SPECTRUM

VOLUME-1
(2022-23)

DEPARTMENT OF PHYSICS

JSS ACADEMY OF TECHNICAL EDUCATION, BENGALURU

JSSATE
BENGALURU

IN PROFOUND MEMORY

OF

PROF. M H DHANANJAYA

ADVISOR, TED, JSSMVP, MYSURU

1933 - 2024

JSSATE
BENGALURU

DEPARTMENT OF PHYSICS

PRESENTS

EDITORIAL TEAM

Dr.BHIMASEN SORAGAON
PRINCIPAL
EDITOR-IN-CHIEF

Dr.ABHILASHA SINGH
ASSISTANT PROFESSOR
EDITOR

Dr.NITYANAND CHOUDHARY
FIRST YEAR COORDINATOR
MEMBER

Dr.SHASHIDHAR R
HOD PHYSICS
MEMBER

STUDENT EDITORS

SAKSHI AURADKAR
DEPARTMENT OF CSE(AIML)
1JS21AI043

ANUMEHA ANAND
DEPARTMENT OF CSE(AIML)
1JS22CI010

OM RAJ
DEPARTMENT OF CSE(AIML)
1JS21AI032

LAB INFRASTRUCTURE

JSSATE
BENGALURU

Spectrum

Volume 1, 2022-2023

Department of Physics, JSS ACADEMY OF TECHNICAL EDUCATION Bengaluru

JSS Academy of Technical Education (JSSATE) was established in the year 1997 at Bengaluru under the umbrella of JSS Mahavidyapeetha, Mysuru. JSSATE is the result of the vision of our President, His Holiness Jagadguru Sri Shivarathri Deshikendra Mahaswamiji to proactively participate in establishing a world class Institution for Technical Education. The Campus is located on a sprawling 21.17 acres land surrounded by lush green plantation on the South-Western edge of Bengaluru City. The institution is affiliated to Visvesvaraya Technological University (VTU), Belagavi, India.

Vision and Mission of Institute

Vision:

To be among the finest Institutions providing Engineering and Management Education empowered with research, innovation and entrepreneurship.

Mission:

- Strive towards Excellence in teaching–learning process and nurture personality development.
- Encourage Research, Innovation & Entrepreneurship.
- Train to uphold highest ethical standards in all activities.

JSSATE
BENGALURU

Spectrum

Volume 1, 2022-2023

Department of Physics, JSS ACADEMY OF TECHNICAL EDUCATION Bengaluru

Department Vision and Mission

Vision:

Creating a thrust for research with societal concern by way of clear understanding the fundamentals of science and applying it to the real-time situation.

Mission:

- To mould a budding engineer with the finer aspects of the basics of Physics.
- To explore the opportunities to innovate in contributing to the advancement of Science and Technology.

Table of Content


THE MESSAGE

Joint Director

I am pleased to learn that Department of Physics is releasing its first issue of Newsletter entitled, "Spectrum". As the name suggests, this newsletter is designed to capture the complete glimpses of the department's activities of last one year. Student's skill Laboratory Projects and articles, research highlight of faculty members, and personal reflection is a testament to the incredible range of talent and expertise that defines our community.

I express my heartfelt appreciation to all the stakeholders who have contributed to this inaugural edition of newsletter ranging from our dedicated writers, Editorial Teams and all other faculty and staff members of the Department of Physics who have contributed from behind-the-scenes to realise "Spectrum" a reality. I look forward to see "Spectrum" evolve and grow with each edition, reflecting the ongoing journey of the Department of Physics.

Dr. H.R. Mahadevaswamy
Joint Director,
Technical Education Division,
JSS Mahavidyapeetha,
Mysuru - 570006

Editor-in-Chief

Greetings to all!

I am honored to share my sentiments with you as we unveil the inaugural edition of the yearly newsletter, 'Spectrum,' from the Department of Physics at JSSATE Bengaluru. From its inception, our institute has been a nurturing ground for students, fostering an environment where excellence is not only encouraged but celebrated.

Our primary objective is to cultivate academic brilliance coupled with strong character and a well-rounded personality, and it brings me immense pride to witness the realization of this goal. This edition of Spectrum offers a glimpse into the dynamic activities of the Department of Physics within the campus. As we believe that happenings create history, we remain dedicated to setting new benchmarks of success. Every edition of Spectrum will be filled with inspiring stories of achievement and success, reflecting the vibrant spirit of our institution.

May 'Spectrum' continue to be a chronicle of our journey, capturing the essence of our achievements and aspirations. Here's to the success of the newsletter and the bright future that lies ahead for the Department of Physics at our institute.

Prof. Bhimasen Soragaon
M.Tech, Ph.D
Principal
JSSATE Bengaluru
e- mail: principal@jssateb.ac.in

First-Year Coordinator

Students have enormous powers inherent in them. The responsibility of faculty is to bring to realize the latent talents of its students. An E-magazine is one of the forums by which both faculty and students can exhibit their talent in literary skills. I am grateful to be associated with the magazine "The Spectrum". As First Year Coordinator, it gives me immense pleasure to understand that the magazine presents the academic excellence of specially first year students like project reports of skill laboratories, articles and many more. The intention to provide a platform for these expressions for students of the engineering college is a very natural need. E-Magazine launched at the website of the institute is the right approach and is an important milestone in this direction. I extend my heartfelt greetings to all participants, authors, report writers, faculty, staff & students associated in this endeavor. My special thanks and appreciation to Dr. Abhilasha Singh, faculty editor of the magazine and HOD Physics, Dr. Shashidhar R for their efforts and contributions to make this dream project into reality. I look at this humble beginning with a great hope that many more students will catch the fire of writing. Some may have flair for writing and some may not, but this challenges one to give it a try as I am doing it now.

We need to go headlong, persistent and undaunted. A small spark is enough to start a furnace. Let each student become an avid reader and prolific writer because of this venture.

Prof. Nityanand Choudhary
M.Sc., Ph.D
Professor (Physics) and First Year Coordinator
e- mail: firstyearcoordinator@jssateb.ac.in

From Desk of HOD

Greetings from the Department of Physics, JSSATE Bengaluru. The department is excited to release the inaugural issue of the Department of Physics newsletter entitled "Spectrum". Both the faculty and student editorial teams have worked very hard to conceive the idea of news letter and developed the content appropriately. My special thanks to Dr. Abhilasha Singh, the Editor of this newsletter for putting the sincere efforts and leading the team to bring it in this form. I wish to convey my thanks to all the faculty members and other staff members of department who have taken keen interest for the success of this newsletter.

I would like to see the better efforts from all the stakeholders for future editions to make it more comprehensible and interesting by including other sections like cartoons, jokes, stories, poems, etc., by our students, faculty and staffs.

Dr. Shashidhar R
M.Sc., Ph.D
Associate Professor and HOD
Department of Physics
e- mail: shashidharr@jssateb.ac.in

Editor

Dear Reader,

We are thrilled to present the very first edition of "Spectrum", the official newsletter of Department of Physics at JSSATE Bengaluru. In this inaugural issue, we have carefully curated a collection of articles that reflect the dynamic and evolving landscape of physics within the realm of engineering.

With boundless excitement and a spirit of exploration, we invite you to embark on a journey through the captivating world where science and engineering converge. Through this inaugural edition our goal is to ignite the flames of curiosity and wonder that reside within each one of us. Through informative articles, thought-provoking features, and real-world applications, we strive to foster a deeper understanding of how physics intertwines with engineering and influences the world we live in. Highlighting the stories of groundbreaking research, innovative applications, and the collaborative spirit within the realm of physics in our engineering college can truly inspire and build a vibrant community of enthusiasts.

