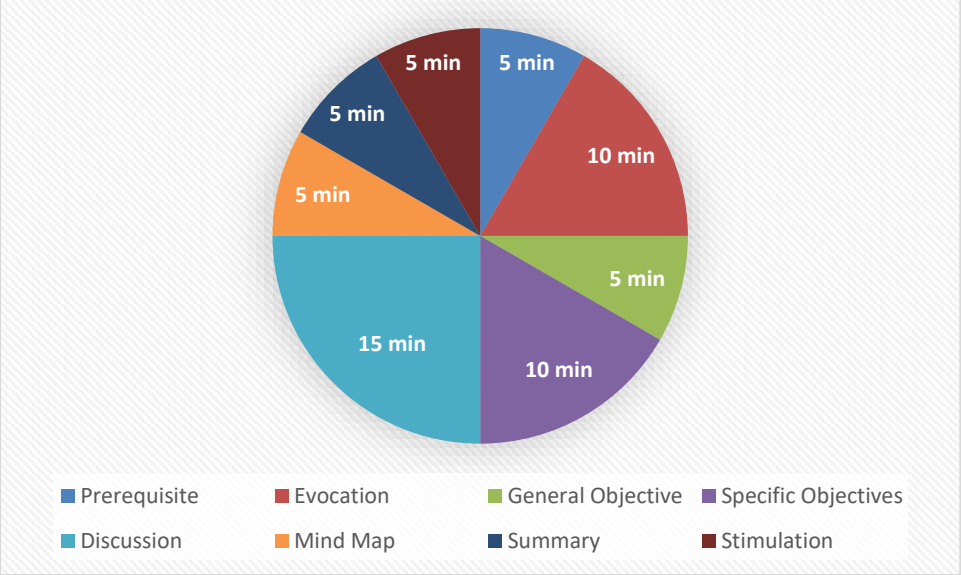
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	II
Subject Title	Skill EnhancementCourse – II: Professional English forPhysics –II
Code	21UPHPE2
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit V - Writing slogans
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding the purpose and impact of effective slogan writing.

Micro-Planning



1. **Topic for Learning through Evocation:**

   Slogans are the heartbeat of communication, evoking emotions, ideas, and aspirations in a few impactful words. They serve as a bridge between a brand or message and its audience, capturing attention and leaving lasting impressions. By tapping into the power of evocative language, students can create slogans that are concise, meaningful, and aligned with professional goals. This activity challenges learners to explore the art of wordplay, emotional resonance, and cultural nuances, enabling them to craft slogans that inspire, persuade, and connect in diverse professional contexts.

2. Topic Introduction:

A slogan is a powerful tool in communication, encapsulating a message or identity in just a few words. It originates from the Scottish Gaelic word *sluagh-ghairm*, meaning "battle cry." In modern times, slogans are widely used in branding, marketing, and professional environments to create memorable impressions.

Effective slogans serve as pillars of communication, much like the vascular bundles in plants, channeling core ideas in a concise and impactful manner. By exploring the art and science behind slogans, learners can enhance their professional English skills while mastering the techniques to craft messages that resonate with diverse audiences.

3.1. General Objective:

To enable the students to understand the principles of creating effective slogans for professional contexts.

3.2. Specific Objectives:

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

1. Define the purpose and importance of slogans in professional communication.
2. Identify key elements of an effective slogan, such as brevity, clarity, and creativity.
3. Analyze examples of successful slogans and understand the strategies behind them.
4. Develop original slogans tailored to specific scenarios, such as branding, marketing, or organisational communication.
5. Evaluate the impact and adaptability of slogans for different cultural and professional audiences.

3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		1,2	2	3		
C. Procedural Knowledge			4	3,5		4
D. Meta Cognitive Knowledge					5	4, 5

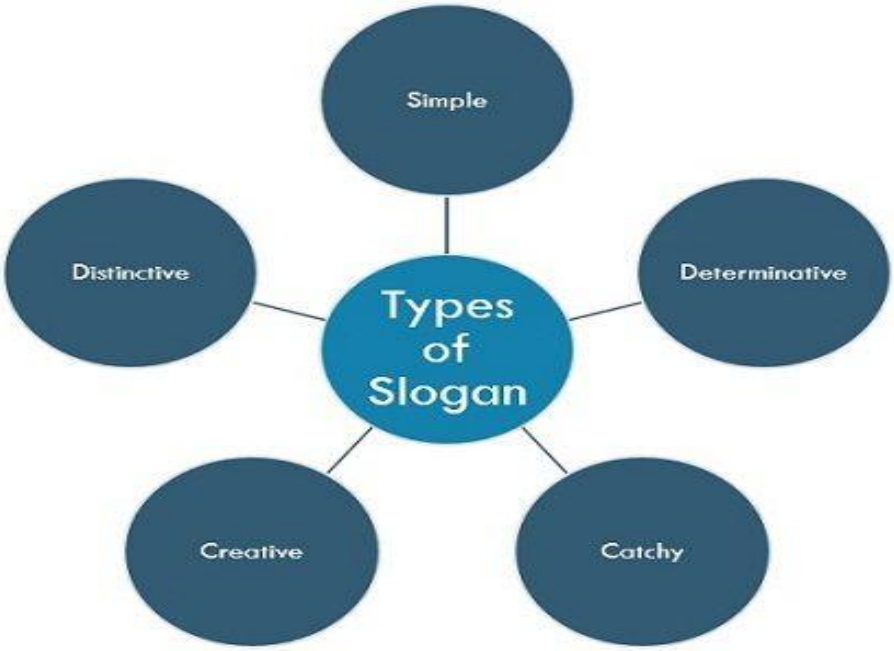
3.4. Keywords:

Brevity,Clarity,Creativity,Impact, Relevance

Discussion:

The students will be asked questions regarding the types of slogans and their impact in professional communication. One student will be asked to create a slogan based on a given scenario (e.g., marketing for a new product). The students will then analyze different examples of successful slogans from brands and explain the strategies behind them.

4. Mind Map:



5. Summary:

Students will be asked to identify how the process of creating effective slogans evolves through brainstorming, iteration, and refinement by using a mind map. They will map out the key components of a successful slogan and discuss how these elements interact to create an impactful message.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generating ideas about creating an e-content piece that explains the process of writing impactful slogans.
2. Producing the e-content, focusing on demonstrating the steps involved in crafting a successful slogan.
3. Provided with examples of existing slogans, students will be asked to identify the key elements (brevity, clarity, creativity) and discuss how these elements contribute to the slogan's effectiveness.

7. FAQs:

1. Find out the incorrect statement about slogans:

   (a) A good slogan is long and detailed.
   (b) An effective slogan should be memorable and concise.
   (c) A slogan should always reflect the brand's identity.
   (d) The slogan must be applicable to all audiences, regardless of context.

2. Identify the key characteristic of a successful slogan:

   (a) Length and complexity.
   (b) Brevity and clarity.
   (c) Use of technical jargon.
   (d) Complexity and hidden meaning.

3. Recall that an effective slogan should:

   (a) Be long and complex.
   (b) Convey the brand's core message simply and clearly.
   (c) Use overly artistic language.
   (d) Include a detailed explanation of the product.

4. Mention the key element of a memorable slogan:

   (a) Brevity and clarity.
   (b) Complexity and length.
   (c) Excessive details.
   (d) Emotional appeal only.

8. References:

Material from the Department of Physics

Dhanalakshmi. P.

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LESSON PLAN

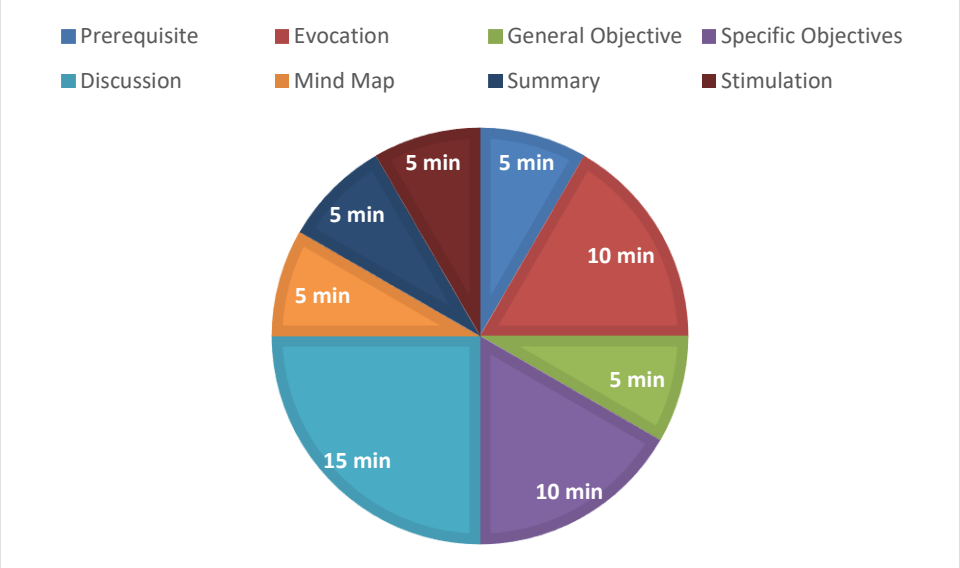
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	III
Subject Title	Core III: Electricity and Electromagnetism
Code	21UPHC31
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	Unit III- Mutual Induction
Name of the Faculty	Dr. M. Sheeba
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of basic electromagnetism, Faraday's Law of Induction, Ampère's Law, and circuit theory.

Micro-Planning



1. **Topic for Learning through Evocation:**

Imagine two coils of wire placed close to each other, but not physically connected. When an electric current flows through one coil, it creates a magnetic field. This magnetic field passes through the second coil and induces an electromotive force (EMF) in it, even though there is no direct contact between the coils. This phenomenon is called mutual induction. Just like how the earth’ smagnetic field affects compasses, mutual induction demonstrates how one coils changing magnetic field influences another coil’ s current. This principle is the basis for devices like transformers, which help regulate electrical voltage. Students can visualise this interaction by thinking of a radio antenna picking up signals from nearby stations, a form of mutual induction. Understanding mutual induction provides insight into how energy is

transferred without physical connection. Reflecting on real-life applications like induction cooktops and wireless charging will deepen students' appreciation of this principle.

2. Topic Introduction:

Mutual induction is a fundamental concept in electromagnetism, where a changing magnetic field in one coil induces an electromotive force (EMF) in a nearby coil. This phenomenon is the basis for the operation of transformers, electric motors, and inductive coupling. In mutual induction, when current flows through the first coil, it creates a magnetic field that changes over time, inducing a current in the second coil. This principle is used in various devices to transfer energy and signals without direct electrical contact. Understanding mutual induction helps in the development of efficient electrical systems, such as wireless power transfer and electromagnetic waves in communication.

3.1. General Objective:

To understand the principles of mutual induction and its role in electromagnetic phenomena, as well as its applications in devices like transformers, electric motors, and wireless power transfer systems.

3.2. Specific Objectives:

Students will be able to

1. Explain the working principle of mutual induction and how a changing magnetic field in one coil induces an electromotive force (EMF) in a nearby coil.
2. Identify and describe the different applications of mutual induction, including transformers, inductive charging systems, and wireless power transfer.
3. Analyse the relationship between the number of turns in a coil, the rate of change of current, and the induced EMF in mutual induction.
4. Evaluate the practical uses of mutual induction in modern electrical devices and its role in energy transfer and signal processing.
5. Investigate the efficiency and limitations of mutual induction in real-world applications, such as power transmission and electromagnetic communication.

3.3. Taxonomy of Objectives:

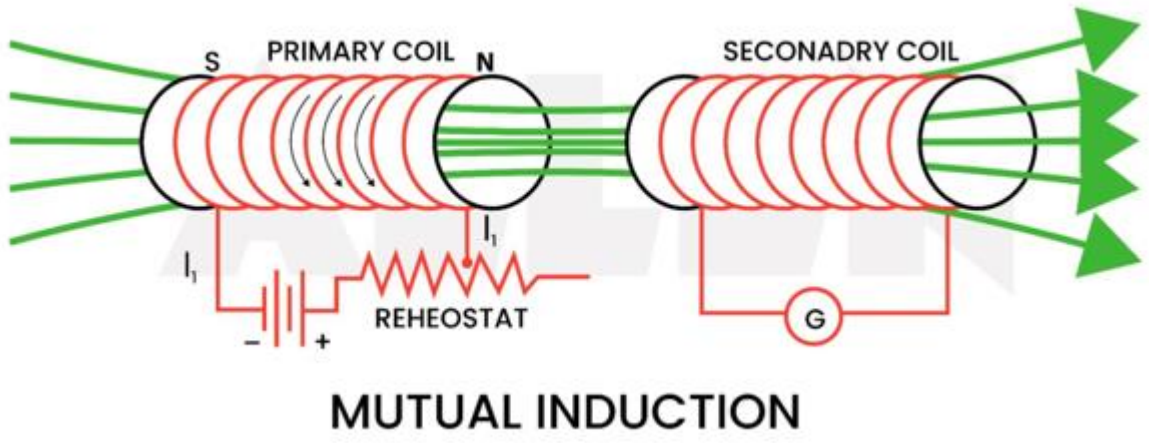
Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		2,4	2,4			
C. Procedural Knowledge				3,5		
D. Meta Cognitive				4,5	4,5	4,5

Knowledge						

3.4. Keywords:

Induced EMF, Magnetic Flux, Coils, Electromagnetic Induction, Faraday's Law

3.5. Key Diagram:

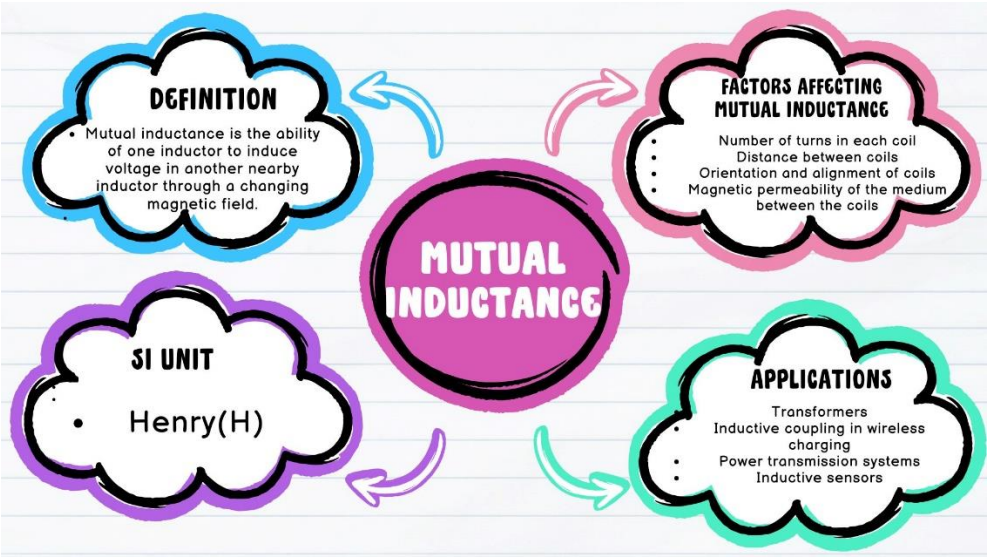


Discussion:

The students will be asked questions regarding the concept of mutual induction. They will explore how mutual induction occurs between two coils when the magnetic flux of one coil induces an electromotive force (EMF) in the other coil.

One of the students will be asked to draw a diagram illustrating the setup of mutual induction, showing the two coils, the magnetic flux, and the induced EMF in the second coil. This will help them visualise the process and solidify their understanding of the relationship between current, magnetic fields, and induction in electrical circuits.

4. Mind Map:



5. Summary:

Students will be asked to identify how mutual induction occurs in electromagnetic systems by using a mind map. This activity will help students visualise and organise the relationships between key concepts such as magnetic flux, induced emf, and the influence of one coil on another. By connecting these ideas, students will better understand the process and applications of mutual induction, such as in transformers and inductive coupling.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Students will be asked to imagine how mutual induction works in everyday electrical devices, such as transformers or wireless chargers. This will help them visualise the concept and its practical applications.
2. Students will be tasked with creating e-content (videos or presentations) that explain the process of mutual induction, including key concepts such as magnetic flux, induced emf, and the role of coils in this phenomenon.
3. Students will be provided with basic equipment, such as coils and magnets, to demonstrate mutual induction. They will be asked to set up experiments and observe the induced emf in a secondary coil when the magnetic field of a primary coil changes. This hands-on activity will reinforce the concept through real-world application.

7. FAQs:

1. What is mutual induction?
2. How does mutual induction differ from self-induction?
3. What is the formula for mutual induction?
4. What factors affect mutual induction?
5. What are the applications of mutual induction?

8. References:

1. Murugeshan R. *Electricity and Magnetism*. New Delhi: S. Chand & company Ltd.Reprint, 2019.
2. Dr.Tewari K.K. *Electricity and Magnetism with Electronics.* New Delhi: S. Chand & company Ltd. Reprint, 2018.
3. Brijlal and Subramanium. *Electricity and Magnetism*. Ratan Prakash mandir. 7th edition 1994.
4. Tayal D.C. *Electricity and Magnetism*. Himalaya Publishing House. 3rd revised edition 1998.
5. David Halliday, Robert Resnick and Jearl Walker. *Fundamentals of Physics.* Wiley & Sons Inc. 6th edition 2006.

