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This landscape of “mountains” and “valleys” speckled with glittering stars is actually the edge of a nearby, young, star-forming region called NGC 3324 in the Carina Nebula. Captured in infrared light by NASA's new James Webb Space Telescope, this image reveals for the first time previously invisible areas of star birth.

Called the Cosmic Cliffs, Webb's seemingly three-dimensional picture looks like craggy mountains on a moonlit evening. In reality, it is the edge of the giant, gaseous cavity within NGC 3324, and the tallest “peaks” in this image are about 7 light-years high. The cavernous area has been carved from the nebula by the intense ultraviolet radiation and stellar winds from extremely massive, hot, young stars located in the center of the bubble, above the area shown in this image.

(https://www.nasa.gov/webbfirstimages)

OBSERVATIONAL ASTRONOMY — *HERSCHEL'S TELESCOPE*

Frederick William Herschel (1738-1822) was German born British astronomer and composer of music. He constructed his first large reflecting telescope in 1774 and spent nine years carrying out sky survey to investigate and discover Binary Multiple Star System and Steller Motion. He was first to catalogue and interpret nebula object (5000 objects).

FDC commemorating 200 years of discovery of Uranus by Hershel **– vignette depict the exact location of Uranus in Gemini Constellation on 13 march 1781, and large telescope used by Hershel he called this new planet as Georgian Star (Georgian sides) after King George III**

William Hershel holding the drawing of map of location of Uranus, is standing with his son John and William Blake with 40 feet telescope in the background

Souvenir Sheet **depicting Hershel and Galelio and their telescope and ring of Saturn. Hershel discovered new moons of Saturn**

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The Bulletin is the official organ of the IAPT. It is a monthly journal devoted to upgrading physics education at all levels through dissemination of didactical information on physics and related areas. Further, the Bulletin also highlights information about the activities of IAPT.

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IAPT Activities: A Conviction of Co-operation and Team Spirit

In the last seven months of 2022, our interaction with Regional Council Executives has been very significant and we are convinced that

(i) Our members are a dedicated lot with very good intentions to improve the quality of activities of IAPT. They want to convert their intentions into actions in and outside classroom.

(ii) IAPT can scale up its activities only by effective dedicated teams with members drawn from across the country, to undertake a task in a mission mode and persist with it.

(iii) Today we are equipped with myriad possibilities through information and communication technology to make IAPT a truly collaborative platform.

(iv) We need to learn a lot from a number of projects already working successfully in IAPT which have reached the physics community in a big Way.

The way NAEAST has grown is the best example of IAPT's strength. I would like to share the result of such a team effort carried forward by *Him Anveshika*, till 28th July 2022 registration in Himachal has reached a good 2000, deserving a shout out. Such a number was unimaginable a year ago but *Him Anveshika* and its satellite network could achieve this milestone with its consistent team effort and very effective social media presence. More such news is trickling from almost all the Anveshika centres from the country.

To further strengthen this kind of effort for all our programs, we need to go for institutional hand shake and create a network of IAPT hubs for our chosen goals. A recent example of one such handshake has been between RC 4 Uttar Pradesh and IIIT Pryag Raj. They together initiated an online UG course-based workshop with registration of 2000 students. No doubt it is a hugely encouraging sign of faith in IAPT, and is very exciting happening. This model can be effectively undertaken by each Regional Council with content tailored around curriculum framework of UGC. It will also provide IAPT Community an opportunity to examine content of each paper and its relevance. In this process one can revisit learning outcomes for effective teaching in the light of National Education Policy 2020.May be this exercise leads to a model course work from the subject society like IAPT who can objectively maintain the quality and rigor of the subject content at a desired level.

It is also very heartening to know that the first Circular of National Standard Examinations prepared by Controller of Examinations IAPT and his team is already out. HBCSE has been very positive about it, thanks for their faith in us. Undertaking this responsibility, maintaining the academic quality and credibility of the whole process requires a sincere effort from each one of us. National standard examinations showcase IAPT's reach to every corner of the country and spirit of volunteerism of its members. No doubt we will stand up to this task, but let us not be complacent. We need to make this examination approachable for the students by sharing the first circular with the teachers and students, it should trigger a chain reaction of committed action towards reaching out to unreached. As individuals we can contribute in many ways, from sharing the circular to the conduct of examinations credibly. Teachers matter a lot in encouraging their students to sit in the exam. Please do reach out to Controller of Examinations IAPT, Prof. BP Tyagi and his team for any further help. These circulars are also being posted to schools. I wish team National Standard examinations a grand success.

May the teams of IAPT rise and achieve their goals. If you also have such success stories of IAPT please do share. IAPT is looking forward to such inspiring efforts.

To quote Mahatma Gandhi: ***Satisfaction lies in the effort not in the attainment***.

On the occasion of **75 years of Azadi ka Mahotsav**, IAPT sends its greetings to all its members. Let us not forget to pay respect to those who laid their lives for a dream of freedom of our countrymen and thank them for where we are today by raising Tiranga.

Jai Hind

PK Ahluwalia
President

PHYSICS NEWS

An alternative superconducting qubit achieves high performance for quantum computing

Quantum computers, devices that exploit quantum phenomena to perform computations, could eventually help tackle complex computational problems faster and more efficiently than classical computers. These devices are commonly based on basic units of information known as quantum bits, or qubits.

Researchers have recently developed a quantum processor using fluxonium qubits, which have so far not been the preferred choice when developing quantum computers for industry teams. Their paper demonstrates the potential of fluxonium for developing highly performing superconducting circuits.

In initial tests, the quantum platform designed was found to attain an average single-qubit gate fidelity of 99.97% and a two-qubit gate fidelity of up to 99.72%. These values are comparable to some of the best results achieved by quantum processors in previous studies. Besides single- and two-qubit gates, the team also integrated, in a robust manner, other basic operations needed for a digital quantum computer—reset and readout.

Read more at : https://phys.org/news/2022-07-alternative-superconducting-qubit-high-quantum.html

Original paper : Physical Review Letters (2022). DOI: 10.1103/PhysRevLett.129.010502

The observation of Chern mosaic and Berry-curvature magnetism in magic angle graphene

Researchers have recently probed a Chern mosaic topology and Berry-curvature magnetism in magic-angle graphene. Their paper offers new insight about topological disorder that can occur in condensed matter physical systems.

Magic angle twisted bilayer graphene (MATBG) has drawn a huge amount of interest over the past few years due to its experimentally accessible flat bands, creating a playground of highly correlated physics. The recent study by this team of researchers greatly contributes to the understanding of MATBG, both in terms of its magnetism and topology. In the future, it could inform the development of more precise theoretical models of this material, while also potentially facilitating its implementation in various quantum computing devices.

Read more at : https://phys.org/news/2022-07-chern-mosaic-berry-curvature-magnetism-magic.html

Original paper : Nature Physics (2022). DOI: 10.1038/s41567-022-01635-7

Magnetizing laser-driven inertial fusion implosions

A new study shows that nickel oxide superconductors, which conduct electricity with no loss at higher temperatures than conventional superconductors do, contain a type of quantum matter called charge density waves, or CDWs, that can accompany superconductivity.

The presence of CDWs shows that these recently discovered materials, also known as nickelates, are capable of forming correlated states—"electron soups" that can host a variety of quantum phases, including superconductivity. Researchers have now created and examined a different nickelate material where neodymium was replaced with another rare-earth element, lanthanum. The experiments showed that this nickelate could host both CDWs and superconducting states of matter—and that these states were present even before the material was doped. This was surprising, because doping is usually an essential part of getting materials to superconduct.

Read more at : https://phys.org/news/2022-07-nickel-oxide-superconductors.html

Original paper : Nature Physics (2022). DOI: 10.1038/s41567-022-01660-6

Pankaj Bhardwaj
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ARTICLE

A Survey Of Various Schemes And Stem Journals To Understand The Present Status Of Research On Stem Education In India

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Abstract

The STEM (Science, Technology, Engineering, and Mathematics) education system of India has been going through a massive change as it is reinventing and rejuvenating itself at par with the changing global scenario. Various schemes have been introduced and implemented by successive governments to improve the overall quality of STEM education and STEM education research (referred here as STEMEER). We have reviewed the schemes and surveyed several peer-reviewed international education journals to understand the current status of STEMEER in India. Our data show that it needs a collective and concerted effort from Indian educators and researchers to catch-up with the international standard.

Introduction: *"We owe a lot to the ancient Indians, teaching us how to count. Without which most modern scientific discoveries would have been impossible."* – Albert Einstein

"My message, especially to young people is to have courage to think differently, courage to invent, to travel the unexplored path, courage to discover the impossible, and to conquer the problems, and succeed. These are great qualities that they must work towards. This is my message to the young people." – Dr. A.P.J. Abdul Kalam.

Indian civilization has been rich in science and technology for a long time. The history of science and technology in India began and flourished from the Indus Valley Civilization. Universities like Takshila (world's first university) Nalanda, Taxila, Ujjain, Kanchi, etc., were the topmost institutions[1-3]. Many eminent scholars and scientists were born in this land of sages. Charaka, Susruta, Aryabhata, Bhaskaracharya, Chanakya, Patanjali, Vatsayayna and several others made groundbreaking contributions to arts, science, mathematics, engineering, medical science, architecture, technology, and many other fields in ancient and medieval India. The mathematical digit 'zero', one of the most important inventions of all time, was given by an Indian mathematician/astronomer Aryabhata in Gupta era. Through his discovery, the digit zero was used in mathematical operations like addition and subtraction. He also significantly contributed to various branches of mathematics (arithmetic, algebra, and trigonometry). The decimal system, numeral notations, Fibonacci numbers, binary numbers, rural measurements etc., all had been given to the world by Indian scholars. Sushruta Samhita by Sushruta in 6th Century BC is considered as one of the most comprehensive textbooks on ancient surgery. The text mentions various illnesses, plants, preparations, and cures along with complex techniques of plastic surgery[1-3].

India also produced great scientists during the 19th - 20th centuries. Sir C. V. Raman (discovered the Raman effect in 1928 and he was the first Indian scientist who was awarded Nobel Prize for Physics for his discovery in 1930); Dr. Subrahmanyan Chandrasekhar (Indian Nobel Prize-winning physicist, who discovered the mathematical formula - Chandrasekhar limit); Srinivasa Aiyangar Ramanujan (one of the greatest mathematician of all time); Prof. S.N. Bose (discovered the B-E Condensation with Albert Einstein and quantum particles which obey B-E statistics are known as Bosons); Sir Jagdish Chandra Bose (discovered the

microwave and device to monitor the growth of a plant); Dr. Prasanta Chandra Mahalanobis (Founder of Indian Statistical Institute); Dr. Homi J. Bhabha, (Father of the India's Nuclear Program); Acharya P.C. Ray (Father of Indian Chemistry); Dr. M.N. Saha (Saha equation); Dr. Shanti Swaroop Bhatnagar (first director-general of Council of Scientific and Industrial Research); Dr. V. A. Sarabhai (Father of India's Space Program); Dr. Har Gobind Khorana, (an Indian American scientist, who shared Nobel prize in Medicine in 1968), and Dr. A.P.J. Abdul Kalam (11th President of India), and many more scientists who reached the prime position in the scientific field[3-4].

