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(Image credit: NASA/GSFC/Arizona State University)

Jupiter and Saturn appear in the Earth's sky about once in every 20 years. On 21st December 2020, the two planets appeared even closer in the night sky and were just a tenth of a degree apart. This proximity in the sky was reported after almost 400 years, previously in 1623, and is known as the "Great Conjunction". The term 'Conjunction' defines the pairing of planets while 'Great' has been used to describe the conjunction of the two largest planets that are visible to the naked eye. The next prominent conjunction is speculated to be witnessed in about 80 years from now, on 15th March 2080. (https://www.space.com/great-conjunction-jupiter-saturn-photo-nasa-lro-spacecraft)

PHYSICS NEWS

Physicists describe a new type of amorphous solid bodies

Many substances with different chemical and physical properties, from diamonds to graphite, are made up of carbon atoms. Amorphous forms of solid carbon do not have a fixed crystal structure and consist of structural units—nanosized graphene particles. A team of physicists from RUDN University (Peoples' Friendship University of Russia) studied the structure of amorphous carbon and suggested classifying it as a separate type of amorphous solid bodies: a molecular amorphic with enforced fragmentation.

Read more at : https://phys.org/news/2020-12-physicists-amorphous-solid-bodies.html

Original paper : Fullerenes, Nanotubes and Carbon Nanostructures (2020).

DOI: 10.1080/1536383X.2020.1815713

Breakthrough in nuclear physics: High-precision measurements of the strong interaction between stable and unstable particles

The positively charged protons in atomic nuclei should actually repel each other, and yet even heavy nuclei with many protons and neutrons stick together. The so-called strong interaction is responsible for this.

Prof. Laura Fabbietti and her research group at the Technical University of Munich (TUM) have now developed a method to precisely measure the strong interaction utilizing particle collisions in the ALICE experiment at CERN in Geneva. Four years ago, Prof. Fabbietti, professor for Dense and Strange Hadronic Matter at TUM, proposed to employ a technique called femtoscopy to study the strong interaction at the ALICE experiment. Meanwhile, Prof. Fabbietti's group at TUM managed not only to analyse the experimental data for most of the hyperon-nucleon combinations, they also succeeded in measuring the strong interaction for the rarest of all hyperons, the Omega, consisting of three strange quarks. Furthermore, the group also developed their own framework that is able to produce theoretical predictions.

So far, the relationship between the mass and the radius of a neutron star is unknown. In the future, Prof. Fabbietti's work will therefore also help to solve the riddle of the neutron stars.

Read more at : https://www.sciencedaily.com/releases/2020/12/201209142807.htm

Original paper : Nature (2020). DOI: 10.1038/s41586-020-3001-6

Trapping nanoparticles with optical tweezers

Optical tweezers are a rapidly growing technology, and have opened up a wide variety of research applications in recent years. The devices operate by trapping particles at the focal points of tightly focused laser beams, allowing researchers to manipulate the objects without any physical contact. So far, optical tweezers have been used to confine objects just micrometres across -- yet there is now a growing desire amongst researchers to extend the technology to nanometre-scale particles. In new research published in The European Physical Journal E, Janine Emile and Olivier Emile at the University of Rennes, France, demonstrate a novel tweezer design, which enabled them to trap fluorescent particles just 200 nanometres across for the first time.

Read more at : https://www.sciencedaily.com/releases/2020/12/201211100648.htm

Original paper : The European Physical Journal E (2020). DOI: 10.1140/epje/i2020-11991-6

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The editors wish all the readers
A
VERY HAPPY
NEW YEAR

Editorial

This issue carries an article by Dr. D. P. Khandelwal, reprinted from the January 1989 issue of the IAPT Bulletin, in which he reviews the then existing state of the Physics (Science) education in the country and asks some pertinent questions in relation to the scenario existing at the time when the country became independent. Finding that we have not done enough since then and that ' the gap between the world science and India has increased with time so far as physics education and research are concerned', he says, ' It is high time that we take firm decision and pursue them with conviction '. And, he suggests some steps in that direction.

Looking at the present scenario, though the country has , definitely made substantial progress since then, the gap still remains and we have to continue our efforts with still greater vigour. Where does the IAPT stand in all this? With the 36 years' history behind us we can certainly claim that we have tried to do our bit . But, was it enough? Couldn't we have done better? Can we increase our momentum? These are some of the questions we have to address ourselves to.

The BCC Committee has come out with an yearlong impressive and a very comprehensive programme of celebrations which is commendable. I think it is also the occasion and time when we ought to assess ourselves in the context of questions asked above. After that we may reshape and recast our strategy and efforts to move in the desired direction with renewed resolve.

U.S. Kushwaha

Prof. R. M. Dharkar No More

Prof Dharkar, IAPT veteran, 85, breathed his last on December 8, 2020 in Pune. Obituary appears on page 24.

Prof. K. C. Thakur No More

Prof. K. C. Thakur, 85, former HOD Physics, MLN College Yamunanagar (Haryana) RC-01, passed away on December 29, 2020. He was a very active member of the association right from its inception.

Obituary will appear in next issue of the bulletin.

Physics Education in India – Challenges & Opportunities

D P Khandelwal
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(This article was published in the Jan. 1989 issue of the Bulletin)

I. Introduction: Indian science has made tremendous progress since Independence, and we can be reasonably proud of this fact. Unlike other under-developed countries, we in India had already an established structure of science education and research at the time of Independence. However, in this context two questions come to mind:

a) Have we progressed and contributed as much as we could have?

b) Does the present state give us hope and assurance that the momentum will increase substantially in the future?

For the first question the answer would be in the negative. The gap between the world science and India has increased with time so far as Physics education and research are concerned. With the same resources we could have done much more. In fact, we could have insisted on getting even more resources being put into Physics education and research if we had planned for the distant future, rather than for immediate interests. For the second question my answer is even more alarming- the base on which we are standing is not only not growing in strength, but is becoming weaker and weaker with time, and it is on the point of collapsing. There is an increasing brain drain away from science within India, so that what we get in science at the top echelons is extremely poor human material on the average. We have not appreciated this fact because we have been depending on "imported talents" far too long.

For the first assessment I will cite just one example. In the context of an International meet, I was party to the preparation of a book titled: "Lasers and Their Applications in the Indian Context" [1]. Part 1 of this contained a state-of-the-art review of the world situation, and part II had data about what we have in India. It was amazing to discover that, in this land of Raman, not one institution was doing experimental research on laser Raman spectroscopy. Also from research programmes specifically granted to produce prototypes of lasers to over to industry, not one came out with meaningfu1 results. I would suggest that preparation of such reports be made an integral part of similar meets in special areas, and the reports published for open view. Let if us educate ourselves on this if self-correction is desired.