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LESSON PLAN

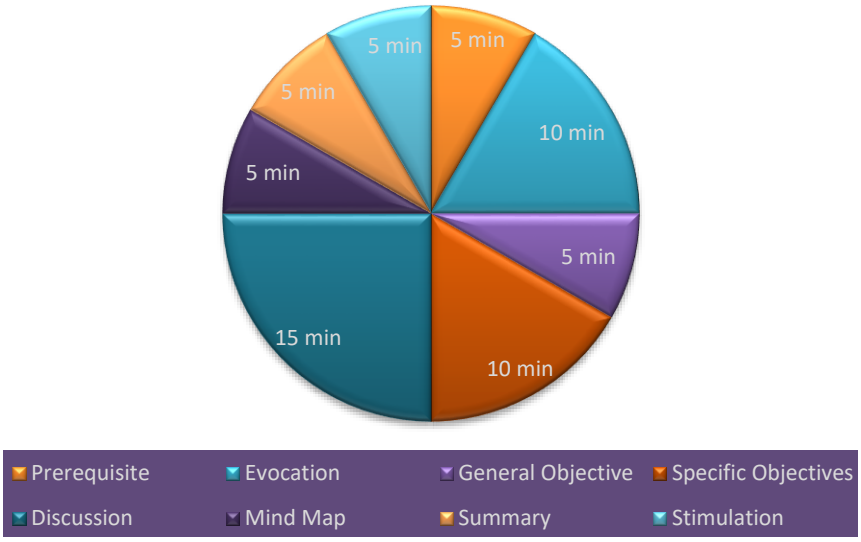
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	III
Subject Title	Skill Based Elective: Instrumentation Physics
Code	21UPHS31
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit IV: Lasers in Medicine
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of laser principles and their interaction with biological tissues.

Micro-Planning



1. **Topic for Learning through Evocation:**

   Lasers in medicine have revolutionized various medical fields by offering precise, minimally invasive treatments. These high-intensity light beams can be focused on specific tissues, allowing for cutting, coagulation, or vaporization without the need for traditional surgical methods. Lasers are used in procedures such as eye surgeries (like LASIK), dental treatments, cancer treatments, and skin therapies. Their ability to target specific areas with minimal damage to surrounding tissues makes them a preferred option in many medical applications. Understanding the underlying principles of laser technology, its types, and its applications in different medical specialties can significantly enhance students' comprehension of this cutting-edge treatment.

2. Topic Introduction:

1. The term "laser" is an acronym for Light Amplification by Stimulated Emission of Radiation.
2. Lasers have become a revolutionary tool in modern medicine, with applications ranging from surgery to diagnostics.
3. In medical treatments, lasers are used for their precision and ability to focus energy on a specific area, minimising damage to surrounding tissues.

3.1. General Objective:

To enable the students to understand the applications and principles of laser technology in medicine.

3.2. Specific Objectives:

Students will be able to

1. Describe the fundamental principles of laser technology and its medical applications.
2. Identify the types of lasers used in medical procedures.
3. Explain how lasers are used in various medical fields, such as surgery, ophthalmology, and dermatology.
4. Analyse the safety considerations and potential risks of using lasers in medical treatments.
5. Evaluate the effectiveness of lasers in different therapeutic and diagnostic procedures.

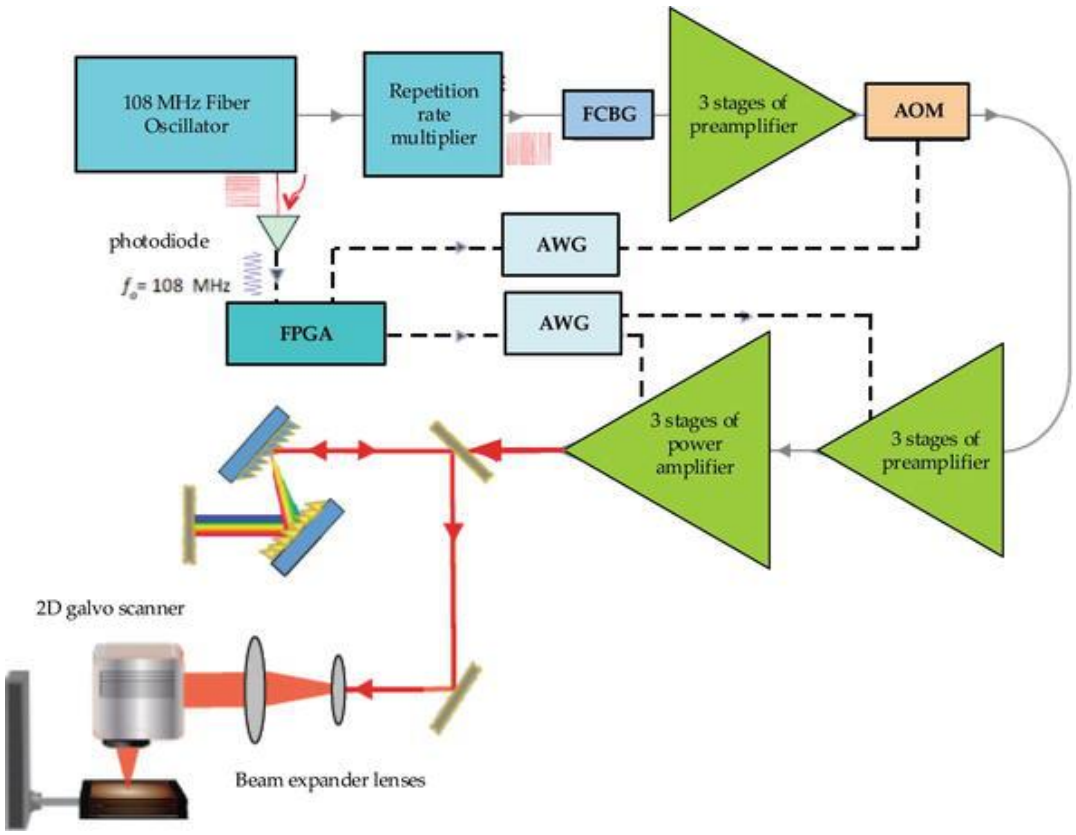
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		2,3	2,3			
C. Procedural Knowledge				4,5		
D. Meta Cognitive Knowledge				4,5	5	5

3.4. Keywords:

Laser, Photobiomodulation, Medical applications, Tissue healing, Laser surgery

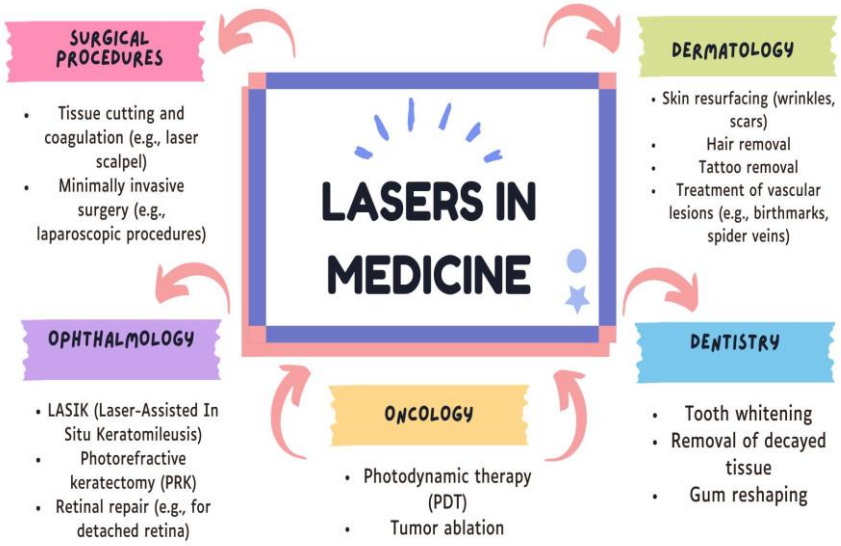
3.5. Key Diagram:



Discussion:

The students will be asked to discuss the various applications of lasers in medicine, such as their use in surgery, diagnostics, and tissue regeneration. They will be encouraged to think about the types of lasers used in medical treatments and the advantages of using lasers over traditional methods. One student will be asked to demonstrate the working principle of lasers using a basic diagram of laser light interaction with tissues.

4. **Mind Map:**



5. Summary:

Students will be asked to summarise the key concepts regarding the application of lasers in medicine, including the different types of lasers, their medical uses, and how they function to treat various conditions. The summary will be assisted by a mind map to connect concepts such as laser types, treatment areas, and mechanisms.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generating mental ideas about how laser technology can revolutionize the future of surgery and diagnostics.
2. Creating a simulation or e-content on the working of lasers in medical treatments.
3. Provided with case studies on laser treatments for various conditions, students will be asked to identify the most appropriate type of laser for each case.

7. FAQs:

1. Which of the following is NOT a use of lasers in medicine?
   (a) Laser eye surgery (b) Laser skin resurfacing
   (c) Laser removal of tumors (d) Laser-based blood pressure measurement

2. What is the primary mechanism by which lasers aid in tissue healing?
   (a) Photobiomodulation (b) Direct chemical reaction
   (c) Heat-induced coagulation (d) Optical amplification

3. Which type of laser is commonly used in laser eye surgery?
   (a) CO2 laser (b) Nd:YAG laser
   (c) Argon laser (d) Diode laser

4. What is the advantage of laser surgery over traditional surgical methods?
   (a) Less blood loss and faster healing (b) More complicated procedures
   (c) Increased risk of infection (d) Requires larger incisions

5. In what type of medical procedures are lasers used for tumor treatment?
   (a) Photodynamic therapy (b) Endoscopic surgery
   (c) Non-invasive imaging (d) Bone fracture healing.

8. References:

1. Albert D. Helfrick and William D. Cooper. *Modern Electronic Instrumentation and Measurement Techniques.* Prentice-Hall of India Pvt Limited. Reprint, 8th edition 2002.
2. Arumugam M. *Biomedical Instrumentation*. Anuradha Agencies. Reprint, 2002.
3. Kalsi H. S. *Electronic Instrumentation*. Tata Mc Graw Hill Education Pvt. Limited. Reprint 2012.
4. Mani P. *A textbook of Engineering Physics-I.* Dhanam Publications. Reprint, 2013.
5. Jose Robin G and Ubald Raj A. *Applied Physics*. Marthandam: Indira Publications. 3rd edition 1998.

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LESSON PLAN

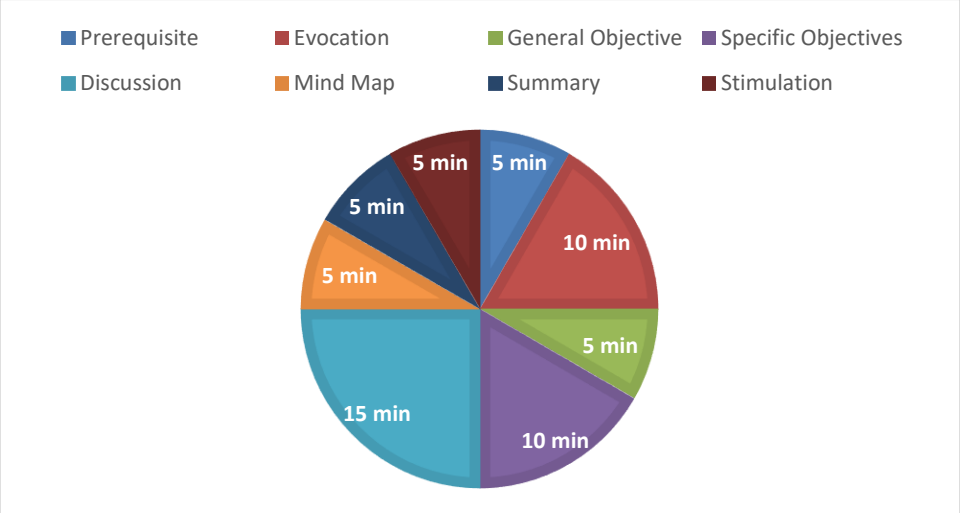
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	III
Subject Title	NME I: Applied Physics I
Code	21UPHN31
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit V- Laser cutting
Name of the Faculty	Dr. M. Sheeba
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of laser technology and its principles, including how lasers interact with materials.

Micro-Planning



1. **Topic for Learning through Evocation:**

Laser cutting is a modern technology that uses focused laser beams to cut, engrave, or etch materials with high precision. It operates on the principle of directing a powerful laser beam onto a material's surface, where the intense heat generated by the beam melts, burns, or vaporizes the material, resulting in a clean and accurate cut. Laser cutting is widely used across various industries for its ability to work with different materials such as metals, plastics, wood, and textiles. It offers benefits like minimal material waste, intricate design capabilities, and high-speed processing. Students are encouraged to explore the principles of laser technology, types of laser cutting systems, and applications in different

fields, understanding how this cutting-edge technology has revolutionised manufacturing and design.

2. Topic Introduction:

1. The term laser cutting refers to a technology that uses a laser to cut materials, often with high precision and accuracy.
2. Laser cutting has revolutionised industries like manufacturing, aerospace, and automotive by enabling faster and more intricate cuts compared to traditional methods.
3. The process involves directing a high-powered laser beam at the material, which melts, burns, or vaporises it to create the desired shape or design. The technique is known for its ability to cut through a wide range of materials, including metals, plastics, and wood, with minimal distortion and clean edges.

3.1. General Objective:

To enable the students to understand the principles, applications, and technology behind laser cutting.

3.2. Specific Objectives:

To enable the students to:

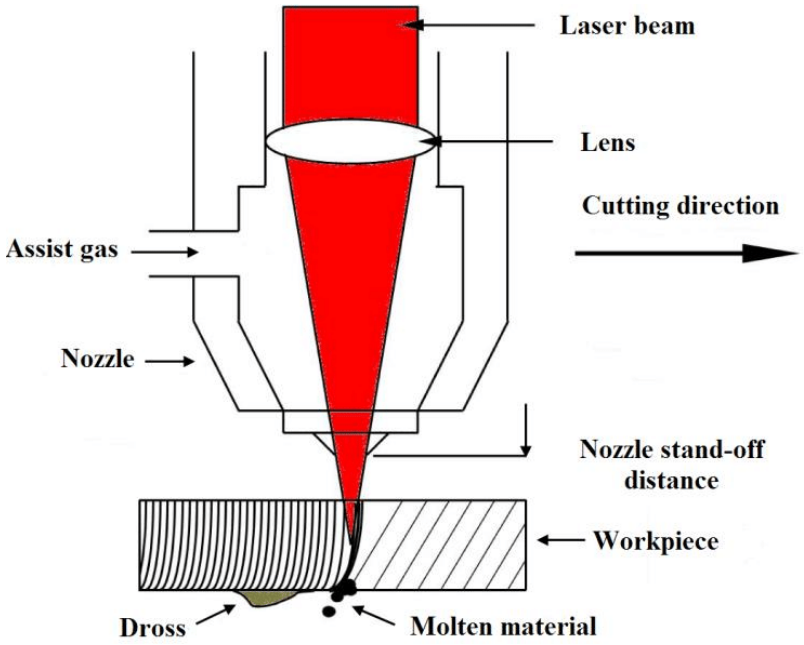
1. Describe the basic principles of laser cutting.
2. Explain the different types of lasers used in cutting processes.
3. Identify materials suitable for laser cutting and their characteristics.
4. Compare the advantages and limitations of laser cutting over traditional cutting methods.
5. Demonstrate the application of laser cutting in various industries.

3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2,3	1,2,3				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge			3,5	4		
D. Meta Cognitive Knowledge			5	4,5		

3.4. Keywords: Laser cutting, Laser beam, Material processing, Cutting techniques, Heat-affected zone

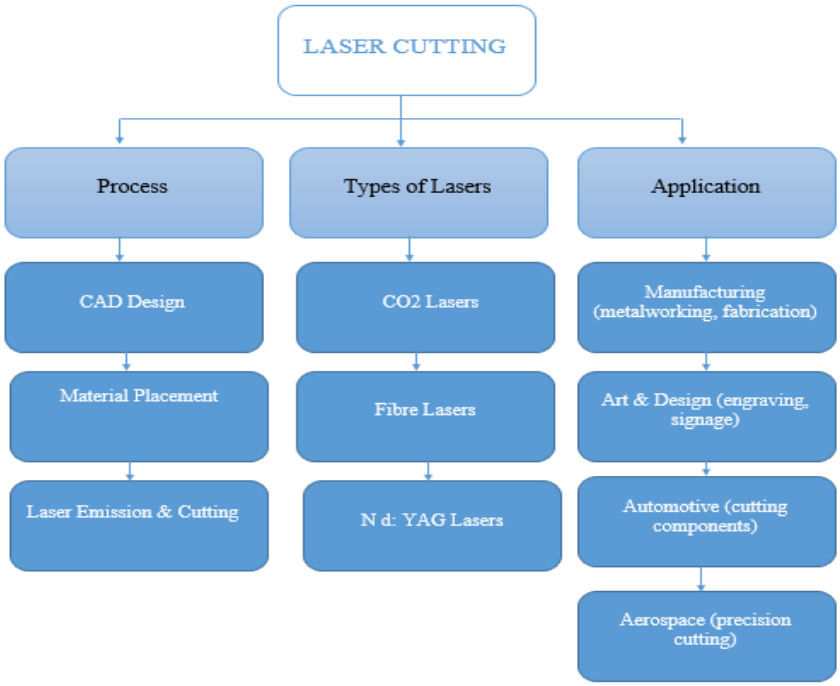
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the principles of laser cutting. One of the students will be asked to explain the working of a laser cutter and describe the different materials that can be cut using this technique. Additionally, students will be asked to analyse the advantages and limitations of laser cutting over traditional cutting methods.

4. Mind Map:



5. Summary:

Students will be asked to summarise how laser cutting works and identify the key factors that influence the cutting process, such as power, speed, and material type, using a mind map.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generating mental ideas about the future applications of laser cutting in various industries.
2. Discussing the concept of the heat-affected zone and how it impacts the material properties during cutting.
3. Providing students with sample materials and asking them to identify the optimal cutting parameters using laser cutting.

7. FAQs:

1. What is the primary advantage of laser cutting over mechanical cutting methods?
   (a) Faster cutting speeds (b)Lower material waste
   (c) Higher precision (d) All of the above

2. Which of the following materials can be cut using a laser cutter?
   (a) Wood (b)Metals (c)Plastics (d)All of the above
3. In laser cutting, what does the heat-affected zone refer to?
   (a) The area where the laser beam is focused
   (b) The area surrounding the cut, where the material properties are altered
   (c) The area of the material that doesn't undergo cutting
   (d) The part of the material that is vaporized
4. Which type of laser is commonly used for cutting metals?
   (a) CO2 laser (b)Fiber laser
   (b) Diode laser (d)Excimer laser.