India has been actively contributing to science, technology, and society even in today's fast-moving world. India regularly undertakes space mission through Indian Space Research Organization (ISRO), lead the International Solar Alliance, and proactively tackle the climate change/reduction of the carbon footprint as per the Paris Agreement, besides fulfilling other internationals commitments[5]. India's space business to witness tremendous growth in the coming years, on the back of technological advancement, multi-billion-dollar global low-cost space business opportunities, and a sharp rise in ISRO's satellite launching capability. Therefore, India has been actively contributing to the demands and needs of a fast-moving society and making this world a better living place.

However, the STEM (Science, Technology, Engineering, and Mathematics)/STEAM (Science, Technology, Engineering, Arts, and Mathematics) education system of India faced various kinds of challenges (e.g., social, economic, & political) as it sailed from pre-independence to post-independence era[6]. Successive governments, since independence, have been working relentlessly on diverse aspects of education to improve the overall quality of STEM education and research on STEM education (or STEM education research). They are executed on the basis of recommendations (suggestions), reports, and policies by various national and international governing bodies, organizations, committees, and commissions[7-11]. For example, the Annual Status of Education Report (ASER), the largest citizen-led annual survey, provides very reliable statistics about children's schooling (education) in the rural parts of entire India[11]. A range of well-funded research schemes, from elementary to higher education, has been conceptualized and executed as well as various institutions/universities have been established in this direction with the vision of making India a global education hub[12-22].

In this paper, we first give an overview of various schemes and policies of the Government of India that have been implemented from time to time. We then review several peer-reviewed international education journals during the period of January – December 2017. Finally, we discuss the outcomes to understand the current status of STEM Education and STEM Education Research (STEMEER) in India. Our findings show that a collective, concerted, effective, and efficient effort is required by Indian educators and researchers to match the international standard besides other factors.

Overview of education in India since independence: After independence, our first Prime Minister Pt. Jawaharlal Nehru decided to focus more on science and research fields, based on rationalism, empiricism, and positivism. As a rationalist, he kept more faith in science than in religion and based his facts on intelligence, experience, and reason. He was against superstitions and wanted to spread a rational and scientific view of life. Consequently, new institutions were established to start science courses.

Education, as per Article 45 of the Constitution of India, is a common subject between the State and the Union Government[23]. That means both the governments must join hands to provide education to the children. But the working could not continue in a systemic manner. The reasons were many - lack of resources, money, infrastructure, skilled human and material resources, corruption in academia, gender-bias and other various kinds of challenges (e.g., social, economic, political, and caste)[6]. Nonetheless, slowly Indian academia (universities and schools) started to gaining pace. Now our country has numerous institutions. Students and teachers are working together to understand the

concepts and ideas of science in pursuance of a common goal – development of science through generating scientific attitude, aptitude, and temperament in students. These institutions are equipped with state-of-the-art laboratories with cutting edge research facilities. IITs (Indian Institute of Technologies), TIFR (Tata Institute of Fundamental Research, tifr.res.in), IISc (Indian Institute of Science, iisc.ac.in), JNU (Jawaharlal Nehru University, jnu.ac.in), BHU (Banaras Hindu University, bhu.ac.in), Delhi University (du.ac.in) and many others are counted among the prestigious institutions in the world. The concept of IIT was originated even before independence[24]. It should be noted that The USA significantly contributed to the development of the post-independence education system in India through the policy of US Land-Grant Universities[25].

Nowadays, science is made an integral part of course curricula from elementary school onwards to make our future generation aware of science and its implication on society and the environment as a whole. Modern laboratories are being established in schools to impart practical knowledge. Hence we know that the subject matter of science takes the central place in school education. The most widely acclaimed views of teaching science in schools is that it can inculcate in children certain values and attitudes – scientific temper, rationality, reasoning, problem-solving, methods of science and so on – that are essential for an enlightened citizenship; also teaching science in schools can expedite progress and development of a nation by creating scientific and technological manpower essential for continued economic growth[7,9].

But what we have is a bit different from what we perceived[26-37]: If we look at the evolution of school science in India, we see a clear trend of including more and more content — overwhelmingly in the form of factual information — in the syllabus. Students are burdened with bookish knowledge and information. Even though activities are enlisted in many science books but they are taught by lecture method. Laboratories that were once set up to perform experiments have declined and are in dilapidated condition, and even demonstrations, once common, are now confined to elite schools. Thus the factual information dominates the science books which students are supposed to learn and mug up to finally split it in examinations. Students have made a mindset that examinations are their priority. They don't understand science but learn it without proper reasoning. Due to more focus on examinations students, therefore, have no option but to memorize the facts. The consequence of this is that students find science not only difficult but also boring. The teachers in many schools and colleges are inexperienced when it comes to the handling of laboratory apparatus. Moreover, growing number of students in classrooms is increasing the chaos. Teachers find it awfully difficult to focus on each and every student. They are under tremendous pressure of finishing the syllabus on time. Thus, they mainly adopt lecture method and skim through the topics to teach rather than demonstrating the activities in class. Also due to lack of apparatus in labs, not all the students get a chance to perform the experiment. Though there are many reasons behind this but notable and avoidable ones are corruption in academia, improper management and proper channelization/utilization of resources. The non-uniformity in the system is quite visible if one looks at the quality and scope of science/integrated STEM education in India. One major cause is the socio-economic difference between rural and urban India. In many rural schools, science is mere a subject as there are no teachers and laboratories. The schemes, facilities, and funding are just on the papers. However, both state and union governments, in tandem, are in a continuous endeavor to bridge this gap to provide quality and affordable science education to every Indian citizen. Higher education, particularly in the science discipline is offered by universities and colleges located in various parts of the country. A lot of Indian universities produce a gigantic number of STEM graduate students every year. However, a majority of them find it difficult to fine-tune themselves with the complexities of science/STEM education at this level due to the lack of proper infrastructure and quality teachers/instructors. Weak understanding of concepts results in incompetence – an awful implementation of

the robust curriculum. Other major factors responsible for the deterioration of standards are lack of proper collaboration and exposure to the industry and unavailability of standard text/reference books.

Overview of various schemes and initiatives: Consecutive Indian Governments, since independence, have been relentlessly working with the vision of improving the overall quality of pedagogical STEMEER from elementary level to higher studies through various schemes, initiatives, and acts, in addition to the research in basic sciences and technology, and innovation[7-15]. Objectives of STEMEER are manifold – creation of a value-based and skill-based education system; supply of qualified teachers and teacher educators; improvement of (interactive) teaching-learning process and environment, learning-ability and learning-outcome; pre-service and in-service teacher training; pedagogical approach; tutoring and mentoring; review, renew, and development of course curriculum, module, and structure; professional and personal development of teachers; inspiring young minds to take teaching as profession; distance learning education, massive online open courses, and technology-enhanced learning/ICT (Information and Communication Technology) based learning to reach out mass population; education for child, adult, rural, and special (differently-abled) people; understanding social, cultural, economic, moral, psychological, and ethical issues in education; association among educational policy, management, and practice; marginalizing various discrimination and reducing gender gap in education as well as women empowerment through basic and proper education; and so on and so forth. These schemes/policies are recommended by Departments/Ministries (University Grants Commission, UGC, Ministry of Human Resource Developments, MHRD; Department of Science and Technology, DST, Ministry of Science and Technology), organizations/scientific bodies (The National Academy of Sciences, Indian Academy of Sciences, Indian National Science Academy etc.), and education experts from time to time. A few of them are:

1. Various committees and commissions such as Kothari Commission, Chattopadhyay Committee, Acarya Ramamurthi Committee, Yashpal Committee, and National Curriculum Framework (NCF 2005, National Education Policy 2018)[7] were constituted to address the issues pertaining to education[7] such learning outcome based curriculum framework, learning through experiments (learning while doing), generating thinking and analytical ability among students, student centric teaching, active participation of students in the class rooms and in the laboratories, practical knowledge oriented teaching, and applications of knowledge to other domains to meet global challenges.

2. The Right to Education (RTE) Act 2009 enacted in Indian Parliament, also known as The Right of Children to Free and Compulsory Education Act, *to deliver free and compulsory elementary education for all children between ages 6 and 14 years as per the Article 21-A*, The Constitution (Eighty-sixth Amendment) Act 2002, of the Constitution of India[38]. Similarly, various other steps have been taken from time to time to improve the quality of education and to ensure that no child gets deprived of education. National Policy on Education was proposed in 2016 by an empowered committee constituted by MHRD, Govt. of India, to improve the quality of education in India[39].

3. (i) Setting-up of IITs, NITs (National Institute of Technology), IISERs (Indian Institute of Science Education Research), NISER (National Institute of Science Education and Research), IIIT (Indian Institute of Information Technology), NITTTRs (National Institute of Technical Teachers' Training and Research), CEBS (Centre for Excellence in Basic Sciences, cbs.ac.in), HBNI (Homi Bhabha National Institute), HBCSE (Homi Bhabha Centre for Science Education, established in line with the International Science and Mathematics Olympiad programs), teacher training institutes (National Council of Educational Research and Training, National Council for Teacher Education), Central, State, Technical and Private universities, institutions, and colleges, national research facilities, and National Council of Science

Museum by Ministry of Culture, Vigyan Prasar (for broadcasting of science program through TV, radio, satellite program, National Science Film Festival etc.,), and National Council for Science & Technology Communication[15]; (ii) initiating online teaching-learning modules such as Virtual labs under the National Mission on Education through Information and Communication Technology, NPTEL (National Programme on Technology Enhanced Learning), National Institute of Open Schooling, and SWAYAM (Study Webs of Active–Learning for Young Aspiring Minds)/MOOCs (Massive Open Online Courses)[15,40]; to name a few, to promote and popularize STEM education culture and research among youths.

4. Moving away from a two-year pass course to three-year general course so that students can compete nationally with traditional Honours (subject major) students and pursue higher studies (master and doctoral degrees)[15-41].

5. Launching of various academic programs such as four-year integrated degree courses (e.g., Bachelor of Science and Bachelor of Education, B.Sc.B.Ed and Bachelor of Arts and Bachelor of Education, B.A.B.Ed), integrated M.Sc., integrated Ph.D., M.Sc. plus Ph.D. etc., to provide a platform so that students can convert their potentials into performances without worrying about various national level entrance exams after graduating from a degree program of their choice[15].

6. Introduction of multidisciplinary and cafeteria like approach, Choice Based Credit System (CBCS), rather than the subject specific to fulfill the demands and needs of contemporary students of higher education. Institutions are also moving from traditional two-semester system to three-semester system per academic year. This is to accommodate various courses and papers so that students can have better knowledge and understanding of other relevant topics/subjects without leaving their own degree programs. It also saves academic year[15,41].

7. INSPIRE (Innovation in Science Pursuit for Inspired Research)[12] and KVPY (Kishore Vaigyanik Protsahan Yojana)[42] schemes have been there to enroll lakhs of school children in the age group from ten to fifteen years and to attract students for pursuing research career in basic sciences with scholarships, respectively[10]. Abdul Kalam Technology Innovation National Fellowship, an initiative of INAE (Indian National Academy of Engineering) and SERB (Science and Engineering Research Board) of DST to attract researchers in doing research in engineering disciplines[43].

8. Pandit Madan Mohan Malviya National Mission on Teachers and Teaching (PMMMNMTT), a flagship mission, has been recently constituted[14]. Through various components/themes (such as schools of education; centres of excellence for curriculum and pedagogy; inter-university centre for teachers' education; innovations, awards, teaching resources, support for faculty, workshops; subject specific network for curricular renewal and reforms; national resource centre for education; and institute of academic leadership and education management) and sub components, the mission of PMMMNMTT is to address all the challenging issues faced by STEM and STEAM (Science, Technology, Engineering, Art, and Mathematics) education system and community by and large and at present.