On close analysis I find that the root cause of such serious lags is that we have failed to look at the entire structure of science education as an integral one. In particular, the top people do not want to spend time and thought to the distortions cropping up below. As examples, science made compulsory up to the High School (a fine idea indeed), but with no intensive preparation; creation of scientific temper in society is sought to be achieved through processions; the standards of syllabi and textbooks and examinations are lowered to ensure a certain pass percentage; and so on. Recently, a very useful Seminar on "Restructuring of Postgraduate Physics Experiments" was held [2] but instead of suggesting some programme for action, it 'appointed a committee'. It is high time we take firm decisions and pursue them with conviction.

II. Research and Postgraduate Education: At present about 75% of our of MSc's are coming out of institutions where there is essentially no research activity. Even where some research is going on, the gap between the MSc and research is becoming larger with time. On the experimental side the situation is quite pathetic. Many very expensive equipment lies under-used by a large factor. The worst is that the University system as such is being considered incapable of taking any large experimental project. The following steps need to be taken to rectify the situation:

1. A National Testing Service be introduced to ensure a minimal level at M Sc. Presently the UGC and CSIR have introduced one for the limited purpose of the of the award of the research fellowship. But the MSc's fill many other positions, including teaching positions, which affect continuing generations. The proposed N T S score could be used for a very wide range of purposes, and then it will force the weaker educational centres to raise their quality lest they die out. I would not propose obligatory or exclusive weightage for NTS score in any opening: but the very presence of NTS wil1 go a long way. In any case, we will then have an evidence for the planners and policy makers about where the different institutions stand. An important point is that NTS should include a considerable attention to the experimental side, and this should not give allowance to centres which do not have the basic equipment. Another possibility is that NTS

score be given for different aspects of the candidate's capability and the weightage to these may be given differently by different agencies depending on the nature of job to be handled.

2. A decision must be enforced on the Government that in future when any large experimental research programme is floated, it shall not be handed over to an organisation outside the University system. It should be attached to some University or a group of them, and consequential administrative steps as needed may be taken. This will help reduce the gap between MSc teaching and research, and also put the University system and specialised research organisations at parity status.

3. For all expensive instrumental facilities in the Universities and Regional Instrumentation Centres and elsewhere there must be a log book system to ensure their optimal use. An agency should be empowered to periodically review these log books and suggest corrective measures in cases of serious under-use or non-use.

4. The talk of relevant Physics and 'job-oriented' Physics education must be curbed with firmness. Physics by itself is very relevant, and good Physics is of the utmost importance to the nation. What is needed to make the Physics understanding stronger and make a Physics laboratory more modern is very important. But any attempt to make Physics MSc's compete with those taking specialised engineering education will be self-defeating. In research programme the distinction between pure and applied is not sharp; our insistence should be on "meaningful" research, not tit-bits in the name of applied physics.

5. For any research programme granted, there must be a condition is that the work conducted is subject to an open review. There is at present a nominal clause of that kind, but apparently the reviews are never quite stiff. In evaluating research publications, the citation index method should be adopted. One most important consideration between those who continue doing research after their Ph D and those who do not continue research work at all after Ph.D; this is of especial importance in the educational system, where there has been very considerable penetration of very weak PhD's.

III. A Close Look at the Base of Education: The Internal Brain Drain: A child has a natural curiosity to explore, learn and master. Since science provides additional experiences, it should attract the child more than other subjects. But, science education as it obtains in India, by and large, does not provide that additional excitement. Worse is that in the name of science we ask for rote memorisation, often of items which are well beyond his comprehension. The result is that the child is repelled from science. To him science becomes a collection of statements, definitions and equations, not an area of exploration and excitement. That feeling is shared by the guardians and the public men. The overall result is that if the children and their guardians think of science at all it is done in terms of the careers for which it is a compulsory channel. In effect, only those children stay in science who have an eye on a professional course.

I will cite one example of how we throttle science in our teaching and evaluation. Newton's law of universal gravitation is given straight away as $F = G\, mm`/r^2$ and then some calculations are done. How is this science, as distinct from algebra? The same topic could start with how the planets are distinguished from stars, how Tycho Brahe measured the positions of several planets night after night for several years, how Kepler failed to find a common pattern in the motions until he switched to the heliocentric reference frame, how from even minor deviations he had to switch over from circular to elliptic orbits and then gave his laws, and how Newton argued that m be placed in the numerator and only r^2 in the denominator would fit the motions. The introduction of **m`** and making **G** a universal constant has further Physics in them; the laboratory to determination of G, leading to deduction of mass of the earth would form the climax of excitement for the child. But how many books give it that way; how many teachers are themselves aware of the damage they are doing by giving the equation straight away, and how many examinations, if ever, ask for the background on which the formula was given?

Another example is from the laboratory. The simple pendulum experiment is given as “determination of g”. The child's first reaction is: 'Where is the free fall with which g is associated?' Then, the measurements involved are of length and time, where no skill is involved. The rest is algebra. There is great lot to see in the pendulum: dependence of its period on mass of the bob (let the child see for himself), on the amplitude, and on the length; then the way the amplitude falls with the number of oscillations and its dependence on the density of the bob material. But we do not let the student study any of these features. Any number of examples can be cited for this: verify Ohm's law (why not I vs V over a wide range?), determine force constant (why not F vs x study for different materials?), determine viscosity by Poiseuille's method (why not flow vs over a wide range?), motion

under a constant force (why not motion under a general force, with the graphical method used?), and so on.

This is not the first time that these questions have been raised. A plea for exciting Physics teaching and exciting laboratory and open-ended experiments has been made repeatedly. I have often been asking:

I am afraid if compulsions of attendance were not there most students would not attend our classes. In any case, with our present kind of examinations, those who stay off may score the same as those who attend the classes!

It is for the teachers and research workers at the highest level to strongly intervene in the matter. Firstly, the education and research at the top level suffers. Secondly - and that is worse - the best brains are driven away from science in a progressive manner, which has a self-multiplying factor over the successive generations. Mere lamenting over it will not work. There is so much talk of brain drain from India to the West; I wish there were even more serious talk of the brain drain within India from the science fields to other fields.

One may attribute this brain drain to the socio-economic factors and show helplessness. That is not the whole story.There always are a fair number of students who have very deep urge for exploration, innovative work, high philosophy, intellectual pursuits, etc. Despite al1 other lures they would still come to Physics if we are able to give an assurance that these urges of theirs will be fulfilled if they choose Physics as a career.