8. References:

1. Jose Robin G and Ubald Raj A. *Applied Physics*. Marthandam: Indira Publications. 3rd edition 1998.
2. Dr. Mani. P *A text book of Engineering Physics-I.* Dhanam Publications. 10thedition 2013.
3. Jose Robin G and Ubald Raj A. *Laser and its Applications*. Marthandam: Indira Publications. First Edition 2003.
4. Jose Robin G and Ubald Raj A. *Maintenance of Electrical Appliances*. Marthandam: Indira Publications. First Edition July 2017.
5. Kakani S L and Shubhra Kakani. *Photonics – Optoelectronics*. CBS Publishers &Distributors Pvt Ltd. First Edition 2017.

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LESSON PLAN

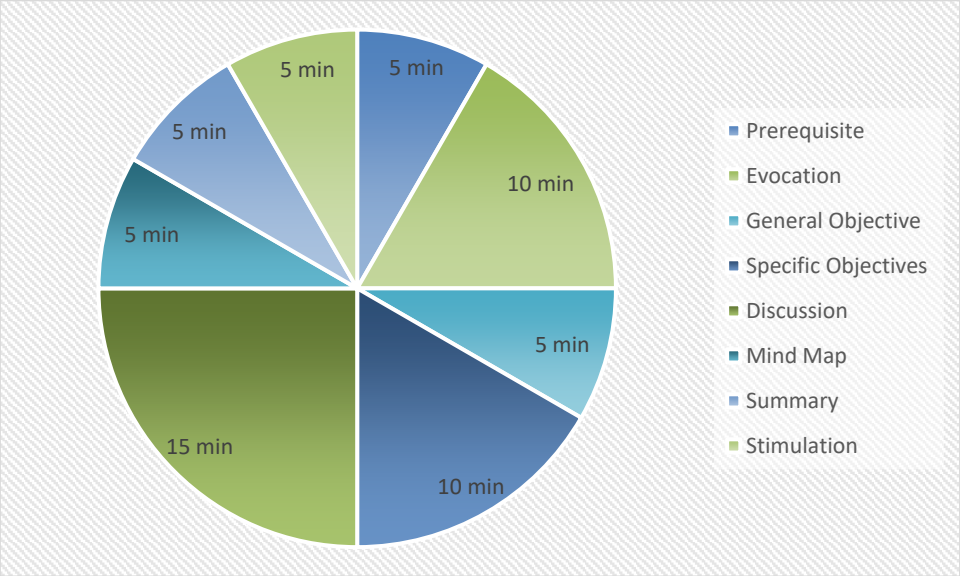
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	IV
Subject Title	Core IV: Electronics and Communication
Code	21UPHC41
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	Unit IV- Summing Amplifier
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of operational amplifiers (op-amps), basic concepts of Ohm's law, Kirchhoff's voltage and current laws, and the principles of superposition in electrical circuits. Familiarity with the functioning of inverting amplifiers and resistive networks is also required.

Micro-Planning



1. **Topic for Learning through Evocation:**

   Imagine a circuit where multiple signals combine into one, much like mixing different colors of paint to create a new hue. A summing amplifier is an electronic device that takes several input signals and combines them into a single output, amplifying each signal proportionally. This is done by using operational amplifiers (op-amps), which are designed to handle multiple inputs and provide a weighted sum at the output. Students are encouraged to think of real-world applications such as audio mixing, where different sound inputs are merged to create a final output. Reflecting on how summing amplifiers allow precise control over the combination of signals can help students appreciate their importance in electronics, audio systems, and signal processing.

2. Topic Introduction:

A summing amplifier is a type of operational amplifier (op-amp) circuit that combines multiple input signals into a single output. It works by summing the weighted contributions of each input voltage, allowing the output to be a scaled version of the total sum of the inputs. Summing amplifiers are widely used in applications such as audio mixing, signal processing, and data conversion. By adjusting the resistors in the circuit, the amplitude and phase of the output can be controlled, making it a versatile tool for engineers and scientists. Understanding how summing amplifiers work helps in the design of systems that require the combination of multiple signals into one coherent output.

3.1. General Objective:

Understand the principles and operation of a summing amplifier, including how it combines multiple input signals and produces an output that is a weighted sum of the inputs. Students will explore its applications in signal processing, audio mixing, and other electronic systems, and comprehend its role in amplifying combined signals with specific gain factors for each input.

3.2. Specific Objectives:

Students will be able to

1. Explain the working principle of a summing amplifier and how it combines multiple input signals.
2. Identify the components and configuration of a summing amplifier, including resistors and operational amplifiers.
3. Analyze the functionality of a summing amplifier in various applications, such as signal mixing and audio processing.
4. Evaluate the advantages and limitations of using summing amplifiers in electronic circuits, considering factors like gain control and signal distortion.
5. Design and simulate a summing amplifier circuit to demonstrate its practical use in real-world applications.

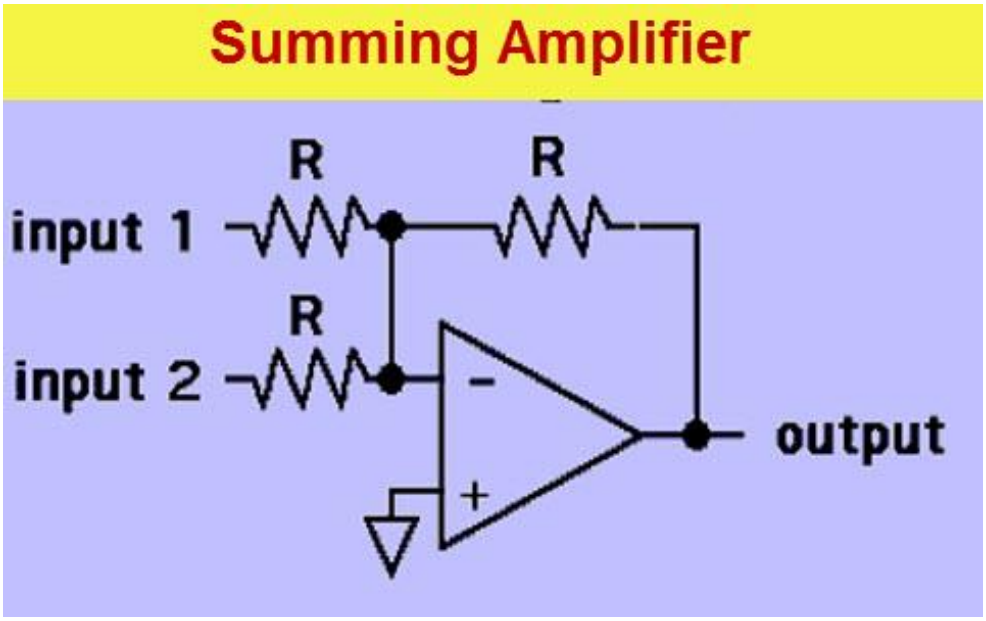
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		3	3			
C. Procedural Knowledge				4		5
D. Meta Cognitive Knowledge				4	4	5

3.4. Keywords:

Op-Amp (Operational Amplifier), Summation, Input Voltages, Inverting Configuration, Feedback Resistor

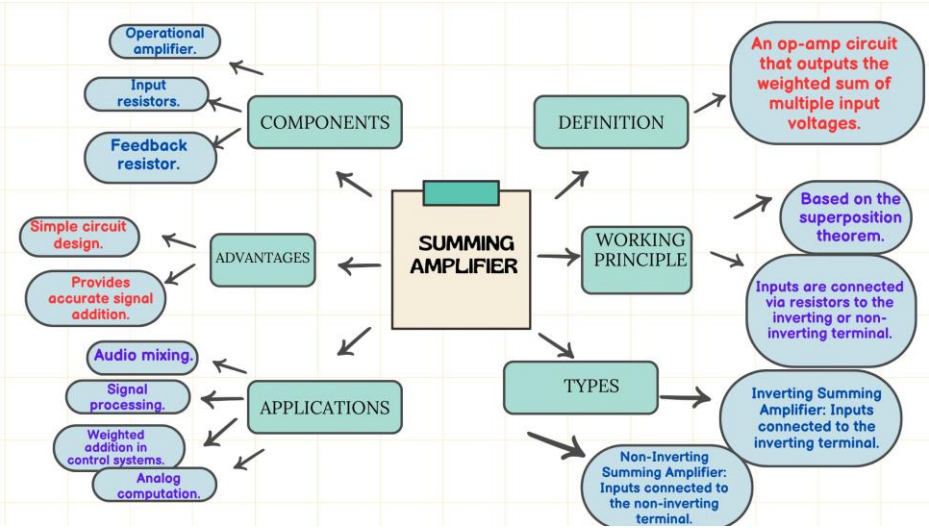
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the summing amplifier. One of the students will be asked to draw the circuit diagram of a summing amplifier, labeling the key components such as the operational amplifier, resistors, and input voltages. Additionally, students will be encouraged to explain how the summing amplifier works and its applications in electronics, particularly in signal processing. This will help them visualize and understand the operational principles behind a summing amplifier.

4. Mind Map:



5. Summary:

Students will be asked to identify how a summing amplifier works by using a mind map. This activity will help students visually organize the concepts related to the summing amplifier, including its operational principles, components, and applications. They will connect the relationship between the input voltages, the operational amplifier, and the resulting output, reinforcing their understanding of how the circuit functions in various configurations.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Students will then be tasked with producing the e-content, demonstrating the mathematical derivation and circuit simulation of a summing amplifier. The e-content will include explanations, visual representations, and step-by-step walkthroughs of how the amplifier works in real-world applications.
2. Students will be provided with various summing amplifier circuit diagrams, and using the principles of operation, they will be asked to identify how different inputs and resistor values affect the output. They will perform calculations to find the output voltage for given input signals.
3. Students will be asked to think about how they would create an e-content to explain the working of a summing amplifier. They will consider key concepts like the superposition principle, inverting/non-inverting inputs, and the role of resistors in determining the output voltage.

7. FAQs:

1. What is a summing amplifier?
2. How does a summing amplifier work?
3. What is the purpose of the feedback resistor in a summing amplifier?
4. Can a summing amplifier be used for both inverting and non-inverting configurations?
5. What are some applications of summing amplifiers?

8. References:

1. Jose Robin G and Ubald Raj A. *Electronics*. Marthandam: Indira Publication, First Edition 2000.
2. Jose Robin G and Ubald Raj A. *Communication Electronics*. Marthandam: Indira Publications. First Edition 2002.
3. Bargava N. N, Kulshreshtha D. C. and Gupta S. C. *Basic Electronics and linear circuits*. New Delhi: Tata McGraw Hill Publishing company Ltd. Reprint, 2012.

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LESSON PLAN

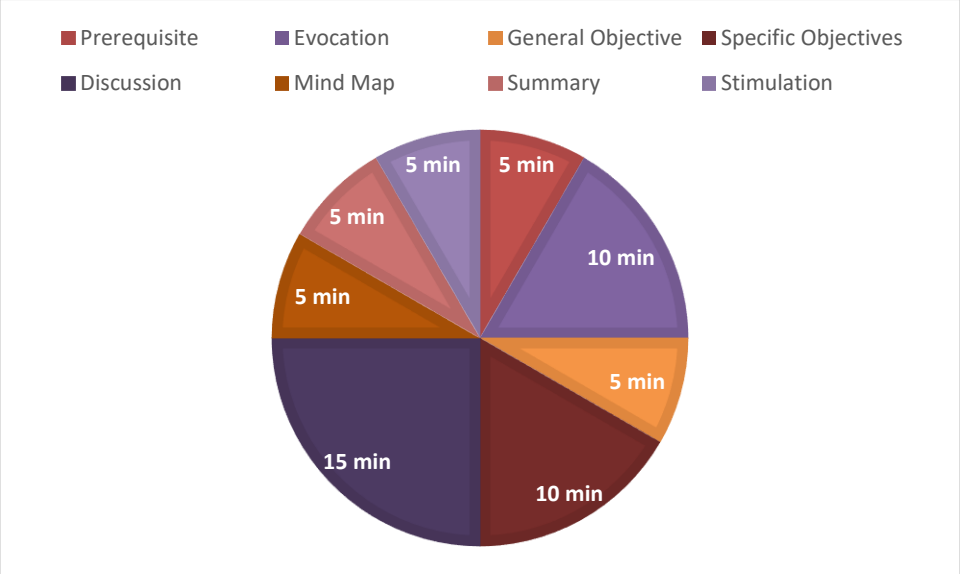
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	IV
Subject Title	Skill Based Elective: Physics for Competitive Examinations
Code	21UPHS41
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit III - Interference
Name of the Faculty	Dr. M. Sheeba
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Basic understanding of cognitive processes and types of interference (proactive and retroactive).

Micro-Planning



1. **Topic for Learning through Evocation:**

   The phenomenon of interference in optics reveals how light waves interact to produce patterns of constructive and destructive interference. By evoking real-world examples, such as the vibrant colors of soap bubbles or the iridescence of a peacock feather, students can delve into the principles of wave superposition. This exploration encourages problem-solving by connecting wave theory to practical applications, such as the design of anti-reflective coatings, holography, and precision measurement in scientific instruments.

2. Topic Introduction:

The phenomenon of interference in optics originates from the principle of superposition, where two or more light waves combine to form a resultant wave of greater, lower, or the same amplitude. Derived from the Latin word interferre, meaning "to strike against," interference plays a pivotal role in understanding the wave nature of light. Thomas Young's double-slit experiment demonstrated how coherent light sources produce characteristic bright and dark fringes due to constructive and destructive interference. By exploring interference patterns in real-world contexts, such as thin film coatings, diffraction gratings, and holography, students can develop critical problem-solving skills and apply these concepts to advanced technological applications, including precision metrology and optical communication systems.

3.1. General Objective:

To enable the students to apply the principles of interference in optics to solve real-world problems.

3.2. Specific Objectives:

To enable the students to:

1. Identify problems involving interference patterns and formulate their underlying principles.
2. Analyze interference phenomena in practical contexts, such as thin films, diffraction gratings, and coatings.
3. Design experiments or models to demonstrate constructive and destructive interference.
4. Solve numerical problems related to path difference, fringe spacing, and wavelength determination in interference.

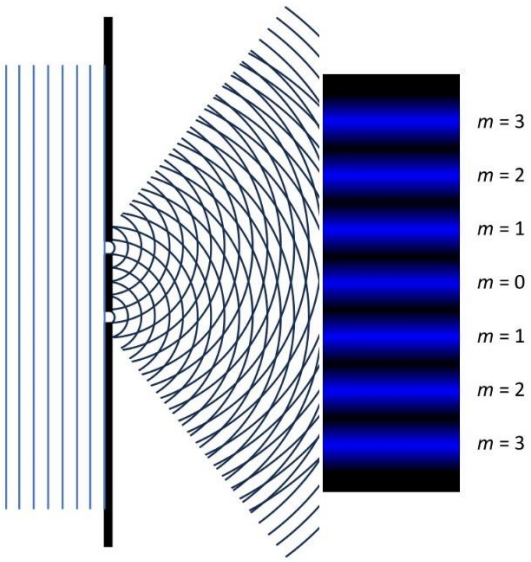
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1				
B. Conceptual Knowledge		1	1			
C. Procedural Knowledge			4	2,4		
D. Meta Cognitive Knowledge				2,3,4	3	3

3.4. Keywords:

Interference Patterns, Constructive Interference,Destructive Interference,Thin Films, Diffraction Gratings

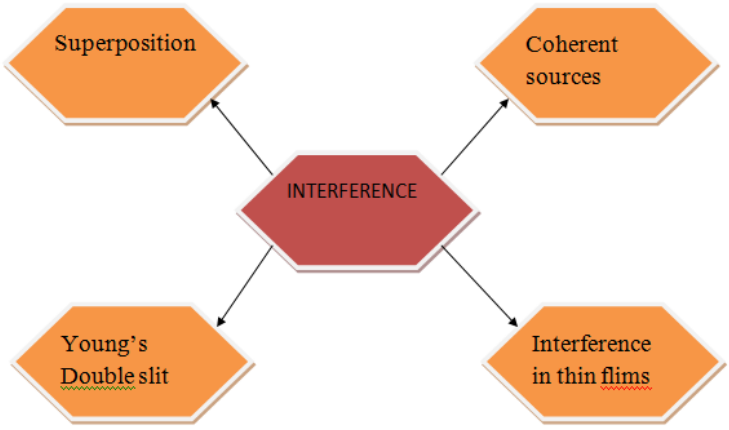
3.5. Key Diagram:



Discussion:

Students will be presented with problem scenarios involving interference in optics, such as calculating fringe spacing in Young's Double-Slit Experiment or determining the thickness of a thin film causing interference. They will discuss the principles of constructive and destructive interference, analyze the given problems, and collaboratively work through solutions. One student will draw and explain the relevant interference pattern, while others contribute by identifying the conditions and equations required to solve the problem. Real-world applications, such as anti-reflective coatings or diffraction gratings, will also be explored to enhance practical understanding.

4. Mind Map:



5. Summary:

Students will engage in identifying and solving problems related to interference in optics by creating a mind map. This activity will guide students in visualizing key concepts, such as the principles of constructive and destructive interference, conditions for fringe formation, and practical applications like thin-film interference and diffraction. Through this process, they will develop strategies for solving numerical problems, analyzing interference patterns, and applying theoretical knowledge to real-world scenarios.

5. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

Stimulating Questions

1. Why do oil spills or soap bubbles display colorful patterns?
2. If one slit in a double-slit experiment is moved closer to the screen, how does the interference pattern change?
3. Can interference occur with sound waves? How does this relate to light?
4. How does the interference pattern of monochromatic light differ from white light?

Analogies

- Water Ripple Analogy: Compare the interference of light to the overlapping ripples of water, where crests and troughs represent constructive and destructive interference.
- Noise-Canceling Headphones: Relate destructive interference to how noise-canceling headphones work, canceling unwanted sounds.

New Ideas and Concepts

1. Real-World Problem Solving: Explore how engineers use anti-reflective coatings on lenses and screens to reduce glare and enhance visibility using interference principles.
2. Nanotechnology Applications: Discuss how interferometers help in precision measurements for semiconductor production.
3. Laser Applications: Examine interference in holography and optical data storage.