9. Innovation & STEM Demonstration', another flagship mission, has been launched by National Council for Science & Technology Communication, DST to popularize the science and technology[13].

10. Rashtriya Avishkar Abhiyan[44] and Sarva Shiksha Abhiyan (SSA)[45] were set-up to encourage school children for science, mathematics, and technology both inside and outside classrooms. Similarly, Udaan is an initiative of Central Board of Secondary Education to encourage girls to pursue engineering courses[46].

11. Rashtriya Uchchatar Shiksha Abhiyan (RUSA) is to contribute to the all-round development of the higher education institutions in states[47].

12. Additionally, other schemes/initiatives such as academic and cultural exchange with international institutions, national/international workshops, training programs, seminars, conferences, competition (e.g., Gandhian Young Technological Innovation Award), refresher courses by Indian Academy of Sciences[48], National Science Day on 28th February in each year to commemorate the discovery of Raman effect by Sir. C.V. Raman and have been there to inculcate other various aspects of education (extracurricular activities, culture, society) and to make a holistic STEAM (Science, Technology, Engineering, Arts, and Mathematics) education and a true-dialog among science, technology, arts, and society[49].

Survey of journals and discussion: We have surveyed various peer-reviewed international educational journals, which are published by reputed international publishers and organizations as given in Table - I. These journals focus on diverse aspects of and related to STEM/STEAM education and educational research as mentioned in the aims and scope of their websites. Volumes and issues published during the period January through December 2017 (one year) have been considered to have a glimpse of STEM education research in India. It should be noted at this juncture that it takes two to three years from conducting the research to the publication of results. It is in this sense that the year 2017 has been considered. It should be further noted that we have concentrated only on the journals, which are periodically/quarterly published by Springer, Elsevier, SAGE, Taylor and Francis/Routledge, Wiley/Wiley Online, American Physical Society (APS), American Chemical Society (ACS), Institute of Physics (IoP), and Royal Society of Chemistry (RSC) as given in Table – I[50], though there are other peer-reviewed international educational journals. Hence, the list is not exhaustive.

It can be easily seen from the Table -II that a few articles were published from India during that period. Majority of them are related to technologically enhanced (virtual/online) learning process. Moreover, the Special Issue (issue 2 of volume 4) of Higher Education for the Future (SAGE) reviewed the National Education Policy (NEP) 2016 of India and only Indian authors contributed to this Special Issue, which indicates that NEP might fail to catch the attention of international education community/organization. Furthermore, only nine articles were published on physics, mathematics and chemistry education, one article on policy at the national level, two on teachers' attitude & knowledge, and one on corruption, which is a joint publication of Indian and American researchers. Rest were on other features. This indicates that quality of STEM education research in India is far from the research being carried out in the USA, Europe, Japan, Singapore, China, and other developing nations. Though the exact reasons are not known but it could be due to high publication charges in terms of Indian currency, shortage/ unavailability of teachers, books and journals, lack of facilities such as infrastructure and internet, miss-management and weak leadership, corruption in teacher's recruitment, underpayment of teachers, teaching and other managerial workload, teacher burnout, communication gap etc. It could be also due to the fact that Indian authors/researchers prefer to publish in Indian educational journals to make their findings easily accessible to the community[35,51] [Resonance, Physics education].

Moreover, most of the publications from other countries are the collaborative efforts of educators either from the same academic department of an institution/ organization, or from different departments within the same institution, or from different institutions within a country, or even from different countries. Therefore, it can be qualitatively suggested that a collective effort from all the teachers/educators, irrespective of their subject expertise and knowledge, is required to overcome the contemporary challenges faced by the STEM education in India as is evident from our data.

Science education is critical for a sustainable and progressive society. It must add value to our society as well as create value for the same. The management, teachers, and students of an academic institution must work together to achieve this goal. The government should regularly monitor the channelization of funds and the schemes that have been launched and implemented to achieve the set goals. Other new schemes and programs need to be launched to inspire students at the school level to take science and further

conduct research in these areas. The government should try to build functioning laboratories in government schools to provide practical/hands-on knowledge to aspiring students. Academia should be re-calibrated as the primary agency for the teaching of all types of subjects and fundamental research. Furthermore, society and societal aspects are necessary to include in the STEM curriculum, as society is one of the main stakeholders of the education.

Conclusion: In summary, we briefly reviewed various schemes of STEM education in India. We surveyed several peer-reviewed international STEAM education journals to comprehend the status and position of our country as compared to other countries for the period of January – December 2017. Our observations revealed that we have to travel a long distance to catch up with the international standard. Nevertheless, this is not a hard task to achieve. To fulfill the dream of seeing a well prospered India, everyone needs to take the initiative - we must join the hands together and work hard towards this common goal of making India a developed country in the field of STEM education.

Table – I: List of publishers/organizations and journals.

Sl. No.	Name of publishers/organizations and journals published by them
(i)	*Springer and Springer Open*: 1. Science & Education, 2. Journal for STEM Education Research (August 2018), 3. International Journal of STEM Education, 4. Education and Information Technologies, 5. Journal of Science Education and Technology, 6. Educational Psychology Review, 7. Educational Technology Research and Development, 8. Research in Higher Education, 9. Vocations and Learning, 10. Instructional Science, 11. Metacognition and Learning, 12. Advances in Health Sciences Education – Theory and Practice, 13. The International Journal of Higher Education Research (or Higher Education), 14. International Journal of Computer-Supported Collaborative Learning, 15. Reading and Writing – An Interdisciplinary Journal, 16. Asia-Pacific Science Education, 17. International Journal for Educational Integrity, 18. International Journal of Child Care and Education Policy, 19. Large-scale Assessments in Education, 20. Research and Practice in Technology Enhanced Learning, 21. Video Journal of Education and Pedagogy, 22. Asia Pacific Education Review, 23. International Journal of Educational Technology in Higher Education, 24. Social Psychology of Education, 25. International Review of Education – Journal of Lifelong Learning, 26. The Asia-Pacific Education Researcher, 27. International Journal of Science and Mathematics Education, 28. Journal of Science Teacher Education (2016), 29. Innovative Higher Education, 30. Academic Questions, 31. Early Childhood Education Journal, 32. Higher Education Policy, 33. International Journal of Research in Undergraduate Mathematics Education, 34. Educational Studies in Mathematics, 35. Mathematics Education Research Journal, 36. Journal of Mathematics Teacher Education, 37. Foundations of Chemistry, and 38. Journal of Educational Change.
(ii)	*Elsevier*: 1. Studies in Educational Evaluation, 2. Learning and Instruction, 3. Teaching and Teacher Education, 4. Thinking Skills and Creativity, 5. The Internet and Higher Education, 6. Journal of School Psychology, 7. Computers & Education, 8. Educational Research Review, 9. Contemporary Educational Psychology, 10. Economics of Education Review, 11. International Journal of Educational Development, 12. International Journal of Educational Research, 13. Learning and Individual Differences, 14. Learning, Culture and Social Interaction, 15. Cognitive Development, and 16. Education for Chemical Engineers.

(i)	*SAGE*: 1. Journal of Teacher Education, 2. E-Learning and Digital Media, 3. Education and Urban Society, 4. Education, Citizenship and Social Justice, 5. Educational Administration Quarterly, 6. Educational and Psychological Measurement, 7. Educational Evaluation and Policy Analysis, 8. Educational Management Administration & Leadership, 9. Educational Policy, 10. Educational Researcher, 11. Teacher Education and Special Education, 12. Higher Education for the Future, 13. Journal of Education, 14. Journal of Experiential Education, 15. Review of Educational Research, 16. Review of Research in Education, 17. Research in Education, and 18. Theory and Research in Education.
(ii)	*Taylor and Francis/Routledge*: 1. Asia-Pacific Journal of Teacher Education, 2. The Journal of Higher Education, 3. Educational Review, 4. The Journal of Educational Research, 5. Teaching Education, 6. Journal of Education for Teaching, 7. Curriculum Inquiry, 8. Professional Development in Education, 9. Mentoring & Tutoring: Partnership in Learning, 10. Studying Teacher Education, 11. Teachers and Teaching - theory & practices, 12. Pedagogies: An International Journal, 13. The Curriculum Journal, 14. Educational Action Research, 15. Teacher Development, 16. Journal of Curriculum Studies, 17. Educational Research, 18. College Teaching, 19. Action in Teacher Education, 20. Journal of Curriculum and Pedagogy, 21. The Teacher Educator, 22. Education 3-13, 23. Higher Education Pedagogies, 24. Research in Mathematics Education, 25. International Journal of Mathematical Education in Science and Technology, 26. Journal of Biological Education, 27. International Journal of Science Education, 28. Engineering Studies, and 29. Technology, Pedagogy and Education.
(iii)	*Wiley/Wiley Online Library*: 1. Journal of Engineering Education, 2. Science Education, 3. Review of Education, 4. Biochemistry and Molecular Biology Education, 5. Journal of Philosophy of Education, 6. Educational Theory, 7. Decision Sciences Journal of Innovative Education, 8. Journal of Competency-Based Education, 9. Higher Education Quarterly, 10. Journal of Educational Measurement, 11. History of Education Quarterly (2016), 12. The Reading Teacher, 13. New Directions for Higher Education, 14. School Science and Mathematics, and 15. Journal of Research in Science Teaching.
(iv)	*Institute of Electrical and Electronics Engineers (IEEE) Xplore:*1. IEEE Transactions on Education, 2. IEEE Transactions on Learning Technologies.
(v)	*American Physical Society (APS)*: Physical Review Physics Education Research.
(vi)	*American Chemical Society (ACS)*: Journal of Chemical Education.
(vii)	*Institute of Physics (IoP)*: Physics Education.
(viii)	*Royal Society of Chemistry (RSC)*: Chemistry Education Research and Practice.

Table – II: No. of research articles published from India during the period of January – December 2017

Name of journal	No. of article(s) published
Education & Information Technologies; Springer	13
Research and Practice in Technology Enhanced Learning; Springer	02
Journal of Mathematics Teacher Education; Springer	01 (India-USA joint publication.)
International Journal of Educational Technology in Higher Education; Springer	01
International Journal of Science and Mathematics Education; Springer – 01 article	01
Social Psychology of Education; Springer	01
Thinking Skills and Creativity; Elsevier	01
Computers & Education; Elsevier	01
International Journal of Educational Development; Elsevier – 02 articles (01 article is a India-USA joint publication)	02 (01 is a India-USA joint publication)
Higher Education for the Future; SAGE	Issue 2 of Vol 4 was a Special Issue, which reviewed the Draft National Education Policy (NEP) 2016 of India.
	01
Teachers and Teaching – theory and practice; Taylor and Francis/Routledge	01

Teacher Development; Taylor and Francis/Routledge	01
International Journal of Mathematical Education in Science and Technology; Taylor and Francis/Routledge	01
IEEE Transactions on Education; Institute of Electrical and Electronics Engineers (IEEE) Xplore	01
Journal of Chemical Education; American Chemical Society (ACS)	02
Physics Education; Institute of Physics (IoP)	05
* NOTE: Authors tried their level best to compile the data. However, unintentional omission might occur.	