IV. Programmes for Action

A. Development of a model Undergraduate Physics Laboratory: A number of Workshops' involving actual user teachers from an all India cross section should be organised with the specific objective of evaluating the educative value of numerous alternative experiments developed at different places and coming out with a comprehensive write-up on some 100 experiments from which any UG lab may choose some 60 or so to make a 3 year programme. The workshop should take account of cost considerations, maintenance and repair factor and actual class-room workability.

These Workshops should not be simultaneous but in tandem, so that the results of one are available to the next one, and improvements go on at successive stages. Involvement of instrument- making industries later will ensure that the new components and instruments suggested are readily available for those who go in for the changes. About one-year time-bound programme, with some 6 Workshops conducted, should be assigned to a specific agency, and the conclusions should be given wide publicity with assurance of financial support from the administration.

Much of the input will certainly come from what numerous agencies have developed in recent years, the University Leadership Projects of UGC being the largest single group. But the teachers in these Workshops will make their independent opinions, and many new suggestions will crop up. Further, in the process we are bound to discover exceptional talent in some teachers, so as to make a continuing programme centred on them.

A preliminary preparatory work in this line has already been done in the form of a book which has attempted to absorb most of the recent developments, with open-endedness as the central theme. What is significant is that a very large part of the improvement in educative value and excitement can be brought about by changing the objectives, extending the parameters and using the existing equipment. Of course, with new technologies coming, we must introduce experience with them at the BSc level, particularly where there is considerable depth in education involved. The need is to give a feeling that it is the user teacher who is at the centre of attention in making the recommendations.

Once a Model is ready (in about a year) the next step should be the orientation of teachers. This can be done at some 20 select institutions region wise, so that at least 2 teachers from every institution are covered in two years. Even in these programmes the participants should be encouraged to play with new ideas of their own, and talent thus spotted may be used as resource person in subsequent programmes.

The programme suggested must not be confused with the ASC (Academic Staff Colleges) programme of UGC. That is designed for new entrants, and (rightly) has emphasis on the methodology of teaching, on philosophy, culture, history etc. What is suggested here is a crash programme to speedily correct the distortions of about a century; its continuing is disastrous in a subject like Physics, we cannot afford to let matters get stagnant again.

It will be advantageous if the programme is handed over as a contract to a voluntary agency of national acceptance. The cost will come out less, the involvement more intense, and the commitment to time-bound, result-oriented character of the programme can be ensured.

B. Development of a Model School Level Physics Laboratory: In this area it is not easy to draw distinctions between experiments at class X level and

those at +2 level, or between what is good for demonstration to a large group and what should go as an experiment to be done by an individual. Further, the very process of teaching will need some guidance about a mix of demonstrations, informative slides a logical build up, and so on. The task is thus more complex than at B.Sc level. Limitations of the vision and subject background of the teacher available at this level are added factors.

For these reasons, the starting point is to make a group of some 20 schools available for field trials of the items developed and the methods of teaching introduced. A necessary condition is that the targets, like class X and +2 examinations, must not be disturbed, otherwise the logistics will get complicated.

We are aware that there are already some special centres working in this field. Of these the Hoshangabad Experiment (Eklavya) and Homi Bhabha Centre for Science Education are widely known. Yet, what is being suggested here is an intensive experiment directly involving some 20 schools and their teachers. The title we use is "Physics Laboratory", but it is obvious that a wide range will be covered, including the development possibly of a new kind of text book, demonstration items, slides, video materials etc. Also there is bound to be a close interaction with other science subjects, because at the school level tight specialisation is not desirable. The direct involvement of the teachers of the chosen schools is an integral part of the suggested programme.

Of course, space and funds will be needed for the work. If an agency governing some 20 schools takes the initiative, then funds can be managed by that agency, as a kind of research in science education. The next is the problem of attracting some 8 to 10 academic persons from outside, who will come and stay at the chosen centre for about 2 to 3 years to work with the teachers and students. I am aware that it is difficult to get persons with wide vision and experience to undertake such a task. But that is where the challenge lies. If the task is assigned by invitation as a national challenge, then we are sure good persons wil1 come forth. It will be advisable to assign the task to a voluntary organisation of dedicated teachers which has a national perspective. The flexibility of approach thus available will go a long way in making the programme a success. Wide publicity is to be a necessary part of the work, since many suggestions may flow from outside for trial. In fact, some enthusiasts may offer to try their ideas with these classes or the experiments. There should be scope of giving them the chance and encouragement. It is to be a national experiment.

We have said that the parameters at class X and +2 level examinations are not to be disturbed. But it is conceivable that this centre may be able to influence the kind of questions asked at these examinations for better evaluation of understanding; also the methods of teaching and the nature of experiments and demonstrations may change at other places as an influence from what are being tried here and propagated.

Unlike the undergraduate level, here we do not propose a "report" preparation. At this level the whole process of imparting education in science is to be seen as a single unit. Of course, the experiences are to be propagated, and we envisage other units/groups of school taking them up, even as this centre goes on with its work.

One may think that this is to be a one-time 3-year work. That is not true. Research in any field is an unending process; so is the improvement in the quality of science education. What I visualise is that in due course there will be one such centre in each state, and the entire system of science education and evaluation in each state may take clues from such a centre. Yet it appears important to stipulate that the academic staff for centres shall not be appointed on a permanent basis. Positions here must not be seen as avenues for promotion for career oriented people; they should be considered as challenging positions for top people on invitation for specific periods.

C. Centres for Science Culture: This is a new concept, designed to accelerate the spread of science culture in the society at large. It is a major challenge to the scientific community. The principle is not under debate; the need is to work out an effective mechanism. Taking out processions would not achieve the results, nor would once-a-while demonstrations, which are seen more by the science people than by the target persons.

Science exhibitions are very useful in this direction. Science museums and Science centres are good too. But the dent they have made is small, particularly relation to the cost involved. Arousing curiosity is not enough; there must be opportunity to discover by doing, and we must arouse the spirit for that.

This is the backdrop against which the building up of Centres for Science Culture (CSC) is being suggested. My basic assumption is that classroom experiments and demonstrations are essentially the simplest ways of developing an understanding of science. Therefore, if we can assemble all such materials for visitors to see and play around with, then it may form the nucleus of a CSC. There are many associated limitations. We may need to change the scale factor, put some additional control

factors, and add many details too. But there are many freedoms: we are not bound by time factor, or sequence consideration, and we may seek assistance from audio and video media. Again, we can make an interesting mix of items from all branches of science, and have units related to explorations in history, geography, culture etc. where science-based techniques are used.