7. FAQs:

1. Two coherent light sources emit waves with a wavelength of 500 nm. If the path difference at a point is 1.5λ will the interference be constructive or destructive? Explain your reasoning.
2. In a double-slit experiment, a student uses two different light sources with slightly varying wavelengths. The interference pattern is unstable and shifts over time. Why does this happen, and how can it be corrected?
3. In Young's double-slit experiment, the slits are separated by 0.5 mm, and the screen is 2 m away. Light of wavelength 600 nm is used. Calculate the fringe spacing. Determine the path difference for the 3rd bright fringe.
4. A soap film (n=1.33) of thickness 500 nm is illuminated with white light. Which wavelength(s) of light in the visible spectrum (400−700 nm) will undergo constructive interference for light reflected off the film?
5. In a diffraction grating experiment, the grating has 6000 lines/cm, and the screen is placed 1 m away. A laser of 633 nm wavelength is used. Determine the angular

position of the first-order maximum. How many orders of maxima can be observed for this wavelength?

8. References:

1. Dr. Kakani S.L. *Objective Physics*. Sultan Chand and sons Ltd. 10th revised edition 2001.
2. Satya Prakash and Er. Vibhav Saluja. *Objective Physics*. Meerut: Prakashan publications. 27th revised edition 2010.

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LESSON PLAN

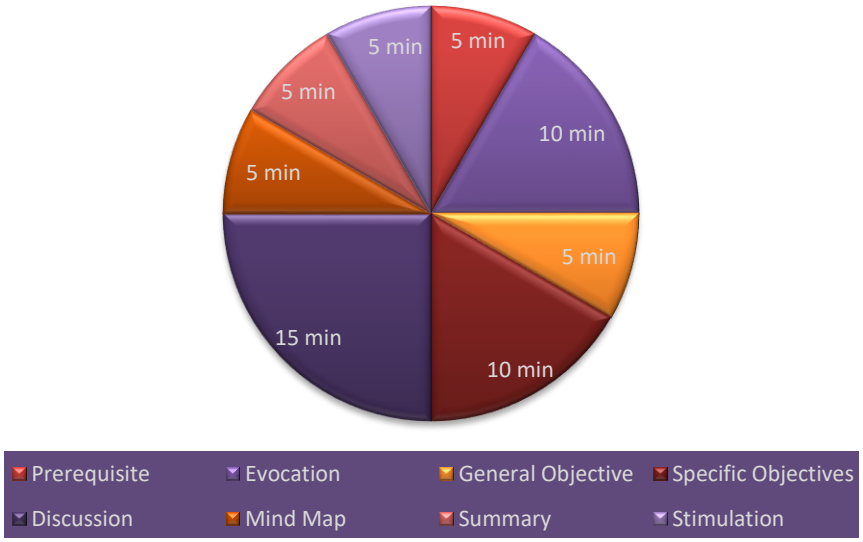
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	IV
Subject Title	NME II: Applied Physics II
Code	21UPHN41
Hours	2
Total Hours	30
Credits	2
Max Marks	100
Unit & Title	Unit I-Solar Water Heater
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of heat transfer and energy conversion principles.

Micro-Planning



1. **Topic for Learning through Evocation:**

   A Solar Water Heater is an innovative system that harnesses the power of the sun to heat water for residential or commercial use. By using solar panels, also known as collectors, these systems capture sunlight and convert it into heat, which is then transferred to a water storage tank. This method of water heating is both eco-friendly and energy-efficient, reducing dependence on fossil fuels and lowering energy bills. Students should explore the working principles of solar water heaters, the components involved, and the various types, such as direct and indirect systems. Understanding the environmental benefits and efficiency of solar water heaters will also be an essential part of the study.

2. Topic Introduction:

1. A solar water heater is a system that uses solar energy to heat water for domestic or industrial use.
2. The technology utilises solar panels, typically installed on rooftops, to capture sunlight and convert it into thermal energy.
3. Solar water heaters are classified into two main types: active and passive systems, depending on the method used for circulating the water.
4. The efficiency of solar water heaters is significantly influenced by factors such as geographic location, the orientation of panels, and the type of collector used.

3.1. General Objective:

To enable the students to understand the working principles, design, and benefits of solar water heaters.

3.2. Specific Objectives:

To enable the students to:

1. Describe the basic components of a solar water heater.
2. Explain the working principle of solar water heaters.
3. Compare different types of solar water heating systems.
4. Analyse the advantages and limitations of using solar water heaters.
5. Demonstrate the environmental and economic benefits of solar water heating.

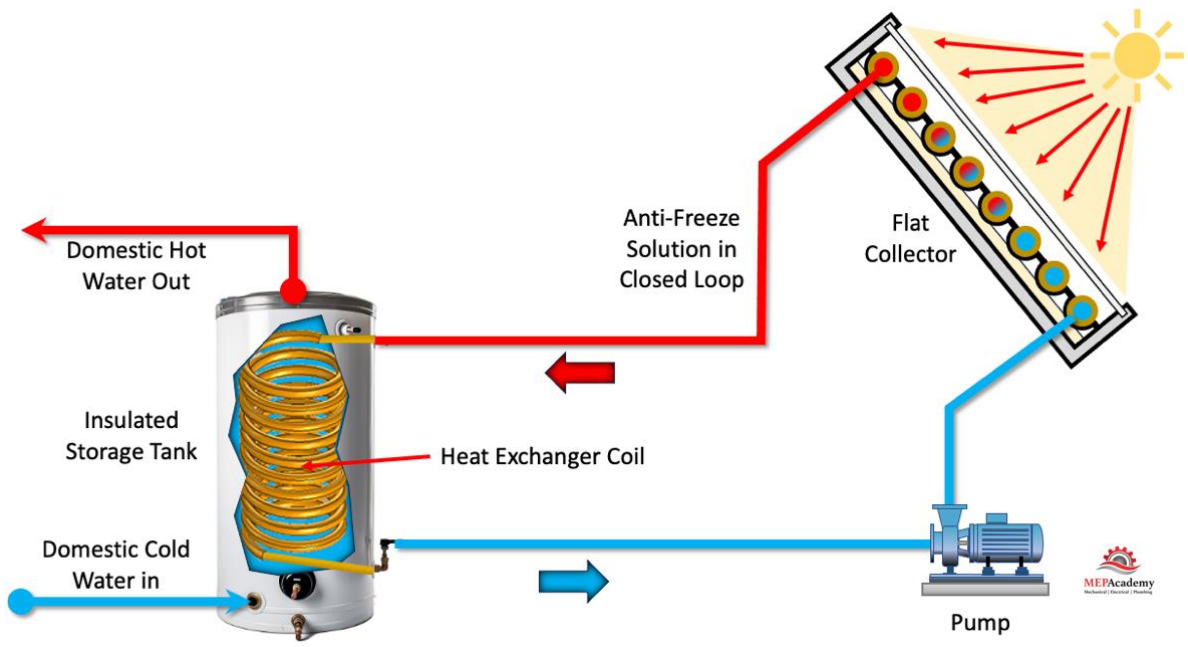
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1,2				
B. Conceptual Knowledge		2,3	3			
C. Procedural Knowledge				4,5		
D. Meta Cognitive Knowledge				4	5	5

3.4. Keywords:

Solar energy, Solar collector, Heat transfer, Thermosyphon, Solar water heater

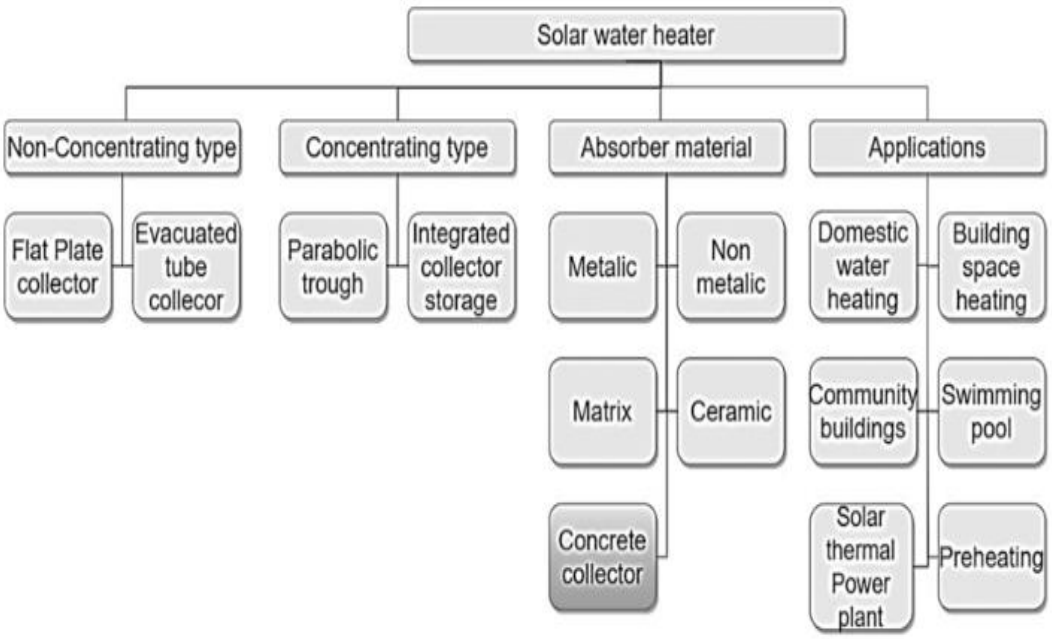
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the working principle and components of a solar water heater. One student will be asked to explain the process of converting solar energy into heat and how it is transferred to water in the system.

4. Mind Map:



5. Summary:

Students will be asked to summarise how solar water heaters work, the key components involved, and the benefits of using solar energy for heating water, through a concept map or diagram.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Encourage students to brainstorm ideas on how solar water heaters can be made more efficient.
2. Discuss innovative ways solar heaters can be used in various climates.
3. Provide models of solar water heaters and ask students to identify the components and their functions.

7. FAQs:

1. What is the main principle behind a solar water heater?
   (a) Conversion of solar energy into heat (b)Use of electricity for heating water
   (c) Heating water using gas (d)Use of wind energy for water heating
2. What is the role of the solar collector in a solar water heater?
   (a) To store water (b)To collect solar energy and heat the water
   (c) To pump water through pipes (d)To regulate the temperature of the water
3. What is thermosyphon in the context of a solar water heater?
   (a) A heat exchanger system (b)A pump that circulates water
   (c) A process by which heated water rises and cooler water sinks
   (d) A type of solar panel
4. Which type of water heater uses solar energy most efficiently?
   (a) Evacuated tube solar water heater (b)Electric water heater
   (c) Gas water heater (d)Hybrid water heater
5. Which of the following is NOT a component of a typical solar water heater?
   (a) Solar collector (b)Storage tank
   (c) Heat exchanger (d)Gas burner.

8. References:

1. Jose Robin G and Ubald Raj A, *Energy Physics*. Marthandam: Indira Publications. First edition 2014.
2. Dr. Sr. GerardinJayam. *Physics Every day*. First Edition 2008.
3. Dr. Mani P. *A text book of Engineering Physics –I*. Dhanam Publication. Tenth Edition 2013.
4. Dr. Mani P. *A text book of Engineering Physics –II*. Dhanam Publication. Tenth Edition 2016.
5. Rai G.D. *Nonconventional Energy Sources*. Khanna Publishers. Reprint, 2014.
6. Ubald Raj A and Jose Robin G. *Solid State Physics*. Marthandam: Indira Publications. second edition 2018.
7. Murugeshan R and KiruthigaSivaprasath. *Optics and Spectroscopy*. S. Chand and Company Ltd. Ninth edition 2019.
8. Arumugam M. *Biomedical Instrumentation*. Anuradha Agencies. Reprint, 2002.

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LESSON PLAN

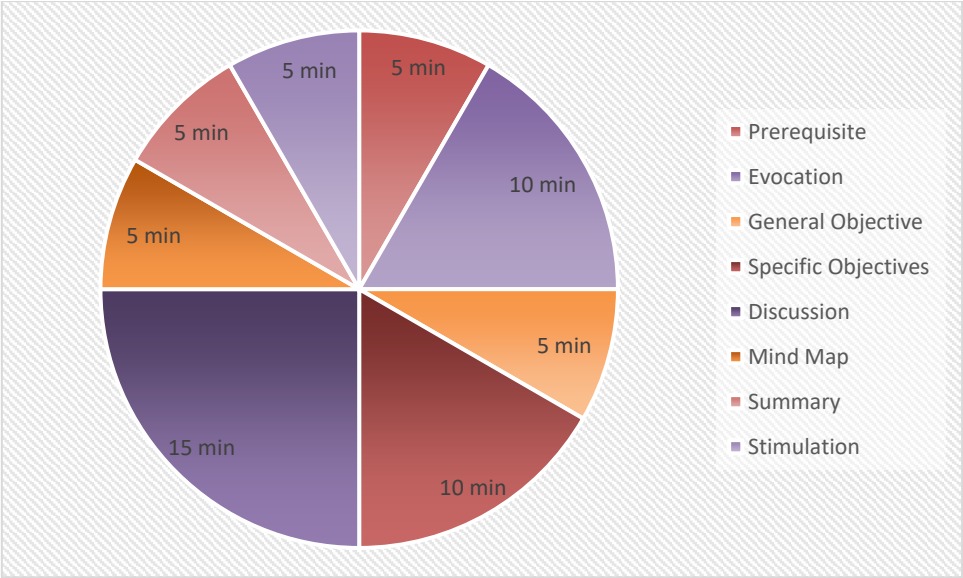
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	V
Subject Title	Core V(Common Core): Material Science
Code	21UPCC51
Hours	6
Total Hours	90
Credits	5
Max Marks	100
Unit & Title	Unit IV-Theory of Paramagnetism
Name of the Faculty	Dr. S. Euchrista Immaculate Sylvia
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of atomic and molecular magnetic moments and their alignment under an external magnetic field.

Micro-Planning



1. **Topic for Learning through Evocation:**

Paramagnetism is a phenomenon observed in materials that are weakly attracted by an external magnetic field due to the presence of unpaired electrons. These unpaired electrons have magnetic dipole moments that align with the applied field, causing a temporary magnetization. Unlike ferromagnetic materials, which exhibit strong, permanent magnetization, paramagnetic materials only show magnetization when exposed to a magnetic field and lose it once the field is removed. This property is explained by the atomic or molecular structure of the material, where the individual magnetic moments are generally random but align under the influence of the magnetic field. Students are

expected to understand the principles of paramagnetism, its relation to electron configurations, and the behavior of paramagnetic substances in various conditions.

2. Topic Introduction:

1. The term paramagnetism refers to the phenomenon where materials are weakly attracted to an external magnetic field due to unpaired electrons.
2. In paramagnetic substances, the magnetic dipoles of unpaired electrons align with the magnetic field, creating a temporary magnetization.
3. This behavior is distinct from ferromagnetism, where materials exhibit permanent magnetization.
4. The alignment of magnetic moments in paramagnetic materials is only observed when an external field is present and disappears when the field is removed.
5. The theory of paramagnetism can be explained by the electron configuration and the presence of unpaired electrons in atoms or molecules.

3.1. General Objective:

To enable the students to understand the theory of paramagnetism and its application in various materials.

3.2. Specific Objectives:

To enable the students to:

1. Explain the concept of paramagnetism and its underlying principles.
2. Describe the behavior of materials exhibiting paramagnetism.
3. Differentiate between paramagnetic, diamagnetic, and ferromagnetic materials.
4. Understand the role of unpaired electrons in paramagnetic behavior.
5. Analyse the effect of temperature on the magnetization of paramagnetic materials.

