Training of KRPs of Western Region on the use of Secondary Stage -2 Physics Kit

PAC-23.24
OCTOBER 7-10, 2024

Session 2024-25

Programme Coordinator
Dr. Kalpana Maski

Programme Co-coordinator
Dr. Chakradhar Behera

REGIONAL INSTITUTE OF EDUCATION
National Council of Educational Research and Training, Bhopal

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Preface

In the journey towards reshaping the Indian educational landscape, the National Education Policy (NEP) 2020 serves as a guiding framework to foster innovation, inclusivity, and academic excellence. One of the critical aspects of NEP 2020 is the emphasis on experiential learning and the development of critical thinking skills. To support this vision, the NCERT has taken a significant step by designing specialized teaching aids such as the Secondary Stage-2 Physics Kits, aimed at enriching the teaching and learning experience in the science classrooms across India.

The primary objective of Secondary Stage-2 Physics kit is to offer students and educators the opportunity to engage with fundamental physics concepts in a hands-on manner. By allowing students to experiment, observe, and derive conclusions based on real-world applications, these kits help bridge the gap between theoretical knowledge and practical understanding.

This training program for the Key Resource Persons (KRPs) of the Western Region on the use of Secondary Stage-2 Physics kit has been designed to familiarize them with the structure, functionality, and potential applications of the Secondary Stage-2 Physics Kit. It is aimed at empowering educators to integrate these kits into their physics curriculum, thereby enriching their teaching methodologies and facilitating a deeper understanding of physics among students.

As catalysts of educational change, the KRPs play a pivotal role in ensuring that the resources, strategies, and pedagogies introduced in this program reach teachers across the region. Their expertise and commitment to the cause will be instrumental in transforming the classroom into a dynamic and engaging learning environment, in line with the objectives of NEP 2020.

This initiative marks a significant stride in the ongoing efforts to modernize education in India, ensuring that both teachers and students are well-equipped to navigate the challenges and opportunities of a rapidly evolving world. We hope this training will serve as a foundation for a brighter, more inclusive future of education, where curiosity, creativity, and innovation are nurtured through collaborative learning.

Dr. Chakradhar Behera
(Programme Co-coordinator)

Dr. Kalpana Maski
(Programme Coordinator)

Acknowledgement

We humbly acknowledge the grace and blessings of Almighty God, whose guidance and support have been ever-present throughout our journey. We are grateful for the strength, wisdom, and providence bestowed upon us, enabling us to undertake this endeavor with purpose and determination.

We are deeply grateful to Professor Jaydip Mandal, Principal of RIE, whose guidance and visionary leadership throughout the capacity-building program have been invaluable. Their leadership has created an environment conducive to professional development and educational advancement.

We extend our sincere gratitude to Professor Chitra Singh, Head of Extension Education, for her kind support throughout the capacity-building program. Her invaluable assistance has been instrumental in ensuring the success of this endeavor.

We are deeply grateful to the Head of the Department of Educational Science and Mathematics (DESM), Prof. Rashmi Singhai, for her strategic direction and constant encouragement, which have played a vital role in integrating the Secondary Stage-2 Physics Kits into the training process.

A special note of thanks is due to the Resource Person(s), namely Dr. Santosh Kumar, Dr. Shivalika Sarkar, Mr. L.S. Chouhan, Dr. Chakradhar Behera (Co-coordinator), Mr. Gourav Sahu (Lab Assistant) whose expertise and dedication to the subject matter have enriched the training experience for all participants. Their detailed knowledge of the physics kits and their ability to present complex concepts in an accessible and engaging manner has been invaluable.

A special gratitude is owed to Joint Project Director Dr. Manoj Rathore MPCST, Mr. Pankaj Godhara Programme coordinator, and Mr. Karan Bhinde Project Associate of Creative Learning Center, MPCST, for their invaluable support and contribution. Their collaboration has played a key role in enhancing the effectiveness of the program. Their dedication to educational innovation and their hands-on involvement have been instrumental in ensuring the seamless integration of the Secondary Stage-2 Physics Kits into the training process. Their expertise and proactive approach helped address numerous challenges, ensuring that all logistical aspects of the program were smoothly executed.

We extend our sincere gratitude to the administrative staff of RIE for their dedicated support and seamless coordination throughout the capacity-building program on “Training of KRPs of Western Region on the use of Secondary Stage -2 Physics Kits. Their efficiency and professionalism have been instrumental in ensuring the smooth execution of various aspects of the program, contributing significantly to its success. We deeply appreciate their hard work and commitment to excellence.

We extend our heartfelt appreciation to all the Participants who have shown great enthusiasm and commitment throughout the training. Their active engagement and eagerness to learn will undoubtedly

ensure the successful implementation of the Secondary Stage-2 Physics Kits in classrooms across the Western Region.

We would like to express our sincere gratitude and appreciation to all those who have contributed directly and indirectly to the successful organization of the training program on the use of Secondary Stage-2 Physics Kits developed by NCERT, in the context of NEP 2020.

Finally, Thankyou, everyone for your contribution to this meaningful and transformative endeavor.

Dr. Chakradhar Behera
(Programme Co-coordinator)

Dr. Kalpana Maski
(Programme Coordinator)

Training of KRPs of Western Region on the use of Secondary Stage -2 Physics Kits

7-10, October 2024

List of Resource Persons

1. Dr. Santosh Kumar, Associate Prof., Regional Institute of Education, NCERT Bhopal
2. Dr. Shivalika Sarkar, Assistant Prof., Regional Institute of Education, NCERT Bhopal
3. Mr. L.S Chouhan, Assistant Professor, Regional Institute of Education, NCERT Bhopal
4. Dr. Pankaj Godhara, Project Coordinator, Center for Creative Learning, MPCST Bhopal
5. Mr. Gourav Sahu, Lab Assistant, Regional Institute of Education, NCERT Bhopal
6. Mr. Karan Bhinde, Project Associate, Center for Creative Learning, MPCST Bhopal
7. Dr. Chakradhar Behera, Assistant Professor, Regional Institute of Education, NCERT Bhopal (Programme Co-coordinator)
8. Dr. Kalpana Maski, Assistant Professor, Regional Institute of Education, NCERT Bhopal (Programme Coordinator)

A Brief Report

Introduction:

The National Education Policy (NEP) 2020 envisions a transformative approach to education that prioritizes critical thinking, experiential learning, and the integration of technology into the curriculum. As part of this vision, the NCERT has developed innovative and comprehensive teaching resources to support the academic and professional development of educators. In this context, the Secondary Stage-2 Physics Kits have been designed to enhance the teaching and learning experience of students of India, empowering them with hands-on, practical knowledge in physics.

The training program focused specifically on the training of KRPs (Key Resource Persons) from the Western Region on the effective use of Secondary Stage-2 Physics Kit. The session aimed to equip the participants with the necessary skills and knowledge to effectively implement the Physics kit in secondary stage classrooms. These kits are designed to enhance practical learning experiences for students and help them better understand complex Physics concepts.

This training program aims to equip the Key Resource Persons (KRPs) of the Western Region with the skills and knowledge necessary to effectively utilize these physics kits in the classroom. The kits are designed to facilitate the learning of key physics concepts through interactive experiments, fostering a deeper understanding of theoretical principles and their real-world applications. By integrating these kits into teaching practices, educators will not only enhance student engagement but also align with the NEP 2020's objective of promoting a more holistic, skill-oriented, and learner-centered educational framework.

Through this training, KRPs will be introduced to the structure, components, and potential applications of the Secondary Stage-2 Physics Kits, enabling them to train and support teachers across the region. This initiative is a significant step in the broader effort to modernize education in India, ensuring that educators are well-prepared to meet the evolving demands of the classroom and foster the development of scientific inquiry among students.

This programme was initiated with the aim of incorporating experiential learning in the physics class at secondary stage. It was designed to enhance the practical understanding of physics concepts through hands-on activities and real-world applications. A total of 26 KRPs from the Western Region participated in the training programme on the use of the secondary stage-2 physics kit at RIE Bhopal, held from October 7 to 10, 2024.

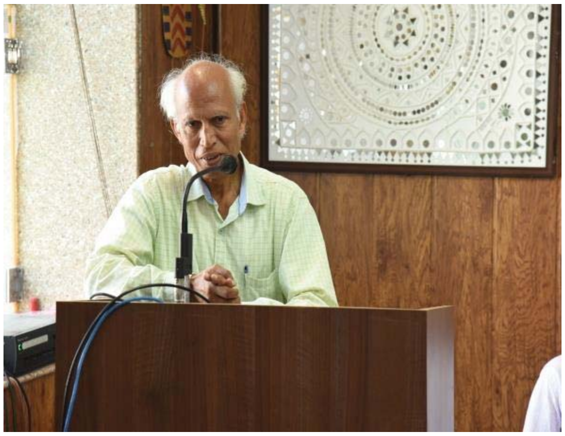
In this training programme, a total of 14 sessions were organized for the participants, covering an orientation of the physics kit, experiential learning, practice sessions, the pedagogical aspects and a visit to the STEAM Park. These sessions were designed to provide hands-on experience, deepen understanding of effective teaching methods, and demonstrate how to integrate the physics kit into classroom activities. The visit to the STEAM Park allowed participants to explore innovative learning environments, offering them practical insights into how interactive and interdisciplinary approaches can enhance student engagement and foster critical thinking in science education.

To make the programme more effective, a visit to the Center for Creative Learning at MPCST Bhopal was organized, where participants explored various models and understood physics concepts through interactive activities. During the visit, they were introduced to innovative teaching tools and resources designed to enhance students' understanding of complex scientific principles. The hands-on experience allowed participants to engage directly with the models, fostering a deeper comprehension of physics concepts while also learning new methods to incorporate these tools into their own classrooms for better student engagement and learning outcomes. The training provided participants with valuable skills to effectively integrate the kit into their classrooms, fostering a deeper engagement with the subject matter among students.

The details of each session are provided below in a comprehensive manner, outlining the specific activities, and outcomes for each part of the programme. Each session was carefully structured to ensure a thorough understanding of the physics kit and to provide practical experience through hands-on activities, and offer opportunities for the participants to engage in reflective discussions. Additionally, the sessions aimed at fostering collaboration among participants, encouraging them to share ideas and strategies for implementing the concepts learned into their own teaching practices.

Day-1
October 7, 2024
Time: 9.30-11.00 am
Session: Registration and Inauguration

The training began with the registration of all the participants, where each participant was provided with the necessary materials and details for the sessions. This organized process ensured that everyone was ready and prepared to engage fully in the training program.

Following the registration, the inaugural session formally kicked off the training program. The inaugural session was graced by the presence of several distinguished guests, including Prof. Mandal, the Principal of the Institute; Prof. Chitra Singh, Head Department of Extension Education; Dr. R.P

Prajapati, Head Department of Education in Science and Mathematics, Dr. Santosh Kumar, Incharge Physics; Dr. Shivalika Sarkar; Mr. L.S. Chauhan; and Dr. Chakradhar Behra, the Co-coordinator of the program. Their presence added great value to the event and set an inspiring tone for the training ahead. Dr. Chakradhar Behra conducted the inaugural session, welcoming all the participants and setting the stage for the training program. His address highlighted the significance of the event and emphasized the importance of continuous professional development for educators. With his guidance, the session was off to a strong start, inspiring all attendees to engage fully in the upcoming training sessions. Dr. Jaydeep Mandal then addressed the attendees, offering a historical review of the efforts made by the Regional Institute of Education (RIE) to train teachers in alignment with the norms of NEP 2020. His speech provided valuable insights into the evolution of teacher training and the goals for future improvements.