All present day science museums are conceived and executed by people outside the teaching system. Museology is, in fact, considered as a separate specialisation. The CSC's are proposed to be built around the educational system, to give the teacher an opportunity, as also the responsibility, for extending his teaching to the masses. In the process, a two-way interaction is expected to start, bridging the gap which at present keeps science education as somewhat of 'distant' thing far away from the normal life-some kind of a mysterious thing.

Within the educational system, non-science students are presently totally unaware of what is there in science labs. Also students of lower classes have no access to what exists in the labs of higher classes. Knowing that the students have a very wide variety of backgrounds and intellect, we would make of science items available for all (who desire) to see and play with. At the CSC level the very design is to be for that. Then there are numerous persons in the society who did not go through the science path, but from the gadgets they use every day and from what they read in newspapers they will be keen to understand the science behind many things. The CSC should be an exciting place for them. Finally, the laymen and the ignorant, many of them steeped in superstition, who need to see for themselves that things happen a particular way because of specific laws of nature. The once-a-while viewing method would not instil science culture in any of these cases. The CSC must therefore be based on involving in doing experiments. It means that provisions for varying the parameters and taking data must be provided. How much one is involved will vary from case to case; but the essence is to let people know that science is not just seeing, but making a series of measurements, analysing them for some regularity of changes, and then building up laws out of them, which are used for further experiments.

For those experiments at CSC which draw greater attention from the visitors for sustained working, cubicles will have to be provided for, where they can work for some length of time. The number of such cubicles that need to be established will be a good measure of the success of the CSC. For channelizing this act as a place where the regular students from neighbouring institutions can come and have the experience of using them for measurements. The other is the CSC may get itself involved in developmental activities for new experiments, demonstration kits, slides, audio and video items, etc. both for regular educational system and the general public. In this last work it may overlap with programmes A and B suggested earlier.

An outline of CSC has been presented earlier in 1986 [4]. But the scope in the present suggestion extends to all sciences and the anticipated investment now would be merely Rs.2 crores. By itself that is not a large sum looking to the investments in any of the Museums and/or the existing Science Centres. Any one State Government can initiate a CSC as its own programme. All that is needed is a powerful agency that will sell this idea with conviction. Top scientists alone can do that.

It has been stated that the CSC has to revolve round the teacher as the nucleus, so as to work as bridge between the educational and the public life. It will also be advisable that the running be placed in the hands of an autonomous body, since considerable freedom of action and innovations will be required.

Once one CSC model starts functioning, we would expect many others to grow up all over the country. That is the culture we envisage. These will be the places of "worship" where people should visit very frequently and seek wisdom.

D. Stage Science Shows: All kinds of arts go up to the 'stage' format and thereby develop internal resources for growth and multiplication. Even magic shows have gone to the stage. Why not science shows then? We have innumerable attractive items to show, as we find from the crowds in exhibitions. All we have to do is make a cumulative and comprehensive list of items prepared for such exhibitions. and give them a format in which they can be presented to around 500 spectators in a hall from the stage. I am aware that the format change is not easy. There lies the challenge. But with so much technology now available, it should certainly be quite possible to achieve that. That will be first step in a Stage Science Show (SSS).

Once some good items are prepared, the next step is to weave an exciting programme around some 25 to 30 items to make a 2-2.5 hours show presented from the stage. All help from dance, drama, music and colour may be taken to create interest. But the central theme must be that some knowledge of science has to be communicated to the general public in the show. Obviously, a good mix

of items from a wide spectrum has to be there, so that the show does not become dull; the objective could be that at least half of the items interest different viewers each. One would imagine that some 5 units of SSS's to start with will be good. There will be a continuing improvement and restructuring of these based on experiences, and after about 10 trial shows we may have a fairly good set of SSS.

At this stage the SSS should be shown in regular hired halls in towns against payment, as for a cinema show. People do pay for circus shows, cinema shows, magic shows, and so on. There is no reason why they would not throng to pay and see the SSS. All the mechanics of publicity and finance should be adopted. The cost of production of items, expenses during the show, (handsome) payments to the "actors" of the SSS, and some provision for future growth must be recovered from the tickets. One benefit could be that Governments are likely to make these collections tax-free. That is how the SSS's are to be envisaged.

It deserves repetition that the central attention must be on communicating science through interesting displays, explaining the innumerable events that occur in nature, the gadgets in wide use and the ways the scientific laws can enrich human life. Teachers should be the "actors" in the shows, and they must use all that a 'magician' in his shows for effect, plus the assistance of music and dance if needed, but keeping explicit science education in mind. The language will have to be the local one, preferably the local dialect too. And with experience the "actors" will improve in communication. The only 'script' for the show will be the chain of items and the basic contents to be communicated.

We visualise that in the bigger towns it should be possible to run at least one Theatre the year round, with 3 shows per day, showing the SSS. Like the cinema, for some cases specific "actors" may develop high reputation for SSS, in other cases people will go with the contents (the counterpart of "story"). Teachers with histrionic talents and with special flavour for demonstrations will find this an excellent avenue.

The next step will be develop travelling counterparts of SSS. These will reach the smaller towns and may become major attractions at the numerous fairs held all over the country. All in all, a new culture is thus sought to be developed-the culture of people paying to get awareness and knowledge of the scientific method and content.

What will be the generating agency for the SSS? Well, any of the existing Science Museums could take it up. The difference between an item seen by individuals and one that can be shown to a large audience from the stage is not small. If they can fill this gap, fine. Another option is that one of the proposed CSC may take it up. The chances of success are larger in that case because they are to be woven around the teachers. Of course, an entirely independent centre may be created just for the development of SSS items, and governing the entire SSS programme. No recurring finances are in any case involved in this. One could even conceive that the recurring expenses on CSC may be met from their SSS wing.

V. Conclusion: It will be seen that from the limited field of Physics I have shifted to the wider field of all sciences. That is because no major work can be taken up in isolation. Physics happens to have a larger content of basic philosophy and many initiatives therefore come from Physics. The different programmes which have been suggested are all interconnected. What is important is that such programmes are strongly propagated and put and into execution. And it is to be seen very clearly that the initiative has to come from Physics alone. The challenge is there for us to take. Fortunately, the right opportunity is now, since the Government is planning for the twenty- first century, the New Education Policy is in the early stages of execution, and we have men of great vision for science at the top. Developing science culture in the society, strengthening the base of science teaching, halting the internal brain drain away from science within India, enhancing the quality of Physics education and research, all come in one chain, and we have to take a comprehensive view of the whole problem and its solution. Let us face the challenge. Let us grab the opportunity when it is before us. Tomorrow may be too late.