We will go through the newsletter together, explore the endless possibilities that arise when science and engineering converge, and pave the way for a future where curiosity knows no bounds.

Dr. Abhilasha Singh
M.Sc., Ph.D (BHU)
Assistant Professor
Department of Physics
e- mail: abhilashasingh@jssateb.ac.in

Overview of the Physics Department

The Department of Physics is a dynamic and innovative academic unit dedicated to fostering excellence in the field of education and research. Founded on a strong foundation of theoretical knowledge and practical applications, the department offers a rigorous curriculum designed to cultivate critical thinking, problem-solving skills, and a deep appreciation for the fundamental laws governing the universe. Our department is committed to provide students with a comprehensive understanding of fundamental principles in physics and prepare them for a wide range of careers and further academic pursuits.

In addition to classroom instruction, the department places a strong emphasis on activity-based learning such as hands-on laboratory experiences, encouraging students to engage in experimental work that complements their theoretical learning. Our state-of-the-art laboratories are equipped with cutting-edge instruments and technology, enabling students to conduct experiments, analyze data, and contribute to the advancement of scientific knowledge.

Our faculty consists of esteemed researchers, educators, and experts in various specialized areas of physics, ensuring that students receive a well-rounded education that covers a broad spectrum of topics. As part of our commitment to research and innovation, the department is actively involved in groundbreaking research endeavors across multiple disciplines.

Faculty Details

Dr. Prasanna Kumar S
(Professor)
e- mail: prasannakumars@jssateb.ac.in

Dr. Prasanna Kumar S obtained his Master's degree in Physics and was awarded with doctoral degree from University of Mysore. He joined JSSATE, Bengaluru in the year 1999. He has nearly 26 years of teaching experience.
He was the recipient of National Scholarship in the year 1986. He qualified State Level Eligibility for Lectureship (SLET) conducted by Government of Karnataka in the year 1997. His area of research is in 'Nuclear Radiation Physics' and has published 12 research articles in international and national journals. Currently one research scholar is pursuing Ph.D at VTU, Belagavi under his supervision.

Faculty Details

Ms. Sushma KC
(Assistant Professor)
e- mail: sushmakc@jssateb.ac.in

Ms. Sushma KC obtained her Master's degree in Physics from Bengaluru University. She joined JSSATE, Bengaluru in the year 2018. She has 12 years of teaching experience. She is pursuing her Ph.D from Tumkur University in the area of 'Nanomaterials' and is likely to obtain her degree in year 2024.

She has published two research articles in the reputed international journals with high impact factor.

Faculty Details

Mr. Mohanakumara LB
(Assistant Professor)
e- mail: mohankumarlb@jssateb.ac.in

Mr. Mohanakumara LB obtained his M.Sc. degree in Physics with a specialization in Condensed Matter Physics from Shivagangothri campus, Davanagere. He joined this institute in the year 2021. He has a total of nearly 8 years of teaching experience.

His dedication to academic excellence is further highlighted by his successful clearance of the Karnataka State Eligibility Test (KSET) in 2021. He is currently pursuing Ph.D. at the Department of Physics, Jnana Bharathi, Bengaluru University, Bengaluru.

Non-Teaching Staffs

Jyothi HR, Lab Instructor

Ms. Jyothi HR is working in this institute as an instructor from 2018. She has successfully completed her B.Sc. and B.Ed. degrees from JSS Institute Mysore. Her journey as an instructor underscores her passion for education. As a part of our institute, Ms. Jyothi HR has proven to be a valuable asset.

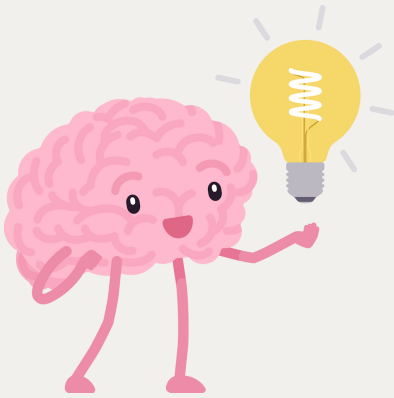
Shiva Murthy, Lab Helper

Mr. Shiva Murthy has joined this institute in 2012 and working as Lab Helper in Department of Physics from 2017. He has completed his ITI from Department of Technical Education, Bengaluru. His educational background has equipped him with the skills and technical acumen essential for his responsibilities in a physics laboratory setting.

Shantamma C, Supporting Staff

Ms Shantamma C is working as supporting staff in this institute from 1997. She has dedicated nearly 27 years of hard work and service in our department. Her long-standing commitment to the department speaks volumes about her dedication and loyalty.

SKILL LAB PROJECTS



ABOUT THE SKILL LAB

Our newly established Skill Lab aims to cultivate a dynamic learning environment where students can bridge the gap between theoretical concepts and practical applications. Beyond theory, Skill Lab empower the students with practical skills that are highly valued in both academia and the professional world. The experiments' outcomes and the insights gained will contribute to participants' overall understanding of physics. These skills are not only integral to scientific research but also relevant in fields ranging from engineering to data analysis.

A good number of projects have been received under the supervision of faculty members of Physics Department for Academic Year 2022-23.

Domain of Skill Lab Projects executed in 2022-23

OPTICS - 10

ELECTRO-MAGNETISM - 6

ELECTRONICS - 19

SEMICONDUCTOR PHYSICS - 6

MECHANICS - 4

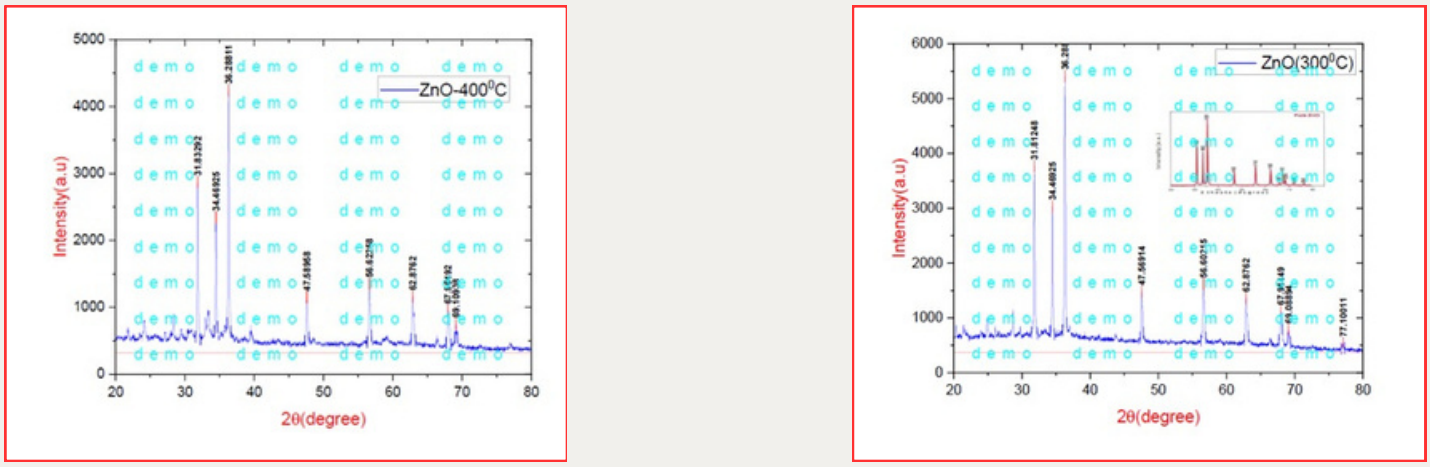
Synthesis of Zinc Oxide Nanoparticles by solution combustion method and its structural characterization

Planned and executed by: Nagashree T S and team (CSE B Section)
Supervised by: Dr. Shashidhar R

The project, conducted by students of Computer Science and Engineering (CSE) "B" for the academic year 2022-23, was focused on the synthesis and characterization of Zinc Oxide nanoparticles (ZnO NPs). The students successfully employed a low-cost solution combustion method for synthesizing Zinc Oxide nanoparticles. The as-prepared particles underwent an annealing process at 400°C for nearly 1 hour in a homemade oven. The initial surface of the particles appeared rough, but post-annealing, a noticeable transformation was observed, rendering the surface smooth. The X-ray Diffraction (XRD) report of the samples revealed that the annealed particles possessed a wurtzite crystal structure. Moreover, the crystallite size exhibited a discernible increase from 41.5 to 42.4 nm as the particles underwent annealing from 300°C to 400°C.