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ARTICLE

Visualization of Some Concepts in Basic Physics and Mathematics through Experiments

Soumen Sarkar, Sanjoy Kumar Pal, Anirban Samanta, Pradipta Panchadhyayee[1], Asit Chakraborti and Subhash Chandra Samanta, Activists of IAPT-Midnapore College Centre for Scientific Culture

Introduction

Visualization of ideas and concepts is a very important process for stimulating thought processes in related directions. If one asks a rural student: How would a long and wide wooden plank float in water? The immediate answer would be: Floating with its thickness perpendicular to the water surface. But an urban student, who has never got an opportunity to see a floating plank, would need to do a lot of mathematics before answering the question. This example is cited to indicate that observation of natural events as well as simulating those events, or to go beyond that, in laboratories is at the core of developing the skill of visualization, which is one of the essential components in science education. This is why the comment is found, in the National Curricular Framework 2005, that students of schools in the proximity of forests digest biological concepts / ideas in a better way than their teachers with urban background. To follow the student-centric learning methodology in educational institutions, the teachers should mandatorily create an effective environment, in order to develop better understating by students, of the subject matter, taught via augmenting the skill of visualization of scientific processes. In a vast and diverse country like ours, the resources available for education are inadequate. So, there is an urgent need to develop laboratory facilities with inexpensive materials and equipment. The Khandelwal -Saraf duo, the founding fathers of the Indian Association of Physics Teachers (IAPT), is the pioneer in developing precise and accurate measurement-based experiments using low-cost set-ups and components. It is possible to construct / justify physics theories and mathematics preliminaries using these experiments. Following the thoughts of these two great men, the IAPT-Midnapore College Centre for Scientific Culture (CSC), founded by Prof. D. P. Khandelwal, has designed and developed a large number of such experiments, in its 30 years of journey, that are relevant for studies in schools, colleges and universities. Some premier organizations and institutions [RC 15; Midnapore College; IIT Kharagpur (Teaching Learning Centre); Homi Bhabha Centre for Science Education (Indian Physics Olympiad Programmes); S N Bose National Centre for Basic Sciences, Kolkata; Indian Association for the Cultivation of Science (integrated PhD programme), Kolkata; Department of Science and Technology and Biotechnology, Govt of WB; Science Centre, Midnapore; and Contai Science Academy, Contai, etc.] used those experiments in different events they organized with active participation of the CSC. These experiments can be profitably used to construct proper environment for science learning. In the CSC, Midnapore College implemented, at least once, this process for teaching electronics to the first batch of their Computer Science students. The senior Physics (Hons.) students of the College and the CSC activists together arranged all the necessary electricity and electronics experiments, useful for learning electronics, under the guidance of the CSC instructors in the CSC lab with a floor area of 2000 square ft. The students tried the experiments, paying attention to the details, to understand the basic theories as well as their applications, comfortably and within reasonable time. Most of these students, settled in academically and technically lucrative positions in India and abroad, still reminisce on this CSC exercise.

This article is primarily focused to disseminate an idea before a wide readership of the physics community that experiments could open up useful as well as easier paths for better understanding of

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harder physics concepts as well as mathematics tools and contribute significantly to the said purpose. Moreover, to perform the experiments, one does not need well equipped labs; low-cost materials available in home environment and local markets often serve to obtain valuable data with accurate and precise outcomes. Even the students and teachers who are eager to do the experiments can easily fabricate them and fix the faults, if any. These experiments can be easily demonstrated even in classrooms to illustrate how the related theories evolve and the data are to be analysed. In this process both learning and teaching would be creative and innovative.

The motivation of writing such an article comes from an experiment designed and implemented by Dr D P Khandelwal and published in the IAPT Bulletin in 1992. He determined the velocity of a long pendulum at different points of its path using a sand clock. For this, he used a bob of relatively large hollow sphere having a hole at its bottom and filled it with sand. Beneath the bob he kept a corrugated paper and the reciprocal of the amount of sand collected at a trough was taken as the measure of velocity at this trough. That could be extended to study the phase trajectory of a simple harmonic oscillator. Of course, at the present time, this study is possible with a simple pendulum and smart phone, taking even air damping into account.

In the sequel, two experiments are discussed in detail for understanding the concepts of uniform velocity and uniform acceleration of a particle undergoing rectilinear motion. One experiment is related to the motion of a small sphere in a highly viscous fluid. In this case, the motion happens with uniform velocity after traversal of a certain distance. While for the case of uniform acceleration we can cite the motion of another small sphere placed on the surface of water taken in a jar having tiny hole near to its bottom. With the passage of time, the jar gradually gets empty and the sphere decelerates uniformly along with the water surface on which it floats. The data collected, have been analyzed and the analytical tools needed for the purpose have been developed as far as practicable and necessary. Even the fundamental theorem of calculus has been justified using the experimental data. Both the experiments have much relevance in different domains of physics, but this small note focuses on the kinematic aspects only. However, some questions have been posed to apprise the readers of their applicability in diverse fields.

Experiment 1:

The Arrangement, procedure and data:

A very viscous liquid (‘mobil’) is taken in a small transparent cylindrical bottle. A scale prepared out of a strip of mm graph paper is pasted vertically on the cylindrical wall. The zero of the scale is 4cm below the free surface of the liquid. Now a small (homoeopathic) spherical glucose globule is dropped in the liquid. The displacement of the sphere (s in cm) at different times (t in second) are observed and recorded in a table. In fact, when the sphere passes through the zero of the scale time is taken to be zero. Along with t and s and (s/t) are also recorded in the table.

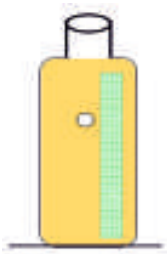


Fig.1

Table 1

Obs. No.	Time, t (sec)	Displacement, s (cm)	Average Velocity, s/t (cm/s)
1	0.00	0.0	-
2	0.66	1.0	1.5

3	1.34	2.0	1.5
4	2.10	3.0	1.4
5	2.84	4.0	1.4
6	3.49	5.0	1.4
7	4.16	6.0	1.4
8	4.93	7.0	1.4
9	5.68	8.0	1.4
10	6.34	9.0	1.4
11	7.01	10.0	1.4

Analysis of the data:

Even a casual inspection of data reveals that the ratio (s/t), which measures the distance travelled by the sphere in unit time, is almost the same for any time. The ratio may be considered as the average velocity of the sphere over the time interval t=0 second to t= t second. Even if one plots the (t, s) values, taking t in second along the horizontal OX axis and s in cm along the vertical OY axis, the t vs s graph is a straight line passing through the origin. The slope of the straight line gives the velocity v of the sphere at any time t and is independent of time. Now it is confirmed that the sphere travels with uniform velocity, v.

How can we perceive the value of (0/0): The graph between t and the ratio (s/t) is plotted with time t in second along OX and s/t in cm/second along OY, but the point corresponding to t=0 and s/t with t=0,s=0 has been excluded. This is the time versus velocity graph. The graph is a straight line parallel to time axis and intersects OY at a point C from which the velocity (0/0) is determined to be 1.4 cm/s in this case.

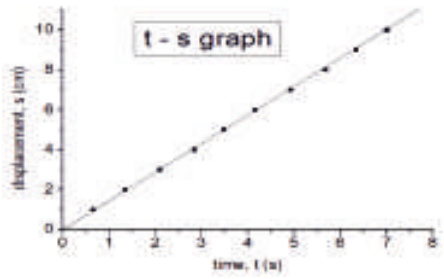


Fig. 2

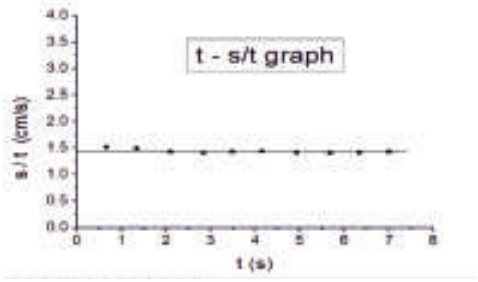


Fig. 3

Displacement s of the sphere in time t: The distance s traversed by the sphere with uniform velocity v, in the time span t = 0 second to t = T second is simply vT cm. But how can we depict this distance in the t-v graph? Let us consider the point M with coordinate (T,0) in the OX axis. Now a perpendicular is dropped at M which intersects the y = v line at A. One gets a rectangle OMAC whose area vT = s. Dimensionally also s and vT are identical. So, the displacement s of the sphere that moves with uniform velocity v in the time span t = 0 second to t = T second is an area vT in cm, in the velocity- time space.

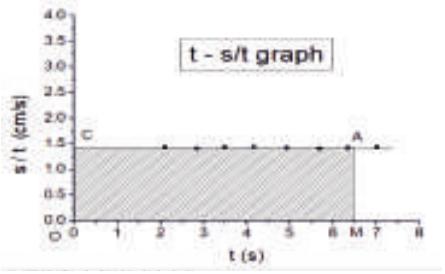


Fig. 4

Some Questions:

1. Why has the zero of the scale been fixed at 4 cm below the free liquid surface?
2. Would the motion of the small sphere be always uniform?
3. If sometimes the motion is not uniform, can you elaborate the analytical tools needed to study that motion?
4. Would the motion of the sphere undergo any change, if the temperature of mobil is raised by 20 Kelvin or so?
5. If you are asked to find the viscosity of mobil from this experiment, then what are the other physical parameters to be measured? How can you do that?
6. Is it possible to compare the motion of the sphere in this experiment with that of rain drops?

Experiment 2:

Arrangement, procedure and recording of data:

This is quite similar to the Experiment 1. Here the cylindrical bottle is somewhat larger and it is filled with water. The bottle has a tiny hole near to the bottom through which water emerges and so the horizontal water level slowly comes down. To determine the height and displacements of the water level a scale prepared out of mm graph paper is pasted. Zero of the scale coincides with the hole. A small spherical thermocol ball is placed on the water surface and with the passage of time t, the ball also descends. The sphere facilitates the measurement of the position of the level, h and hence displacements (in cm) at time t (in second). In the present study, h is not that useful but it helps to measure s at various time t. So, as before, t, s and the ratio (s/t) are recorded.

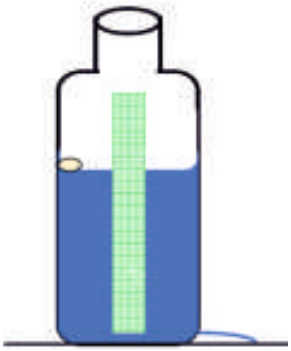


Fig. 5

Table 2

Obs No	Time t (sec)	Displacement, s(cm)	s/t (cm/s)
1	0.00	0.0	-
2	64.32	1.0	0.016
3	125.07	2.0	0.016
4	194.48	3.0	0.015
5	267.36	4.0	0.015
6	305.12	4.5	0.015
7	345.56	5.0	0.014
8	386.42	5.5	0.014
9	434.03	6.0	0.014
10	481.72	6.5	0.013
11	531.21	7.0	0.013
12	583.95	7.5	0.013
13	637.56	8.0	0.013
14	703.52	8.5	0.012
15	783.34	9.0	0.011
16	893.69	9.5	0.011

17	1052.38	10.0	0.010

Analysis of the data:

A glance at the water level in the jar reveals that it moves initially with a velocity which decreases over time. The small thermocol sphere floating on water comes down with a decreasing downward velocity; in other words, the motion of the sphere happens with a deceleration. The experimental data reveals that the motion of the sphere is non uniform but its negative acceleration is a constant of time.