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The NAEST Prelims experiments designed without any lab equipment

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Abstract

National Anveshika Experimental Skill Test (NAEST) is one of the Annual competitions organized by IAPT. The experiments given to participants of NAEST 2020 were designed in such a way that these could be performed completely with household items. We designed four such Experiments, of which each participant had to perform 3. Here are the write ups of these experiments.

1. NAEST 2020

NAEST 2020 was a challenge for NANI and its 26 Anveshikas spread over different parts of India. Every year it used to be like a big festival for us. All the coordinators of Anveshikas and their team members used to contact hundreds of schools/colleges in their localities to enroll students. We had a cap of maximum 10 students from each institution to keep the number within our manageable resources. With the committed efforts of these IAPT activists the number of institutions participating in NEST continued to increase and we had 25,726 enrollments from 1,889 institutions in NAEST 2019.

But 2020 was a totally different story. We could not have thought to go to the schools/colleges neither we could have called the students to come over to our centers. NANI coordinators decided to go for online mode and it was a big challenge to do Experimental skill test of thousands of students in online mode.

With the collaboration of IIT Kanpur and Vigyan Prasar DST, we made a website for NANI Screening round and the whole team put the efforts to publicize it all over the nation. ALL sorts of connections were used including social media, youtube promotion and all that. One of our Anveshika coordinator from Andhra Pradesh dubbed the promo video in Telugu and made it reach widely in Telugu regions. More than 48,000 registered at NANI screening site.

After a screening test at the website, the description of which has been published in September issue of Bulletin, 1,526 students were selected for the Prelims round where they had to perform the given experiments and we had to evaluate. Both the tasks were very challenging as no one was supposed to step out from the home for this purpose.

While Anveshika teams took up the task of conceiving the experiments, performing them to see the feasibility and polishing them, RCs of IAPT came forward to help us in evaluation. A total of 118 Physics teachers from different RCs participated in the evaluation task. The evaluation is in its final stage at the time of this writing and we are gearing up for the FINAL round of NAEST 2020.

This article is to share the 5 Experiments that we designed for the Prelims. One was a practice Experiment to give the students and evaluators a feeling of what is in the store. This was not evaluated. Each student had to do 3 Experiments out of the 4 for the competition. Some had to do EXPT 1, 2 and 3 whereas the others had to do EXPT 2, 3 and 4. Students were given 3 days of time for each experiment. They were not invigilated and were allowed to take help of family members. They had to put lot of thinking as they had to arrange the set up from the household items only and still perform the experiment with utmost care and make measurements, do quantitative analysis and draw conclusions.

The experiments were sent one by one after a gap of 1 or 2 weeks. After the first experiment, we also learnt that students are to given the write up in more details telling them the minimum expected points in the report.

2. EXPERIMENTS

Practice Experiment

To get the time period of oscillation of a JHARANA (used in Kitchen)

Task

(a) Find the CM (Centre of Mass) of the Jharana. You can balance the Jharana on a pointed tip. Does it depend on which side of Jharana is facing upwards? Is the CM right at the point where is gets balanced?

(b) Measure the total length, diameter of the disk, diameter of the hole, average width of the handle using the 15 cm plastic scale of your geometry box. Also measure the distance d1 of the hole in the handle and the distance d2 of the farthest hole in the circular disk from the CM. Draw a sketch of the Jharana on a plane paper and show these structures with the dimensions.

What is the least count of your scale used for the measurement? Find the percentage uncertainty in each measurement.

© Suspend the Jharana from the hole in the handle using some fixed horizontal rod/long nail or some other appropriate object. Oscillate it in a vertical plane. How easy or difficult is to oscillate the Jharana in a vertical plane as to increase the amplitude of the oscillations. Measure the time period using the stopwatch in your mobile phone. Can you calculate the uncertainty in the calculated value of the time period?

$k = \sqrt{I/m}$ is called radius of gyration of the object about the suspension axis where I is its moment of inertia about this axis. Also the time

period is $T = 2\pi\sqrt{\frac{I}{mgd}}$

Get the radius of gyration.

(d) Suspend the Jharana from the farthest hole in the disk. Repeat the above to get the radius of gyration.

Experiment for 18th September

Rolling a Belan on an inclined horizontal surface.

Introduction : A Belan is used in kitchens for spreading Chapatis from flour dough. This is also an interesting instrument for physicist to study rolling motion on an inclined surface and with some effort one can find the value of g. In this experiment you will take a plane surface, lift it from one side to make it an incline and measure the time taken by your Belan to move a specific distance on this surface.

Following steps are suggested

- Choose a plane surface in your home with a length around a meter or more. It can be a study table, an wooden plane cot (called Chauki or Takhat) or a Deewan, a ply board or some such thing in your house. Let me call it "Board".
- Make two marks on the surface with as much separation as your surface allows. Measure length between these marks.
- Measure the dimensions such as lengths and radii of the Belan and record them with percentage errors using the accuracies involved with your measuring tools.
- Give some inclination to the Board using books or anything else put below one side of it. .
- Find the angle of inclination by measuring horizontal/inclined length between two points of the surface and the difference in their heights above the ground.
- Rest your Belan at the lifted end of the surface at the mark you have made. Allow the Belan to roll down the surface and measure the time taken to reach the other mark. You can use the stop-watch of your mobile phone to measure the time.
- Start with an inclination of about 2 degree and measure the time for 6-8 inclinations going up to 15 degrees.
- Record your observations in tabular or any other clearly understandable format. Give the values of angles q in degree (showing the calculations separately) and the time t is seconds.
- Plot t versus q.
- Try with other quantities like t^2, 1/t etc and similarly with q. Try to get a linear plot.
- The equation for the linear acceleration of a cylindrical object rolling on an inclined surface is

$a = g\sin\theta/(1+I/mr^2)$

Can you use this information to find some interesting quantity related to your Belan or an estimate of "g"? Make your own approximations to get such quantities.

Experiment for 25th September 2020

u and v of a thick cylindrical water lens

Description:

For thin lenses, we know the relation between object distance u and image distance v.

In this experiment you will explore the relation between u an v for a thick convex lens. It will be water in a cylindrical vessel/tumbler or pot. Though the lens so formed is not spherical, but if the rays are collected in a plane, one can still use such u- v relations and see the effect of the thickness of the lens.

Collect and assemble the set up as suggested below and perform the said task. In addition, you can do experiments with the setup on your own.

(a) Light beam

You will use your mobile torch (no laser etc.) as the light source. You have to make an arrangement where the mobile can be placed on your working table in a stable position in proper orientation to have the torch at a desired height.

To get a beam which is visible, make a slit in a cardboard/drawing sheet or any reasonably hard sheet like that used in gift cards etc. The slit may be of say 1mm width and 5- 10 cm height (Figure 1).