After Dr. Mandal's address, Dr. Chitra Singh, Head of the Extension Education Department, motivated the participants with her encouraging words. She stressed the importance of taking the training seriously and effectively applying the knowledge gained in classrooms. Dr. Singh also urged the teachers to share their learnings with others, fostering a collaborative and growth-oriented environment.

Dr. R.P. Prajapati, Head of the Department of Education in Science and Mathematics, then addressed the participants. In his speech, Dr. Prajapati emphasized the importance of an integrated approach to science education. He highlighted how the use of innovative teaching methods, such as those demonstrated in the training, could transform how physics is taught in classrooms. Dr. Prajapati encouraged the participants to adopt an interdisciplinary approach, incorporating practical activities and real-world applications into their lessons. He also stressed the need for continuous reflection on teaching practices and the significance of staying updated with the latest developments in the field of Physics.

Dr. Santosh Kumar, Incharge of Physics, also addressed the gathering. He emphasized the significance of integrating practical physics learning in the classroom to make the subject more engaging and relatable for students. Dr. Kumar shared his insights on the evolving role of educators in creating dynamic learning environments and urged the participants to adopt innovative methods to enhance student understanding and participation. His words further enriched the training atmosphere, encouraging teachers to think critically and creatively about their teaching approaches.

The inaugural session was an inspiring start to the training, leaving all participants energized and ready to dive into the sessions ahead. The vote of thanks was delivered by Dr. Chakradhar Behra, who expressed gratitude to all the distinguished guests, speakers, and participants for their valuable contributions.

He thanked the Principal, Prof. Mandal, Prof. Chitra Singh, Dr. Santosh Kumar, Dr. Shivalika Sarkar, Mr. L.S. Chauhan, and all other members involved in making the event a success. Dr. Behra also acknowledged the efforts of the organizing team and encouraged everyone to make the most of the training sessions, fostering a collaborative and productive learning environment.

Day-1
October 7, 2024
Time: 11.30-1.00 pm
Session: Hands on Minds on
Resource Person: Dr. Santosh Kumar
Regional Institute of Education, NCERT Bhopal

After the inaugural ceremony, Dr. Santosh Kumar led a highly interactive session on effective learning through a hands-on, minds-on approach. He provided an in-depth discussion on the significance of experiential learning and shared practical strategies for incorporating it into our classrooms. Dr. Kumar emphasized how this approach not only engages students actively but also deepens their understanding by allowing them to experience concepts firsthand through experiments.

The session covered how the various components of the Physics kit can be used to conduct experiments that align with the curriculum for higher secondary classes. Emphasis was placed on the importance of hands-on, experiment-based learning to foster a deeper understanding and engagement among students.

Dr. Santosh Kumar provided detailed insights into how the Physics kits can be used to conduct experiments related to key topics such as mechanics, electricity, magnetism, optics, and thermodynamics. He also emphasized the importance of creating a supportive and interactive learning environment, where students are encouraged to explore and learn through direct interaction with the materials.

Participants were actively engaged in practical sessions, where they had the opportunity to work with the Physics kits and design experiments. This allowed them to experience firsthand how the kits can be used to facilitate better teaching and learning outcomes. The training not only focused on the technical use of the kits but also provided valuable insights into how to create an atmosphere of curiosity and experimentation in the classroom.

By the end of the session, the KRPs were well-prepared to share their knowledge with other teachers in their respective regions, ensuring that the Physics kits would be effectively used to enhance the learning experience for secondary stage students across the Western Region. The session aimed to foster a culture of innovative teaching and practical, experience-based learning that would have a lasting impact on both educators and students.

Day-1
October 7, 2024
Time: 2.30 -5.30 pm
Session: Orientation of Secondary Stage-2 Physics Kit
Resource Person: Mr. L.S. Chouhan
Regional Institute of Education, NCERT Bhopal

The second session centered on the orientation of the Physics kit, conducted by Mr. L.S. Chouhan. He provided a comprehensive introduction to the Secondary Stage-2 Physics kit, thoroughly explaining its components, functions, and various applications for conducting experiments. These experiments were specifically designed to align with the higher secondary curriculum and address key concepts in Physics, such as mechanics, electricity, magnetism, optics, and thermodynamics. Mr. Chauhan emphasized the versatility of the kit, demonstrating how it could be used to teach a wide range of topics through hands-on, experiment-based learning.


In addition to the technical aspects of using the kit, Mr. Chauhan also focused on the importance of creating an engaging and supportive classroom environment. He stressed that maintaining a cheerful and positive atmosphere in the classroom not only makes learning easier but also encourages student participation and curiosity. By fostering a relaxed yet focused learning space, teachers can help students feel more comfortable experimenting and exploring new concepts, leading to a deeper understanding and long-lasting retention of knowledge.


This session was an essential part of the training for KRPs from the Western Region, equipping them with the necessary tools and strategies to effectively implement the Secondary Stage-2 Physics Kits in their classrooms. The hands-on approach of the session allowed the participants to gain practical experience with the kit, ensuring that they were fully prepared to deliver the experiments and activities to their students. Mr. Chouhan's session provided both the technical knowledge and pedagogical insights needed to enhance the teaching of Physics and make the learning process more interactive, enjoyable, and impactful for secondary school students.

Day-2
October 8, 2024
Time: 9.30 -11.00 am
Session: Experiential Learning
Resource Person: Dr. Kalpana Maski
Regional Institute of Education, NCERT Bhopal

On the second day of the KRP training for the Physics subject at the secondary stage, the first session was conducted by Dr. Kalpana Maski on experiential learning under the framework of NEP 2020 and NCFSE 2023. The process of teaching and learning for both students and teachers was explained in simple and easy-to-understand language. Dr. Kalpana Maski emphasized the Gurukul education system, highlighting its importance, while also stressing the need for modern teaching methods that are based on practical, competency-based Education. The session focused on creating value-based education through project-based learning, with an emphasis on experiential learning, self-assessment, and experience-based learning activities.

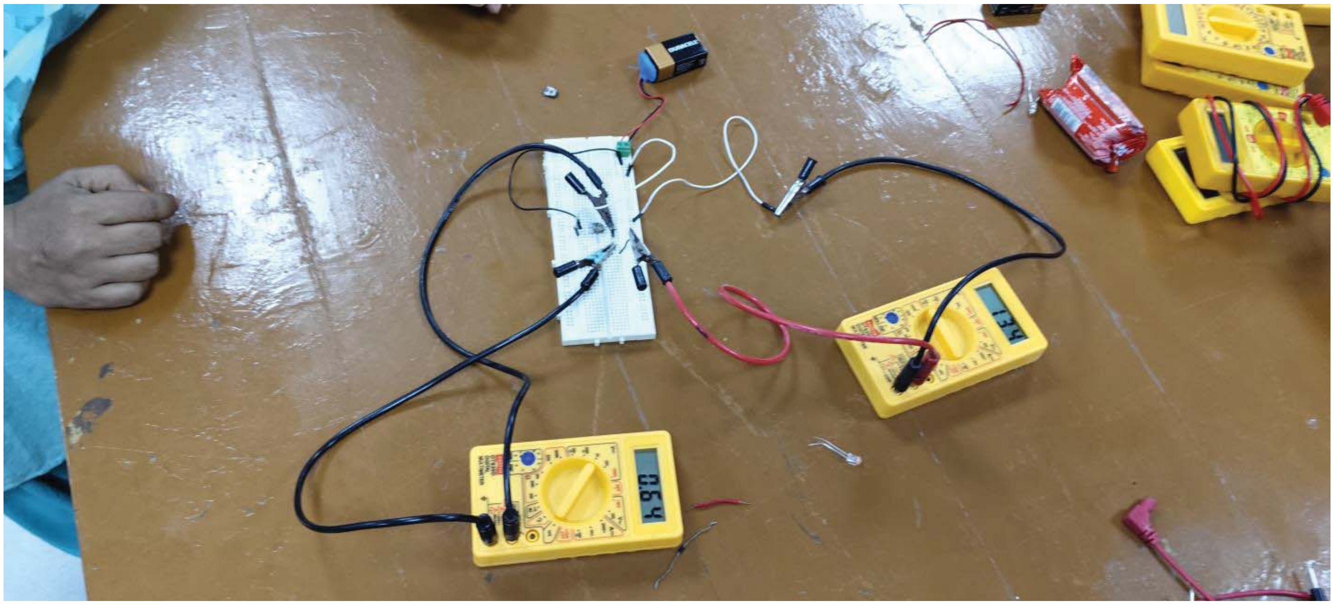

The importance of selecting topics for learning based on the curriculum and competency-based learning outcomes was discussed. Dr. Maski also spoke about the importance of "learn to learn," "learn to relearn," and "learn to unlearn" for weak students. She guided teachers on how to explain science concepts to children using experiential learning models. The stages of the learning cycle were explained through the experience-based learning process, including apply, reflect, share, generalize, and apply again. The learning cycle was further explained through a flowchart, illustrating the learning process through the Deweyi model and the Kolb model, which were described and discussed.

Dr. Maski encouraged teachers to engage all five senses—taste, hearing, sight, smell, and touch—in the teaching process to enhance learning. She also spoke about how teaching should be clear, accurate, brief, and specific, based on the "CABS" formula. For the role of the teacher, she emphasized the need for innovation, creativity, and facilitation, highlighting that teachers must be creative and innovative. She urged teachers to participate in the teaching learning process to make it more effective.

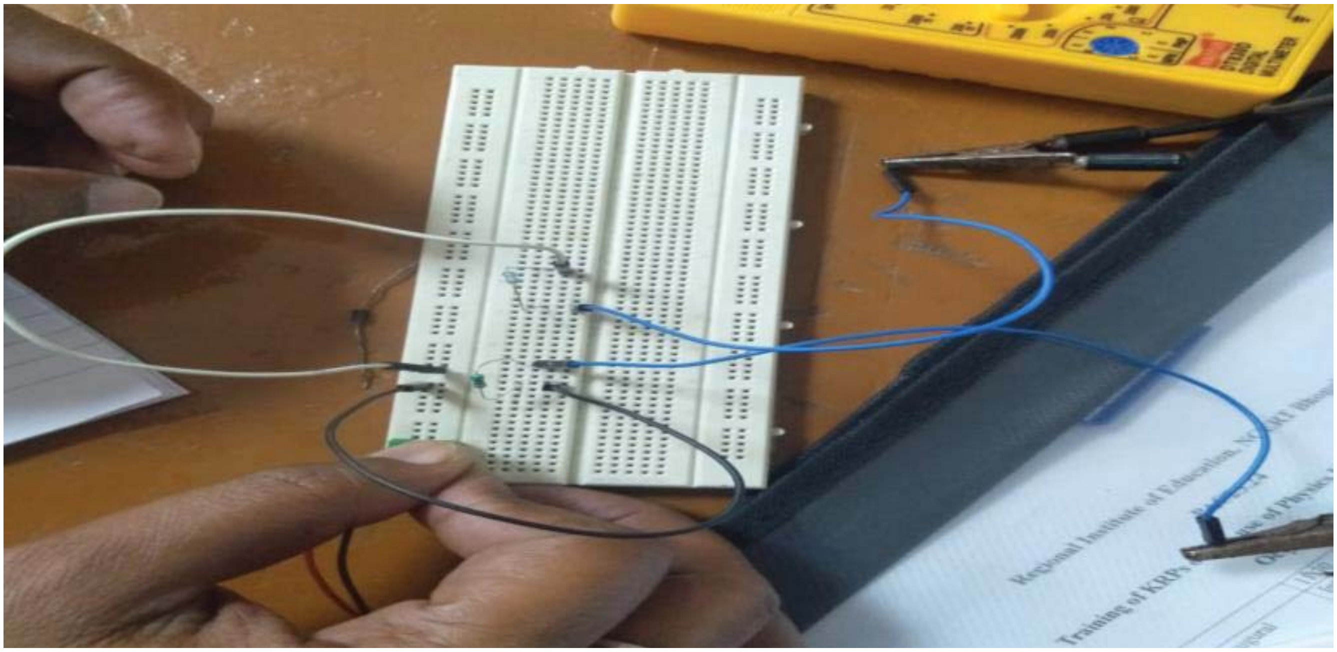
After the tea break, Dr. Maski took the participants to the laboratory, where she demonstrated various physics experiments. These included the use of Vernier calipers, screw gauges, and meters, and explained the methods for error calculation in these experiments."