As before t in second is plotted along OX and s in cm along OY, ignoring its negative sign. The value of s is zero at t=0. The graph is found to be a nonlinear curve, almost resembling a semi parabola. This gives a hint that unlike the motion with uniform velocity s (t) cannot be a simple linear function of time of the form $s = at$; The t-s graph also suggests that $s(t)$ may be a parabolic function of time i.e. $s(t) = at + bt^2$.

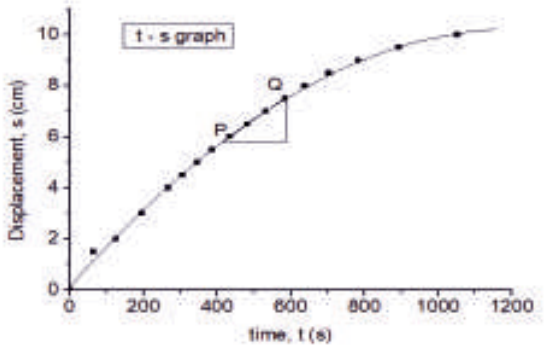
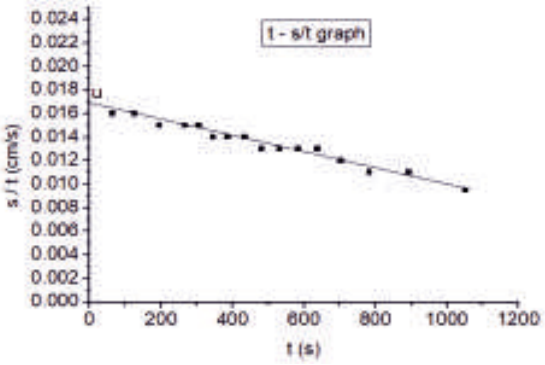


Fig.6



F ig. 7

Again, t (in second) vs s/t (in cm/s) is also plotted with t along OX and (s/t) along OY. All the (t, s/t) points except the point (t=0 and s/t with t = 0, s = 0). This graph is found to be a straight line, within experimental errors, with a y-intercept u and a negative slope -m. So(s/t) = u-mt.
But (s/t) actually measures the average displacement of the sphere in one second i.e., its average velocity over the time span- 0 second to t second. From this graph we identify the initial velocity (s/t) at t=0 as (0/0) = u and it is experimentally determined. If we compare this straight line equation (s/t) = u-mt with the relation(s/t) = $a + bt$, then we find that our assumption s (t) = $at + bt^2$ is quite justified. Not only that using the experimental values of b =- m and a = u, the (t-s) graph has been redrawn and that almost coincides with the earlier experimental graph. Experimental value of a and b are as follows: $a = u = 0.017$ cm/s and$b = -m = -6.88 \times 10^{-6}$cm/s^2.

To interpret m we assume, consistent with our observation, that the velocity $v(t)$ of the sphere at time t is u-ft. This means decrease in velocity v of the sphere in time t is ft, f being the decrease in velocity per second. So average velocity in the time span (0 to t seconds) is $v_m = \frac{u+u-ft}{2} = u - \frac{1}{2}ft = u - mt$, so $f = 2m = -2b$. As b is a constant of time (t), so the deceleration of the sphere is also constant. Thus, the motion of sphere may be 'modelled as uniform motion with a uniform velocity v_m over the time span (0 to t seconds)'.So, its displacement in this interval of time

$$s(t) = s = ut - \frac{1}{2}ft^2$$

We have seen that for non-uniform motion with uniform acceleration $s(t)$ is parabolic in t involving only two constants a and b. But for a general non-uniform motion with non-uniform acceleration it is quite logical to propose a polynomial for $s(t)$ in time t i.e.
$s(t) = at + bt^2 + ct^3 + dt^4 + \cdots$, in commensurate with the experimental condition: at $t = 0$ the displacement (s)=0. However, only the constants 'a' and 'b' are significant for our present experiment and all other constants of time 'c', 'd 'etc are considered to have negligible contribution.

Instantaneous velocity, $v(t)$-differentiation of $s(t)$ with time

Now let us consider two close points P and Q on t-s graph (Fig.6) with coordinates(t,s) and($t+\Delta t$, $s+\Delta s$).When Δs and Δt are much smaller than s and t, respectively, $\Delta s/\Delta t$ indicates the average velocity in the time span (t to $t+\Delta t$). If we take $s(t)= at+bt^2$, obviously
$s(t+\Delta t)= a(t+\Delta t) +b(t+\Delta t)^2$.
So, $\Delta s = s\ (t+\Delta t) - s(t) = a(t+\Delta t) +b(t+\Delta t)^2 - at - bt^2 = (a+2bt)\ \Delta t + b(\Delta t)^2$.
The slope of the line PQ, a segment of the parabola, is given by
$\frac{\Delta s}{\Delta t} = a + 2bt + b\Delta t$,becomes$a+2bt$at P or Q if $\Delta t << t$ .This happens in the limit when Δt is as small as we please (but not zero) and the points P and Q becomes very close to each other on the t-s graph, so that they are one and the same point and the sector PQ becomes the tangent to the t-s curve. In this situation, when Δt is very small i.e., as small as we please, then Δt can be replaced by dt, the differential in t and Δs by ds, the differential in s.
This ratio $\frac{\Delta s}{\Delta t}$ in the limiting condition ($\Delta t \to 0$), $\lim_{\Delta t\to 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$. The symbol, $\frac{ds}{dt}$, called the instantaneous velocity (v) at time t and is defined in calculus as time derivative of $s(t)$ or derivative of $s(t)$ with respect to time, t ($\frac{d}{dt}$of s). The $\frac{ds}{dt}$ is actually the slope of the tangent to the s-t graph at P or Q.
From the above discussion, we see instantaneous velocity is a function of time:
$v(t) = \frac{ds}{dt} = a + 2bt = u - ft$, where a and b are constants in time. We have already seen that they are respectively found to be u and $-f/2$ from the experiment.

Instantaneous acceleration, f

Acceleration is defined as the change of velocity in unit time,$\frac{\Delta v}{\Delta t}$, and in the limiting condition ($\Delta t \to 0$) the $\frac{\Delta v}{\Delta t}$ becomes $\frac{dv}{dt}$ i. e., $\lim_{\Delta t\to 0} \frac{\Delta v}{\Delta t} = \frac{dv}{dt}$, the time derivative of velocity becomes instantaneous acceleration, $f = \frac{dv}{dt}$. So

$$\frac{dv}{dt} = \lim_{\Delta t\to 0} \frac{\mathrm{v(t+\Delta t) - v(t)}}{\Delta \mathrm{t}} = \frac{\mathrm{a + 2b(t+\Delta t) - (a + 2bt)}}{\Delta \mathrm{t}} = 2b = -f$$

In this specific case of motion with uniform deceleration, the average and instantaneous velocities are one and the same. But this is not true for motion in general.

Construction of displacement function from velocity function: An introduction to Integral Calculus.

In the t -v graph the straight line CBA represents the velocity function $v = u$-ft, with u as initial velocity and f as the deceleration. Now our problem is how to find the distance $s(t)$, the sphere travels in time t, when velocity function $v(t)$is given. Let us suppose the coordinates of A are (T,v). A perpendicular AM is drawn from A on OX, such that the coordinates of M are (T,0); then AM = v =u-fT and OM=T. Let us divide the entire time

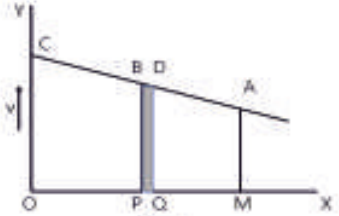


Figure 8

span (0to T seconds) into n equal time-intervals each of width Δt. There are two close points P$(t_1,0)$ and Q $(t_1+\Delta t,0)$ on the line OM. P and Q are the feet of the perpendiculars on OM from two very close points B (t_1, v) and D $(t_1+\Delta t, v+\Delta v)$ on CBA. The area of the strip BPQD is practically a rectangle with length $v(t_1)$and width Δt. Hence one may consider that the displacement of the particle in the time Δt is $\Delta s_1 = v(t_1)\,\Delta t$. In this way entire quadrilateral OMAC can be divided into very large number of such strips, so the displacement $s = \sum \Delta s_r = \sum v(t_r)\,\Delta t$, $r=1, 2, \ldots n$, n being a very large number. In this case, s = OM(OC+AM)/2 $= uT - \frac{1}{2}fT^2$; displacement has been obtained as a summation of infinitesimal areas in t-v graph.

We have another way of finding $s(t)$. We have defined $v(t)$ as $\frac{ds}{dt}$, the differentiation of $s(t)$, so we may look at $s(t)$ as inverse of differentiation of $v(t)$,with respect to t or integration of $v$as a function of t. This means that we have to reconstruct $s(t) = at + bt^2$ when $\frac{ds}{dt} = a + 2bt$, is known. So in the language of mathematics inverse differentiation or integration of $\left[\frac{ds}{dt} = (a + 2bt)\right]$ means

$$s = \int ds = \int (a + 2bt)dt = at + bt^2 + k.$$

Whether we take $s(t)$, or $s(t)+ k$, when k is an arbitrary constant in time. $\frac{ds}{dt}$ remains unchanged as time derivative of a constant term is always zero. So, an unknown constant k has to be added to the integration. This constant could be determined from the initial conditions of the problem. In this case $s = 0$ at $t=0$. So, $k=0$, and as we are interested to find the displacements in the interval $t=0$ *to* $t=T$, $s = uT - \frac{1}{2}fT^2$.

Finally, we see, $\int v dt$ in the time range 0 to $T = \sum \Delta s_r$

The experimental data lead to justification of the fundamental theorem of calculus. In this approach, mathematical rigour is certainly absent but students of classes XI and XII can visualize how basic calculus can be developed and understood from experimental observations.

Some Questions:

1. A ball is allowed to move along a rectilinear path on plain surface. Investigate it's motion using s(t) as a polynomial in t.
2. Are the experimental data consistent with the equation of continuity, Bernoulli's theorem, and Poiseuille's law?
3. How is the deceleration related to acceleration due to gravity?
4. Is it possible to find the time in which half the bottle would be empty?
5. What would be the deceleration if water is allowed to flow horizontally through a capillary tube inserted at the position of the hole?
6. What would happen if instead of water a more viscous liquid is taken?

Conclusion:

1. We have tried to demonstrate that performing simple experiments, it is possible to understand basic physics concepts and the underlying mathematical tools.
2. Data has been recorded with two significant digits in conformity with the rules.

Relevant Remarks:

Finally, it is to be mentioned that Midnapore College (Autonomous), which is in the midst of celebrating its 150 years of glorious journey, desires to publish a volume on the experiments tried and developed at the IAPT-Midanapore College CSC founded by Professor D. P. Khandelwal. This volume would be dedicated to this great physics teacher. For this purpose the experiments are to be

revisited and reported by a group of teachers and students in a structure largely followed in this article.

Acknowledgement

Urge of developing a very simple experiment on uniform motion resulted in Experiment 1. The experiment has been performed in different CSC workshops involving school and college students, sometimes also for measuring viscosity at different temperatures.

Idea of the second experiment was received from Dr S. Chakrabarti, Guest Professor, Ramkrishna Mission Vidyamandir, Belur, Howrah, WB, in a Workshop in Kolkata for UG students organized by IAPT RC 15along with CSC. In this Workshop he showed theoretically and experimentally that the water level in a leaky container moves down with uniform deceleration. We are grateful to Dr Chakrabarti for allowing us to use his findings in developing this article.