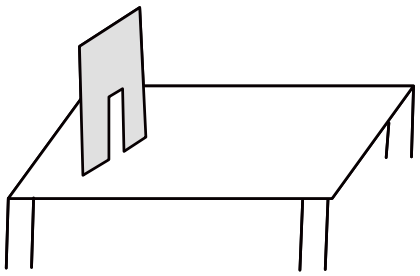


Figure 1

Spread a white paper sheet of width about 8 inches and length about 20 inches on the working table. You can join two A4 sheets to make such a long sheet.

Put the slit vertically on the paper sheet. See how to fix the slit in this position. You can use plastic clips used to fix cloths for drying after wash. Any other type of clips or any other arrangement is also possible.

Place the mobile torch behind the slit so that a part of the light going through the slit falls on the paper and makes an illuminated beam like structure there. We will call it a "beam". Make your adjustments so that the beam is intense, long and narrow. This is a crucial part of the experiment and put good effort in getting a nice beam. Draw a dotted line on the beam as a reference. Put a pencil mark (a small dot) just after the slit on the light beam. This point is going to act like an "object" for the water lens. Make sure that the slit remains undisturbed for each part of the experiment.

Answer the following question in your Report.

Question 1. Is it justified to call this illuminated part of the paper as a beam of light?

(b) Placing the water lens

Choose a transparent cylindrical vessel for making the water lens. It may be a glass tumbler or a plastic box of that shape with a radius around 3-5 cm or some such thing in your house. Put it on the paper sheet symmetrically over the beam. Choose a distance between the slit and the center of the vessel to be around the value of diameter of the vessel. This is going to be the first value of the object distance u. You should still get a transmitted, undeviated beam.

Mark the circumference of the vessel on the paper with a pencil. For each part of the experiment with a fixed object distance, you must ensure that the vessel is within this boundary.

Pour water in the vessel up to say 5- 8 cm. Look at the beam on the other side of the vessel.

(c) Making two incident beams to fall on the water lens

Shift the mobile slightly on one side so that the beam from the slit to the vessel gets slightly bent. Make sure that the slit is in its position. Look at the incident and transmitted beams. Put pencil marks at different points of the incident beam and also of the transmitted beam. These are needed to draw these beams (treated as rays) on the paper.

Question-2. Describe the shape of the beam from the slit to the vessel and from the vessel onwards.

Shift the mobile on the other side so that the incident beam bends on the other side of the central line. Put pencil marks at different points of the incident and transmitted beams for future joining (Figure 2).

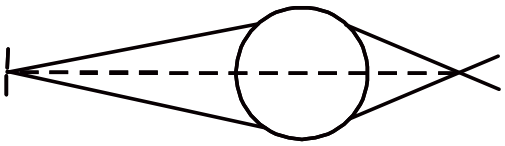


Figure 2

(d) Measuring u and v

Remove the vessel, slit and mobile. The intersection of the two incident beams is the object (should be at your pencil dot) and that of the two transmitted beams is the image.

Find the object distance u and the image distance v from the center of the vessel. You may also use more than 2 incident beams to locate the image.

Question 3. Estimate the uncertainty in the measured value of u and of v. What are the sources of the uncertainty?

(e) Repeating the measurements

Repeat the experiment for at least 6 different values of object distance u. For each case, use either a separate paper sheet or well-separated place for your experimental arrangement. For each diagram, write the value of u and v close to the drawing on the paper sheet.

Choose the values of the object distance judiciously to cover a good span.

(f) Calculations and Discussions

Calculate the errors in u, v, 1/u, 1/v and in the effective F calculated from the equation

$$\frac{1}{F} = \frac{1}{|u|} + \frac{1}{|v|}$$

It corresponds to the focal length in the case of a thin convex lens. Tabulate all the quantities in proper format. Write your observations from this table and from your drawings.

(g) Plotting graphs

Make u-v and 1/u - 1/v graphs on graph sheets (no software for graphing]. Draw your conclusions.

Lens makers formula for thin lens is

$$\frac{1}{f} = (\mu - 1) \times \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Taking refractive index of water to be 1.33, calculate f from this formula.

Discuss your data and graph accordingly.

(h) Any other work you may think of.

Make any kind of data collection using this set up and discuss your findings.

The following photos/scan are expected from you. Together with this, if you have come up with some new work/observation, you can send its description.

1. A close up of your slit
2. Side view of the arrangement. Mobile, slit, together with the beam on the white paper
3. Top view of incident and transmitted beams when the beam falls on the water lens obliquely.
4. (3 photos) Top view of your pencil drawing of image formation for three values of object distance u. Write the measured values of u and v on the drawing in each case. Put a plastic scale of 15/30 cm at appropriate place near the drawing.
5. Data/ Calculation/Graphs/Discussions/New work. Preferably send this in one pdf file.

No video is needed in this experiment.

Experiment for 9th October 2020

Refraction phenomena of some liquids.

There are several phenomena when light goes from air to a liquid placed in a vessel. The effect comes from refraction of light as it goes into the liquid and comes out, and also the shape of the vessel if that also is involved in the whole process. We utilize Three such phenomena and find quantities which can be related to the refractive index. Thus there are three parts of the experiment.

Part- A. Shift in the image

You will dip a rod vertically in the liquid in a cylindrical transparent vessel and see the image from outside.

(a) Set up

You need a transparent vessel, cylindrical in shape, having diameter of about 10 cm or more. Larger the diameter better will be the result. If a larger vessel is not available you can use a glass tumbler.

Take a cylindrical rod of diameter few millimetres. Measure the diameter of the rod. A pencil can also be used for the rod. You have to make an arrangement so that this rod can stand vertically in the middle of the vessel.

One way to do it is suggested in Figure-1. You are welcome to come out with your own way to make the rod stand vertically.

Figure-1

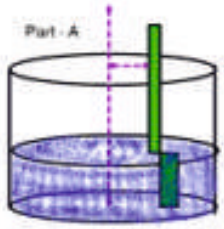
(b) Liquids

You will do each of the 3 parts of the experiment with two liquids.

Liquid-1: water

Liquid-2: Vegetable oil (mention the brand)

(c) Making and seeing the image



Place the vessel on the working table/slab. Fill half the vessel with liquid-1. Put your rod in place so that a part of it is in air and the rest is in liquid. The rod should be at the central part of the vessel. Place your eye in one position and try to keep it there till this section of experiment is complete. Imagine the line from your eye to the rod. You have to slowly shift the rod perpendicular to this line.

Devise your own method to ensure this.