Day-2
October 8, 2024
Time 2.30-3.00 pm
Session: Hands on Electronics
Resource Person: Dr. Shivalika Sarkar
Regional Institute of Education, NCERT Bhopal

On October 8, 2024, the second day of training, Dr. Shivalika Sarkar conducted a detailed session on **Hands on Electronics** for the participants. The session, which began at 2:30 PM in the Physics laboratory, was focused on introducing the core concepts of basic electronics and providing a hands-on learning experience. The session's key objective was to enable the participants to develop a strong foundation in electronics by combining theoretical knowledge with practical skills.

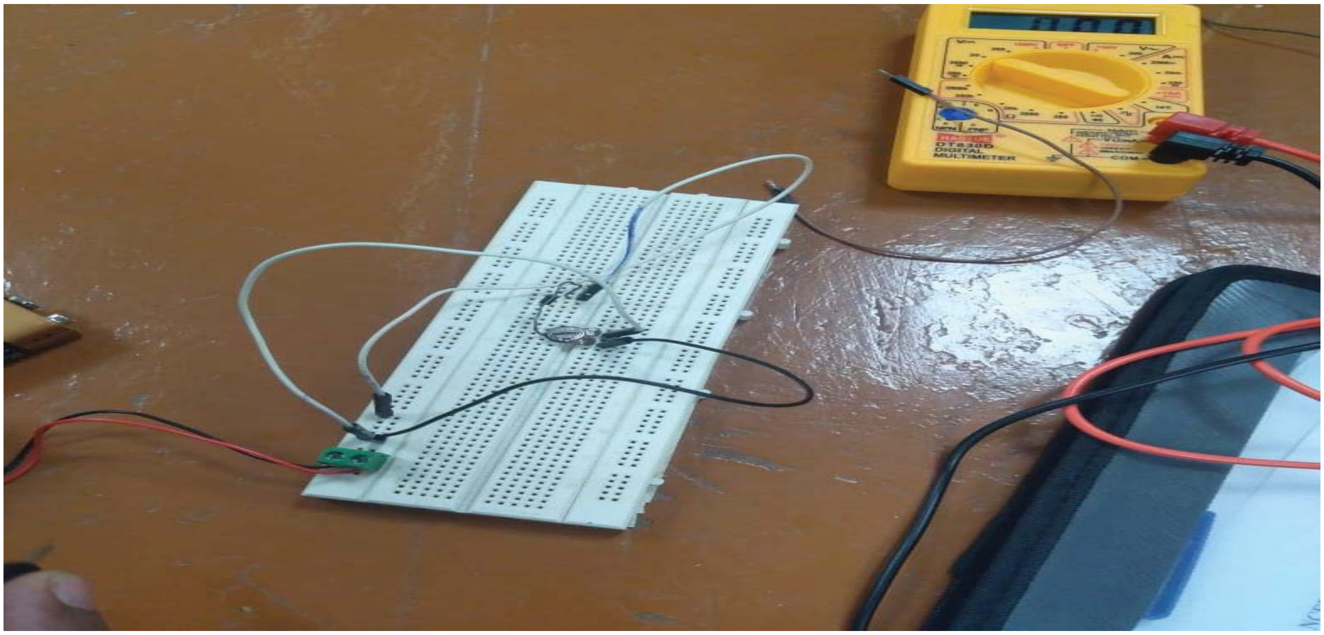


To make the session more engaging and effective, Dr. Sarkar adopted a 'learning by doing' approach, encouraging the participants to actively participate in the hands-on experiments and circuit-building activities. The session started with an introduction to the basic electronics components that are essential for building circuits. This included components like Bread Board, **jumper wires**, **LEDs**, **resistors**, **diodes**, **variable resistors**, and more. Each component's function was explained in detail, followed by practical applications to showcase how these components interact in different circuit configurations.



All the electronics experiments were made on the breadboard, allowing for easy construction and testing of circuits without the need for soldering. The breadboard provided a flexible and reusable platform for experimenting with various components, such as resistors, capacitors, transistors, and integrated circuits, enabling quick modifications and adjustments during the testing process.

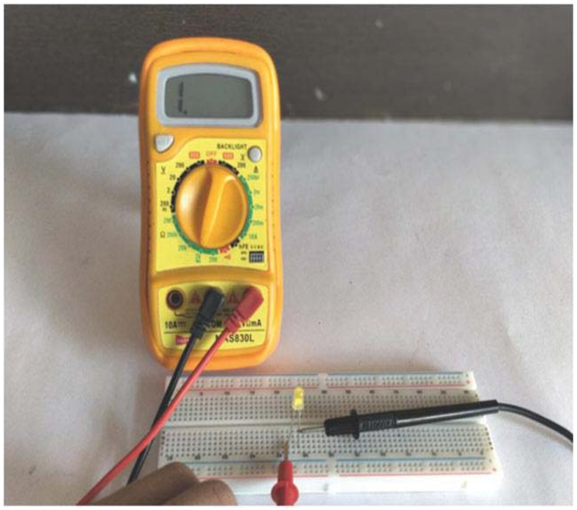
A major part of the session was dedicated to the practical work of building circuits using various electronics components. Participants were given the opportunity to design simple circuits from scratch, starting with basic configurations like LED circuits. Through this exercise, they understood how current flows through circuits, the importance of resistors in limiting current, and the role of LEDs as indicators of circuit functionality.



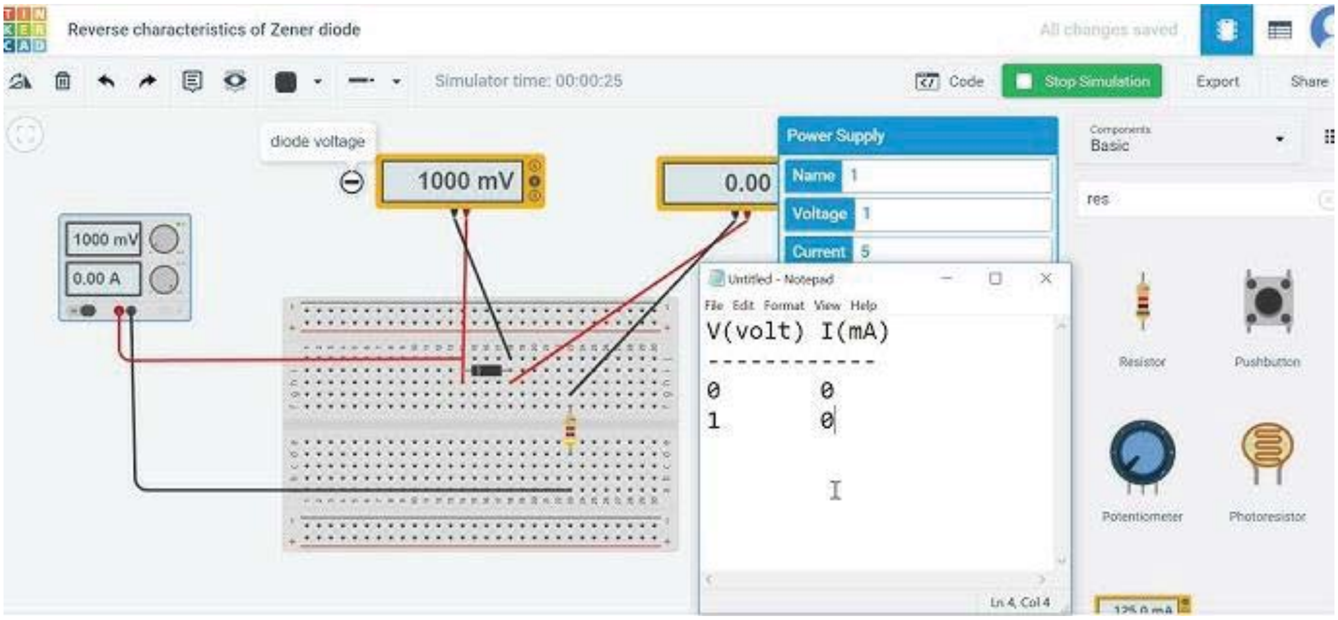
The session also focused on specific types of diodes, such as the PN junction diode, Zener diode, and transistors, all of which play vital roles in modern electronics:

- **PN Junction Diodes**: The participants were introduced to the behavior of PN junction diodes in forward and reverse bias, explaining their function in rectifiers and other electronic devices.
- **Zener Diodes**: The concept of Zener diodes was explored, especially their use in voltage regulation and breakdown characteristics, a crucial aspect for students involved in power electronics and voltage regulation circuits.
- **Transistors**: The importance of transistors as amplifiers and switches was discussed. Participant's learned how transistors control current flow in circuits, with practical examples to highlight their role in modern electronic devices like computers, radios, and televisions.

Use of Multimeter: Another significant learning outcome of the session was the hands-on experience with a **multimeter**. Participants learned how to use this essential tool to measure voltage, current, and resistance. The multimeter was used to test the functionality of the circuits they built, ensuring that the correct values of voltage and current were being measured. Through this practical application, students were able to familiarize themselves with the tools they will likely use in future electronic projects, honing their troubleshooting skills.



Tinkercad Simulation: To further enrich the learning experience, the participants used **Tinkercad**, a free online simulation tool, to design and simulate circuits virtually. This platform enabled students to experiment with circuits without the need for physical components, allowing them to make quick adjustments and observe how changes in the circuit affected performance. Using Tinkercad, participants were able to simulate the behavior of **LEDs**, **diodes**, and **transistors** in various circuit configurations, offering them a safe, interactive environment to learn and explore electronics principles.



After designing the circuits, participants tested their work under the guidance of Dr. Sarkar. She helped them troubleshoot any issues that arose, ensuring that they fully understood the behavior of each component in their circuits. This real-time feedback and support made the learning process more engaging and effective, as students could immediately apply corrections to their circuits and understand the causes behind any malfunctions.