We also thankfully acknowledge Dr. G. C.Bera (Principal, Midnapore College and Chairman, IAPT – Midnapore College CSC), Dr. D.Syam (Former Professor, Presidency University, Kolkata), Dr. C. K.Ghosh (Former Director, NCIDE, IGNOU), Dr. V. Wagh (Centre for Science Learning), Dr. S. K. Sarkar (Former Professor, Deptt of Applied Physics, University of Calcutta), Dr A. K.Chakraborty (Professor, IIT, Kharagpur), Dr. B. K.Patra (Professor, IIT, Roorkee) and Dr. A Das (Faculty, Indian Association for Cultivation of Science, Kolkata) for careful reading and valuable suggestions.

The Article is dedicated to D P Khandelwal, Founder of both IAPT and IAPT- Midnapore College Centre for Scientific Culture as a Tribute in his Birth Centenary Year

To our readers

For change of address and non-receipt of the Bulletin, please write (only) to:
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REPORT

INDIA WINS 1 GOLD AND 4 SILVER MEDALS IN IPhO-2022

Arun Kulkarni

India has performed well at the 52nd International Physics Olympiad (IPhO) 2022, organized by the Physics Association of Switzerland, and held in online mode from July 10 to July 17, 2022. The venue for India was the Homi Bhabha Center for Science Education (HBCSE) at V.N. Purav Marg, Anushakti Nagar, Mumbai- 400088. Five students were selectedthrough a rigorous two stage evaluation process to compete in the International Physics Olympiad (IPhO).

The Selection:-

The selection process to identify the competing students in the IPhO is usually quite rigorous involving several stages of selection. The first stage exam titled the National Standard Exam in Physics (NSEP) is conducted by IAPT. Usually the second stage Exam, called Indian National Physics Olympiad (INPhO) and the last and final stage Exam, called the Orientation Cum Selection Camp (OCSC), are both conducted by HBCSE with only about 5 students being selected at the end of the third stage. However this year due to the pandemic, the first two stages NSEP and INPhO were conducted together as two parts of the Indian Olympiad Qualifier in Physics (IOQP). About 300 students qualified for evaluation of the second part of IOQP (equivalent to INPhO) based on their performance in the first part (equivalent to NSEP) and five students qualified after evaluation in the second part of IOQP. The third stage of selection in a usual year, the Orientation-cum-Selection Camp (OCSC) in Physics, had to be cancelled this year due to a clash with delayed board examinations. The team of five students was, therefore, selected on the basis of the IOQP Part II exam. The extended training of OCSC was thereforemissed and the students were trained in the Pre-Departure Camp (PDC) for only about a week.

Pre Departure Camp :-

The selected students were asked to come to HBCSE for a Pre-Departure Camp (PDC) program which was held from the 4^{th} to 9^{th} July. During this time the students were taught in several lecture and practice sessions in how to conduct experiments, draw graphs and draw appropriate inferences from graphs and to carry out error analysis. This exercise was conducted by the experimental team of Shyamala Bodhane, Vivek Bhide, Shirish Pathare, and several of his staff and students at HBCSE. The theory training was conducted by Praveen Pathak, Arun Kulkarni, and several helpers at HBCSE. This training consisted of posing several difficult theory problems to the selected students and later discussing their solutions. Subject lectures on Relativity, Normal Modes of Vibration, were also delivered to the students.

The Indian Contingent :-

The five Indian students who were selected to enter the IPhO -2022, all did well in the exams and all of them won medals. India got 5 medals *viz*: 1 Gold and 4 Silver medals. The students were:-

Deevyanshu Malu (GOLD)
Abhijeet Anand (SILVER)
Anilesh Bansal (SILVER)
Dheeraj Kurukunda (SILVER)
Harsh Jakhar (SILVER)

India was placed at the tenth position, jointly with Singapore and Kazakhstan in the country-wise medals tally. The Chinese team and 5 Russian students competing under the IPhO flag came at the top with 5 Golds.The Indian contingent was led by two team leaders: Praveen Pathak (HBCSE), and Shyamala Bodhane (Retd., St. Xaviers' College, Mumbai), who were assisted by two Scientific Observers:- Arun V. Kulkarni (BITS Pilani, Goa Campus, Goa) and Vivek Bhide (GogateJogalekar College, Ratnagiri).

International Organizers:-

This year'sIPhO was originally scheduled to be held in Belarus. In view of the war situation, it was quickly converted to a virtual competition organized from Switzerland where students could participate from their own countries. Students from each country were supposed to collect in one single location under continuous video surveillance. A total of 368 students from 75 countries participated in the competition.

The Examination:-

Exams were held on two days viz. 11th July (Experimental Exam) and 13th July (Theory Exam).

Each exam was of 5hours, duration. A separate team, not consisting of the team leaders andscientific observers were in charge of invigilating the exams. There were three problems in the Theory Exam and two problems in the Experimental Exam.Soft copies of both the Question papers and the Answer papers were provided by the organizers. The answer papers for the Experimental Exam had graph papers within them, and students were supposed to use these graphs to analyze data. The process of 'making observations' was replaced by computer simulation. A student could enter the free variable value into the computer and the computer would provide all the observable values. These would have to be tabulated and used for analysis.

Theory Problem 1:-The first problem was based on a chain constructed out of small permanent magnets attracted to each other. This problem had several parts. In part A, two cylindrical magnets were placed with their magnetic moments parallel to each other and to the radius vector joining their centers. It was required to find the force between the two magnets. In continuation, the magnets could be replaced by current loops, with the same fields. It was required to find the current in these equivalent current loops. Next identical spherical magnets were connected to each other to form a long chain. It was desired to find the largest length of this chain which if hung vertically would not break off. Clearly this involved a comparison of the magnetic force with the force due to gravity. Finally in the same part, the magnetic field due to a vertical chain of magnets, at a point close to one of the ends but far from the other end was required to be calculated. This problem involved treating each spherical magnet as being composed of two magnetic poles, the only significant contribution to the field would be from the pole closest to the field point. In part B of this question, students were supposed to use the method of images to construct the magnetic moment vectors within a Ferromagnetic plate kept in the vicinity of one of the magnetic spheres, and also when a magnetic sphere is kept between two ferromagnetic plates. In part C the magnetic moment ordering for two types of crystal lattice were to be drawn, one indicating a ferromagnetic order and the other an antiferromagnetic order. Both parts B & C of this problem were qualitative in nature.

Theory Problem 2:-The second problem dealt with some elements of the design of the James Webb Space Telescope (JWST). The image of distant objects such as a red giant (89 light years distant, whose surface temperature, and diameter are given, is captured by CCD camera. Part A of this question dealt with image formation on the CCD camera, and the heating of the camera, if only cooling by radiation is allowed. Part B of this question dealt with conversion of photons striking the camera surface into electrons, provided the photon energy exceeds the energy band gap ΔE_g. Leakage of these electrons leads to a dark current, whose temperature dependence is given in the problem. It is required to estimate the lowest temperature star that would just barely be detectable by JWST. Students were also required to find the uncertainty (error) in the total electron count as a function of the readout noise, the dark current value, the incoming photon rate, and the exposure time of the CCD Camera. They are required to use this expression to find the minimum photon incoming rate so that the electron count becomes 10 times the uncertainty value. In parts C & D, the cooling of the IR CCD Camera was explored. In part C multiple reflective layered shielding of the camera via multiple sheets, is described, and questions asked here dealt with finding the equilibrium temperatures of the sheets (5 of them). In Part D cryo-cooling of the camera via a Helium gas flow through a porous plug is considered and the questions asked dealt with temperature drops in this Joule Thompson like Helium flow.

Theory Problem 3:-This problem dealt with using scaling arguments to solve problems in physics. It consisted of 4 unrelated parts. Part A dealt with a bending of a cylindrical straw under its own weight when pivoted about its middle. The dependence of the length at which the straw breaks and the dependence of this length on the diameter of its cross section is sought to be used to compare two cases when the diameters are 1mm and 1cm. Part B deals with constructing identical cylinders out of two types of grains of sand mixed with water. The coarse grained sand particle is assumed to have a volume 10 times that of fine grained sand. The strength of each cylinder under compressive stress applied on the flat surfaces of the cylinders is compared. Apparently students are required to use scaling arguments to compute the ratio of the Breaking Force on the two cylinders. Part C dealt with accelerated relativistic motion. This part didn't have anything to do with scaling arguments. Part D dealt with a wooden ball floating half submerged and oscillating vertically about its equilibrium position. It is given that these oscillations are damped, and the frequency of the damped oscillations in terms of the free oscillations is given. Students are required to use scaling arguments to find the minimum radius of a ball capable of small oscillations when displaced from its equilibrium position.

Experimental Problem 1:- In this problem the student was asked to suppose that he was on an imaginary planet next to a huge tower, on top of which he could drop from rest, spherical bodies of several radii and of different densities and measure the time (t) of its fall, and the horizontal distance (s) it lands from the point of letting go. The observer (viz. the student) is assumed to be near the equator of the planet. The planet has an atmosphere which provides negligible buoyancy, but does provide viscous resistance to motion of objects through it. There is also a wind blowing in the horizontal direction with a velocity that is a constant. In Part A of the problem, several different balls (r , ρ) are dropped from varying heights (h) and the data (t & s supplied by the computer) are to be analyzed to determine 1) the acceleration due to gravity *g* of the planet, 2) the radius R of the planet, and 3) The mass M of the planet. In part B atmospheric properties of the planet are sought to be found given the temperature of the atmosphere at the foot of the tower, and its density profile. Among questions asked are to find the speed of the wind, the density of air on the surface of the planet, its molar mass, and the pressure on the planet surface. The last part *viz* C asks the student to obtain and analyze more data to find the duration of a day on this planet.

Experimental Problem 2:- In this problem a schematic of a cylindrical diode is given. The diode consists of two coaxial cylinders. The inner cylinder is the emitter, and the outer cylinder is the collector. The region between the cylinders is supposed to be filled with plasma when the tube is in operation. The relevant observables here are the radii (R_E , R_C) of the emitter and the collector cylinders, and the length L_E of the emitter. The diode current dependence upon these observables for $L_E >> R_C$ is given in terms of some parameters α, β, and γ, as $I_\infty = G\left(\frac{R_C}{R_E}\right) {R_C}^{\alpha} {L_E}^{\beta} V^{\gamma}$ where V is the voltage and G is a function of the ratio $\left(\frac{R_C}{R_E}\right)$. A correction to this dependence for when L_E and R_C are comparable is given as $I_L = I_\infty F(R_C, R_L, L_E, V)$where F is a dimensionless function of some or all the arguments. In Part A of the Problem, data needs to be collected and analyzed to find the values of the parameters α, β, and γ. In part B the function G needs to be found, and in part C the dimensionless function F needs to be found. A linear relation is suggested for some range of parameters, which helps in finding F.

Invigilation and Moderation :- The students took the exams at HBCSE over two days under thorough continuous video supervision by the organizers and local invigilators. Thelocal invigilators consisted of a four member team of Supervisors lead by Shirish Pathare. The moderation exercise was jointly carried out by Team Leaders and the Scientific Observers.