Solution Combustion Setup

As-prepared and annealed ZnO particles



XRD pattern of as prepared and annealed ZnO nano particles

Throughout the project, students gained valuable hands-on experience in synthesizing nanoparticles and delved into the art of structural characterization. This experiential learning process not only allowed them to apply theoretical knowledge but also underscored the practical importance of structural characterization in nanomaterial research.

Hydraulic Anti-Flood System (HARS)

Planned and executed by: Mr. Bhuvan K and team (Mechanical Section)
Supervised by: Dr. Prasanna Kumara S

The concept of the Hydraulic Anti-Flooding System (HAFS) is intriguing. The idea of using hydraulics to lift a house based on water levels during flooding events is not only creative but also addresses a pressing global concern. The consideration of the potential increase in flooding due to global warming adds a sense of urgency to finding effective solutions. The HAFS, operating on both air and liquid pressures, showcases versatility and resource efficiency. The focus on saving both lives and property is crucial, emphasizing the immovability of property compared to humans. The futuristic approach of incorporating this mechanism before construction aligns with the preventive nature of the solution. The flexibility of HAFS to operate manually or in an automated manner is a thoughtful design consideration, with the manual option being highlighted as the most viable. This practicality ensures that the solution can be implemented effectively, even in areas with limited resources or technological infrastructure.

Overall, this project not only demonstrates technical process but also reflects a deep understanding of real-world challenges and a commitment to finding sustainable solutions. The recognition at the National Science Fair is well-deserved, and the potential impact of the Hydraulic Anti-Flooding System in mitigating the effects of flooding is indeed promising.

The students of Mechanical Engineering of second semester Mr. Ayush Ravish, and Mr. Kishan B R, have won the second prize in the National Science Fair-2023 held on 31st August to 2nd September-2023 at JSSATE, Bengaluru.

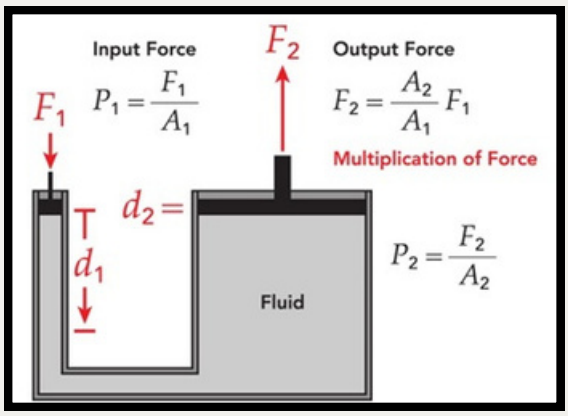
Magnetic Hydraulic Lift

Planned and executed by: Shreya P and team (AIML Section)
Supervised by: Dr. Nityanand Choudhary

Electromagnetic Hydraulic Lift is designed with a objective of separating heavy iron particles from products that are in liquid or slurry form. It's a method that can be used in nearly any environment where ferrous, para-magnetic, and grinding medium contamination is an issue. Magnetic Hydraulic lift makes this type of filtration easy and effective.

Principle: A magnetic hydraulic lift is used for moving magnetic objects using the force created by pressure on a liquid inside a cylinder. This force moves a piston upward. The hydraulic Lift Principle is based on Pascal's law for generating force or motion. The principle states that pressure change on an incompressible liquid in a confined space is passed equally throughout the liquid in all directions.

A piston with a small cross-section A1 has been used to exert a force F1 directly on the liquid. The pressure characterized by P = F/A is then transferred throughout the liquid to the larger cylinder attached to a larger piston of area A2, resulting in an upward force P × A2.



Therefore, it can be said that the piston can support a large force, which is the large weight. By varying the area A1, the platform can be shifted either up or down. Therefore, the applied force is thus increased by a factor of A2/A1 and this factor can be expressed as the mechanical advantage of the device. The magnet attached at the nose of the lift will attract the magnetic objects.

Building the Model Hydraulic Lifts:

In this project, three models hydraulic lifts using syringes with pistons of different areas and metal wall plates have been used. The syringes act as hydraulic cylinders.

a.To build the lift model which involves attaching the top of a secondary syringe's piston to the back of a metal plate with epoxy and then connecting the primary syringe to the secondary syringe with tubing.

b. Every lift has a 12 cubic centimeter (cc) primary hydraulic cylinder and each with one of three different secondary hydraulic cylinders of 12 cc, 35 cc, and 60 cc.

c. Water has been used as the hydraulic fluid.

d. A syringe has been attached to the metal plates. Tops of the pistons in these syringes are flat because they will be attached to the back of the metal plates, and they need to be flush against the plates. Epoxy the top of one 12 cc, 35 cc, and 60 cc syringe each to a separate metal plate, has been used to create half of the model lift. Following the safety recommendations and directions on the epoxy package, mix up enough epoxy to make one lift at a time. The above steps are repeated for 35-cc syringe and one 60-cc syringe.

e. 30 centimeter (cm) piece of tubing has been used.

Working:

- ·12 cc syringe is paused (that is not epoxied to a wall plate) into one end of the tubing.
- The primary syringe is now ready to attach to the secondary syringe (secondary hydraulic cylinder) to create the hydraulic lift. Primary syringe is filled and its tubing with water is prepare to attach it to the secondary syringe to create the hydraulic lift.
- Piston in the primary syringe is pushed all the way down so that it is fully depressed into the cylinder.
- The free end of the tubing is placed into the glass of water and piston is pulled up (while firmly holding the rest of the syringe). This will suck water into the tubing and syringe.

- The primary syringe's piston is pulled up as far as it can go without falling out of the cylinder of the syringe.
- Primary syringe's piston is depressed a tiny bit to remove any bubbles at the end of tubing.
- Now 12 cc secondary syringe is inserted into the free end of the tubing that is attached to the primary syringe.
- Above steps are repeated using the 35 cc secondary syringe/metal plate assembly and a 12 cc primary syringe/tubing assembly, to create the 35 cc model hydraulic lift.
- The metal tips attached at the nose of the lift will lift only magnetic materials.

Design and Development of Smart Blind Stick for Impaired

Planned and executed by: Tejas S and team (EIE Section)
Supervised by: Dr. Abhilasha Singh

The "Smart Blind Stick" project was undertaken by students of the 2022-23 batch in the 1st semester of the Electronics and Instrumentation Engineering (EIE) program. This innovative project aimed to address the navigation challenges faced by visually impaired individuals by leveraging technology to enhance their mobility and safety. The primary goal of the Smart Blind Stick project was to design a cost-effective and user-friendly prototype capable of detecting obstacles and providing real-time feedback to the user, thereby improving their navigation capabilities. The students utilized a combination of hardware and software skills to create the Smart Blind Stick prototype.