Throughout the session, the students not only learned the theory behind electronics components but also developed the skills to work with them practically. By the end of the training, they had gained confidence in **building and testing circuits**, a crucial skill for anyone venturing into the field of electronics. They also gained proficiency in using tools like the multimeter and Tinkercad, which are indispensable for circuit design and testing in real-world applications.

In conclusion, the session was a great success, with participants gaining valuable insights into electronics and hands-on experience with essential components and tools. They left with a deeper understanding of **LEDs**, **PN junction diodes**, **Zener diodes**, **transistors**, and the tools used to test and measure them. The session was designed not only to teach basic electronics but also to instill confidence in participants to explore more advanced concepts and projects in the future. The combination of theoretical knowledge and practical application ensured that the participants were well-equipped to continue their journey in electronics and apply their newfound skills in real-world scenarios.

Day-2

October 8, 2024

Time 3.30-5.30 pm

Session: Visit to STEAM Park

Resource Person: Dr. Shivalika Sarkar, Dr. Kalpana Maski & Dr. Chakradhar Behera

Regional Institute of Education, NCERT Bhopal

After Dr. Shivalika Sarkar's session, the group visited the **Steam Park**, where the participants had the opportunity to explore a diverse array of captivating models that brought fundamental principles of Physics to life. These models ranged from simple concepts to complex systems, each designed to demonstrate key ideas in an engaging and interactive way. Some of the most intriguing exhibits included the Pi Gate, Magical Tap, Blast Furnace Model, Whispering Dishes, Infinity Well, Archimedean Screw, World of Numbers (featuring the abacus and mathematical scales), Full Protector, Circular Discs, Euclidean Space, Sundial Model, Inclined Plane, Double Ended Cone, Rotating Disc, Set of Levers, Bird in a Cage, Pendulum Wave, Gyroscope, Newton's Cradle, 3D Crystal Structure (NaCl), Newton's Disc, Centrifugal Force, Planck's Law, Vortex, Pythagorean Theorem, Lissajous Figures, Resonance Strips, Geodesic Dome, Gravity Tower, Echo Tube, Tug of War, Perception of Depth (Zebra), Sculptures of Scientists, Mathematics-Based Models, and the Herbal Garden.

These exhibits provided not only theoretical insight but also practical experience, demonstrating how these principles work in the real world. For example, the Whispering Dishes showed how sound waves travel in parabolic paths, while the Inclined Plane helped us visualize how objects behave under different angles of inclination. The Gyroscope and Newton's Cradle vividly illustrated concepts of angular momentum and energy conservation. The Gravity Tower offered a tangible experience of gravitational forces, and the Echo Tube provided an interactive way to experience sound reflection.

We also explored the Herbal Garden, which illustrated how nature can be a part of scientific study, combining environmental science with the principles of Physics. Additionally, the Sculptures of Scientists and Mathematics-Based Models not only showcased the connection between Physics and other scientific fields but also gave us a deeper appreciation for the historical figures whose work continues to shape modern science.

What made the visit even more enriching was the hands-on nature of the exhibits. Unlike traditional classroom teaching, we were able to directly interact with the models, manipulate them, and observe the principles in action. This experiential approach helped us see how abstract concepts are applied in the real world, making the learning process far more tangible and memorable.

The visit sparked new ideas and provided clarity on concepts that were initially difficult to grasp. It allowed us to move beyond the theoretical understanding of Physics and experience it firsthand, making the learning both exciting and meaningful. The enthusiasm that arose from engaging with the exhibits was palpable, and the interactive nature of the session inspired everyone to delve deeper into the subject.

Overall, the visit to Steam Park proved to be an invaluable part of our training. It not only expanded our understanding of Physics but also instilled in us a renewed passion for scientific exploration. By seeing the real-world applications of the concepts we had studied, we left the session feeling inspired, with a greater sense of curiosity and a deeper appreciation for the wonders of science. The hands-on experience provided us with insights we had never encountered before, and it reinforced the idea that learning is most effective when we actively engage with the material in dynamic and interactive ways.

Day-3

October 9, 2024

Time 2.30-5.30 pm

Session: Visit to Center for Creative Learning, MPCST, Bhopal

Resource Person: Mr. Pankaj Godhara & Mr. Karan Bhinde

Center for Creative Learning, MPCST, Bhopal

Dr. Kalpana Maski & Dr. Chakradhar Behera

Regional Institute of Education, NCERT Bhopal

A visit to the Center for Creative Learning, MPCST Bhopal was organized for the participants on October 9 at 2:30 PM. The purpose of the visit was to explore innovative educational approaches and hands-on learning experiences that foster creativity and critical thinking. Participants had the opportunity to engage with interactive exhibits, demonstrations, and activities designed to promote problem-solving skills and a deeper understanding of various concepts. The visit aimed to inspire participants to incorporate creative learning strategies into their teaching practices, encouraging a more engaging and student-centered approach to education. The event was well-received, providing valuable insights into how creative learning can enhance the educational experience.


At the center, the model based on principles of physics was displayed, and Shri Pankaj Godara the project coordinator demonstrated various models developed at the center. He explained the method of making models, their working process, utility in daily life, including the differences between liters and kilograms. Additionally, the technique for creating different types of caps was explained, which could be used to make life jackets for survival in difficult situations. This was quite inspiring.


Later, Dr. Rajesh Sharma, the Director of MPCST, gave a talk about Creative Learning (CCL). He also showcased different models of bicycles that were built and explained how we could understand their functioning practically by riding them. Afterward, we participated in a paper-based competition, where each participant was asked to cut a square into a single line shape, which was both fun and challenging.

After the competition, we took a group photograph at Khushi Lal Maidan. We then had the chance to witness the flight of an aircraft built by MPCST, which was an exciting experience.

It was a thrilling and enriching day full of excitement, knowledge, and hands-on activities. We hope that these models will inspire new innovations in the field of education.

Overview of Practice Sessions on Secondary Stage-2 Physics Kit

The practice sessions on the Secondary Stage-2 Physics Kit were held over multiple days, providing participants with hands-on experience and practical knowledge. Resource persons from the Regional Institute of Education, NCERT Bhopal guided the sessions, focusing on experiments for Class 11 and 12 physics. The sessions were structured to ensure that participants gained practical experience in conducting experiments and applying the concepts using the Secondary Stage-2 Physics Kit.

Schedule of Practice Sessions

Day-2
October 8, 2024
Time: 11.30 -1.00 pm
Practice Session-1: Use of Secondary Stage-2 Physics Kit

Resource Persons: Dr. Kalpana Maski, Dr. Santosh Kumar & Dr. Chakradhar Behra, Mr. Gaurav Sahu
Regional Institute of Education, NCERT Bhopal

Day-3
October 9, 2024
Time: 9.30 – 11.00 am
Practice Session-2: Use of Secondary Stage-2 Physics Kit
Resource Persons: Dr. Kalpana Maski, Dr. Shivalika Sarkar & Dr. Chakradhar Behra, Mr. Gaurav Sahu
Regional Institute of Education, NCERT Bhopal

Day-3
October 9, 2024
Time: 11.30-1.00 pm
Practice Session-3: Use of Secondary Stage-2 Physics Kit
Resource Persons: Dr. Kalpana Maski, Mr. L.S Chouhan & Dr. Chakradhar Behra, Mr. Gaurav Sahu
Regional Institute of Education, NCERT Bhopal

Day-4
October 10, 2024
Time: 9.30-11.00 pm
Practice Session-4: Use of Secondary Stage-2 Physics Kit
Resource Person: Dr. Kalpana Maski, Dr. Santosh Kumar & Dr. Chakradhar Behra, Mr. Gaurav Sahu
Regional Institute of Education, NCERT Bhopal

Day-4
October 10, 2024
Time: 11.30-1.00 pm
Practice Session-5: Use of Secondary Stage-2 Physics Kit
Resource Person: Dr. Kalpana Maski & Dr. Chakradhar Behra, and Mr. Gaurav Sahu
Regional Institute of Education, NCERT Bhopal

The laboratory manual, developed by NCERT, includes experiments that can be conducted using the equipment from the Secondary Stage 2 Physics Kit. It contains practical's and activities for both Class 11 and 12. These practical's were divided among participant groups and performed during the practice sessions.

In the practice session, the participants were divided into 10 groups, with 3 participants in each group. Each group was assigned a set of tasks and instructed to sequentially perform 3 experiments from the laboratory manual. The experiments were designed to help participants apply theoretical knowledge in a practical setting. Throughout the session, the groups were closely monitored by instructors who provided guidance and clarification when needed. Participants were encouraged to collaborate, share ideas, and discuss their observations with each other. This collaborative environment fostered teamwork and improved problem-solving skills.

In addition, each experiment required participants to record their results and analyze the data, providing them with valuable experience in data interpretation and scientific documentation. The hands-on approach allowed participants to gain a deeper understanding of the concepts while refining their practical skills. At the end of the session, a review was conducted to discuss the outcomes of the experiments and address any challenges faced during the process. This allowed for feedback and helped the participants reinforce their learning.

The practice session on the laboratory manual developed by NCERT for the Stage-2 Physics Kit is designed to offer a comprehensive and interactive learning experience for participants, particularly students and educators. It begins with a detailed introduction to the kit, providing a clear understanding of its contents, including the various instruments, materials, and the accompanying manual. The session aims to familiarize participants with the proper use of the kit and the manual, ensuring they can effectively conduct experiments related to key physics concepts such as force, motion, energy, and light.

During the session, participants are guided through a series of fundamental experiments, such as measuring force, studying the laws of motion, investigating energy conservation, and exploring the properties of light. Each experiment is demonstrated step-by-step, with the participants actively engaging in setting up and performing the experiments themselves, following the instructions provided in the manual. This hands-on approach enables them to develop a deeper understanding of the practical applications of the physics concepts they are learning.

List of Experiments conducted during Practice Session

1. Use of Vernier Callipers to:
   (i) measure diameter of a small spherical/cylindrical body.
   (ii) measure the dimensions of a given regular rectangular solid body of known mass and to calculate its volume and density.
   (iii) measure the internal diameter and depth of a given hollow cylindrical object like beaker/tumbler/calorimeter and to calculate its volume.

2. Use of screw gauge to:
   (i) measure diameter of a given wire,
   (ii) measure thickness of a given sheet; and
   (iii) determine volume of an irregular lamina.

3. To determine the radius of curvature of a given spherical surface by a spherometer.
4. To determine mass of two different objects using a beam balance.
5. Measurement of the weight of a given body (a wooden block) using the parallelogram law of vector addition.
6. Plot L – T and L – T^2 graphs for a simple pendulum and to find the effective length of second's pendulum using appropriate graph.
7. To study the relation between force of limiting friction and normal reaction and to find the coefficient of friction between surface of a moving block and that of a horizontal surface.
8. To find the downward force due to gravity acting on a roller along an inclined plane, and to study its relationship with the angle of inclination 'θ' by plotting graph between force and sin θ.
9. To find the force constant and effective mass of a helical spring by plotting T^2 - m graph using method of oscillation.
10. To study the variation of volume (V) with pressure (P) for a sample of air at constant temperature by plotting graphs between P and V and that between P and 1/ V .
11. To determine the coefficient of viscosity of a given liquid by measuring the terminal velocity of a spherical body.
12. To study the relationship between the temperature of a hot body and time by plotting a cooling curve.
13. (i) To study the relation between frequency and length of a given wire under constant tension using a sonometer.
    (ii) To study the relation between the length of a given wire and tension for constant frequency using a sonometer.
14. To determine the speed of sound in air at room temperature using a resonance tube.
15. To determine the specific heat capacity of a given (i) solid and (ii) liquid by the method of mixtures.