The Closing :- The IPhO-2022 was declared closed by the organizers on 17th July in a closing ceremony that was online. The results were displayed and also the statistics was discussed. The venue for the next Physics Olympiad was also disclosed to be Tokyo Japan. Thus many sleepless nights for the team at HBCSE came to an end on the evening of 17th July.

References:-

These are the links to the exact problem statement for both Theory as well as Experimental Problems.

Theory Problem 1:-

[https://ipho2022.oly-exams.org/downloads/f/Theory/T1/exam-theory-Q1-english.pdf],

Theory Problem 2:-

[https://ipho2022.oly-exams.org/downloads/f/Theory/T2/exam-theory-Q2-english.pdf]

Theory Problem 3:-

[https://ipho2022.oly-exams.org/downloads/f/Theory/T3/exam-theory-Q3-english.pdf].

Experimental Problem 1:-

[https://ipho2022.oly-exams.org/downloads/f/Experiment/E1/exam-experiment-Q1-english.pdf].

Experimental Problem 2:-

[https://ipho2022.oly-exams.org/downloads/f/Experiment/E2/exam-experiment-Q2-english.pdf].

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NGPE - 2022 Part C
(An Examination in Experimental Skill)

NGPE - 2022 Part C has been conducted on July10, 2022 at the Department of Applied Science, Indian Institute of Information Technology (IIIT), Allahabad, Prayagraj, Uttar Pradesh so to say IIITA-IAPT-Akhil Anveshika

On the basis of their performance in NGPE – 2022 Part Aand Part B, top 25 students were called to appear for the NGPE – 2022 Part C examination at the above centre. Sixteen of them reported at IIITAllahabad on 08.07.2022 for the examination. The stay arrangement of all the examinee (sixteen in number) and the invited faculty (three in number) to work as evaluator/ examiner were made in the Institute guest house the Visitor Hostel no. 1 for three days.

The introductory session was organised on 9.7.2022 with Prof. Dileep Jatkar , a Senior Professor of Physics at Harish Chandra Research Institute (HRI), Prayagraj as the chief Guest and the session was chaired by Prof B P Tyagi, Chief Coordinator (Examination), from Dehradun along with Prof. Y. K. Vijay President, IAPT RC-6, President, MRSI Rajasthan Retd. Professor, Department of Physics, University of Rajasthan, Jaipur who was guest of honour. The programme was conducted by Dr. Akhilesh Tiwari, the examination superintendent of this experimental skill examination and Dr. Pramod Kumar of IIITA proposed the vote of thanks to all the stakeholders. After usual colloquium with the students, the Chief Coordinator (Examination) Dr B P Tyagi spoke about the performance of the students at NGPE – 2022.He expressed that even though the conditions were not good throughout the country yet we could have a 50% increase in the enrolment of NGPE over the enrolment of last year. Off course we remained far behind the ever maximum enrolment of 14000. He alerted all the toppers of NGPE to work as an ambassador and communicator for NGPE in their own region. They were requested to motivate their Juniors for NGPE. Prof B P Tyagi expressed his deep sense gratitude to the Direct IIT to allow IIT Allahabad as the all India centre for NGPE - 2022 Part C. After lunch, the students were relieved. All the students were asked to be present at 8.00 AM on 10.07.2022 for the Part - C examination at this centre.

Later in the afternoon Prof B. P. Tyagi discussed the proposed sets of experiments & their outcomes with the organizers and the examiners. The fruitful contribution of Prof Y K Vijay from Jaipur, Prof Devesh K Tyagi President RC – 4 from Muzaffarnagar, Dr Sarita Khandaka, Dr Pramila Gupta, Dr Promod Kumar, Dr Upendra Kumar, Dr Gyan Prakash, Dr Neeraj Kumar, Dr Ashok Kumar Pathak and Dr Prem Prakash Singh all from Prayagraj as examiners has been very well appreciated and thankfully acknowledged. Apart from this a number of Research Scholars in Physics at IIIT A and other members of Technical staff have been a great help in the successful conduct of NGPE -2022 Part C Their services are thankfully acknowledged and appreciated.

The necessary instructions and precautions for all the experiments were set on 9th July, 22 itself. On July 10, the day of examination, students were divided in four groups and each was expected to work independently. The apparatus were available in

multiple numbers. The four groups were rotated to the four experiments one by one.They were cyclically allowed to perform the experiments within 1 hour of duration.

The four experiments were -

1. Spark on Electrodes to find dielectric strength
2. Input and output impedance of a Transformer
3. Design and analysis of Common Emitter Amplifier
4. Spotting of Components

After completing the experimental task by 1.30 PM, the students left for lunch and the examiners prepared the result. A dedicated group of examiners evaluated the performance of the students. The final result was prepared after summing up the marks obtained in Part A, Part B and Part C. The name of five Gold Medallists were announced by myself in the capacity of Coordinator NGPE at 3.00 PM . The five recipients of the NGPE -2022 Gold medal for the year are

1. G-1109 22404 Ashutosh Joshi
   Bsc Iii Hansraj College Du Delhi
2. G-4213 22411 Parnav Maheshwari
   Int Msc I IISER Pune
3. G-5628 22412 Hemansh Shah
   Bsc Ii IISC Bangalor
4. G-7103 22402 Santanu Samai
   Bsciii Midnapore College Midnapore
5. G-7108 22401 Subhajit Manna
   Bsc Iii Pk College Kontai

The medals will be conferred on them in the XXXVII Annual IAPT Convention – 2022 to be held in themonthof October, 2022 at Patna.

The valedictory part was chaired by Prof. Y. K. Vijay and Prof B. P. Tyagi . Both of them congratulated the winners and appreciated the overall performance of the students.Prof B P Tyagi stressed that it is good towin but more important is to participate in an event. The students were given opportunity to come to dais and express their experiences. Most of the students appreciated the arrangements at Allahabad both for their stay and fooding as well as the academic input they collected by working on the apparatus. In general they were of the opinion that they lagged in experimental activities because of Covid conditions over the last two years. However they were happy to say that at least by way of this examination they could see a good laboratory. Prof. D. K. Tyagi, President RC-04 proposed the vote of thank, appreciating the hospitality of the organizers and congratulated the winners. The programme ended with the group Photograph.

Akhilesh Tiwari

Examination Superintendent

Anil Kumar Singh

Coordinator, NGPE

Activity 1

Name: Online Lecture Series on NEP-2020: Implementation, Challenges and Path Ahead

Date: February 19 – April 02, 2022

Organisers: This lecture series was organized by School of Physical Sciences JNU, Prof. Manish K. Kashyap, Prof. P. K. Ahluwalia, and Dr Seema Vats

Youtube Link:

https://www.youtube.com/watch?v=XjjsulhJ5vA&t=13s

This lecture series was planned to see NEP from the point of view of eminent educationists with a focus on how its implementation can bring a change and how much effort is needed to achieve the goals laid down in it. Seven lectures were organized to achieve essentially the goals of NEP. The chief guests (one for each lecture) who have given their presidential remarks were (i) Prof. Sanjay Dwivedi, Director General, Indian Institute of Mass Communication, New Delhi, (ii) Prof. Alok Kumar Chakarwal, Vice Chancellor, Guru Ghasidas Central University, Bilaspur (C.G.), (iii) Prof. S. K. Tomar, Vice Chancellor, J C Bose University S&T (YMCA), Faridabad, (iv) Prof. Sarat Kumar Patra Director, Indian Institute of Information Technology, Vadodara, (v) Prof. Tankeshwer Kumar, Vice Chancellor, Central University of Haryana, Mahendargarh, (vi) Prof. Ajoy K Ghatak, President, National Academy of Science, India (NASI), Allahabad & Former Prof. of Physics, IIT Delhi, (vii) Prof. Balaram Pani, Dean of Colleges, University of Delhi, New Delhi

The eminent speakers (one for each lecture) who delivered the lecture on the theme of the lecture series were (i) Prof. Mazhar Asif, Dean, SLLCS, JNU, New Delhi, (ii) Prof. Kannan M Moudgalya, Dept. of Chemical Engineering, IIT Bombay, Mumbai, (iii) Prof. Oum Parkash Sharma Director, NCIDE, IGNOU, New Delhi, (iv) Prof. B.D. Shrivastava, HoD Physics, Govt. PG College, Dhar, M.P. & President, IAPT, RC09, (v) Prof. P.K. Ahluwalia, President, IAPT & Former Prof. of Physics, H.P. University, Shimla, (vi) Prof. Furqan Qamar, Centre of Management Studies, Jamia Millia Islamia, New Delhi & Former Vice Chancellor, Central University of H.P. (vii) Prof. A.D.N. Bajpai, Vice Chancellor, Atal Bihari Vajpayee University, Bilaspur (Chhattisgarh). The topics covered in this lecture series were as under:

(i) Role of teachers in implementation of NEP for higher education
(ii) Will NEP 2020 make science learning a real exploration?
(iii) NEP: A game changer in online learning
(iv) NEP 2020 As it stands today
(v) Will NEP 2020 make choice-based credit system a reality across India?
(vi) Roadmap For Implementation of NEP 2020
(vii) Learning outcome: What do these mean to a learner, teacher and examination bodies?

This lecture series was organized by Prof. Manish K. Kashyap, SPS, JNU and Prof. P. K. Ahluwalia, President, IAPT in collaboration with RC-1.

Activity 2

Name: 10th Ved Ratna Memorial Lecture Series

Date: 15th April 2022

Speaker: Prof Venu Gopal Achanta, Director, CSIR-NPL

Topic: MetrologyFor Societal Applications

Youtube Link:

https://www.youtube.com/watch?v=G9EnQDQMcuA

Prof. Achanta began his talk by highlighting the fact that CSIR-NPL is recognized by the Indian Parliament as the National Metrology Institute (NMI). He laid an historical context on the techniques used by ancient Indian civilizations on making precise measurements by referring to the fine brick structures in Nalanda which was made possible from uniform bricks.he emphasized the importance of adopting a uniform measurement system for national and international trades and mentioned various conferences and treaties such as Treaty of Meter Convention and General conference on Weights and Measures that strived for this uniformity.

Welcome address was given by Dr Yogesh kumar, Secretary after that introduction about IAPT was taken by Dr M.S. Bhandari, Former Secretary IAPT, further Dr. Seema Vats, Introduced Prof. Venu Gopal Achanta, Director, NPL, Delhi and at last Dr S.K.Singhal, Treasurer presented the Vote of Thanks. The programme

was coordinated by Dr Poonam Jain**.**

Activity 3
Name: Short term training workshops on "Innovative Hands- on Experiments
with Arduino and its Applications"
Date: 18th and 19th June 2022
Resource Person: Prof H.K.Sahajwani
Registered Participants**: 300**
Youtube Link
:https://www.youtube.com/watch?v=XjZDBpZeT9Y
https://www.youtube.com/watch?v=IHIPYgGbVYI&t=6s
Basic concepts of Arduino were discussed. Participants learnt download and install Arduino IDE from WWW.ARDUINO.CC. They also learned to join TINKERCAD and create circuits of projects using Arduino Board, breadboard, led's, resistances available in tinkercad site. They created traffic light, button as a sensor. LDR sensor and we're given the assignment to create a project to run motor, buzzer and led (on/off) depending upon the value read from LDR.Concept to create and call own functions was explained in details.