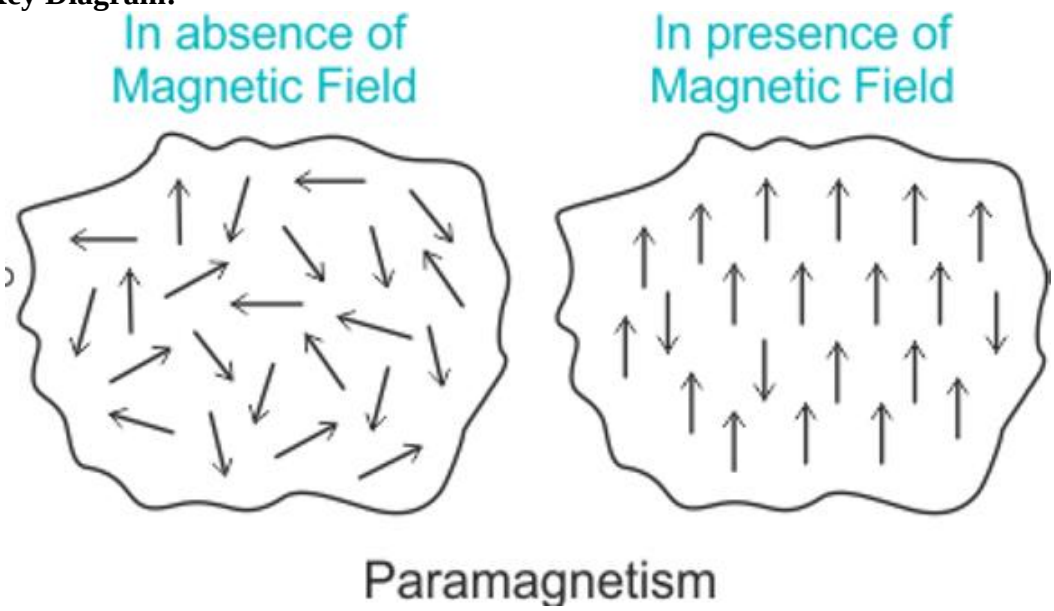
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		2,3	2,3			
C. Procedural Knowledge			4	5		
D. Meta Cognitive Knowledge				5		

3.4. Keywords:

Paramagnetism, Unpaired Electrons, Magnetic Dipole Moments, Magnetic Susceptibility, Magnetic Field

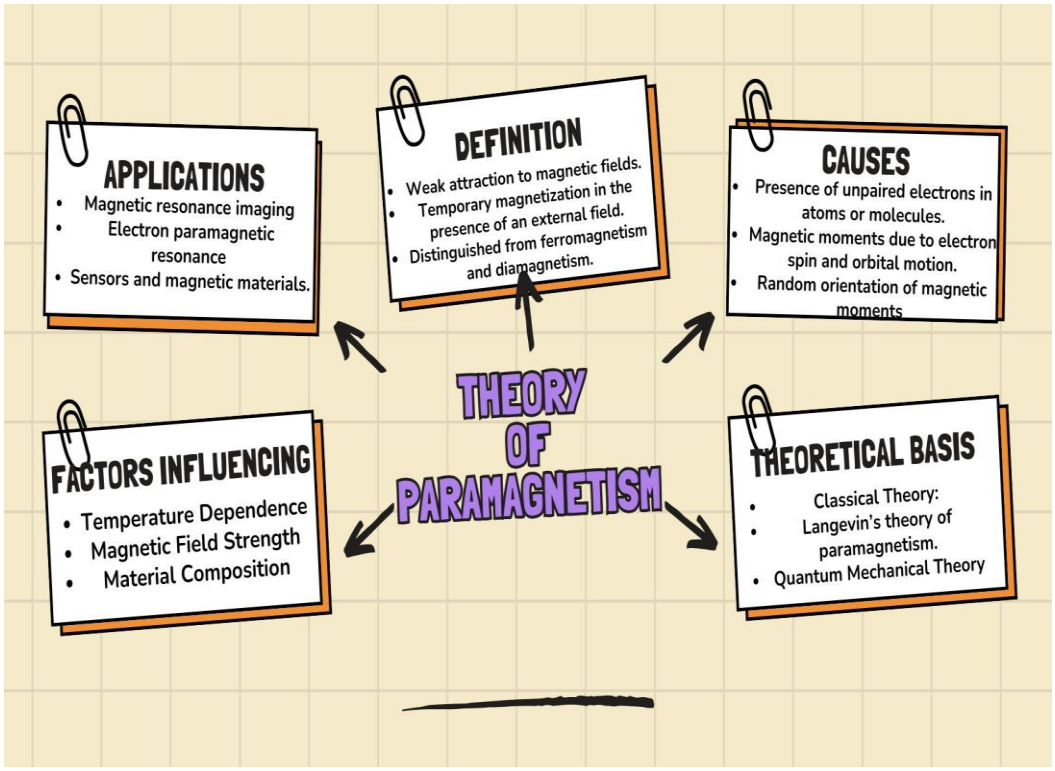
3.5. Key Diagram:



Discussion:

Students will be asked questions regarding the behavior of paramagnetic materials, how they differ from other types of magnetic materials, and the role of unpaired electrons in the magnetization process. One of the students will be asked to describe the alignment of magnetic dipole moments in a paramagnetic substance and explain how this influences its response to an external magnetic field.

4. Mind Map:



5. Summary:

Students will be asked to summarize the key concepts of paramagnetism, focusing on how unpaired electrons contribute to the magnetic properties of materials, and how this behaviour varies with temperature and external magnetic fields. They will also use a mind map to organize the relationship between paramagnetic materials and their atomic structure.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Generate a mental analogy between the behavior of paramagnetic materials and the alignment of compass needles in a magnetic field.
2. Create a presentation explaining the theory of paramagnetism, incorporating its real-world applications in materials science.
3. Provide samples of different materials and ask students to identify whether they are paramagnetic, diamagnetic, or ferromagnetic based on their properties.

7. FAQs:

1. Which of the following materials is paramagnetic?
(a) Aluminum (b) Iron
(c) Copper (d) Gold
2. What causes the paramagnetic behavior in a material?
(a) Presence of unpaired electrons (b) Alignment of electron pairs
(c) High density of atoms (d) Strong external magnetic fields
3. How does temperature affect the magnetic susceptibility of a paramagnetic material?
(a) Increases with temperature (b) Decreases with temperature
(c) Remains constant (d) Becomes independent of temperature
4. Which of the following best describes the alignment of dipole moments in a paramagnetic material when exposed to a magnetic field?
(a) Randomly oriented (b) Strongly aligned in one direction
(c) Opposed to the magnetic field (d) None of the above

8. References:

1. Arun Bahl, Bahl B.S. and Tuli G.D. *Essentials of Physical Chemistry.* New Delhi:
2. Rajendran.V. *Material Science.* New Delhi: Tata Mc Graw Hill Education Pvt. Ltd. 2012
3. Arumugam M. *Material Science.* Anuradha Publication. 2008.
4. Sri Vasta C M & Srinivasan C. *Science of Engineering materials*. New Age International
5. Palanisamy P.K. *Solid state Physics* Copyright (2003). Chennai: Scitech Publication (India) Pvt Ltd. 3rd reprint, 2008.
6. Mureghesan R and Kiruthiga Sivaprasath. *Modern Physics*. S.Chand & Co Ltd. 17th Edition 2013.
7. Dr. Mani P. *A Text Book of Engineering Physics*. Chennai : Dhanam Publications. Revised Edition 2008.
8. Marikani A. *Materials Science.* Delhi: PHI Learning Pvt. Ltd. 2017.

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LESSON PLAN

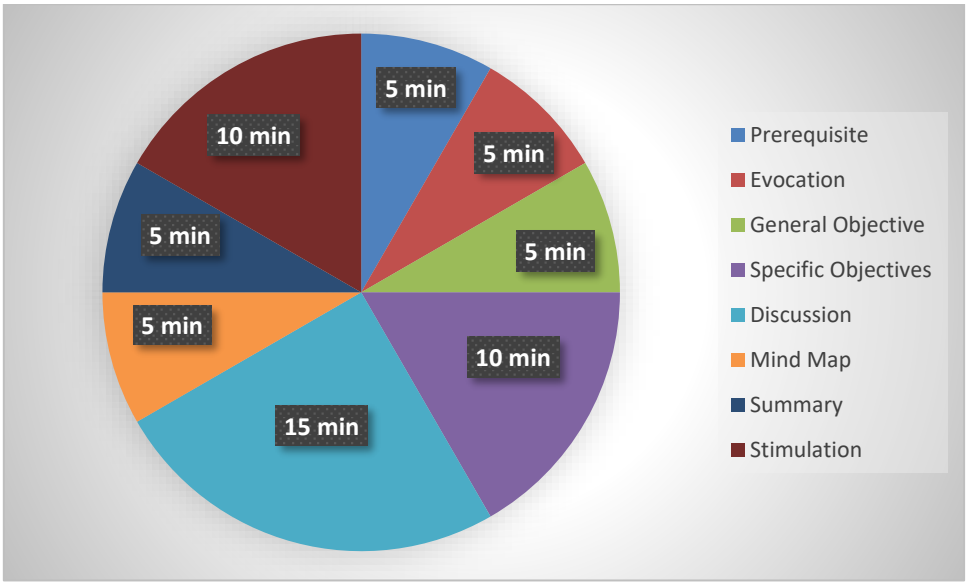
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	V
Subject Title	Core VI: Digital Electronics
Code	21UPHC51
Hours	5
Total Hours	75
Credits	5
Max Marks	100
Unit & Title	Unit I –Number System
Name of the Faculty	Ms. A. Lucas Rexceline
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Basics of binary, octal, Decimal and hexadecimal number system, and its applications

Micro-Planning



1. Topic for Learning through Evocation:

The number system forms the foundation of digital electronics and computing. It is essential to understand how data is represented and processed in digital circuits. In digital systems, all datawhether numbers, text, or multimediais represented using a binary number system, which operates with only two digits: 0 and 1. Binary numbers align perfectly with the on/off state of electronic devices (on = 1, off = 0). This makes binary the simplest and most efficient way to store and process information electronically. Students will be engaged by asking where they encounter binary systems in daily life. For example:

- **Calculators:** Basic mathematical operations rely on binary logic.
- **Computers:** Everything from files to images is stored in binary form.
- **Smartphones:** Apps and data are processed using binary instructions.
- **Digital Clocks:** Time is often managed internally using binary counters.
- **Programming:** Binary forms the basis of machine code, the language understood by computers.

Students will be asked to support the statement "The binary number system is the key to explore digital technologies like memory addressing, programming, and data processing".

2. Topic Introduction:

Number systems are mathematical frameworks for representing numbers in various bases, such as Binary (Base-2), Decimal (Base-10), Octal (Base-8), and Hexadecimal (Base-16). They are essential in digital electronics to encode, store, and process data. Understanding these systems and conversions between them is crucial for working with digital circuits and computing systems.

3.1. General Objective:

To make the students understand and differentiate between various number systems used in digital electronics

3.2. Specific Objectives:

To enable the students

1. To define and explain the Binary, Octal, Decimal, and Hexadecimal number systems.
2. To perform conversions between different number systems accurately.
3. To understand the significance of Binary and Hexadecimal systems in digital electronics.
4. To identify real-world applications of number systems, such as in computing, memory addressing, and programming.

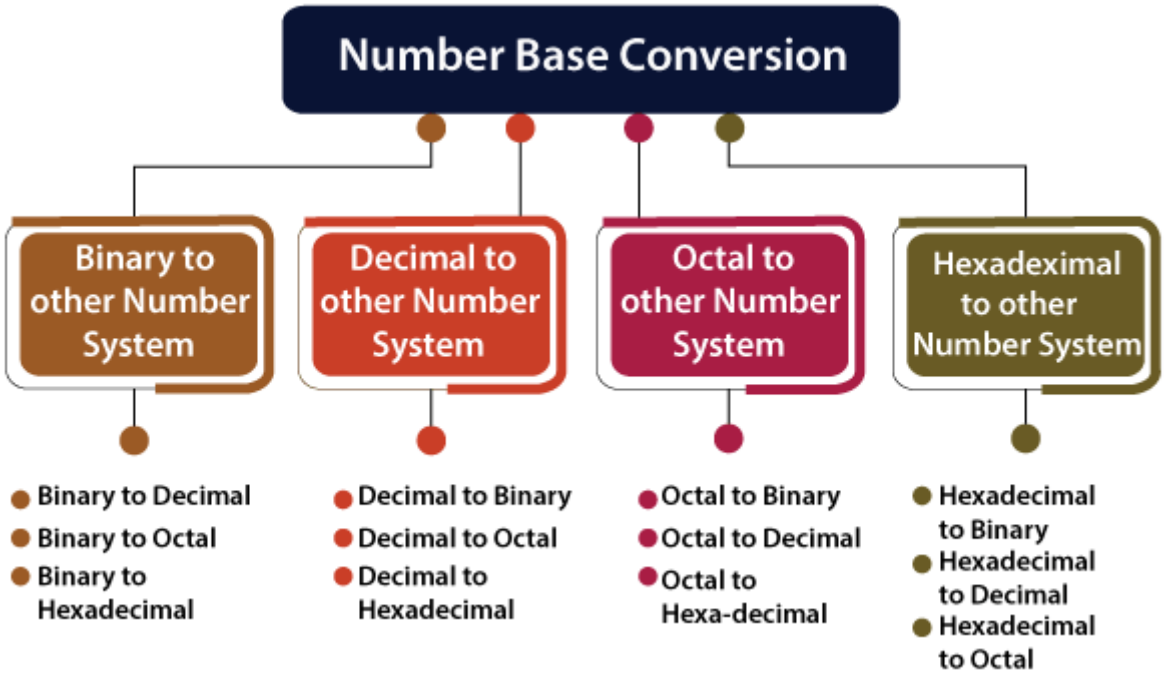
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1				
B. Conceptual Knowledge			2	2		
C. Procedural Knowledge			3	3	3	
D. Meta Cognitive Knowledge				4	4	4

3.4. Keywords:

Binary (Base-2), Octal (Base-8), Decimal (Base-10), Hexadecimal (Base-16), Conversions

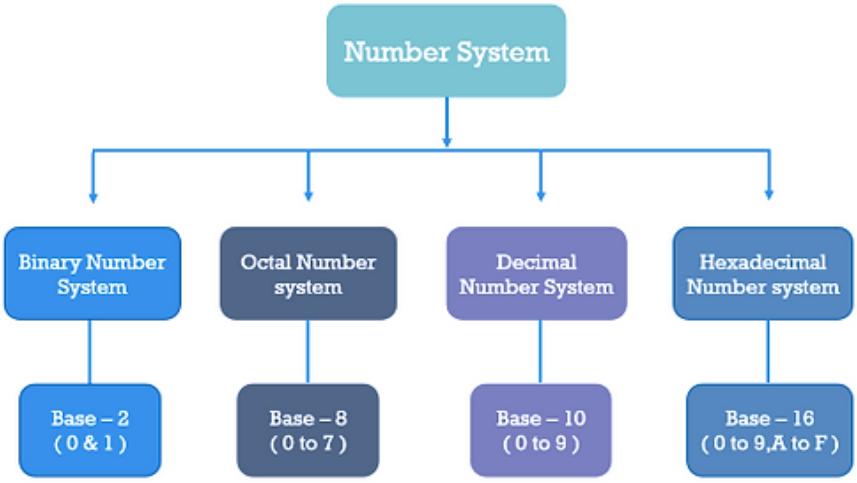
3.5. Key Diagram:



Discussion:

Students will be asked to compare and contrast the different number systems (Binary, Octal, Decimal, and Hexadecimal). They will analyse their applications and significance in computing and digital circuits.

4. Mind Map:



5. Summary:

Students will be asked to summarise the differences between the number systems and their conversions, along with key applications.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Describe how binary numbers are used in computing.
2. Convert the decimal number 255 to hexadecimal.
3. Explain the role of hexadecimal numbers in memory addressing.

7. FAQs:

1. What are the common number systems used in digital electronics?
2. How do you convert binary to decimal?
3. Where are hexadecimal numbers used?

8. References:

1. Jose Robin G and Ubald Raj A. *Digital Electronics.* Marthandam: Indira publications. Reprint, 2018.
2. Albert Paul Malvino and Donald P. Leach *Digital principles and applications.* 7th edition 2013.
3. Millman and Taub. *Integrated Electronics.* International student edition (TMH).
4. Jain R.P. *Modern digital Electronics.* Tata Mc Graw Hill Pvt. Ltd. 4th Reprint, 1988.

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LESSON PLAN

Objective-Oriented Learning Process Based on RBT

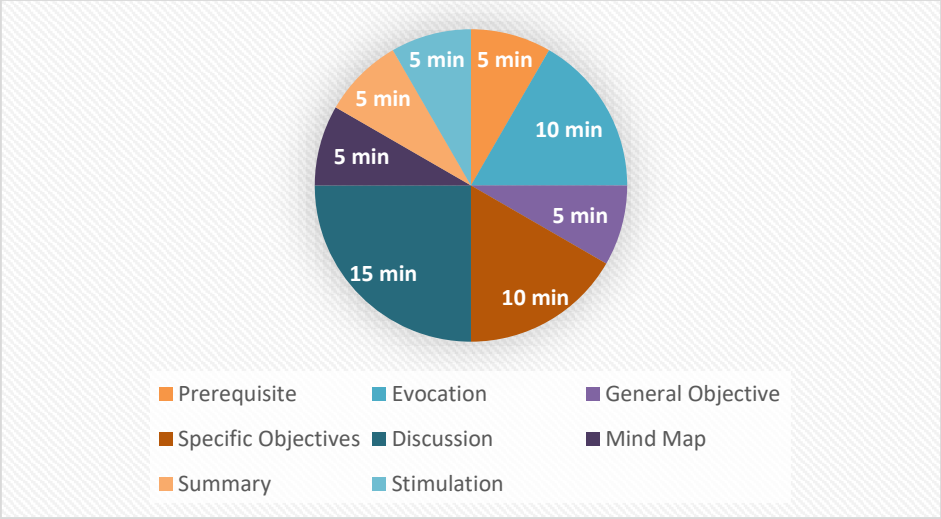
Programme	B.Sc. Physics
Semester	V
Subject Title	Core VII: Computational Physics
Code	21UPHC52
Hours	5
Total Hours	75
Credits	5
Max Marks	100
Unit & Title	UnitI- Operators in C++
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Understanding of programming fundamentals, including:

- Basics of C++ syntax and structure.
- Knowledge of variables and data types in C++.
- Familiarity with mathematical operations and logic concepts.
- Introduction to control structures (e.g., if-else, loops).
- Awareness of the concept of memory allocation and data manipulation.

Micro-Planning



1. **Topic for Learning through Evocation:**

Imagine you are a master craftsman working with various tools to shape a piece of raw material. In C++, operators act as your set of tools, each designed to perform a specific task, such as performing mathematical calculations, comparing values, or manipulating data. Think of arithmetic operators as your chisels, carving out the necessary operations like addition and multiplication. Relational operators serve as your rulers, helping you compare values to see if they are equal, greater, or less than one another. Logical operators act as decision-makers, guiding you through logical conditions like true or false. Bitwise operators, on the other hand, allow you to work with data at a finer level, manipulating individual bits. Assignment

operators are like your hammer, setting values into variables, while increment and decrement operators work as quick adjustments to modify values in an efficient manner. Reflecting on the power of operators in C++ will help you appreciate how they come together to create dynamic, functional programs that solve complex problems efficiently.

2. Topic Introduction:

Operators in C++ are fundamental tools used to perform operations on variables and values. They enable a wide range of mathematical, logical, and bitwise manipulations within a program. Operators in C++ can be categorised into several types, including arithmetic operators (such as +, -, *, and /), relational operators (like ==,!=, <, and >), logical operators (&&, ||, and !), and assignment operators (=, +=, -=, etc.). Understanding how to use these operators is crucial for performing calculations, making comparisons, and controlling the flow of a program. Operators form the building blocks for developing efficient and functional C++ programs, making them a key area of study in learning the language.

3.1. General Objective:

To understand the principles and usage of operators in C++ and their significance in performing operations on variables and values. Students will learn how different types of operators such as arithmetic, relational, logical, bitwise, and assignment operators are used to manipulate data, control flow, and solve problems efficiently in C++ programming.