16. To determine resistance per unit length of a given wire by plotting a graph of potential difference versus current.
17. To determine the resistance of a given wire using a meter bridge and hence determine the resistivity of the material of the wire.
18. To verify the laws of combination of resistances (series and parallel) using a metre bridge.
19. To compare the emf of two given primary cells (Daniel and Leclanche cells) using a potentiometer.
20. To determine the internal resistance of a given primary cell using a potentiometer.
21. To determine the resistance of a galvanometer by half-defection method and to find its figure of merit.
22. To convert the given galvanometer (of known resistance and figure of merit) into
    (i) an ammeter of a desired range (say 0 to 30 mA) and
    (ii) a voltmeter of desired range (say 0 to 3 V) and to verify the same.
23. To determine the frequency of alternating current using a sonometer.
24. To find image distance (v) for different values of object distance (u) for a given concave mirror and to calculate its focal length.
25. To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and 1/v.
26. To find the focal length of a convex mirror using a convex lens.
27. To find the focal length of a concave lens with the help of a convex lens.
28. To determine the angle of minimum deviation for a given glass prism by plotting a graph between the angle of incidence and the angle of deviation.
29. To determine the refractive index of a liquid (water) using (i) concave mirror, (ii) convex lens and a plane mirror.
30. To draw the I-V characteristic curves of a p-n junction in forward bias and reverse bias.
31. To draw the characteristic curve of a Zener diode and to determine its reverse breakdown voltage.
32. To study the characteristics of a common emitter npn (or pnp) transistor and to find out the values of current and voltage gains.

Schedule for Allotment of Experiment to Each group

Group No.	Date	Time	Experiment No.
1	8.10.24	11.30 am -1.00 pm	1-3
2			4-6
3			7-9
4			10-12
5			13-15
6			16-18
7			19-21
8			22-24
9			25-27
10			29-30

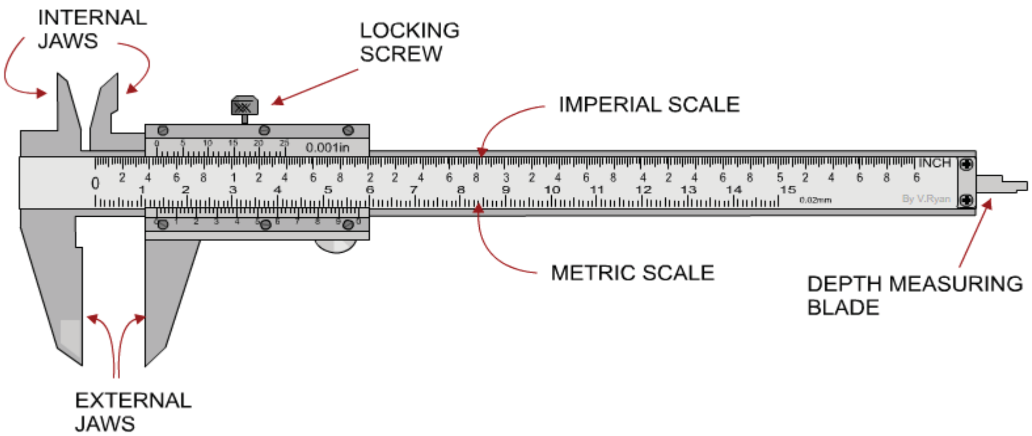
Group No.	Date	Time	Experiment No.
1	9.10.24	9.30 am -11.30 pm	4-6
2			7-9
3			10-12
4			13-15
5			16-18
6			19-21
7			22-24
8			25-27
9			29-30
10			1-3

Group No.	Date	Time	Experiment No.
1	9.10.24	11.30 am -1.00 pm	7-9
2			10-12
3			13-15
4			16-18
5			19-21
6			22-24
7			25-27
8			29-30
9			1-3
10			4-6

Group No.	Date	Time	Experiment No.
1	10.10.24	9.30 am -11.00 pm	10-12
2			13-15
3			16-18
4			19-21
5			22-24
6			25-27
7			29-30
8			1-3
9			4-6
10			7-9

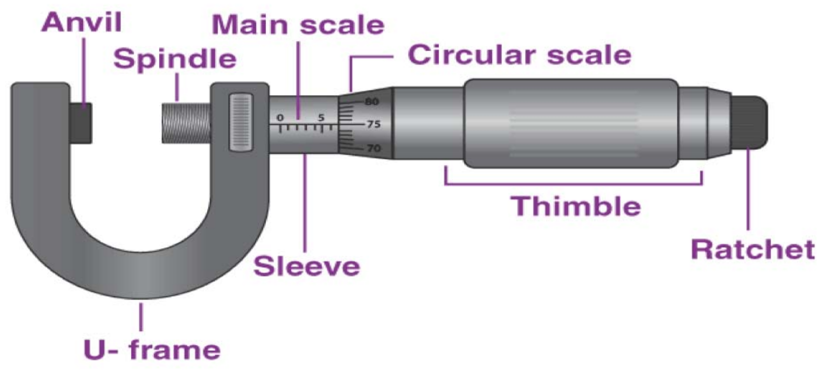
Group-1

1. **Use of Vernier Callipers:**
   - **(i) Measure the diameter of a small spherical/cylindrical body**: The Vernier callipers are a precise instrument that helps measure the external diameter of small spherical or cylindrical objects, providing accuracy to fractions of a millimetre. This is essential when working with objects that are too small for standard rulers.
   - **(ii) Measure the dimensions of a regular rectangular solid body**: Vernier callipers are used to measure the length, width, and height of the body, allowing the calculation of its volume (Volume = length × width × height). By knowing the mass of the object, its density can be determined (Density = Mass/Volume), which is important for material identification and various applications in physics.



   - **(iii) Measure the internal diameter and depth of a hollow cylindrical object**: For measuring hollow objects like beakers, tumblers, or calorimeters, Vernier callipers help in determining the inner diameter and the depth (height). The volume of the hollow object is calculated using the formula for the volume of a cylinder, considering the inner dimensions.

2. **Use of Screw Gauge:**
   - **(i) Measure the diameter of a given wire**: The screw gauge provides a highly accurate method of measuring small diameters, such as the thickness of a wire. With its screw thread mechanism, it offers precision up to 0.01mm or even finer depending on the instrument's resolution.
   - **(ii) Measure the thickness of a given sheet**: The screw gauge allows the measurement of thin materials such as sheets with great precision. It is essential when measuring materials with very small thicknesses, where even minor variations can be significant in applications like engineering or material science.

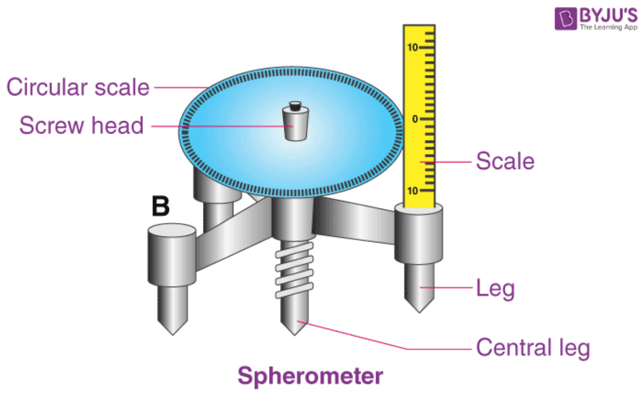


Screw Gauge

(iii) Determine the volume of an irregular lamina: By measuring the thickness of various points on an irregular lamina, one can calculate the volume using an averaging method for the thickness, combined with the area of the lamina. This is especially useful when the lamina's exact shape is irregular and complex.

3. To determine the radius of curvature of a given spherical surface by a spherometer:

The spherometer is a specialized instrument used to measure the curvature of spherical surfaces. It works by measuring the vertical height of the surface at three points. The spherometer is used to measure the height (h) of the spherical surface at three points. Using the readings and a known formula, the radius of curvature (R) is determined.



Spherometer

https://byjus.com/physics/spherometer/

The experiments conducted with Vernier Callipers, Screw Gauge, and Spherometer demonstrate the importance of precision measurement in physics and material science. The Vernier Callipers allowed us to accurately measure the dimensions of small and regular objects, including the diameter of spherical or cylindrical bodies, the length, width, and height of rectangular solids, and the internal diameter and depth of hollow cylindrical objects. These measurements were essential for calculating volume and density, which are crucial in material identification. The Screw Gauge provided a highly accurate method to measure the diameter of a wire and the thickness of sheets, with precision down to 0.01mm, which is essential for applications requiring fine measurements. Additionally, it facilitated the determination of the volume of irregular laminae by averaging thickness measurements. The

Spherometer enabled us to measure the radius of curvature of spherical surfaces, offering another example of how precise tools can be applied to complex shapes. These experiments highlight the significance of measurement tools in obtaining reliable data for various scientific and engineering applications.

Group 2

4. **To determine the mass of two different objects using a beam balance**: A beam balance is a fundamental tool in determining the mass of objects with high accuracy. By comparing the two objects on either side of the beam with known standard weights, the mass of the objects can be determined. This method is often used in laboratories for high-precision measurements, as it compensates for small fluctuations in gravity.
5. **Measurement of the weight of a given body (a wooden block) using the parallelogram law of vector addition**: This method involves applying two forces to the wooden block at an angle and measuring the resultant force. The parallelogram law of vector addition states that the resultant of two vectors is represented by the diagonal of the parallelogram formed by them. This resultant vector corresponds to the weight of the body when the forces involved are gravitational.
6. **Plot L-T and L-T^2 graphs for a simple pendulum and to find the effective length of the second's pendulum using an appropriate graph**: The motion of a simple pendulum is dependent on its length and the acceleration due to gravity. By measuring the period T for different lengths L and plotting T against L or T^2, one can derive the relationship between the period and length. The graph of T^2 vs. L is typically a straight line, and the slope of this graph can be used to determine the effective length of the second's pendulum. This experiment allows students to explore the basic principles of harmonic motion and the factors affecting it.

   These exercises not only help participants to understand the precision and functionality of measurement instruments but also give them a hands-on understanding of core physics principles like density, volume, and the laws of motion. They provide valuable experience in accurate data collection, calculation, and graphing, which are key skills in experimental physics.

Group-3

7. **To study the relation between force of limiting friction and normal reaction and to find the coefficient of friction between the surface of a moving block and that of a horizontal surface**: In this experiment, the relationship between the limiting friction and the normal reaction is studied by varying the applied force on a block moving on a horizontal surface. The frictional force is measured at different normal forces, and the coefficient of friction (μ) is calculated using the formula $f=\mu N$, where f is the frictional force and N is the normal reaction. A graph of frictional force vs. normal reaction is plotted to verify this relationship.

8. **To find the downward force due to gravity acting on a roller along an inclined plane, and to study its relationship with the angle of inclination 'θ' by plotting a graph between force and sin θ**: In this experiment, a roller is placed on an inclined plane, and the downward force

(component of gravitational force) acting on it is measured for various angles of inclination. The force is related to the angle θ by the equation $F= mg\sin\theta$ where m is the mass of the roller and g is the acceleration due to gravity. A graph of force vs. $\sin\theta$ is plotted, and the slope is used to confirm the relationship between the force and the angle.