Activity 4
Name: Advance training workshops on "Innovative Hands- on Experiments
with Arduino and its Applications"
Date: 18th and 19th June 2022
Resource Person: Prof H.K.Sahjwani
Registered Participants**: 54**
Uniqueness: Feedback taken, formed a group, Allotted Projects, online Quiz and Assignments,Certificates and marks were given accordingly. Assistance provided to solve assignments and projects**.**
Session was coordinated by Dr S.K.Singhal, Dr Manoj Kaushik and Dr Vikas Mittal

Activity 5
Organised (RCWEP-2022) Regional Competition on Essay Writing in Physics on
"Physics Behind The Climate Change".

Seema Vats
President

REPORT

Regional Competition in Innovative Experiment in Physics (RCIEP) 2022 Finals

Venue: Maharani Lakshmi Ammanni College (Autonomous), Bangalore
Date: 10 Jul 2022
Time: 11- 3.15 pm
Judges: Dr M K Raghavendra and Dr M S Jogad

Figure 1: Hod ,physics, Mlac Introducing The Judges

Participants: Teachers and students

Figure 2: Guests, Judges and Participants Brainstorming!

Title of the experiment

1. Dr Ganesh S Hegde, Asst Prof and Vinod

Thermoelectric device feasibility ….

2. Harshvardhan V, Std XII
   Wireless environment
3. Dr Manu Shanmugam, Asst Prof and
   Energy gap of photo-conducting Cell
   Sarmistha Sahu,retired
4. Smt Manjula S N, Asst. Prof.
   Establishing the relation between physical
   and Sarmistha Sahu ,
   quantity from First Principles
5. Dr Shiva LingappaUdachan,
   Low cost experiment for Four Probe Technique
   Shrishshail Shanmukhappa,
   Shivkumar Siddanna, Ramya S (student)

Participants were requested to come with their set-up and get ready with their experiments in the first one hour. The program started with welcome address by Prof Anupama HOD, MLAC. Judges were introduced to the gathering. Thereafter, the judges interacted with each team for about 20 minutes each. Presentation by the participants was vibrant and joyful. Questions pertaining to the experiment and beyond were entertaining and informative for the entire group.Mundane to research level questions were furled to the audience along with the participants, a fun time for all.

Based on the previous year's announcement, RCIEP announced two categories A < 45 yrs and B > 45 yrs. Accordingly prizes were announced by the panel.

Team 4 bagged the First prize in Category B and Team 3 and 4 got the first and second respectively. The certificates and prize distribution function will be conducted later.

The teams have been requested to participate in the NCIEP 2022 after improving/modifying/ enriching their experiments within this month. Hence, the details of the experiments are not being disclosed now.

Team 1 had a rather interesting research level experiment and have been requested to use their experimental set-up for college level work and proceed to NCIEP!

A formal vote of thanks was followed by some good words by the senior guests at the end.

Sarmishtha Sahu

REPORT

Student's Views About NGPE - 2022 Part C

In my entire lifespan, spending two days for NGPE Part C 2022 in IIIT, Allahabad, was an excellent and unbelievable experience. There we stayed for two days. Our lodging was arranged in Visitor Hostel – 1 (VH-1). NGPE Part C examination was mainly a test to assess experimental skill. Top 25 students from different states of India were invited to join the programme. But for some unavoidable reasons only 16 students participated. It was really good to know that 9 students were from West Bengal. The students came from IISC Bengaluru, IISER PUNE, Delhi University, Ramakrishna Mission, Belur, Midnapore College, Prabhat Kumar College, Orissa and also from several other places. It was my proud privilege to spend time with them. It was really an amazing experience for me. On 9th July we reached the institution and attended the interaction session. On the next day at 8.40 am we entered into the lab. Our mentors instructed us what to do. We were divided into four teams but every member was to perform every experiment in the stipulated time. There were four experiments namely Sparking, Spotting, Transformer and Amplifier.

After completing the four experiments we went for lunch. At 3 pm we returned to the lecture hall and everybody submitted feedback sharing personal experience. At last our final result was announced and the 5 gold medalists were declared. Good news was that a 2nd year student from Delhi University was in the list of the top 5 students. He proved that practice and patience were finally rewarded. Next we went for photo-shoot session. At 8 pm we took our dinner from Visitor Hostel and left the campus. We returned to our home with a very colorful memory. NGPE is not only a theoretical examination but also tuned with hands on experiment components. The concept of such type of designing of examination appeared to me something different and effective. I was really thankful to NGPE and the concerned team to offer me a beautiful opportunity

Subhajit Manna

ANNOUNCEMENT

Date Extended For Essay Submission (NCEWP-2022)

It has now been decided to extend the essay submission deadline to 15th August 2022. It is applicable to both 'Teachers' and 'Students' categories. Rest of the details/information for NCEWP-2022, that appeared earlier in the IAPT bulletin April 2022(Page 139-140) and was also published on the IAPT website, remains unchanged.

S.K.JOSHI
Coordinator
NCEWP-2022
E-mail: joshisantoshk@yahoo.com

ANNOUNCEMENT

State Level Seminar
One Day Seminar On International Year Of Glass: Recent Trends In Glass Research

The history of glass making dates back to more than 5000 years, glasses are the most important materials recorded in human history. Advances in glass science and technology have served as essential ingredients for modern day society, including architecture, transportation, medicine, energy, science exploration as well as in communication. **The year 2022 has been declared as the international year of glass by the General assemble of United Nation** to throw a light on the role of glass in our societies and show how technologies like glass can contribute to sustainable development. To commemorate this event Goa RC - 21 is organizing one day seminar on **"International year of glass: Recent trends in Glass Research**". All the teachers and researchers are invited to participate.

Venue: Goa University
Date: 24th September 2022
Schedule: 9:00 am to 5:30 pm
Number of beneficiaries: 120

Resource Persons:

1. Prof Erwin Desa, Former faculty Department of Physics Goa University
2. Prof. Atul Khanna, Department of Physics Guru Nanak Dev University Amritsar
3. Dr. Saurabh Wajhal, Scientist in Solid State Division Bhabha Atomic Research Center Bombay.

Reshma Raut Dessai
Coordinator
SPAS Goa University

ANNOUNCEMENT

XXXVI ANNUAL CONVENTION OF INDIAN ASSOCIATION OF PHYSICS TEACHERS

XXXVI Annual convention of IAPT will be held on December 3 and 4, 2022 at College of Commerce, Arts and Science, Patliputra University, Patna. An EC meeting may be scheduled on December 2, 2022.
Details about Registration and the Program will be notified later.

Rekha Ghorpade
General Secretary-IAPT

FIRST STEP TOWARDS INTERNATIONAL OLYMPIADS

NATIONAL STANDARD EXAMINATION IN PHYSICS	: NSEP 2022 - 23
NATIONAL STANDARD EXAMINATION IN CHEMISTRY	: NSEC 2022 - 23
NATIONAL STANDARD EXAMINATION IN BIOLOGY	: NSEB 2022 - 23
NATIONAL STANDARD EXAMINATION IN ASTRONOMY	: NSEA 2022 - 23
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE	: NSEJS 2022 - 23

These are the only examinations that lead to participation of Indian students in the National and International Science Olympiads. No other examination is recognized for this purpose.

Organized by

INDIAN ASSOCIATION OF PHYSICS TEACHERS (IAPT)

206, Adarsh Complex, Awas Vikas - I, Keshavpuram, Kalyanpur, Kanpur-208017

In co-ordination with
ASSOCIATION OF CHEMISTRY TEACHERS (ACT) &
ASSOCIATION OF TEACHERS IN BIOLOGICAL SCIENCES (ATBS)

Step II Toppers from these NSEP, NSEC, NSEB, NSEA & NSEJS from each State/Union Territory will be eligible for II stage i,e Indian National Olympiads (INOs) 2023 in respective subjects. For details see the website: www.iapt.org.in and the student's brochure

Step III About 35 toppers in each of INPhO, INChO, INBO, INAO and INJSO will qualify for the Orientation Cum Selection Camp (OCSC) in respective subject for about two weeks at Homi Bhabha Centre for Science Education (HBCSE), Mumbai. Indian teams to participate in International Olympiads-2023 will be selected on the basis of performance of students in respective OCSC.

In addition, about 8 toppers from INPhO may get an opportunity to participate in **Asian Physics Olympiad (APhO)**. APhO will be held in Ist week of May 2023.

Awards: Students attending OCSC will be awarded Gold medals and a merit certificate in all subjects. Certificates shall be awarded to Toppers (National & State) of National Standard Examination.

Syllabus: NSEP, NSEC, NSEB: Upto CBSE class XII; **NSEA:** Physics & Mathematics upto CBSE class XII along with basic Astronomy; **NSEJS:** Physics, Chemistry and Biology upto CBSE class X.

Programme: Centre registration: Aug 1, 2022 to Aug 20, 2022. **Student enrolment:** August 21 to Sep 14, 2022

1. **Enrollment at Centre:** Pay fee to Centre In-charge.
2. **Direct Online Enrolment:** A student can enroll directly online at www.iapt.org.in; He/She will pay fee by online payment.

DATE AND TIME OF EXAMINATION: SUNDAY 27.11.22
NSEP : 8:30 AM to 10:30 AM
NSEC : 11:30 AM to 1:30 PM
NSEB : 2:30 PM to 4:30 PM
NSEJS : 2:30 AM to 4:30 PM
SATURDAY 26.11.2022
NSEA : 2:30 PM to 4: 30 PM

Fee Rs. 200.00 per student per subject

PREVIOUS 5 YEARS QUESTION PAPERS BOOKLET IN EACH SUBJECT IS AVAILABLE FOR Rs 100/- EACH FROM IAPT KANPUR OFFICE.

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Chief Coordinator (Examination)
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Visit Website: www.iapt.org.in

Dr. Anand Singh Rana (9412954316) NSE Coordinator
Dr. Vijay V Soman (9822107522) NSEJS Coordinator
IAPT Examination Office:
15, Block II, Rispana Road, DBS College Chowk, Dehradun-248001
Email: iapt.nse@gmail.com
Helpline: 9632221945, 9411190162, 8533993332

For all queries regarding the examination: Student may contact local centre in-charge else the helpline.

OBSERVATIONAL ASTRONOMY — *REFLECTING TELESCOPE*

Reflecting telescope uses single or combinations of spherical mirrors, was invented by Isaac Newton in 1668, in an attempt to overcome the defect of ***chromatic aberration*** present in Galenian refracting telescope. It consists of two mirrors – primary converging mirror of larger aperture and secondary mirror to form final image at eyepiece. Mirrors are made of ***Speculum Metal***. Nearly all large research graded astronomical telescope are ***reflectors***

Initially Reflecting Telescope were manly of three type-***Gregorian Telescope*** by James Gregory (1663) with concave secondary mirror. ***Newtonian Telescope***- by Isaac Newton (1668) with plane secondary mirror and ***The Cassegrain Telescope*** by Laurent Cassegrain (1672)- with hyperbolic secondary mirror.

William Hassell's 48' equatorial reflector (1861) ***Cassegrain Telescope***

Herschel's 40-foot ***Newtonian Telescope*** (1785-1789) with 48' diameter primary mirror – discovered 6th and 7th moon of Saturn

Stamp with additional value of +25 youth welfare charity fund Typical ***Gregorian equatorial Telescope*** (1770)

Modern reflecting ***Catoptric Telescope*** used by amateur astronomer

Justus Von Liebig (1803-1873)- he developed a technique of depositing silver on glass surface which is used in making mirrors for telescope

Jean Bernard León Foucault (1819-1868) -first to prepare silver plated glass reflectors for telescope

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