The experiment showcased the feasibility and potential benefits of a smart blind stick using Arduino Uno and an ultrasonic sensor. By combining technology with user-centered design, the project aimed to enhance the quality of life for visually impaired individuals. The insights gained from the experiment serve as a foundation for further research and development in the field of assistive technology for the visually impaired.


DEPARTMENT
ACTIVITIES

Research Centre

Department of Physics was recognized as Research Centre in 2017 and offers opportunities for scholars to register for Ph.D programs on both full-time and part-time basis. Currently four research scholars are pursuing their research work at this research center. In 2022-2023, one research scholar was awarded doctoral degree from VTU, Belagavi. The publication of ten research articles from the department in peer-reviewed journals in 2022 is a remarkable achievement.

The faculty's publications in prestigious journals underscore the department's commitment to high-quality research. Notably, an article with an impact factor of 6.633 was published in the Journal of Molecular Liquids, and another article with an impact factor of 3.84 was featured in the Journal of Molecular Structure.

Towards the extended and committed help to the research scholar, a proposal was submitted for catalytic grant of Rs. 1.9 lakh under reverse funding scheme to ISTEM, IISc Bengaluru and sanctioned in the financial year 2022-2023. This grant will undoubtedly contribute to the department's research objectives and support ongoing projects. The achievements mentioned showcase the dedication and competence of both faculty members and research scholars within the department.

Humidity Sensing Setup

Muffle Furnace

Spray Coating Setup

RESEARCH SCHOLARS

R.S.Madhukeswara & 1JS17PGA03
Guide: Dr. R Shashidhar
Co-Guide: Dr. Raghu

Prakasha G S & 1JS17PGS04
Guide: Dr. R Shashidhar

Bharath M J & 1JS18PPY01
Guide: Dr. R Shashidhar
Co-Guide: Dr.Roopashree B

Anand B C & 1JS17PGS02
Guide: Dr. R Shashidhar
Co-Guide: Dr.Nityanand Choudhary
Awarded degree in 2023

Faculty Publications (2022-23)

- Shashidhar R, “Annealing temperature dependent structural and optical characteristics of spray pyrolyzed ZnO thin films", Materials Today Proceedings, Volume 92, 2023. pp 1453-1458.
- Abhilasha Singh, “Thermodynamic model to study the structural and electro-optical properties of chiral antiferroelectric smectic C phase exhibited by mesogenic homologous series 3FnHBM6(s) and W-316 mixture”, Phase Transitions, Volume 96, 2023. pp 720-730.
- Sushma KC, “Efficient red-emitting SrZrO3: Eu3+ phosphor super structures for display device applications” , Journal of Molecular Structure, Volume 1283, 2023. pp 135192.
- Shashidhar R and Nityanand Choudhary, “Positive impedance and low hysteresis Mo S type humidity sensors via SRCBD polycrystalline SnxOy thin films” , Digest Journal of Nanomaterials and Biostructures, Volume 18, 2023. pp 695-699.
- Shashidhar R and Nityanand Choudhary, “Application of SRCBDS: SnO2 nanostructured Thin Films as Room Temperature Gas and Humidity Sensors” , Journal of the Korean Physical Society, Volume 82, 2023. pp 392-410.
- Prasanna Kumar S, “Measurement of the incoherent scattering cross sections and average effective atomic numbers of some Sodium salts by Gamma Irradiation for commercial applications”, High Technology Letters, Volume 28, 2022. pp 204-209.
- Sushma KC, “Color tunable SrZro3: Sm3+ nanopowders with satisfactory photoluminescent, band engineering properties for warm white LEDs and advanced forensic applications”, Journal of Molecular Structure, Volume 1254, 2022. pp 132302.
- Abhilasha Singh, “A systemic review on liquid crystals, nanoformulations and its application for detection and treatment of SARS – CoV- 2 (COVID – 19)”, Journal of Molecular Liquids, Volume 362, 2022. pp 119795.
- Abhilasha Singh, “Thermodynamic model to study the ferroelectric behaviour of lactic acid derivatives with keto linkage group” , Phase Transitions, Volume 95, 2022. pp 698-706.
- Abhilasha Singh,“Thermodynamic Model to Study the Phase Transition Properties of SmC_A^* Phase in Antiferroelectric Mesogen W-358 Series”, Indian Journal of Pure and Applied Physics,Volume 60, 2022. pp 695-699.

Academic Excellence

It is heartening to understand that a significant number of students have achieved exceptional success in "Engineering Physics" and "Introduction to Nanotechnology" in Academic Year 2022-23. The majority of students have scored an impressive distinction marks reflecting their dedication and mastery of the subject. A good number of students have scored more than 90% marks in both the subjects.

This collective achievement underscores the commitment of our students to academic excellence in the intricate domain of Engineering Physics and Nanotechnology.

Students scored 100 marks in "Physics for CSE Stream"

JSSATE BENGALURU

A+ NAAC

JSS ACADEMY OF TECHNICAL EDUCATION

DEPARTMENT OF PHYSICS

Congratulations!

To toppers in physics
VTU 2nd SEMESTER EXAM Sept/Oct-2023

Ms.Ruthu B Jain
1JS22IS115
100 Marks

Mr.Shreyas P Rayas
1JS22IS139
100 Marks

BEST WISHES FROM
DEPARTMENT, PRINCIPAL AND MANAGEMENT

Industrial Visit

Title: **Educational Visit to Indian Institute of Astrophysics**
Date: March 4, 2023
Venue: IISc. Bengaluru

Participants:

- EIE Branch: 34
- Civil Branch: 10

Faculty Coordinators:

Dr. Abhilasha Singh and Mr. Mohanakumara LB

Departments Visited:

- Aeroelasticity Lab
- Turbulent Shear Flow Physics and Engineering Laboratory
- Health Monitoring of Aerospace Structures using Acoustic Wave Propagation
- Centre for Atmospheric and Oceanic Sciences
- Centre for Infectious Diseases Research (CIDR)
- Electronics Communication Engineering Department
- Supercomputer Education and Research Centre (SERC)
- Other departments

Learning Highlights:

- Simulation of tornado in a box
- Generation of vortices
- Understanding various viruses and bacteria causing infectious diseases
- Exploring the skeleton of a supercomputer
- Details of power transfer
- Insights into 5G technology

The students' exposure to such diverse and advanced areas of research and technology undoubtedly will enhance their understanding and enthusiasm in their respective fields. Such experiences contribute significantly to the holistic development of students and foster a spirit of curiosity and innovation.

Title: **Educational Visit to Indian Institute of Astrophysics**
Date: August 17, 2023
Venue: Indian Institute of AstroPhysics, Bengaluru

Participants:

- ISE Branch: 33

Faculty Coordinators:
Dr. S Prasanna Kumar and Mr. Mohanakumara LB

Visit Highlights:

- Introduction to IIA:
  - The visit to the Indian Institute of Astrophysics (IIA) included a warm welcome and an introduction by Mr. Vikrant Pulamathi and Dr. Prasanna Deshmukh.
  - The students and faculty were briefed about the various facilities and opportunities available at IIA.
- Insight into Astronomy:
  - Mr. Vikrant Pulamathi and Dr. Prasanna Deshmukh provided valuable insights into the field of science and astronomy, emphasizing the associated technology.
- Optics Lab Tour:
  - The team was taken to the Optics lab, where the basics of optics were explained, and students had the opportunity to observe different telescopes.
- UVIT (Ultra Violet Imaging Telescope) Demonstration:
  - Mr. Vikranth Pulamathi explained the working of the Ultra Violet Imaging Telescope (UVIT), offering a deeper understanding of its functionality.