9. **To find the force constant and effective mass of a helical spring by plotting T^2 - m graph using the method of oscillation**: This experiment involves oscillating a helical spring with known masses attached and measuring the period T of oscillation. By plotting T^2 (the square of the period) against the attached mass m, a linear relationship is obtained. The slope of the graph gives the force constant k of the spring, and the effective mass is derived from the relationship between the period of oscillation and the spring's properties.

The experiments conducted in this series provided valuable insights into fundamental concepts in mechanics. The study of the relationship between the force of limiting friction and the normal reaction confirmed the linear nature of this relationship, allowing for the calculation of the coefficient of friction between the block and the surface. By plotting the frictional force against the normal reaction, we were able to verify the equation $f = \mu N$. In the second experiment, the downward force due to gravity acting on a roller along an inclined plane was measured, and the relationship with the angle of inclination was established. The graph of force versus sin θ confirmed the theoretical equation $F = mg\sin\theta$, demonstrating the direct proportionality between the force and the sine of the angle of inclination. Lastly, the oscillation experiment with a helical spring provided a practical method to determine the force constant and effective mass of the spring by analyzing the T^2 vs. m graph. The slope of the graph gave the force constant, and the relationship between the period of oscillation and mass allowed for the determination of the effective mass. Together, these experiments demonstrated key principles of friction, gravitational force, and spring dynamics, enhancing our understanding of motion and forces in physical systems.

Group-4

10. **To study the variation of volume (V) with pressure (P) for a sample of air at constant temperature by plotting graphs between P and V and that between P and 1/V**: This experiment investigates Boyle's Law, which states that at constant temperature, the volume of a gas is inversely proportional to its pressure. The volume of a fixed amount of air is measured at various pressures, and two graphs are plotted: one between P and V, and another between P and 1/V. The latter should yield a straight line, confirming the inverse relationship between pressure and volume.

11. **To determine the coefficient of viscosity of a given liquid by measuring the terminal velocity of a spherical body**: In this experiment, a spherical body (such as a metal ball) is allowed to fall through a liquid. The terminal velocity (constant velocity) of the ball is measured, and using Stokes' Law, the coefficient of viscosity η of the liquid is determined by the equation $F_{viscous}=6\pi\eta rv$, where r is the radius of the sphere and v is the terminal velocity.

12. **To study the relationship between the temperature of a hot body and time by plotting a cooling curve**: This experiment involves monitoring the temperature of a hot body (such as a metal block) as it cools over time in a surrounding environment. The temperature is recorded at regular intervals, and a cooling curve (temperature vs. time) is plotted. According to Newton's Law of Cooling, the rate of change of temperature is proportional to the difference between the temperature of the object and the surrounding temperature. This relationship is studied using the cooling curve to analyze the rate of heat loss from the body.

These experiments provide a practical understanding of important physical principles such as friction, gravitational force, oscillation, gas laws, viscosity, and heat transfer. They help develop skills in data collection, graph plotting, and analysis, while deepening conceptual understanding.

Group-5

13. (i) **To study the relation between frequency and length of a given wire under constant tension using a sonometer**: In this experiment, a sonometer is used to study how the frequency of a vibrating wire changes with its length while maintaining a constant tension. The wire is stretched over a wooden box, and the frequency is measured for various lengths of the wire. The relationship between the frequency and the length of the wire is explored, showing that the frequency is inversely proportional to the length of the wire, i.e., $f \propto 1/L$

    (ii) **To study the relation between the length of a given wire and tension for constant frequency using a sonometer**: In this part of the experiment, the frequency is kept constant, and the tension in the wire is varied by adjusting the weight. The length of the wire is measured at different tensions, and the relationship between the length of the wire and the tension is explored. This shows that the length is proportional to the square root of the tension, i.e., $L \propto \sqrt{T}$, when frequency is constant.

14. **To determine the speed of sound in air at room temperature using a resonance tube**: In this experiment, a resonance tube (a tube open at both ends) is used to find the speed of sound in air. The tube is partially submerged in water, and sound waves are produced inside the tube. The tube is adjusted for resonance by varying its length to find the points where maximum sound intensity occurs. Using the observed resonant frequencies and the known wavelength of the sound, the speed of sound is calculated using the formula v=fλv, where v is the speed of sound, f is the frequency, and λ is the wavelength.

15. **To determine the specific heat capacity of a given (i) solid and (ii) liquid by the method of mixtures**: This experiment involves determining the specific heat capacity of both a solid and a liquid. For the solid, a known mass of the substance is heated and then placed into a known mass of water, and the temperature change is measured. For the liquid, a known mass of the liquid is heated and mixed with water, and the final temperature is recorded. The specific heat capacity is then determined using the formula Q=mcΔTQ, where Q is the heat absorbed or released, m is the mass, c is the specific heat capacity, and ΔT is the temperature change.

The experiments conducted helped establish fundamental relationships in wave motion, thermodynamics, and sound. In the sonometer experiment, we confirmed that the frequency of a vibrating wire is inversely proportional to its length under constant tension ($f \propto 1/L$) and that the length is proportional to the square root of the tension when frequency is constant ($L \propto \sqrt{T}$). The resonance tube experiment successfully demonstrated the determination of the speed of sound in air, reinforcing the relationship between frequency, wavelength, and sound speed. Lastly, the specific heat capacity of a solid and liquid was determined using the method of mixtures, with the results helping to understand heat transfer and the material properties of the substances involved. Together, these experiments provided a deeper understanding of physical principles in acoustics and thermal physics.

Group-6

16. **To determine resistance per unit length of a given wire by plotting a graph of potential difference versus current**: This experiment involves measuring the current passing through a wire for various potential differences applied across it. Using Ohm's law ($V=IR$), the resistance of the wire is calculated for each measurement. A graph is plotted between potential difference (V) and current (I), and the slope of the graph represents the resistance of the wire. The resistance per unit length can be determined by dividing the total resistance by the length of the wire.

17. **To determine the resistance of a given wire using a meter bridge and hence determine the resistivity of the material of the wire**: A meter bridge is a simple apparatus used to measure the resistance of a wire. By using a known standard resistor, the unknown resistance of the given wire is determined by balancing the bridge and measuring the length of the wire at equilibrium. The resistivity of the wire material is then calculated using the formula $R=\rho LA$, where R is the resistance, ρ is the resistivity, L is the length, and A is the cross-sectional area of the wire.

18. **To verify the laws of combination of resistances (series and parallel) using a metre bridge**: In this experiment, the meter bridge is used to verify the laws of combination of resistances in series and parallel. When resistors are connected in series, the total resistance is the sum of the individual resistances, and when connected in parallel, the total resistance is less than the smallest individual resistance. By measuring the total resistance for both series and parallel combinations using the meter bridge, the experimental results can be compared to the theoretical values to verify the laws of resistances.

These experiments involve fundamental concepts in mechanics, thermodynamics, and electricity. They provide valuable insights into the relationships between physical quantities, the properties of materials, and the principles governing electrical circuits, sound waves, and heat transfer. They also help students develop practical skills in measurement, data analysis, and experimentation.

Group-7

19. **To compare the emf of two given primary cells (Daniel and Leclanche cells) using a potentiometer**: In this experiment, a potentiometer is used to measure the electromotive force (emf) of two primary cells — the Daniel and Leclanche cells. The potentiometer is connected in such a way that the potential drop across a known length of wire is balanced by the emf of the cells. By comparing the length of the wire required to balance the emf of both cells, their

respective emfs can be compared. The experiment provides a precise method to compare the voltage of different cells without drawing current from them.

20. **To determine the internal resistance of a given primary cell using a potentiometer**: In this experiment, the internal resistance of a primary cell is determined by using a potentiometer. The cell is connected in series with a known resistor and the potential drop across the resistor is measured. By measuring the voltage across the entire circuit (including both the external resistor and the internal resistance of the cell), and using the formula V=I(R+r), where r is the internal resistance, I is the current, and R is the external resistance, the internal resistance of the cell can be calculated.

21. **To determine the resistance of a galvanometer by half-deflection method and to find its figure of merit**: The resistance of a galvanometer is determined by the half-deflection method, where a known resistance is added in series with the galvanometer and the current is adjusted to achieve a deflection on the galvanometer's scale. The process involves finding the resistance that causes the needle to deflect to half its full-scale value. The figure of merit of the galvanometer is calculated by dividing the voltage required to produce a certain deflection by the deflection itself. This gives the sensitivity of the galvanometer.

The experiments conducted provided valuable insights into the principles of electromotive force (emf) and electrical resistance. Using a potentiometer, we successfully compared the emf of the Daniel and Leclanche cells, confirming the precision of this method for measuring voltage without drawing current. The determination of the internal resistance of a primary cell further emphasized the importance of considering internal resistance in real-world electrical circuits. Finally, the half-deflection method allowed us to determine the resistance of a galvanometer and calculate its figure of merit, highlighting the sensitivity of the instrument. These experiments enhanced our understanding of electrical measurements and the behavior of various components in a circuit.

Group 8

22. **To convert the given galvanometer (of known resistance and figure of merit) into:**
    - **(i) An ammeter of a desired range (say 0 to 30 mA)**: A galvanometer can be converted into an ammeter by connecting a low-value resistor (shunt resistor) in parallel with it. The value of this shunt resistor is chosen such that the desired maximum current (e.g., 30 mA) corresponds to the full-scale deflection of the galvanometer. The ammeter is calibrated to show the total current flowing through the circuit.
    - **(ii) A voltmeter of desired range (say 0 to 3 V)**: A voltmeter is created by connecting a high-value resistor in series with the galvanometer. This resistor limits the current to the galvanometer, allowing it to measure voltage within the desired range. The value of the series resistor is calculated using the desired voltage range and the figure of merit of the galvanometer.

23. **To determine the frequency of alternating current using a sonometer**: In this experiment, a sonometer is used to determine the frequency of an alternating current (AC) by observing the vibration of a wire under tension. The wire is placed over a sonometer box and subjected to the AC. The frequency of the alternating current is determined by measuring the natural frequency of vibration of the wire for different lengths under constant tension. The relationship between the frequency of the AC and the vibration frequency of the wire is used to calculate the frequency of the current.

24. **To find the image distance (v) for different values of object distance (u) for a given concave mirror and to calculate its focal length**: This experiment involves determining the image distance for various object distances using a concave mirror. By placing an object at different positions relative to the mirror and measuring the corresponding image distances, the relationship between object distance (u) and image distance (v) can be established. Using the mirror formula $1/f=1/v+1/u$, where f is the focal length, the focal length of the concave mirror is calculated. This experiment helps students understand the properties of concave mirrors, including how image distance changes with object distance.

These experiments cover important concepts in electricity, magnetism, optics, and measurements, helping students develop practical skills in using instruments like potentiometers, galvanometers, sonometers, and mirrors. They provide a deeper understanding of how electrical and optical systems work and the calculations required to analyze and manipulate them.

Group 9

25. **To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and 1/v**: This experiment involves determining the focal length of a convex lens using the lens formula $1/f=1/v-1/u$, where f is the focal length, v is the image distance, and u is the object distance. By varying the object distance u and measuring the corresponding image distance v, the relationship between these two quantities is established. A graph is plotted between u and v, and the focal length can be determined. Alternatively, a graph of 1/u vs. is plotted, and the focal length is obtained from the slope of the graph.