3.2. Specific Objectives:

Students will be able to

1. Explain the different types of operators in C++, including arithmetic, relational, logical, bitwise, and assignment operators, and their functions in performing various operations on data.
2. Demonstrate the use of arithmetic operators in C++ to perform mathematical calculations like addition, subtraction, multiplication, and division.
3. Analyse the role of relational and logical operators in evaluating expressions and making decisions through conditional statements such as if, else, and loops.
4. Understand and apply bitwise operators for manipulating data at the binary level and performing tasks like shifting bits or performing bitwise AND, OR, and XOR operations.
5. Evaluate the use of assignment operators in C++ to assign values to variables and combine operations with shorthand operators like +=, -=, *=, and /= for efficient coding practices.

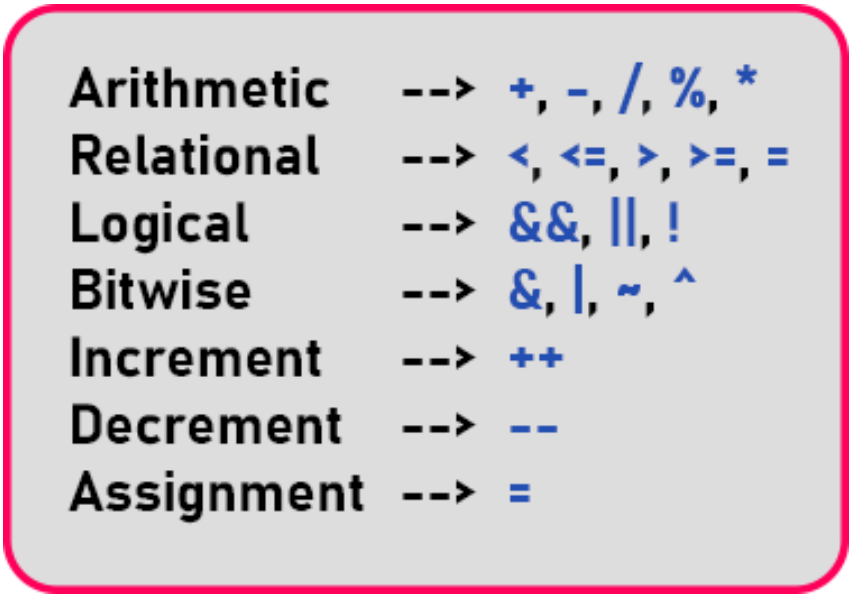
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		1,3,4	1,3,4			
C. Procedural Knowledge			2,4	3,4,5		

D. Meta Cognitive Knowledge					5	5

3.4. Keywords: Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Assignment Operators

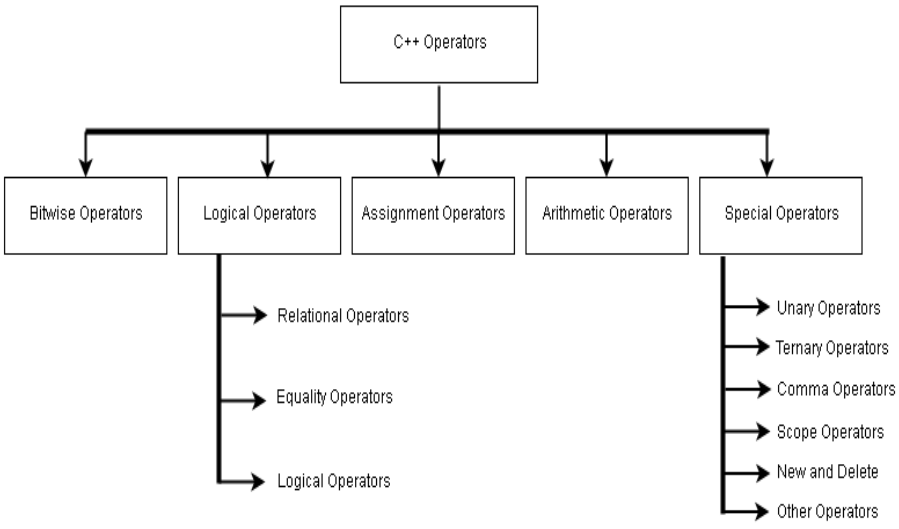
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the different operators in C++. These may include questions about arithmetic, relational, logical, and bitwise operators. One of the students will be asked to demonstrate how an operator works by writing a small C++ program that uses any type of operator studied during the class. They will also be asked to explain the function and syntax of the operator they used in the program.

4. Mind Map:



5. Summary:

Students will be asked to identify and categorise the different types of operators in C++ (arithmetic, relational, logical, bitwise, etc.) by creating a mind map. This activity will help students organise the operators based on their functionality and usage, making it easier to understand how each operator is used in programming. The mind map will highlight key concepts, such as the purpose of each operator and examples of their application in C++ code.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Provided with different C++ code snippets, students will identify and categorize the operators used (e.g., assignment, comparison, arithmetic) and explain their role within the context of the code. They will take code "sections" and interpret their functionality, reinforcing practical understanding of operators in programming.
2. Students will be tasked with creating e-content explaining the function and use of various C++ operators. This could include examples of arithmetic, relational, logical, and bitwise operators, alongside real-world analogies and code demonstrations.
3. How do you visualise the role of different operators (arithmetic, logical, relational) in a C++ program? Think of them as tools in a toolbox; how do you select and use them based on the task at hand?

7. FAQs:

1. What are operators in C++?
2. What is the difference between the == and = operators in C++?
3. What are the types of operators in C++?
4. What is the purpose of the ++ and -- operators in C++?
5. What is the difference between the & operator and the && operator in C++?

8. References:

1. Balagurusamy E. *Object oriented programming with C++*. New Delhi: Tata McGraw – Hill publishing company Ltd. 4th Reprint, 2015.
2. Ramesh Gaonkar. *Microprocessor Architecture Programming and Applications with the 8085*. India: Penram International Publishing Private Limited. Fifth edition 2011.
3. Ravichandran D. *Programming in C++*. New Delhi: Tata Mc. Graw Hill Publishing company Ltd.

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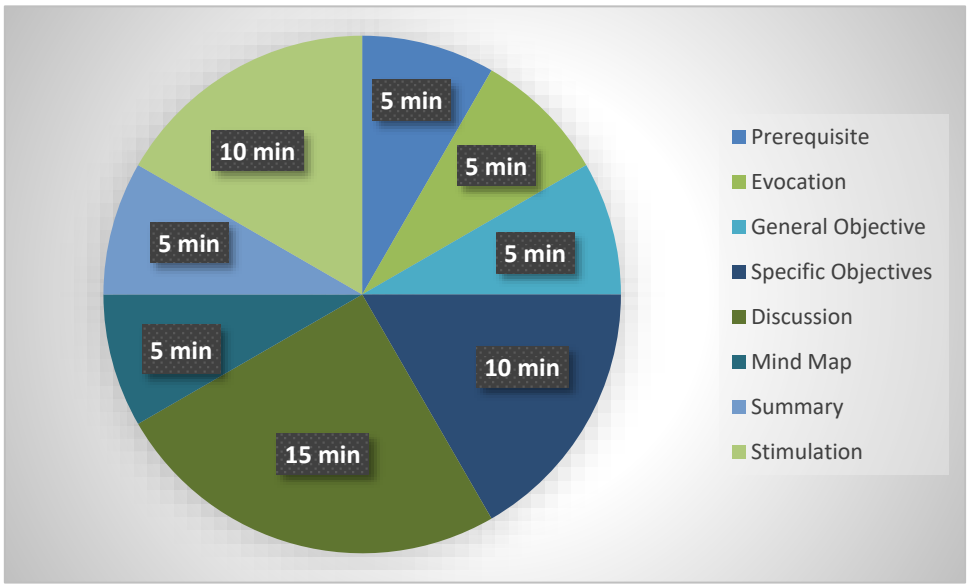
LESSON PLAN

Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	V
Subject Title	Core Elective: Renewable Energy Sources
Code	21UPHE51
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	UnitV- Geothermal Power Plant
Name of the Faculty	Dr. P. Padmavathi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge: Understanding of geothermal energy, basic thermodynamics, heat transfer principles, and the functioning of conventional power plants.

Micro-Planning



1. Topic for Learning through Evocation:

Imagine the Earth's interior as a massive, untapped source of energy. Beneath the crust lies immense heat, generated by the planet’s molten core and radioactive decay. This heat, known as geothermal energy, can be harnessed to produce electricity. Students are encouraged to think about natural phenomena like hot springs, geysers, and volcanic activity as evidence of Earth's internal energy. A geothermal power plant taps into this energy by extracting steam or hot water from deep reservoirs. This heat is converted into electricity through turbines, similar to traditional power plants. Reflecting on the sustainability and low environmental impact of geothermal energy will help students appreciate its role in a greener future.

2. Topic Introduction:

A geothermal power plant harnesses the Earth's internal heat to generate electricity. This heat comes from the planet’s molten core and radioactive decay, accessible through reservoirs of steam or hot water beneath the surface. By converting this thermal energy into mechanical and then electrical energy, geothermal power plants provide a renewable and sustainable energy source. Their low environmental impact makes them an essential part of future energy solutions. Natural phenomena like geysers and hot springs demonstrate the potential of geothermal energy.

3.1. General Objective:

To understand the principles and operation of geothermal power plants and their significance as a sustainable energy source.

3.2. Specific Objectives:

Students will be able to

1. Explain the working principle of geothermal power plants and the process of harnessing Earth's heat.
2. Identify the different types of geothermal power plants, such as dry steam, flash steam, and binary cycle systems.
3. Analyse the advantages and limitations of geothermal energy compared to other renewable energy sources.
4. Evaluate the environmental and economic impact of geothermal power plants on sustainable energy production.

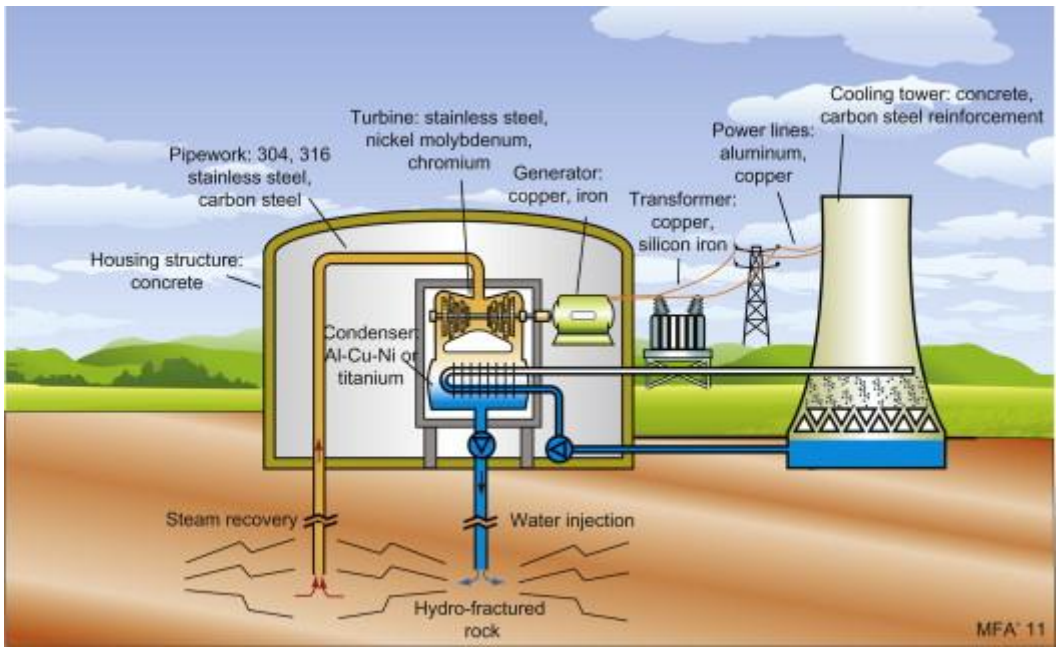
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1,2	1,2				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge				3,4		
D. Meta Cognitive Knowledge				3, 4	4	4

3.4. Keywords:

Geothermal Energy, Renewable Energy, Heat Reservoirs, Flash Steam System, Binary Cycle Power Plant

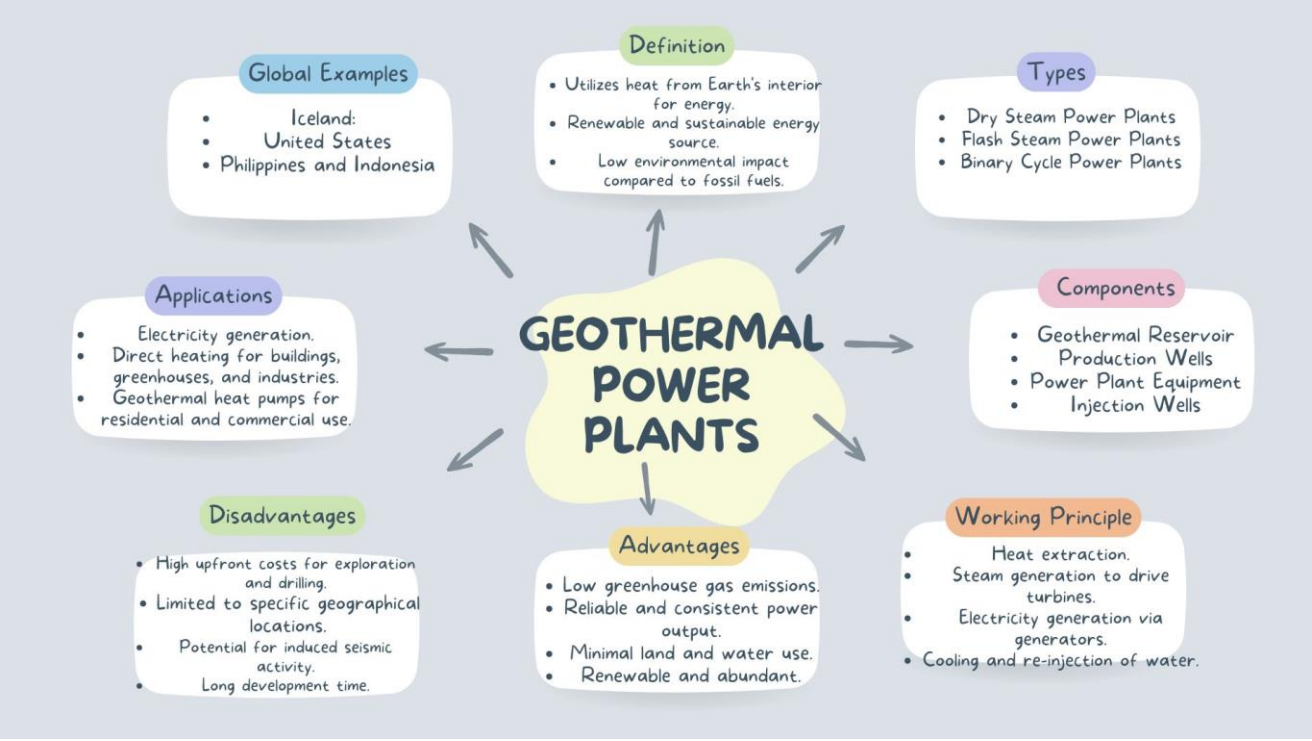
3.5. Key Diagram:



Discussion:

The students will be asked to discuss how geothermal power plants harness heat from the Earth's interior to generate electricity. They will explore why geothermal energy is a reliable and sustainable resource compared to other renewables. One student will be invited to draw and explain the working of a specific type of geothermal power plant, such as a flash steam or binary cycle system. The discussion will also include practical implications, such as its role in reducing carbon emissions and its potential in regions with high geothermal activity.

4. Mind Map:



5. Summary:

Students will be asked to identify how geothermal power plants evolve by using a mind map. The activity will help students visualise and understand the development and technological advancements in geothermal energy. They will map out the key stages in the evolution of geothermal power plants, including the history, improvements in drilling technology, and the environmental impact, thus reinforcing their comprehension of the topic.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. What real-world examples can you use to visualize mutual induction in action (e.g., wireless charging, power transmission)?
2. Create an e-content explaining the relationship between two coils in mutual induction, highlighting the role of magnetic flux and induced emf in each coil.
3. Provide students with electromagnetic components such as coils and ask them to demonstrate mutual induction by varying current in the primary coil and measuring the induced emf in the secondary coil.

7. FAQs:

1. What is a geothermal power plant?
2. How does a geothermal power plant work?
3. What are the different types of geothermal power plants?
4. What are the environmental impacts of geothermal power plants?
5. What are the advantages of geothermal energy?

8. References:

1. Dr. Rai G.D. *Non conventional Energy Sources*. Khanna Publishers. Reprint, 2014.
2. Jose Robin. G and Ubald Raj A. *Energy Physics.* Marthandam: Indira Publications. First edition 2014.
3. Vaidyanathan G and Purniah V. *Energy and Environment*. Yes Dee Publication..2020.

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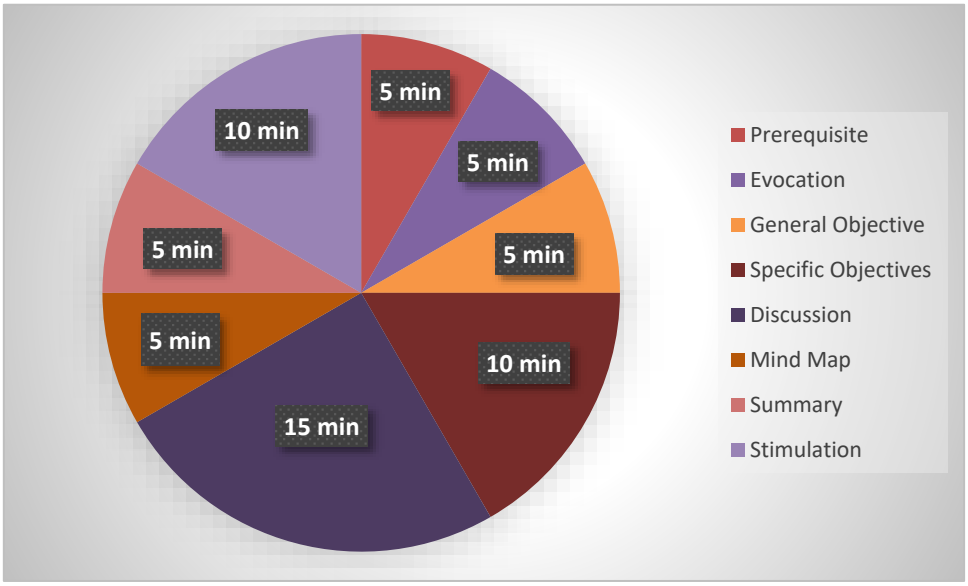
LESSON PLAN

Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	VI
Subject Title	Core VIII: Relativity and Quantum Mechanics
Code	21UPHC61
Hours	5
Total Hours	75
Credits	4
Max Marks	100
Unit & Title	Unit I- Length Contraction
Name of the Faculty	Ms. A. Lucas Rexceline
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge: Understanding of special relativity, reference frames, and the speed of light as a constant.