The students had an opportunity to interact with the scientists at IIA and had discussions.


GPS Map Camera
Bengaluru, Karnataka, India
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Long 77.504768°
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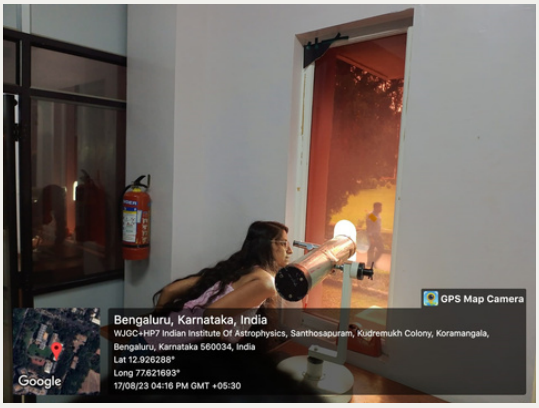
Google


GPS Map Camera
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Long 77.621693°
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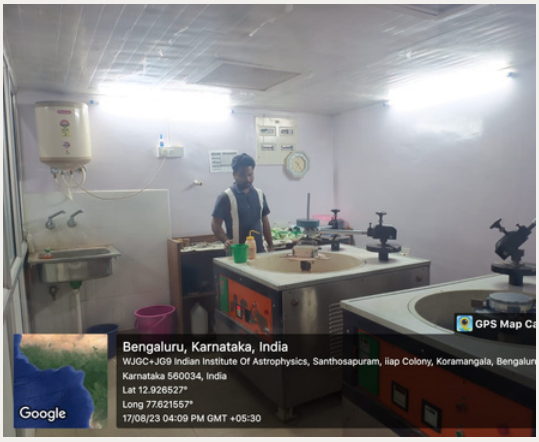
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WJGC+JG9 Indian Institute Of Astrophysics, Santhosapuram, Iiap Colony, Koramangala, Bengaluru, Karnataka 560034, India
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Bengaluru, Karnataka, India

Event: **SDP on "Recent Trends in Physical and Mathematical Sciences"**
Date: April 18, 2022
Target Audience: B.Sc. (Hons.) Students

Resource Persons:

1. Dr. Nagaraja D:
   - Designation: Professor and Head
   - Affiliation: BIT Bengaluru
2. Dr. Dinesh P A:
   - Designation: Associate Professor
   - Affiliation: MSRIT Bengaluru

The SDP aimed to provide insights into the recent trends in Physical and Mathematical Sciences to the B.Sc. (Hons.) students. Dr. Nagaraja D, with expertise as the Professor and Head at BIT Bengaluru, shared valuable knowledge with the participants. Dr. Dinesh P A, an Associate Professor at MSRIT Bengaluru, contributed his insights to the program. The program likely covered recent advancements, emerging topics, and significant developments in the field of Physical and Mathematical Sciences. Participants had the opportunity to engage in interactive sessions with the resource persons, fostering a conducive environment for learning and knowledge exchange.

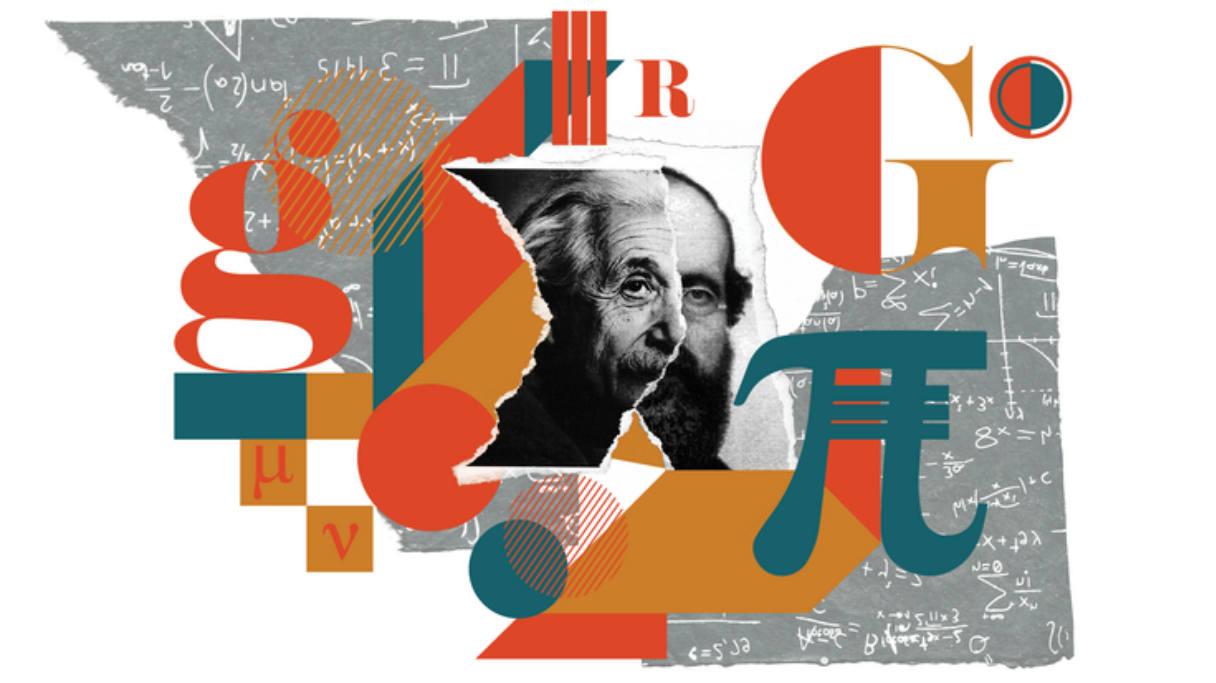
The Department of Physics successfully organized a knowledge-enriching SDP, facilitating a deeper understanding of recent trends in Physical and Mathematical Sciences. The insights shared by the distinguished resource persons likely contributed to the academic and intellectual growth of the B.Sc. (Hons.) students.

Event: Visit to JSS AJDTC, Bengaluru
Date: April 11, 2022
Target Audience: B.Sc. (Hons.) Students

Resource Person:
Mrs. Keerthana, Student, JSS AJDTC, Bengaluru

During the visit, students gained knowledge of casting, design, and other processes carried out at JSS AJDTC, Bengaluru. Mrs. Keerthana, student, has outlined all the amenities offered at the center and provided our students with practical experience. Mr. Manjunatha, lab assistant, helped during the visit.

ARTICLE FROM FACULTY AND STUDENTS



Intellectual property

Intellectual property (IP) refers to creations of the mind, such as:

- Inventions
- Literary And Artistic Works
- Designs
- Symbols
- Names And Images Used In Commerce

Dr. Gowreesh S
Associate Professor
Mechanical Department

What are the IPRs in India?

Intellectual property rights in India includes the following common types:

- Copyright - Grants the protection of written or published works such as books, songs, films, web content, and other artworks
- Patents - The patent rights protect an invention, new business product, or the process
- Design - Getting a design registration protects the design such as a drawing, colour, pattern, or combination of designs
- Industrial designs - An industrial design constitutes the ornamental or aesthetic aspect of an article. Geographical indications - Geographical indication includes the name of the place of origin of the goods
- Trademarks - A trademark protects signs, symbols, logos, words, or sounds that distinguish between the products and services from the competitors
- Trade secrets -Trade secrets must be actively protected by the company and are typically the result of research and development.