26. **To find the focal length of a convex mirror using a convex lens**: In this experiment, a convex mirror's focal length is determined indirectly by using a convex lens. The convex lens is used to form an image of an object, and the image is then reflected by the convex mirror. By measuring the object distance and the image distance formed by the lens and then using the lens formula and the mirror formula, the focal length of the convex mirror can be calculated. This method combines the properties of both lenses and mirrors to determine the focal length of a convex mirror.

27. **To find the focal length of a concave lens with the help of a convex lens**: The focal length of a concave lens can be found by using the convex lens in combination with the concave lens. The two lenses are placed in such a way that the concave lens is placed in front of the convex lens. The object distance and image distance for this combined system are measured. By applying the lens

formula for the system and knowing the focal length of the convex lens, the focal length of the concave lens can be determined.

These experiments provided a practical understanding of determining the focal lengths of different lenses and mirrors. By plotting graphs between object distance (u) and image distance (v) or their reciprocals, the focal length of a convex lens was accurately determined. The indirect method of using a convex lens to find the focal length of a convex mirror and the combination of a convex lens and concave lens for determining the focal length of the concave lens demonstrated the versatility of optical principles. These experiments effectively illustrated the application of the lens and mirror formulas in optical systems.

Group 10

28. **To determine the angle of minimum deviation for a given glass prism by plotting a graph between the angle of incidence and the angle of deviation**: This experiment involves studying the refraction of light through a glass prism. The angle of deviation is measured for different angles of incidence. By plotting a graph between the angle of incidence (i) and the angle of deviation (δ), the angle of minimum deviation can be determined. The angle of minimum deviation occurs when the light passes symmetrically through the prism, and it provides information about the refractive index of the material of the prism.

29. **To determine the refractive index of a liquid (water) using (i) concave mirror, (ii) convex lens, and a plane mirror**: The refractive index of a liquid (such as water) can be determined by using a concave mirror, a convex lens, and a plane mirror. For the concave mirror, the image formed by the mirror when the liquid is placed in front of it is used to calculate the refractive index. In the case of the convex lens, the focal length of the lens is measured when the lens is immersed in the liquid. By comparing the focal lengths and using the formula for the refractive index n=sini/sinr, where i is the angle of incidence and r is the angle of refraction, the refractive index of the liquid is determined.

30. **To draw the I-V characteristic curves of a p-n junction in forward bias and reverse bias**: This experiment involves studying the current-voltage (I-V) characteristics of a p-n junction diode. The diode is connected in both forward bias and reverse bias, and the current through the diode is measured for various applied voltages. In forward bias, the current increases exponentially with voltage beyond a certain threshold, and in reverse bias, a very small reverse current is observed until the breakdown voltage is reached. The I-V characteristic curve for both forward and reverse bias is plotted, and from this graph, the diode's behavior, including the threshold voltage and the reverse saturation current, can be analyzed.

    These experiments cover important concepts in optics, refraction, and semiconductors. They help students understand the behavior of light through lenses and prisms, as well as the properties of diodes, essential in understanding modern electronic devices. Through these experiments, students gain valuable experience in data collection, graph plotting, and practical applications of theoretical principles.

31. **To draw the characteristic curve of a Zener diode and to determine its reverse breakdown voltage**: In this experiment, the I-V characteristic curve of a Zener diode is plotted by applying a reverse bias voltage across the diode and measuring the current at different reverse voltages. The curve typically shows a small current at lower reverse voltages, followed by a sharp increase in current once the reverse breakdown voltage (also called the Zener breakdown voltage) is reached. The reverse breakdown voltage is the voltage at which the Zener diode starts conducting heavily in reverse bias and is a key characteristic of the diode. This value is important because Zener diodes are commonly useds in voltage regulation applications, where they maintain a constant voltage once the breakdown voltage is reached.

32. **To study the characteristics of a common emitter npn (or pnp) transistor and to find out the values of current and voltage gains**: In this experiment, the characteristics of an npn (or pnp) transistor in a common emitter configuration are studied. The current-voltage characteristics are obtained by measuring the collector current (I_C) for various values of the base current (I_B) and the emitter current (I_E). The current gain (β) of the transistor is determined by calculating the ratio of the change in collector current to the change in base current. The voltage gain is also determined by analyzing the relationship between the output voltage (across the collector) and the input voltage (across the base). This experiment helps in understanding the behavior of transistors as amplifiers and in determining their efficiency in switching and amplification applications.

These experiments provide valuable insights into the operation of diodes and transistors, which are fundamental components in electronic circuits. The Zener diode's reverse breakdown behavior is crucial for voltage regulation, while the transistor's current and voltage gain characteristics are important for amplification and switching in analog and digital circuits.

Conclusion

The experiments conducted across various groups provided hands-on experiences in understanding and applying key concepts of physics, measurement techniques, and electronics. From the precise use of instruments such as Vernier Callipers, screw gauges, and spherometers to the study of fundamental laws like Boyle's law, friction, and oscillation, the students gained practical knowledge and developed valuable skills in experimental methods.

In conclusion, these experiments provided a comprehensive understanding of key concepts in physics, mechanics, thermodynamics, optics, and electronics. Through the use of various instruments and experimental setups, participants gained invaluable experience in data collection, analysis, and the application of theoretical principles to practical situations. These skills are essential for developing a deeper understanding of the physical world and for future careers in science and engineering.

The participants were provided with a detailed schedule outlining which group would conduct which experiment and at what time. Based on this schedule, each participant was allocated 5 dedicated practice sessions to familiarize themselves with the procedures. Throughout the sessions, all participants performed the experiments with great attention to detail, ensuring the accurate collection of data. They then analyzed the data thoroughly, created relevant graphs for better visualization, and interpreted the results to draw meaningful conclusions. Additionally, they were encouraged to reflect on their findings and identify any patterns or trends. The entire process ensured that the experiments were carried out systematically, providing reliable and valid results for further analysis.

The participants were assigned experiments on a rotational basis. Each participant rotated through different experiments according to the schedule, ensuring that all groups had the opportunity to perform various tasks. This rotation allowed for a balanced distribution of the experiments, ensuring that each participant experienced a variety of conditions and tasks throughout the study.

Day-4

October 10, 2024
Time: 2.30-4.00 pm
Session: Presentation by Participants
Resource Person: Dr. Kalpana Maski, & Dr. Chakradhar Behra
Regional Institute of Education, NCERT Bhopal

The third session of the fourth day was devoted to participant presentations. Each participant was asked to bring a model demonstrating a physics concept, which they had developed during Secondary Stage-2, for presentation. These models were designed to showcase the participants' understanding and creativity in applying scientific principles. The session provided an opportunity for each individual to explain their chosen concept, demonstrate their model, and engage in discussions with peers and instructors. It was an insightful experience that encouraged the sharing of innovative ideas and deepened the participants' grasp of physics at the secondary level.

In addition to the presentations, participants had the chance to receive feedback from their peers and mentors, fostering a collaborative environment of learning. The models covered a wide range of physics topics, from classical mechanics to modern physics, reflecting the diverse interests and expertise of the group. The interactive nature of the session also allowed for critical thinking, problem-solving, and the exploration of new ways to explain complex scientific ideas in a simplified manner. Overall, the session proved to be an enriching experience, highlighting the importance of hands-on learning in understanding and applying physics concepts.

Day-4

October 10, 2024

Time: 4.00 -5.00 pm

Session: Valedictory Function

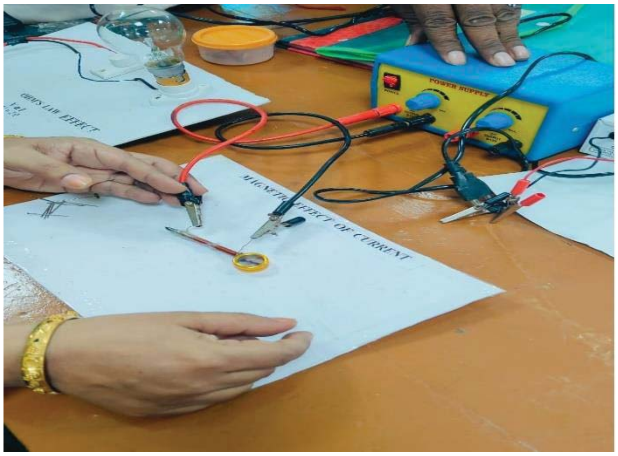
Resource Person: Dr. Kalpana Maski, & Dr. Chakradhar Behra

Regional Institute of Education, NCERT Bhopal

“Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful." – Albert Schweitzer

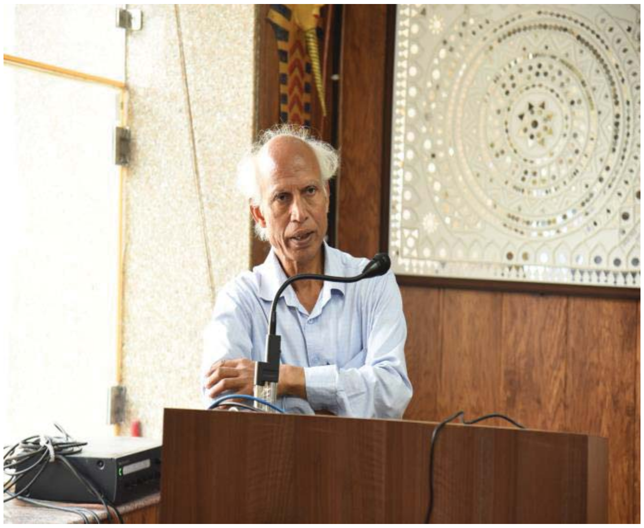
The valedictory function took place at 4:00 PM in the gracious presence of the Principal, Prof. Jaydip Mandal; the Incharge of Physics, Dr. Santosh Kumar; and Dr. Chakradhar Behera, Co-coordinator of the program. The event was coordinated by Dr. Kalpana Maski, the program coordinator of the “Training of KRPs of Western Region on the use of Secondary Stage -2 Physics Kits.”

During the event, feedback was gathered from the participants, allowing them to share their experiences and insights. Many participants expressed their appreciation for the well-structured sessions, hands-on activities, and engaging discussions. They highlighted how the training enhanced their understanding of physics concepts and their confidence in using the kits effectively. They also emphasized the practical applicability of the training in their teaching methodologies.



Additionally, participants shared positive feedback regarding their visit to the Center of Creative Learning at MPCST, where they explored innovative teaching-learning approaches and interactive educational tools. The visit to the STEAM Park of the institute was also highly appreciated, as it provided an opportunity to witness and engage with interdisciplinary learning experiences that integrate science, technology, engineering, arts, and mathematics in an inspiring and hands-on manner. These visits added immense value to the training program, reinforcing the importance of experiential learning in education.

The open exchange of thoughts and reflections reinforced the program's impact and provided valuable suggestions for future improvements.



Certificates were then distributed to acknowledge the participants' efforts and achievements, serving as a token of appreciation for their dedication and hard work. The certificates were presented by the Principal, Prof. Jaydip Mandal, who commended the participants for their commitment to learning and professional growth. Prof. Mandal addressed the gathering, congratulated the participants on the successful completion of the training, and praised the team's efforts in organizing and executing the program seamlessly. He emphasized the importance of continuous learning and innovation in teaching practices in physics. Dr. Santosh Kumar, the Incharge Physics, extended his best wishes to all the participants, encouraging them to implement the physics kits in their classrooms and apply the knowledge they had gained to enhance their teaching methodologies. He highlighted how hands-on experiments and activity-based learning can significantly improve students' understanding of physics concepts.