Micro-Planning



1. Topic for Learning through Evocation:

Imagine travelling on a spaceship moving close to the speed of light. As you look outside, distances between stars appear shorter than usual. This phenomenon, known as length contraction, is a cornerstone of Einstein's theory of relativity. It states that objects appear compressed in the direction of motion relative to an observer when moving at relativistic speeds. This counterintuitive idea challenges our everyday experiences and highlights how space and time are interconnected. Students can reflect on how this concept reshapes our understanding of the universe and its implications for high-speed travel and cosmic phenomena.

2. Topic Introduction:

Length contraction is a key concept in Einstein's theory of special relativity, describing how the length of an object moving at relativistic speeds appears shortened along its direction of motion relative to a stationary observer. This effect only becomes significant as the object's speed approaches the speed of light. It demonstrates the interplay between space and time, challenging classical notions of absolute measurements. Understanding this phenomenon helps us explore high-speed travel and cosmic observations. It's mathematically described using the Lorentz factor.

3.1. General Objective:

To understand the concept of length contraction and its significance in the framework of special relativity.

3.2. Specific Objectives:

Students will be made to

1. Explain the phenomenon of length contraction and its dependence on relative velocity.
2. Derive the mathematical expression for length contraction using the Lorentz transformation.
3. Analyse scenarios where length contraction is significant, such as near-light-speed travel.
4. Relate length contraction to other relativistic effects like time dilation.

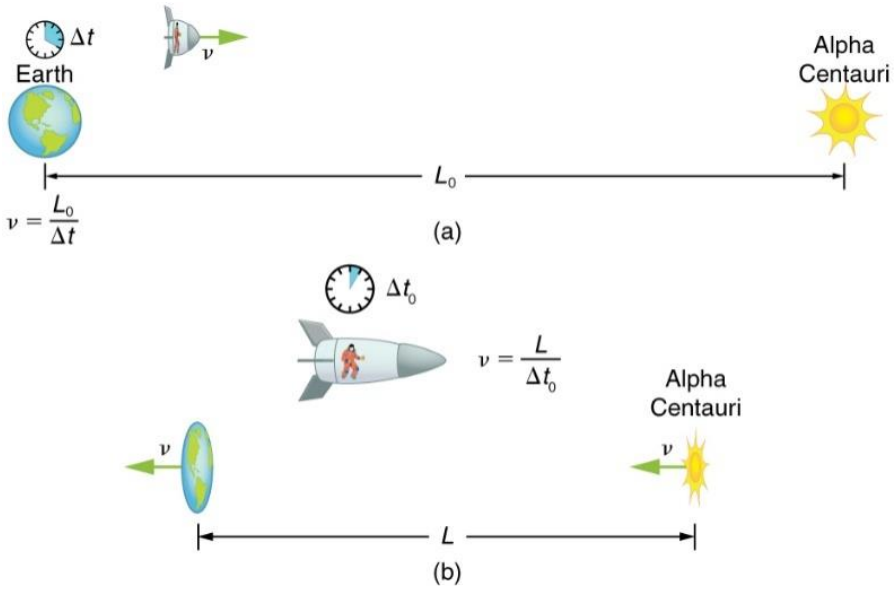
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge				3		
D. Meta Cognitive Knowledge				4	4	4

3.4. Keywords:

Length Contraction, Lorentz Transformation, Relativistic Speed, Reference Frame, Special Relativity

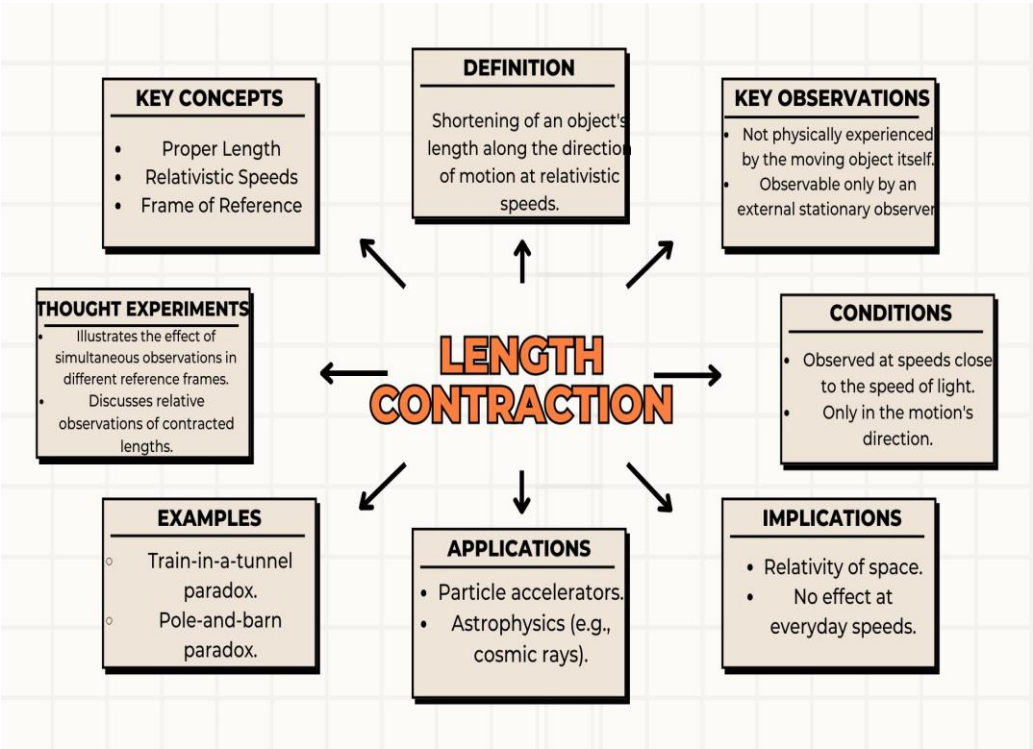
3.5. Key Diagram:



Discussion:

The students will be asked to discuss how the length of an object changes as its speed approaches the speed of light. They will explore why this phenomenon is not noticeable in everyday life but becomes significant in relativistic scenarios. One student will be invited to illustrate the length contraction formula on the board and explain its components. The discussion will also include practical implications, such as in high-speed particle accelerators and interstellar travel.

4. Mind Map:



5. Summary:

Students will summarise the concept of length contraction, emphasizing its dependence on relative velocity and its mathematical formulation using the Lorentz transformation. They will discuss its significance in relativistic scenarios, such as high-speed travel and particle physics, and relate it to other phenomena like time dilation. Practical examples and applications will be identified, reinforcing the importance of length contraction in understanding the principles of special relativity.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Compare length contraction to the compression of a spring. How does the object's motion affect its "perceived" length?
2. If a spaceship traveling near the speed of light appears shorter to a stationary observer, how would the spaceship's crew perceive the stationary observer's surroundings?
3. Imagine designing a high-speed train system operating at relativistic speeds. How would length contraction impact track measurements and station designs?
4. Develop a thought experiment or analogy to help explain the concept of length contraction to someone unfamiliar with special relativity.

7. FAQs:

1. What is length contraction?
2. Why does length contraction occur?
3. At what speeds does length contraction become significant?
4. Does length contraction affect the object's actual size?

8. References:

1. Murugeshan R and KiruthigaSivaprasath. *Modern Physics*. S. Chand & Co. Ltd. 18th revised edition 2016.
2. Kamal Singh and Singh S. P. *Quantum Mechanics*. S. Chand & Co Ltd. 1998.
3. Brijlal and Subramanyam. *Modern Physics*. 8th edition 2007.
4. Rajam J. B. *Atomic Physics*. S. Chand & Co. 8th edition1981.

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LESSON PLAN

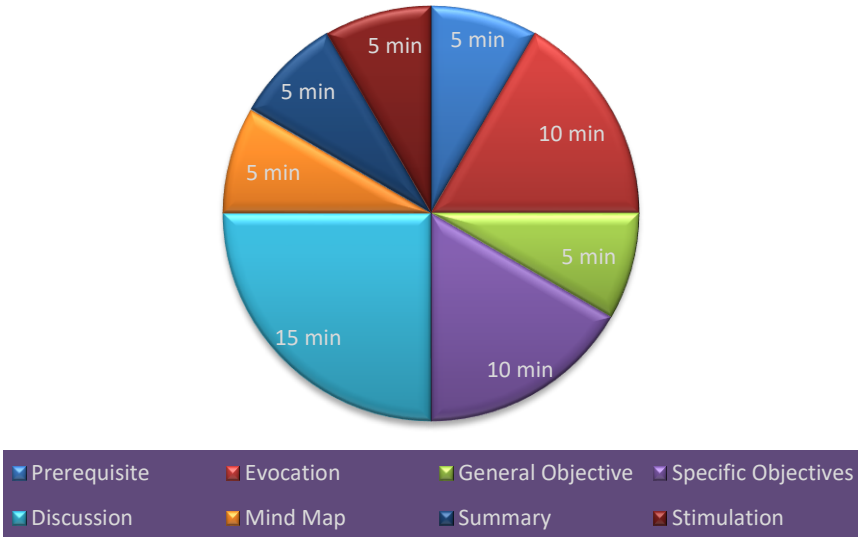
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	VI
Subject Title	Core IX: Atomic and Nuclear Physics
Code	21UPHC62
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	Unit V – Chain Reaction, Nuclear Fusion, and Nuclear Fission
Name of the Faculty	Dr. S. Euchrista Immaculate Sylvia
T-L tools	Lecture method, Visual aid: PPT

Prerequisite Knowledge:

Students should have basic knowledge of atomic structure and the role of protons, neutrons, and electrons in nuclear reactions.

Micro-Planning



1. Topic for Learning through Evocation:

Atoms are the building blocks of matter, and their nuclei harbor enormous energy. In natural and man-made processes, these energies are harnessed through chain reactions, fusion, and fission. These phenomena power stars, nuclear reactors, and atomic weapons.Students will be asked to recall their understanding of atomic nuclei and share examples of where they believe nuclear energy is used (e.g., power plants, the Sun).

2. Topic Introduction:

1. Chain reactions occur when a nuclear reaction causes subsequent reactions in a self-sustaining series.
2. Nuclear fission is the splitting of a large nucleus into smaller nuclei, releasing energy and neutrons.
3. Nuclear fusion is the combining of small nuclei to form a larger nucleus, accompanied by massive energy release.

3.1. General Objective:

To enable the students to understand the fundamental principles and applications of chain reactions, nuclear fusion, and nuclear fission.

3.2. Specific Objectives:

Students will be able to

1. Define chain reactions, nuclear fusion, and nuclear fission.
2. Differentiate between fusion and fission processes.
3. Understand the role of chain reactions in sustaining nuclear processes.
4. Identify practical applications of nuclear reactions (e.g., power generation, medicine).

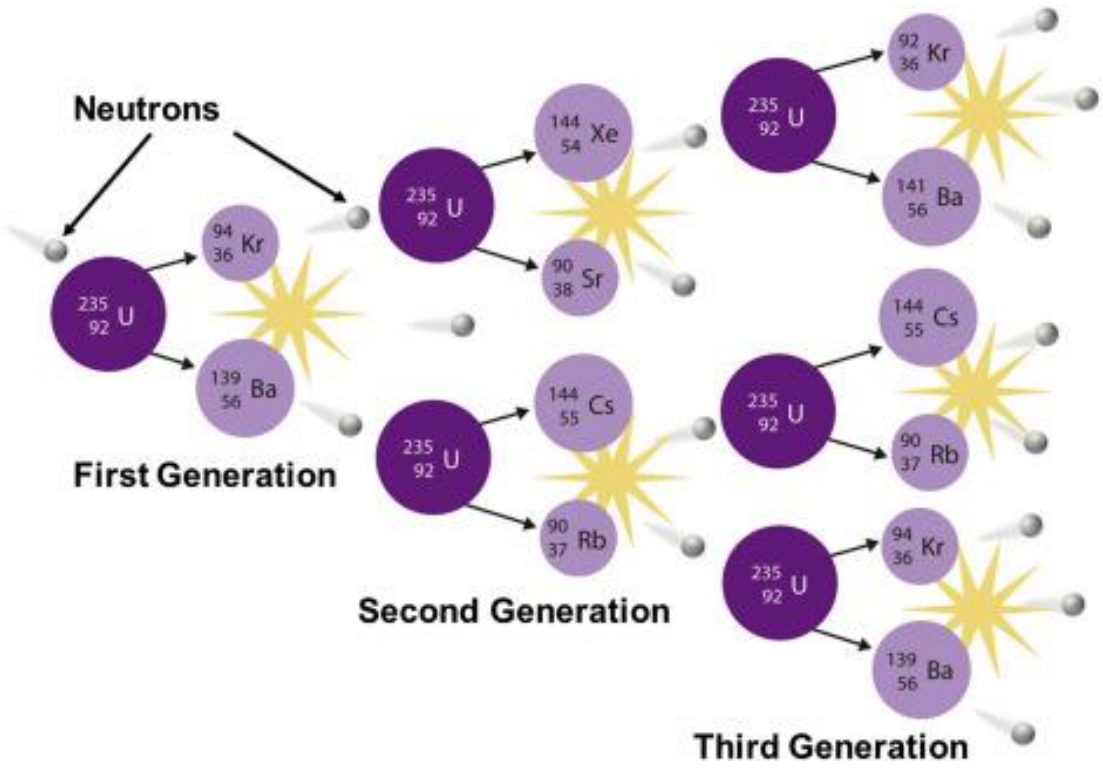
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1					
B. Conceptual Knowledge		2		2		
C. Procedural Knowledge			3		3	
D. Meta Cognitive Knowledge				4		4

3.4. Keywords:

Chain reaction, fission, fusion, nuclear energy, neutron moderation, thermonuclear reaction.

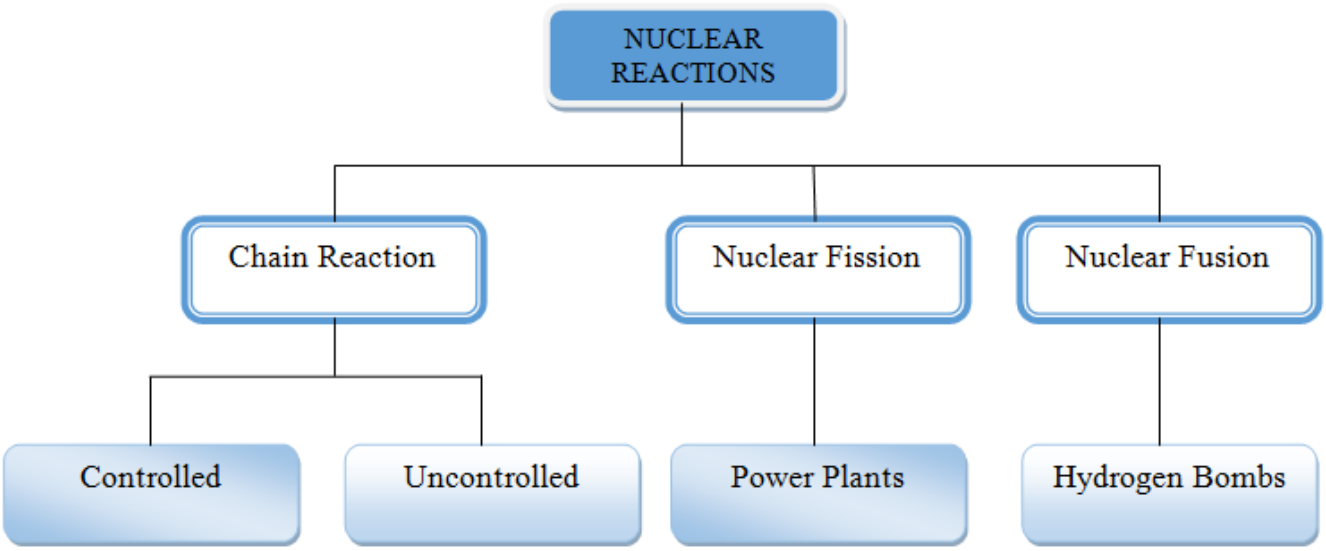
3.5. Key Diagram:



Discussion:

Students will be made to discuss how chain reactions differ in controlled environments (e.g., nuclear reactors) versus uncontrolled ones (e.g., atomic bombs). They will work in pairs to describe the processes of nuclear fission and fusion and share their insights.

4. Mind Map:



5. Summary:

Students will be asked to summarise the key differences between nuclear fission and fusion. They will explain how chain reactions enable these processes, referring to the provided diagrams and mind map.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Describe how chain reactions sustain energy production in nuclear power plants.
2. Compare and contrast the energy output of nuclear fusion and fission.
3. Generate an idea for a presentation on nuclear energy's role in future technology.
4. Discuss the challenges of harnessing nuclear fusion on Earth

7. FAQs:

1. What is a chain reaction?
2. How does nuclear fission differ from fusion?
3. Why is nuclear fusion challenging to achieve on Earth?
4. What role do moderators play in nuclear reactors?

8. References:

1. Murughesan R and KiruthigaSivaprasath. *Modern Physics*. S.Chand& Co Ltd. 18th revised edition 2016.
2. Gupta A. *Modern Physics*. Book and Allied Pvt. Ltd. First edition 2006.
3. Tayal D. C. *Atomic and Nuclear Physics*. Himalaya Publishing House. 3rd revised edition 1998.