Why is it important to register intellectual property?

While talking about protecting IPRs, it is first necessary to understand the importance of registration. When an individual or an organization develops a new product, which involves a lot of processes, content, resources etc., a lot of time and money is invested. It is natural for the inventor or organization to have the expectation of being able to own exclusive rights over the invention, while excluding others from benefiting from it. This exclusivity is provided through IP systems and IP laws. Although it is not mandatory to register an IP or trademark, it provides the inventor certain advantages including the prima facie ownership proof that enables the owner to enforce IPR in a court of law, if deemed necessary. There are several dangers if IPRs are not protected. For instance, not protecting IP can result in getting benefits from the unprotected invention in an unauthorized manner to anyone. There is no law that can stop one from duplicating and seeking financial benefits from someone else's innovation if IP is not filed. Furthermore, it falls upon the owner to prove the ownership of the IP in a court of law if the IP is unregistered. If a trademark remains unprotected, the court cannot help the inventor, as it is not possible to claim ownership and/ or sue for infringement.

Thin film Technology and its importance

Dr. Shashidhar R

Thin film: A layer of material that ranges in thickness from several micrometers to fractions of a nanometer is known as a thin film. For many applications, the first step is the controlled synthesis of materials as thin films. Often, a thin metal coating forms a reflective interface on the back of a sheet of glass in household mirrors, which are a common example. Mirrors were originally made by the silvering process, but more recently, sputtering has been used to deposit the metal layer. The 20th century saw a number of technological advances made possible by improvements in thin film deposition techniques. These included the creation of magnetic recording media, electronic semiconductor devices, integrated passive devices, LEDs, hard coatings on cutting tools, optical coatings (like antireflective coatings), and thin-film solar cells and thin-film batteries for energy generation and storage. Thin-film drug delivery is another area in which it is being used in medicine. A multilayer is made up of several thin film layers.

Principle: One of the most straightforward methods for thin film deposition is the evaporation of a material followed by its condensation on a substrate. The material to be deposited in this method is either in the liquid or solid state, and it needs heat energy to change into the vapor phase.

The processes for depositing and processing thin layers, ranging in thickness from a few microns to individual atoms, are known as thin film technologies.

Advantages: Compared to crystalline silicon cells, thinner-film cells are lighter because they require less semiconductor material. Additionally, the cost of production and installation is lower. Lower efficiency counteracts this, necessitating additional space in order to install more panels.

DYSON SPHERE

Artificial Star Sources of Artificial Infrared Radiation.

Mukunda M
ISE B
Sem:1st Sem

Did you know that the sun delivers 120,000 terawatts of energy to Earth's surface? Humans currently use about 13 terawatts of energy, which is only 0.01% of the sun's energy. Now imagine being able to use 100% this would be 200,000,000,000,000,000 times more than the largest nuclear power plant that we currently have.

When we use a use an electric device which has a solar panel we try to get it in contact with as much light as possible, the concept of Dyson Sphere is the same.

Dyson sphere is a theorem that will be very difficult to implement in the practical life. In this article, I will provide you with information about the Dyson sphere. Technology is developing in order to meet the increasing need of it's users, and as a result of this development, a lot of energy is being consumed daily. As people grow and technology evolves, our energy needs are increasing. This level of development is called the Type 1, Type 2, Type 3 civilization level. Each of these civilization levels has energy needs. Scientists are doing research on this subject.

The largest and cleanest source of energy we can get is now the Dyson sphere. The Dyson sphere has a flawless design to meet all your energy needs. This concept was originally proposed by the Physicist Freeman Dyson, Dyson provided the most exciting theoretically proposed ideas in the world of AstroPhysicists today. The idea came to Dyson after reading the 1937 novel Star Maker. An editorial dated 1960, says that Dyson proposed an article in Science magazine entitled 'Search Artificial Star Sources of Artificial Infrared Radiation'. He described a superstructure built near or around the sun, which could capture the energy of the Sun and return it to Earth. If this happened, the earth would not have to rely heavily on fossil fuels or other existing energy sources. Defenders of solar energy know that only a small part of the total energy of the sun strikes the Earth. What if we collect all the solar energy as a civilization? To do this a kind of Dyson sphere called the Dyson shell or structure can be used. Dyson proposed advanced civilizations in our galaxy would inevitably use a massive amount of energy. Dyson argued that the search for evidence of the existence of such structures could lead to the discovery of advanced civilizations elsewhere in the galaxy. In recent years, astronomers explored that possibility with a bizarre star, known to astronomers as KIC 8462852 – more popularly called Tabby's Star for its discoverer Tabetha Boyajian. This star's strange light was originally thought to indicate a possible Dyson sphere. That idea has been discarded, but, in 2018, other possibilities emerged, such as that of using the Gaia mission to search for Dyson spheres.

Now the main question is can we build a Dyson sphere?

In order to make the Dyson sphere we need to discover new materials for our spacecraft to be able to make a production base on another planet, as we don't have enough materials. First, the Dyson sphere is designed to turn around the sun, but the gravitational law will not allow it. So how do we design the Dyson Sphere? We can do it perfectly with satellites and a series of optical panels that we will send into the orbit of the sun. The aim of the hypothesis is building huge structure to harness 100% of its energy and also living on it.

The structure's building block is special block, which can transform one star's whole power to useable energy for us. The mass required for the construction of the Dyson Sphere is M = ρ4πr2t where ρ is the density of the material of the Sphere and t its thickness. For Earth-like density, radius of 3 × 106 km and thickness of 1 meter, we find a mass of 6 × 1023 kg, slightly less than the mass of the Moon! Obviously, this is a small fraction of the usable mass in the solar system, and the mass of one terrestrial planet will easily give a 10 m-thick shell, so that the inhabitants will not worry very much about accidentally puncturing it.

The Dyson Sphere: In 1960 Professor Freeman Dyson proposed that it was indeed possible, and if such a civilization were to exist it would be one of extraordinary capability when it came to the use and harnessing of energy for work, also to contain radio emissions it must be an enclosed system for total isolation, but due to the laws of thermodynamics, the civilization that created the hypothesized Dyson Sphere and using such large flows of energy, whether or not it wished to communicate with other species it would have no choice via the laws of thermodynamics but to dispose of waste heat, this heat must then be radiated into space in the form of infra-red radiation. Dyson then proposed that uncommunicative civilizations could possibly be detected from sources of infra-red radiation emitted from the gravitational wells surrounding the mass of a star if they used a flow of energy large enough when compared with natural infra-red sources in the same part of the sky. Per Kardashev's Scale, a civilization that can create a Dyson Sphere and harnessing all of a star's energy would be categorized as a Type 2 civilization.

Speculative Nature and Future Possibilities: Dyson Spheres remain largely speculative and are often discussed in the context of advanced science fiction and futurism. As our understanding of physics and engineering advances, the feasibility and potential applications of such megastructures may be reevaluated. In summary, the concept of a Dyson Sphere represents a fascinating intersection of science fiction, astrophysics, and speculative engineering.

Exploring the Wonders of Plasma Theory: A Fundamental Understanding of the Fourth State of Matter

Om Raj
USN:1JS21AI032
Sem:5th Sem

Plasma, often referred to as the fourth state of matter, occupies a unique and intriguing position in the realm of physics. Unlike solids, liquids, and gases, plasma consists of charged particles—ions and electrons—making it an electrically conductive medium. The study of plasma theory has become increasingly vital in various scientific disciplines, including astrophysics, fusion research, and space exploration. In this article, we will delve into the fundamental aspects of plasma theory and explore its significance in our understanding of the universe.