The session concluded with a heartfelt vote of thanks, delivered by Kalpana Maski, the programme coordinator. She expressed sincere gratitude to the Principal, Resource Persons, Participants, and all those involved in making the event a success. Dr. Maski acknowledged the collaborative efforts that contributed to the smooth execution of the event and the positive impact it had on everyone involved. The function marked a fitting end to the proceedings, leaving participants with lasting memories, a sense of accomplishment, and a renewed enthusiasm to apply the knowledge and skills they had gained. The closing ceremony was a celebration of learning, growth, and the spirit of teamwork.

Enhancing Experiential Learning through the NCERT Stage-2 Physics Kit : Aligning with NEP 2020 for a Holistic Education Approach

In alignment with the National Education Policy (NEP) 2020, the practice session on the NCERT Stage-2 Physics Kit emphasizes experiential learning, critical thinking, and practical application of knowledge, which are key principles outlined in the policy. NEP 2020 advocates for a shift from rote learning to a more holistic, student-centered approach that fosters creativity, problem-solving, and practical skills. The session encourages active participation through hands-on experiments, promoting inquiry-based learning where participants are not just passive recipients of information but active creators of knowledge. By engaging with the Stage-2 Physics Kit, participants develop a deeper understanding of scientific concepts while honing their ability to apply theoretical knowledge in real-world contexts. This aligns with NEP 2020's vision of nurturing well-rounded individuals equipped with the skills needed to navigate the challenges of the 21st century. Furthermore, the focus on collaborative learning, discussion, and feedback reflects the policy's emphasis on promoting a culture of continuous learning, critical inquiry, and peer interaction, ensuring that education is both engaging and impactful.

In addition to the hands-on experiments, the session also provides a strong theoretical foundation. Participants are encouraged to understand the scientific principles behind each experiment, allowing them to connect the practical activities with the underlying theories of physics. The facilitators explain how the results from each experiment align with the concepts being tested, providing real-life applications of the principles, and fostering a deeper appreciation for the subject.

After completing the experiments, participants are given time to analyze their results and observations, allowing them to critically evaluate the outcomes and draw conclusions. Group discussions are held to compare findings, share insights, and clarify any doubts. This collaborative approach encourages peer learning and enhances the overall understanding of the material. The session also emphasizes the importance of safety protocols when handling the materials in the kit, ensuring that all experiments are conducted in a safe and controlled environment.

The session concludes with a wrap-up discussion, where key concepts and lessons from the day's activities are summarized. Participants are encouraged to provide feedback on the session, which helps improve future training sessions and ensures that the Stage-2 Physics Kit can be used effectively in classrooms. The overall goal of the session is not only to familiarize participants with the kit and its experiments but also to inspire a deeper interest in physics and foster a practical understanding of how the subject relates to the world around us.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भोपाल

Appendix-1
Time Table

Regional Institute of Education, NCERT Bhopal

PAC23.24

Training of KRPs on the use of Physics Kit of Western Region

October 7-10,2024

	9.30-11.00 am	11.30 – 1.00 PM	**2-30 to 4.30 PM**	4.00 -5.30PM
7.10.24	Registration and Inaugural	Introduction to DEK SK	**Orientation of Physics Kit LSC**	
8.10.24	Experiential Learning (NEP-2020 and NCFSE) KM	Practice Session-2 KM+CB+SK	**Practice Session (Electronics) SS**	**Visit to STEAM Park SS+KM+CB**
9.10.24	Practice Session-3 KM+CB+SS	Practice Session-4 KM+CB+LSC	**Visit to Center of Creative Learning, MPCST KM+CB**	
10.10.24	Practice Session-5 KM+CB+SK	Practice Session-6 KM+CB	Presentation by Participants KM+CB	Valedictory

SK: Dr. Santosh Kumar

KM: Dr. Kalpana Maski

LSC: Mr. L.S Chouhan

SS: Dr. Shivalika Sarkar

CB: Dr. Chakradhar Behera

Co.Coordinator 03/10/2024 Principal 3/10/24

Appendix -2

Attendance of the Participants

THL - 23-24
Dr. Kalpana Marki

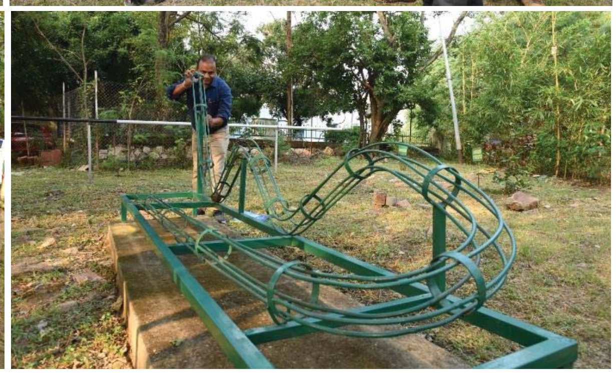
Region on the use of Second. Stage 2 ..
Oct. 7-10

S#	Name & Off. Address	7/10/24	8/10/24	9/10/24	10/10/24
1.	Dr. Anju Agrawal, Lect. Govt. H.S.S. Tilda Raipur (CG)	[signature] 7/10/24	[signature] 8/10/24	[signature] 9/10/24	[signature] 10/10/24
2.	MRS. SAPANA SONI, LECT. Swami Atmanand Ex. Hindi Med. Sch. Jeora-Sirsa, Durg	[signature] 7/10/24	[signature] 08.10.24	[signature] 09/10/24	[signature] 10/10/24
3.	Dr. Poonam Bichpuria, SAGES GHSS Patora Dist- Durg.	[signature]	[signature]	[signature]	[signature]
4.	Dr Bhoopendra Dhar Diwan, Govt H S S. Budhikhar Bilaspur (CG)	[signature]	[signature]	[signature]	[signature]
5.	L. R. Karsh, Govt. H.S.S Kudurmal (Korba)	[signature]	[signature]	[signature]	[signature]
6.	Rishi Kumar Pandey (Lect), Govt. Hr. Sec. School Salka Block UDAIPUR Surguja	[signature] 7.x.24	[signature] 08/x/24	[signature] 09/x/24	[signature] 10/x/24
7.	Sanjeev Nahar, Govt. H.S.S. Rajpur (Rajpur) Distt – Balrampur	[signature]	[signature]	[signature]	[signature]
8.	Ajay Kumar Vaishnav, SAGES Kotmikala (Pendra) Dist- GPM	[signature]	[signature]	[signature]	[signature]
9.	Mahavir Bijarson, G.H.S.S. Kutra (Nawagarh) Dist- Janjgir-Champa (C-G)	[signature]	[signature]	[signature]	[signature]
10.	Yogwendra Dicsena, SAGES, Berla (Bemetara) (C.G.)	[signature]	[signature]	[signature]	[signature]
11.	RAKESH SINGH, SAGES KUKANAR, SUKMA - District (C.G.)	[signature]	[signature]	[signature]	[signature]

S.No.	Name & Off. Address	7/10/24	8/10/24	9/10/24	10/10/24
12.	Partha Kumar Sarkar Lect. G.H.S.S. Geedam Dantewada C.G. 494449	[signature]	[signature]	[signature]	[signature]
13.	Vikas Barkar Lect. Govt.H.S.S. DHARAMPURA Bastar. C.G. 494001	[signature]	[signature]	[signature]	[signature]
14.	Nirmal kumar Lect. - Govt. H. S. S. Edka Narayanpur (C.G)	[signature]	[signature]	[signature]	[signature]
15.	Dr. Omprakash Verma Lect. GHSS Piperchhedi Gariyaband (C.G)	[signature]	[signature]	[signature]	[signature]
16.	Mr. Ravikant Pitarmare Lect. GHSS Sarangpurkala Kabirdham (Kawardha) C.G	[signature]	[signature]	[signature]	[signature]
17.	Mr. Yashwant Singh Kushwaha Lect. Swami Atmanand English Medium School, Chakarbhatha	[signature]	[signature]	[signature]	[signature]
18.	Thakur ramsahu G.H.S.S Nawapara Dist. Balodabazar (C.G)	[signature]	[signature]	[signature]	[signature]
19.	Manoj kumar Sahu G.H.S.S. Khallari Distt. Mahasamund (C.G)	M.Sahu	M.Sahu	M.Sahu	M.Sahu
20.	Janak sahu G.H.S.S. KUSUMKASA DIST BALOD	[signature]	[signature]	[signature]	[signature]
21.	Bhanu Pratap Sinha G.H.S.S. Kumhari (Manpur) Dist. MMAC. (C.G.)	[signature]	[signature]	[signature]	[signature]
22.	Yogesh kumar Gautam GHSS, Surgi, Rajnandgaon Distt - Rajnandgaon (C.G.)	[signature] 7.10.24	[signature] 8.10.24	[signature] 9.10.24	[signature] 10.10.24

Sl#	Name & Off. Address	7/10/24	8/10/24	9/10/24	10/10/24
23	BISHNU DAS JOSHI Lect. Dr PPB SAGES Khairagarh Dist. Khairagarh C Chhuikhadan gandai C.G	1.2	1.2 8/10/2024	1.2	1.2
24.	Sevaram Verma Lect. (LB) Govt HSS Madhi Tilda Raipur C.G	Reng	Reng	Reng	Reng
25.	Lalit Kumar Patel GHSS Bondih Dist Baramleela Sarangarh (C.G.) Bilaigarh	[signature]	[signature]	[signature]	[signature]
26.	Gulab Chand Sonwani Govt. H.S.S Dudhawa Kanker	[signature]	[signature]	[signature]	[signature]
27.					
28.					
29.					
30					
31					


Wave Formation

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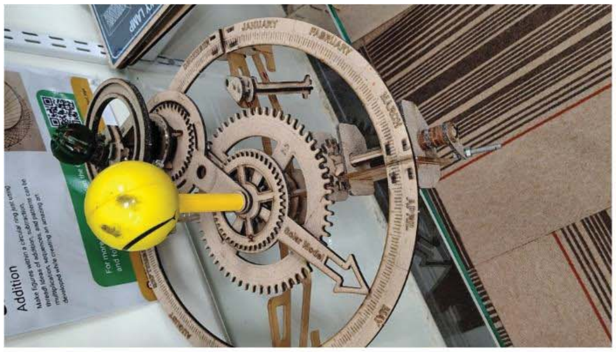



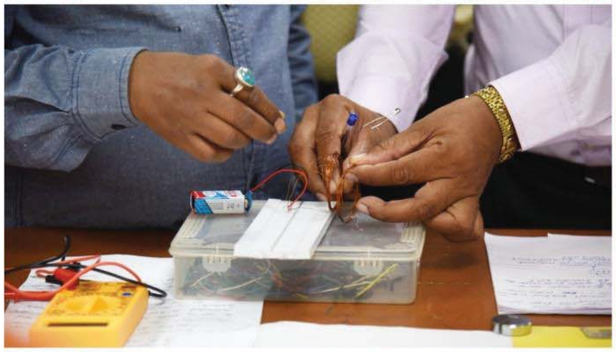




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