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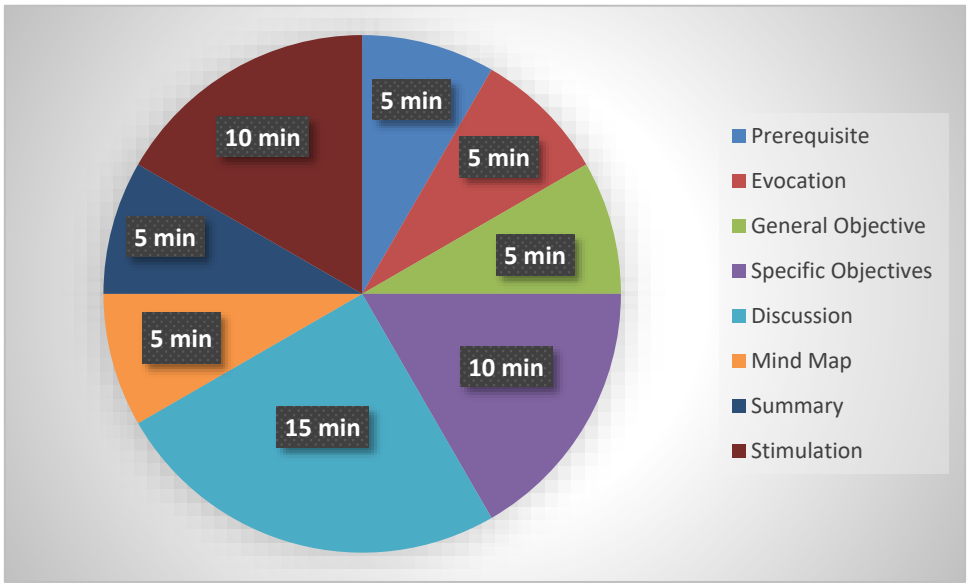
LESSON PLAN

Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	VI
Subject Title	Core X: Opto Electronics and Fibre optic communication
Code	21UPHC63
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	UnitI- Direct band gap and indirect band gap semiconductors
Name of the Faculty	Ms. P. Dhanalakshmi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge: Understanding of energy bands, band gaps, and the interaction of electrons with photons and phonons in semiconductors.

Micro-Planning



1. Topic for Learning through Evocation:

Semiconductors play a vital role in modern technology, enabling devices like LEDs, lasers, and transistors. The efficiency of these devices depends on whether the material has a direct or indirect band gap. In direct band gap semiconductors, electrons can transition between the conduction and valence bands without a change in momentum, emitting photons efficiently. In contrast, indirect band gap semiconductors require a phonon to conserve momentum, making them less efficient for light emission but ideal for electronic applications. Materials like gallium arsenide and silicon exemplify these types. Students will be encouraged to reflect on the role of energy band alignment in these processes and how it influences applications in optoelectronics and electronics.

2. Topic Introduction:

Semiconductors are categorised based on their band gap alignment into direct and indirect types. In direct band gap semiconductors, electrons transition between energy bands efficiently, emitting photons, making them ideal for light-emitting devices. Indirect band gap semiconductors require phonons to facilitate transitions, focusing their use on electronic applications like transistors. Understanding the alignment of energy bands and their interactions is crucial to grasping the difference. Examples include gallium arsenide (direct) and silicon (indirect).

3.1. General Objective:

To understand the fundamental principles and applications of direct and indirect band gap semiconductors in electronics and optoelectronics.

3.2. Specific Objectives:

Students will be able to

1. Explain the distinction between direct and indirect band gap semiconductors based on energy band alignment.
2. Analyze the role of momentum conservation in photon and phonon interactions during electron transitions.
3. Identify examples of direct and indirect band gap materials and their corresponding applications.
4. Evaluate the efficiency of these semiconductors in devices like LEDs, lasers, and transistors.

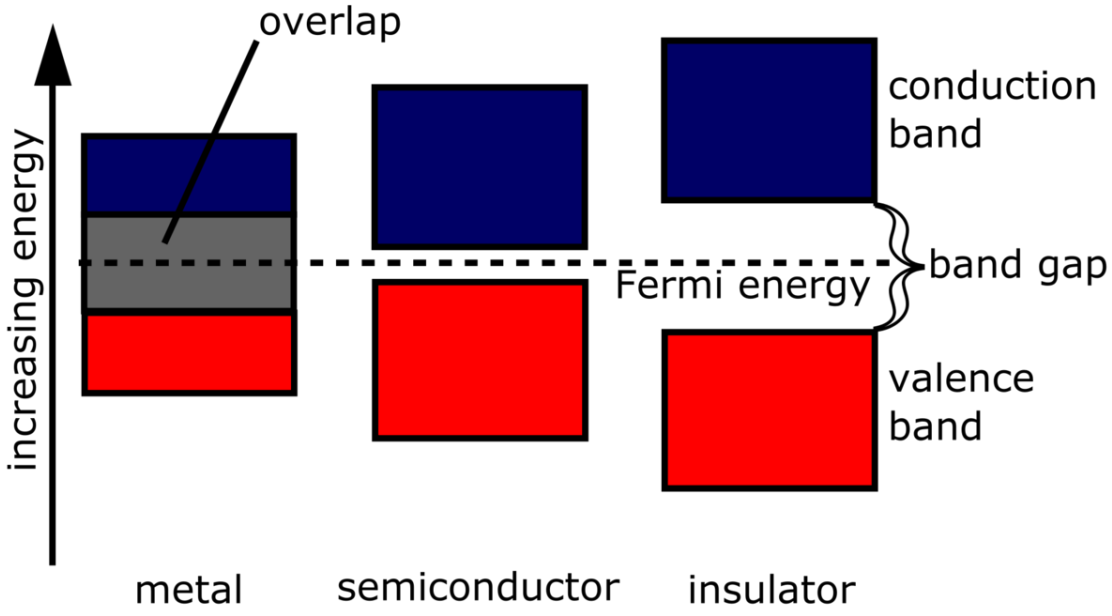
3.3. Taxonomy of Objectives:

Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1				
B. Conceptual Knowledge		2	2			
C. Procedural Knowledge				3		
D. Meta Cognitive Knowledge				4	4	4

3.4. Keywords:

Direct Band Gap, Indirect Band Gap, Photon Emission, Momentum Conservation, Semiconductor Applications

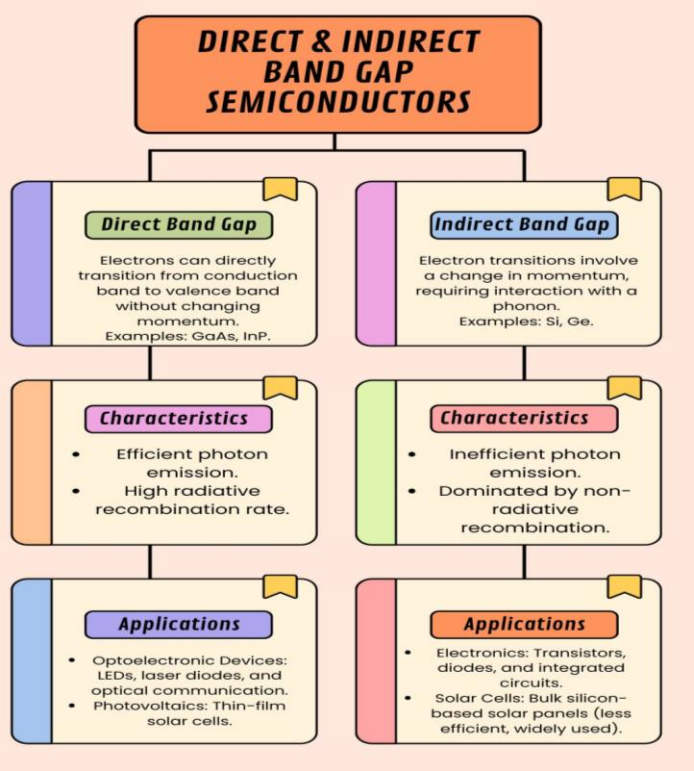
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the distinction between direct and indirect band gap semiconductors and their impact on photon emission. One of the students will be asked to illustrate the energy band alignment in direct and indirect band gap semiconductors with a diagram.

4. Mind Map:



5. Summary:

Students will summarise the key differences between direct and indirect band gap semiconductors, focusing on their energy band alignment, photon and phonon interactions, and efficiency in light emission. They will also identify practical examples and applications, reinforcing the connection between semiconductor properties and their use in optoelectronic and electronic devices.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

1. Compare the behavior of direct band gap semiconductors to a smooth slide where electrons transition effortlessly, emitting light. How does this differ from the bumpy path of indirect band gap semiconductors?
2. If silicon is inefficient for light emission, why is it still the most widely used material in electronics?
3. Imagine designing a solar cell. Would you choose a direct or indirect band gap material? Why?
4. Generate a concept for an e-content module explaining the application of direct band gap semiconductors in LEDs using interactive visuals.

7. FAQs:

1. What is the primary difference between direct and indirect band gap semiconductors?
2. Why are direct band gap semiconductors more suitable for LEDs?
3. Can indirect band gap semiconductors emit light?
4. Why is silicon widely used in electronics despite being an indirect band gap material?
5. How do phonons influence the performance of indirect band gap semiconductors?

8. References:

1. Dr. Arumugam M. *Semiconductor Physics & Optoelectronics*. AnuradhaPublications. Reprint, First edition 2009.
2. Jose Robin G and Ubald Raj A. *Optoelectronics*. Marthandam: Indira Publication. Reprint, 2012.
3. Pallab Battacharya. *Semiconductor optoelectronic devices*. NewDelhi: Pearson Education. Second edition 2000.
4. Ajoy Ghatak. *Optics.* India: McGraw Hill Education Private Limited. Fourth reprint, 2014.
5. Ajoy Ghatak and Thyagarajan K. *Introduction to Fibre optics*. India: Cambridge University Press Pvt. Ltd. Reprint, 2011.
6. Subir Kumar Sarkar. *Optical fibre and fibre optic communication system*. S. Chand & company. Reprint, First edition 2008.

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LESSON PLAN

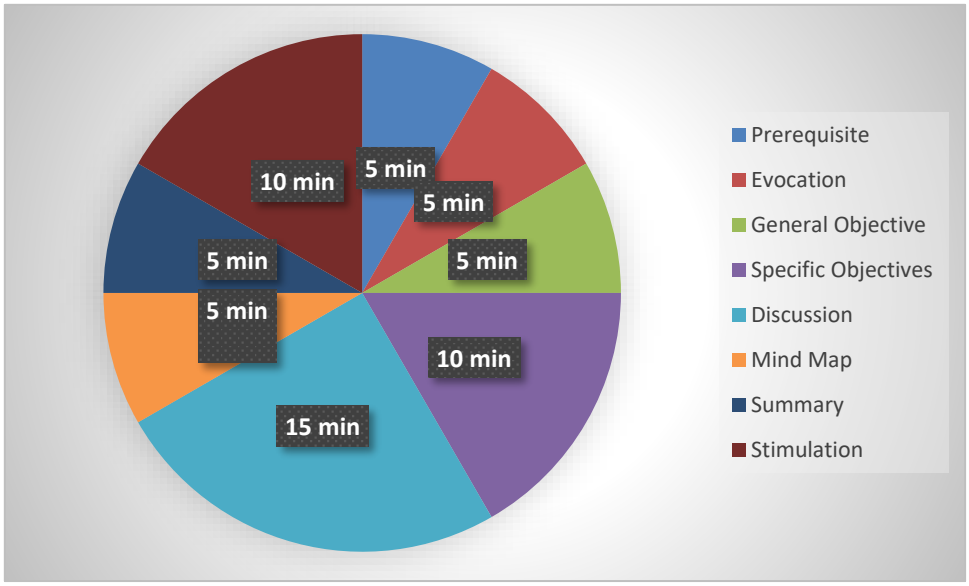
Objective-Oriented Learning Process Based on RBT

Programme	B.Sc. Physics
Semester	VI
Subject Title	Core XI: Advanced Physics
Code	21UPHC64
Hours	4
Total Hours	60
Credits	4
Max Marks	100
Unit & Title	Unit IV – BCS Theory
Name of the Faculty	Dr.P.Padmavathi
T-L tools	Mind Maps, PowerPoint, Group Discussion

Prerequisite Knowledge:

Basics of quantum mechanics, electron pairing, and an overview of superconductivity.

Micro-Planning



1. Topic for Learning through Evocation:

Superconductivity, first discovered in 1911, is a fascinating phenomenon where materials exhibit zero electrical resistance and expel magnetic fields below a certain critical temperature. This mysterious behaviour puzzled scientists for decades. In 1957, Bardeen, Cooper, and Schrieffer introduced the BCS theory, revolutionising our understanding of superconductivity. They proposed that electrons can pair up through interactions with lattice

vibrations (phonons), forming Cooper pairs. These pairs behave collectively as a single quantum state, eliminating scattering and resistance.

To spark curiosity, students will be asked:

- How can electrons, which repel each other, pair up?
- Why do materials lose resistance entirely instead of just reducing it?
- How does this relate to real-world applications like MRI machines or quantum computing?

2. Topic Introduction:

The BCS theory, developed by Bardeen, Cooper, and Schrieffer, provides a microscopic explanation of superconductivity. It describes how electrons, through lattice vibrations (phonons), form Cooper pairs, which collectively behave as a quantum state. This pairing mechanism leads to zero electrical resistance and the expulsion of magnetic fields (Meissner effect). The theory successfully explains the energy gap observed in superconductors. It remains a cornerstone in understanding conventional superconductors, though it does not cover high-temperature superconductivity.

3.1. General Objective:

To understand the foundational principles and applications of the BCS (Bardeen-Cooper-Schrieffer) theory in explaining superconductivity.

3.2. Specific Objectives:

Students will be able to

1. Define and describe the BCS theory.
2. Explain the concept of Cooper pairs.
3. Analyse how the BCS theory explains zero electrical resistance and the Meissner effect.
4. Relate the BCS theory to experimental observations in superconductors.

3.3. Taxonomy of Objectives:

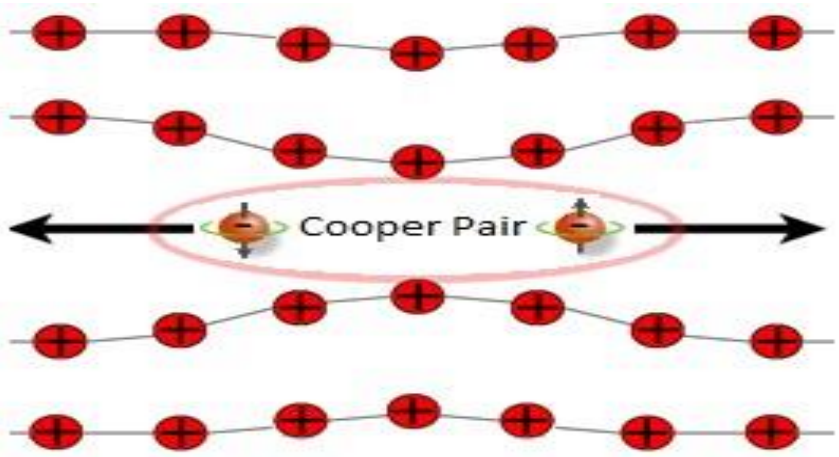
Taxonomy of Objectives						
Knowledge Dimension	**The Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
A. Factual Knowledge	1	1				
B. Conceptual Knowledge		2	2			

C. Procedural Knowledge				3		
D. Meta Cognitive Knowledge				4	4	4

3.4. Keywords:

BCS Theory, Cooper Pairs, Energy Gap, Phonons, Superconductivity

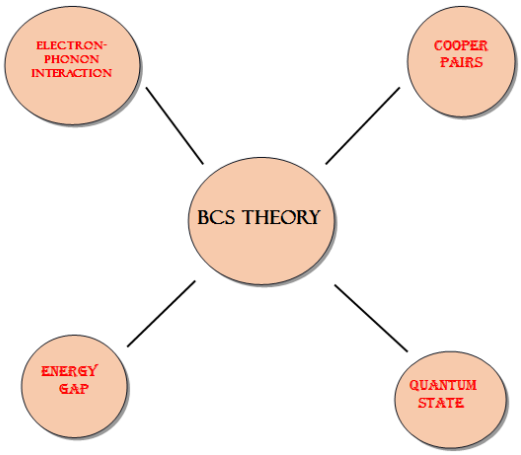
3.5. Key Diagram:



Discussion:

The students will be asked questions regarding the concept of Cooper pairs and their role in superconductivity. One of the students will be asked to illustrate the energy gap or the formation of Cooper pairs with a diagram.

4. Mind Map:



5. Summary:

Recap the significance of Cooper pairs and the energy gap in explaining superconductivity. Discuss how BCS theory laid the groundwork for modern superconducting technologies.

6. Assessment through Stimulating Questions/Analogies/New Ideas and Concepts:

Short Questions:

1. Define Cooper pairs.
2. State the significance of the energy gap in superconductivity.
3. Why is the BCS theory limited to conventional superconductors?

Problem-Solving:

1. Calculate the critical temperature given the energy gap and material properties.

7. FAQs:

1. What is the BCS theory?
2. What are Cooper pairs?
3. How does the BCS theory explain zero electrical resistance?
4. What is the energy gap in BCS theory?
5. What role do phonons play in the BCS theory?

8. References:

1. Murugeshan R. *Optics and spectroscopy*. S. Chand & Co. 1995.
2. Coswami A. *Thin film fundamentals*. New Age International Publishers. Reprint, 2017.
3. Rajendran V. *Materials Science*. New Delhi: Mc Graw Hill Education Pvt Ltd. Reprint, 2018.
4. Palanisamy P. K. *Solid state Physics*. Chennai: Scitech publication (India) Pvt Ltd. 3rd Reprint, 2008.
5. Sri Vastava C M and Srinivasan C. *Science of Engineering materials and Carbon Nanotubes*. New Age International Publishers. Reprint, Third Edition 2012.
6. *Physics education*, volume 19, No.1, April – June 2002.
7. Dr. Mani P. *A text book of Engineering Physics II*. Dhanam Publications.

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