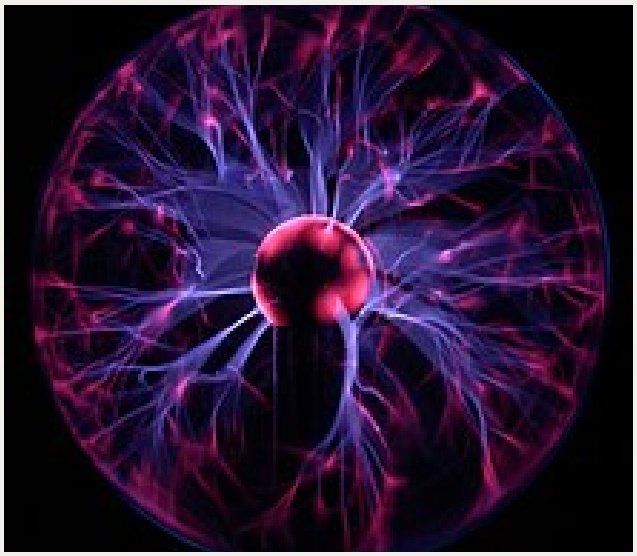
The Basics of Plasma Theory: Plasma is commonly found in high-temperature environments, such as stars, lightning, and the auroras. Understanding the behaviour of plasma requires a grasp of fundamental plasma theory concepts. Plasma theory encompasses various topics, including plasma waves, instabilities, and the interaction of plasma with magnetic fields.

- Plasma Waves: Waves in a plasma medium play a crucial role in understanding its dynamics. Alfvén waves, ion-acoustic waves, and Langmuir waves are examples of waves that can propagate through plasmas, influencing their behaviour.
- Instabilities: Plasma instabilities are phenomena where small disturbances can grow and significantly alter the plasma state. Examples include the Rayleigh-Taylor instability and the Kelvin-Helmholtz instability. These instabilities are vital in understanding the evolution and stability of plasmas.

- Magnetic Confinement: Plasmas are often subjected to magnetic fields, and the study of magnetic confinement is essential for applications like controlled nuclear fusion. Magnetic confinement devices, such as tokamaks and stellarators, rely on the principles of plasma theory to contain and control high-temperature plasmas.

Applications of Plasma Theory: Understanding plasma theory has practical implications across various fields:

- Fusion Research: Plasma theory is instrumental in the pursuit of controlled nuclear fusion, a potential clean and virtually limitless energy source. Research facilities like the International Thermonuclear Experimental Reactor (ITER) rely heavily on plasma theory to design and optimize fusion devices.
- Astrophysics: Plasma is abundant in the universe, constituting the majority of visible matter. Studying plasma theory helps astrophysicists comprehend phenomena like solar flares, the behaviour of stars, and the dynamics of interstellar space.
- Space Weather: Plasma theory contributes to our understanding of space weather, including phenomena like solar wind and the Earth's magnetosphere. This knowledge is crucial for spacecraft operations, satellite communications, and even power grid management on Earth.



The Multiverse Hypothesis

Vignesh S
EC B
Sem:1st Sem

The concept of multiple universes, or a multiverse, has been discussed throughout history, including Greek Philosophy. It has evolved over time and has been debated in various fields, including cosmology, physics, and philosophy.

Even in Bhagwat Gita, the concept of multiverse has been mentioned. In one passage, Krishna describes the universe as being like a cosmic dream. He says that the universe is created by Brahma, the Supreme Being, and that it is ultimately unreal. This could be interpreted as suggesting that there are other universes that are also created by Brahma and that are also ultimately unreal.

Theoretical foundations for the concept of a multiverse come from several areas of theoretical physics and cosmology. For example:

• Inflationary Cosmology foundation states that, the birth of multiverse is a cosmic inflation and each universe is a ‘Bubble Universe’.

• String Theory Landscape unifies the fundamental forces of nature into a vacuum called ‘vacua’. Each state has different set of constants and physical laws. This would conclude that multiverse is one of many possible solutions within this landscape.

• Anthropic principle suggests a philosophical idea that the physical laws and conditions in our universe are turned accordingly to allow the existence of an intelligent life. It might just seem similar to String Theory, because here in suggested universe the constant and laws of physics keep changing but only some of these universes can support life.

In some potential theories, be infinite universes, but only a small or relatively small real number of universes where humanity could exist and only one where it ever does exist. It has been suggested that a universe that "contains life, in the form it has on Earth, is in a certain sense radically non-ergodic, in that the vast majority of possible organisms will never be realized". On the other hand, some scientists, theories and popular works conceive of a multiverse in which the universes are so similar that humanity exists in many equally real separate universes but with varying histories.

In conclusion, the question of whether the multiverse is possible remains one of the most intriguing and debated topics in contemporary physics. While theoretical frameworks such as string theory and inflationary cosmology suggest the feasibility of a multiverse, the lack of direct empirical evidence poses challenges to its acceptance within the scientific community.

Bullet Trains in India

Sinchana K
R&A
Sem:1st Sem

Indian Railways is the fourth largest railway network in the world. Indian Railways are not only developing but also introducing superfast express trains with modern technology and top-notch facilities such as the Vande-Bharata Express. Bullet trains, are the latest topic in India as the country plans to import high-speed trains from Japan. According to Railway Minister Ashwini Vaishnav, the first bullet train is expected to run from August 2026. We expect that this will boost our economy. The bullet trains are high-technology trains that are the fastest, most comfortable mode of rail transport.

There is a new generation of trains called the Maglev trains which work on the principle of magnetic repulsion between the cars and the tracks using powerful electromagnets. We know that opposite poles attract and like poles repel eachother. This is the basic principle behind electromagnetic propulsion. Electromagnets are similar to other magnets in that they attract metal objects, but the magnetic pull is temporary. Maglev trains, short for magnetic levitation trains, are a marvel of modern engineering. These futuristic trains hover over guideways, held up by the force of powerful magnets, and move without any physical contact between the train and the track. This technology eliminates rail friction, allowing these trains to reach speeds of hundreds of miles per hour, making them one of the fastest modes of transportation in the world.

Maglev systems may be monorail or dual rail. Some railway transport systems incorporate linear motors but use electromagnetism only for propulsion, without levitating the vehicle. Such trains have wheels and are not maglevs.
High speed is just one of the major benefits of maglev trains. These trains rarely (if ever) touch the track, there's far less noise and vibration than typical, earth-shaking trains. Less vibration and friction results in fewer mechanical breakdowns, meaning that maglev trains are less likely to encounter weather-related delays.

The big difference between a maglev train and a conventional train is that maglev trains do not have an engine, like the ones used to pull typical train cars along steel tracks. The engine for maglev trains is rather inconspicuous. Instead of using fossil fuels, the magnetic field created by the electrified coils in the guideway walls and the track combine to propel the train.
According to different sources, it is said that the Indian Railways is currently building the country's first bullet train from Ahmedabad, Gujarat to Maharashtra over a total 508 kilometres route. The high-speed bullet train will run through by connecting top metro cities like New Delhi, Mumbai, Ahmedabad, Chennai and Kolkata etc.This project will surely bring a revolutionary change in the Indian Railway's mode of transportation. Hence, we are all set to welcome the high-speed rail network in our country India.