As the rod is shifted keeping your eye fixed, the image seen in the water will shift on one side. Suppose you shift the rod towards right. As you shift the rod more and more, the shift in the image will also be more. Adjust for a position so that the right edge of the rod in air just touches the left edge of the image (See the adjacent figure). Now you can relax. Measure the separation x of the rod from the axis of the vessel. You can repeat the experiment several times to get an estimate of statistical uncertainty and a better average value.

Repeat for liquid 2 and find x.

Part-B : Magnification of the image

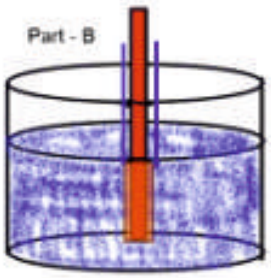
If you place a rod vertically in a liquid, and see through the liquid, the image seen is larger in size as compared to the rod. In this part you will measure this magnification.

(a) Set up

Figure-2

Use the transparent, cylindrical vessel and the rod, that were used in Part-A. Fix the rod to the inner surface of the vessel using a cellophane tape or do it in some other way. The rod should be vertical. Now make an arrangement to make two pointed objects, like sewing needles or new sterilised injection needles or long toothpicks or some such things, stand vertically. They should be roughly on the two sides of the rod, the pointed ends inside the vessel and be movable in horizontal direction. See Figure 2 for one such arrangement where two sewing needles are separately fixed to two wooden strips and these strips are placed on the rim of the vessel on the two sides of the pencil. Come out with your own arrangement.

(b) Measuring the diameter of the image.



Pour the liquid to fill the vessel up to a height so that the pointed objects just touch the surface of the liquid. You have to look at the rod through the water keeping the eye in line with the rod and the axis of the vessel. Now move one of the pointed objects little bit while looking at the image so that the pointed object (in air but just touching the water surface) just touches the left edge of the image of the rod. Similarly move the other pointed object so that it touches the right edge of the image. Make sure that you look at the image from the proper position so that the image is symmetrically seen on the two sides of the rod.

Now measure the separation between the two pointed objects. This gives the diameter of the image

Calculate the magnification,

m = width of the image/width of the object

Do it for the other liquid.

Part-C : Measuring refractive index

If an object is placed at the bottom of a vessel with some transparent liquid and it is seen from the top, the object seems to be lifted up. The ratio of the real depth to the apparent depth from the surface gives the refractive index. You will use this phenomena to get the refractive index.

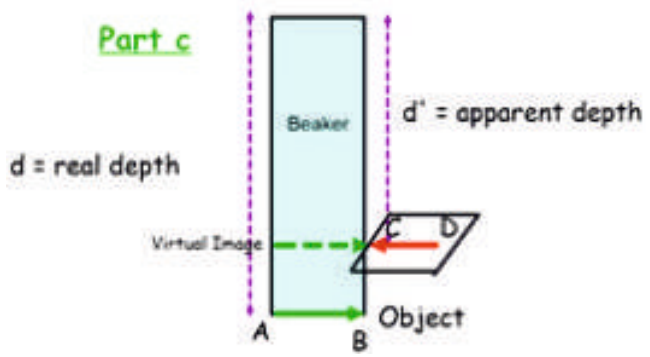
(a) Set up

You need a transparent vessel with a thin flat bottom. You may use a suitable plastic box (height at least 10-12 cm) used to store kitchen materials. If you have a beaker of that size that will be fine. You need some cardboards (say 4 cm x 4 cm or larger but of small thickness less than or of the order of a millimetre) or some other material to have an arrangement whose height can be adjusted.

Take a piece of paper and draw a thick straight line AB on it. Place your vessel on this paper so that the line is visible from the top. Make a similar thick line CD on a cardboard or a piece of chart paper or any other slightly stiff object. Keep the height raising arrangement ready.

(b) Removing Parallax

Put the cardboard with line CD outside the vessel but touching it in such a manner that AB and CD are in the same straight line.



Pour the liquid in the vessel to some height. Look from the above. If you place your eye in appropriate position, you will still see AB and CD in the same straight line. But if you shift the eye perpendicular to AB, the two lines will be separated.

Adjust the height of CD so that AB and CD seem to be in the same straight line even if the head is moved through large distances in the direction perpendicular to these lines.

You have removed the parallax between the two lines. The image of AB is formed at the height of CD.

(c) Calculation of refractive index

Calculate the refractive index n by measuring/calculating real and apparent depths from the surface. Do it for the other liquid too.

Calculations and Inferences

Now for each liquid, you have x from Part A, m from part B and n from Part C. Measure the radius of the vessel used in the first two parts.

From your data propose a relation between

(a) x, R and n and (b) m, R and n.

Extra-exploration

Please do whatever more experiment you can think of related to the above. Here are some suggestions (you can explore other problems too):

(a) Magnification when the rod is kept at different distances from the center

(b) Data on x and m for vessels of different radii

(c) Effect of the shape of the object, a rectangular object instead of the rod.

(d) Anything else.

Expected points in the report

1. Part-A

(a) A clear photograph showing the arrangement of the rod standing vertically in the liquid. Description of this image.

(b) Description of the vessel and its radius.

(c) Method to ensure that the rod is co-axial with the cylindrical vessel.

(d) The arrangement to shift the rod horizontally perpendicular to your line of sight.

(e) Description of the method used to measure the distance between the axis of the rod and axis of the vessel. A photo of the scale readings to measure this distance.

(f) Estimate of statistical and least count errors in the measurement of x for each liquid.

2. Part-B

(a) Description of the two pointed objects put vertically to touch the surface of the liquid. (in case some other arrangements ae made, description of that)

(b) A photo of the rod stuck to the wall of the vessel together with the pointed objects fixed with the vessel. (in case some other arrangements ae made, photo of that)

(c) A photo after the pointed objects are adjusted to touch the two edges of the image of the rod. The camera should be placed so that the positions of the objects and the rod are clearly visible. . (in case some other arrangements ae made, photo of that)

(d) A photo showing scale measurement of the separation between the two edges

(e) Estimate of uncertainty in **'m'**

3. Part-C

(a) Description of the vessel

(b) A photo of the vessel with the line AB and CD clearly visible with a liquid in it (top view)

(c) Please make a 5 to 10 sec video by holding the camera above the beaker and card such that both

the lines AB and CD are visible. Now shift the camera laterally to the left and right side of the matched lines AB and CD to prove that you have successfully removed the parallax between the two lines.

4. All data to be presented neatly and preferably in tabular form.
5. Ray diagram for all three parts.
5. Your comments on the possible relation between x, R and n, and also between m, R and n
6. Any exploratory work other than that asked for.