Benefits of Bullet Trains in India:

- Bullet trains in India will be helpful in reducing congestion on roads due to traffic. If passengers move to take the train for travelling then there will be a lot of congestion from roads. Apart from that we all know that less traffic on roads leads to less air and noise pollution so we can say that it is also eco-friendly in nature as well.

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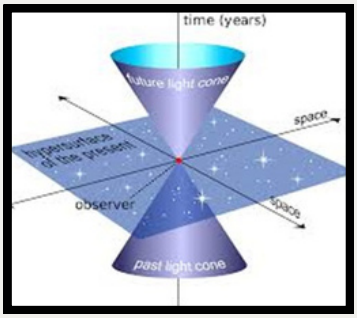
- Bullet trains in India will not only bring economic development and technological advancement in our country but it will also increase direct and indirect employment.
- One of the best things about this high-speed bullet train is that it is totally safe and secure for the passengers. We all know that these days train accidents are increasing day by day continuously and due to this reason passengers feel insecure while travelling. This advanced technology bullet train is not only safe and secure for travelling but it will also provide you ultimate comfort during the journey.
- ·These high-speed bullet trains are generally fuel efficient which makes them eco- friendly.
- One of the most important advantages of bullet trains is that it is time-saving for passengers as we all know that bullet trains are very high-speed trains.

These are the major benefits of high-speed bullet trains in India. We all know that growth in technological advancement in any country leads to growth in the economy. The high-speed bullet train will surely bring economic development and growth and modernization to Indian Railways and transportation system.

SPECIAL THEORY OF RELATIVITY

Amoghvarsh Bhasme
ECE
Sem:1st Sem

Albert Einstein's 1905 theory of special relativity is one of the most important papers ever published in the field of physics. Special relativity is an explanation of how speed affects mass, time and space. The theory includes a way for the speed of light to define the relationship between energy and matter — small amounts of mass (m) can be interchangeable with enormous amounts of energy (E), as defined by the classic equation E = mc^2.



Special relativity applies to "special" cases — it's mostly used when discussing huge energies, ultra-fast speeds and astronomical distances, all without the complications of gravity. Einstein officially added gravity to his theories in 1915.

Foundations of the Special Theory of Relativity:

The idea that the laws of physics remain the same for all observers travelling at a constant speed forms the foundation of the Special Theory of Relativity. The idea that space and time, two essential components of the cosmos, are combined to form a one entity called spacetime is presented by this principle, which contradicts our instinctive comprehension of both concepts.

THE POSTULATES:

Einstein's theory is built upon two postulates:

The Principle of Relativity: The laws of physics are the same for all observers in uniform motion relative to one another. In other words, there is no absolute state of rest or motion in the universe. Any observer moving at a constant velocity should perceive the same physical laws, regardless of their speed or direction.

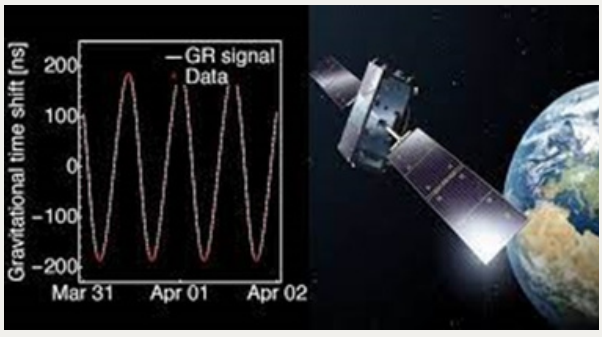
The Speed of Light Postulate: The speed of light in a vacuum is constant for all observers, regardless of their motion relative to the light source. This constant speed is denoted by 'c' and is approximately 299,792 kilometres per second.

TIME DILATION

Time dilation asserts that time is not an absolute and uniform concept but is instead relative and depends on the observer's motion. The faster an object is moving relative to an observer; the slower time appears to pass for that object.

The phenomenon of time dilation arises from the constancy of the speed of light, as postulated in the theory. According to the theory, the speed of light (c) is the same for all observers, regardless of their motion. This postulate challenges our common-sense notion of time as an absolute and consistent entity.

The time dilation effect becomes noticeable when objects approach speeds that are a significant fraction of the speed of light. The mathematical expression for the time dilation is given by the Lorentz factor:



$$t = \frac{t_o}{\sqrt{1-\frac{v^2}{c^2}}}$$

t represents the proper time (time elapsed for the moving object), ′t0′ is the time observed by the stationary observer, 'v' is the velocity of the moving object, and 'c' is the speed of light.

Quantum Computing: Unraveling the Future of Information Processing

DAKSHITA M.V.
1JS22CV003
Sem:3rd Sem

In the esoteric realm of quantum mechanics, a revolutionary frontier is emerging-one that promises to redefine the very essence of computing as we know it. Welcome to the enigmatic world of quantum computing, where the rules of classical physics no longer apply, and the binary boundaries of 0s and 1s dissolve into a quantum dance of infinite possibilities. In this article, we embark on a journey through the fascinating landscape of quantum computing, exploring its principles, potential applications, and the tantalizing prospect of a computational paradigm shift that could reshape the future of information processing. Fasten your seatbelts as we delve into the quantum realm and unravel the mysteries that hold the key to the next era of computational evolution.

Quantum computing is a field of computing that takes advantage of the principles of quantum mechanics to perform certain types of calculations more efficiently than classical computers. Classical computers, the kind most people are familiar with, use bits process information. These bits can exist in one of the two states, 0 or 1, representing binary code. In short, a quantum computer is a computer that takes advantage of quantum mechanical phenomena.

Quantum computers operate using quantum gates, analogous to classical logical gates but with the ability to manipulate qubits in ways that classical bits cannot be manipulated. Quantum algorithms, such as Shor's algorithm and Grover's algorithms, exploit these properties to solve certain problems exponentially faster than their classical counterparts. Shor's algorithm, for instance has the potential to factor large numbers exponentially faster than the best-known classical algorithms.

The potential applications of quantum computing span a wide array of fields, including cryptography, optimization problems, drug discovery, material science and artificial intelligence. Quantum computers could revolutionize drug development by simulating molecular interactions with unprecedented accuracy, significantly reducing the time and resources required for the discovery of new pharmaceuticals. In material science, quantum computers can model complex structures at the quantum level, leading to the development of advanced materials with unique properties. Moreover, quantum computing holds the promise of revolutionizing artificial intelligence (AI). Quantum machine learning algorithms have the potential to outperform classical machine learning algorithms, enabling faster and more efficient data processing, pattern recognition, and optimization tasks.

While the potential benefits of quantum computing are immense, there are significant challenges to overcome. Quantum systems are highly susceptible to environmental disturbances and decoherence, which can cause errors in calculations. Researchers are actively working on developing error-correction techniques and building more stable quantum hardware. The construction of scalable and reliable quantum computers also poses a significant challenge. Current quantum computers are often smallscale and delicate, requiring extremely low temperatures to maintain the coherence of qubits. Advancements in quantum hardware including the development of fault-tolerant qubits, are crucial for the realization of large-scale, practical quantum computers.

As quantum computing progresses, ethical considerations and potential security risks come to the forefront. The ability of quantum computers to break widely-used cryptographic algorithms raises concerns about data security. The field of quantum-resistant cryptography is emerging to address these vulnerabilities and develop encryption methods that can withstand quantum attacks. Additionally, questions surrounding the ethical use of quantum computing in areas such as artificial intelligence and data privacy need careful consideration. Striking a balance between technological advancement and responsible use is imperative to ensure the positive impact of quantum computing on society.

FACULTY & STAFF

SKILL LAB