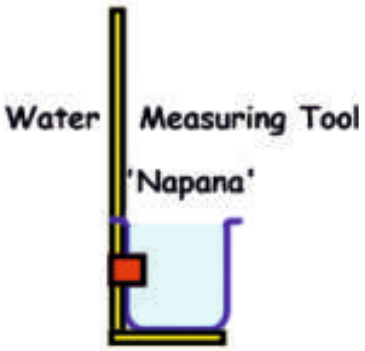
Note

1. Kindly Paste all your pictures with your text at appropriate places before saving it as a pdf document. This helps to have a better view of the process and steps followed by you.
2. A video to guide and assist you in removing the Parallax for part C of the experiment has been prepared. The You tube link for it is https://youtu.be/Ng4sQNCi2iI
3. While evaluating the previous experiments it was observed that students need support and guidance about Statistical errors and Least-count error and how to calculate them. A video tutorial of same is available at https://youtu.be/C2gP2-QL8qw

Experiment for 16th October, 2020.

Load - Extension of a Rubber Band

A rubber band does not seem to follow Hooke's law as the extension in the length is not proportional to the load applied to pull it. Moreover, a rubber band can show different extensions for the same load depending on the history of loading. In this experiment, you will explore the behaviour of a rubber band under loading and unloading.



Process:

Choosing the rubber band and fixing it:

Get a rubber band of total length not less than 4-5cm. Tie one end at a sufficient height from the floor so that it can be stretched to 10 times its original length. Choose 4-5 such rubber bands.

Arrangement for loading:

You have to put weights in equal steps to a maximum when further stretching becomes very small on adding one step of the weight. Estimate this maximum weight and decide on to step of the weight. This will depend on the length and the quality of the rubber band so you have to decide it for your rubber band. You should make at least 12-15 measurements in the full range of the weights. We suggest the following process to arrange for increasing the weights in equal steps.

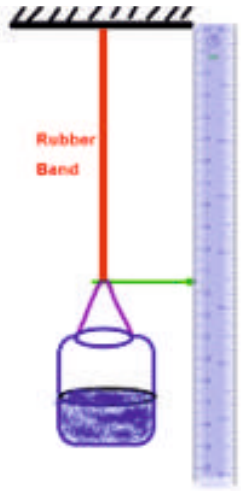
Weights:

Equal volume of water can be added each time to increase the load in equal steps. You will need a container of proper size to hold the maximum amount of water. This container can be fixed at the lower end of the hanging rubber band. To pour water in the container you can make a structure as shown in the figure. It has a handle and a NAPANA fixed to it. The *'Napana'* can be a 'Katori', a small plastic box or any such thing. Each time you want to increase the weight by one step, you can fill the 'Napana' with water and pour it into the container. Similarly if you want to decrease the weight by a step, you can easily do it using this NAPANA.

Part-A Seeing the Non-linearity and the Hysteresis

Arrangement:

Hang the rubber band by fixing its one end at appropriate height. Get the weight of the container to be fixed at the lower end. Device your own way to do it but you should not use electronic balances or anything needed from market. Get the volume of the NAPANA. Again device your own method to get it. The mass of water filling the 'Napana' of volume say x mL will be x gram, since density of water is 1 gm/ml.



Putting the load in Steps

Make an appropriate table on you answer sheet to note the weight hanged and the length of the rubber band. You will do it by increasing the weight in steps and then by decreasing the weight in steps. You will also need to write extension of the rubber band from its natural length for each load. The table should be designed that way.

Tie the container at the lower end. Enter the load (in grams) and the extension (in millimetres or centimetres).

Weight for few minutes as the band takes time to reach its length once a load is applied. Measure the length of the band. You may have to think ways to accurately measure this length if it exceeds the length of your scale. Increase the load in steps of one Napana of water till the maximum you had decided.

Removing the load in steps

Now remove one Napana of water from the container. Wait for few minutes and measure the length. Keep doing this till you can fill the Napana in the container. You can remove the water by holding the container and tilting it. But you should ensure that the rubber bnd remains in its position during the operation.

Graph plotting

Show the load and extension on a graph paper with appropriate labels for both adding and removing each Napana of mass on the same graph paper and draw your conclusion. We will call this Hysteresis loop.

Part-B Dependence on step size

Investigate the change in load-extension behaviour if the step size is increased. Increase the mass and load at once. Compare the extension with part A (for the same mass). For example if the load was increased up to 500g in Part-A, you put 500g in one go and compare the extension. Similarly you can do it in steps of 250g.

Compare the results with the case in PART-A.

Part-C Relaxing the rubber band at each step

Start as in Part-A. Put one step of water and note the corresponding extension. Now hold the container in your hand so that the rubber band is relaxed. Relax the rubber band for load increasing and load decreasing both. Pour one more step of water and then let the band expand and note the extension. This way, go up to the maximum amount of water. Next do the same experiment with decreasing the load in samw steps. Draw the full cycle on a separate graph paper. Compare with the case in PART-A.

Extrapolations

Do whatever else you want to do with similar set up.

Some suggestions are:

(i) You can use different types of rubber bands/valve tube of bicycles to compare the load- extension behaviour.

(ii) You can cut a rubber band in two equal parts and join ends to make a parallel combination. Compare the load-extension behaviour with the original rubber band.

(iii) You can use half the length of the rubber band and do a load-extension study comparing with the original rubber band.

Expected points in the report

1. Designing and arranging the apparatus:

I) Description of the container which should preferably be a transparent Container with at least a capacity to hold 1 litre of water

II) Description of arrangement to tie the lower end of the rubber band to the container

Iii) Description of the arrangement for hanging the upper end of the rubber band

Iv) Photo of the entire set up.

2. Making the napana:

I) Construction of the napana

II) Method of measuring the capacity of the napana should be explained

III) A photo of the napana

Part A: Seeing the non-linearity and the hysteresis:

1. Arrangement:

I) Method of measuring the weight of the empty container

II) Methos of measuring the volume of the NAPANA

III) Photos of the set up for measuring these

A. Show arrangement of the scale for measurement with a photo

B. Taking at least 10-12 readings in steps of 1 napana and tabulate the readings

2. Graph plotting

I) Graph of load vs. extension for loading and unloading on the same graph sheet with proper scales

II) Area of the hysteresis loop

III) Interpretation of the graph

Part B. Dependence on step size:

Expected points

I) Describe the way step size is increased

II) Take the readings and tabulate them

III) Plot the Load vs. extension graph

IV) Compare the results with part A

PART-C: Relaxing the rubber band at each step: 15 marks

Expected points

I) Describe the new method of relaxing the rubber band between the loading steps

II) Take the readings and tabulate them

III)Plot the Load vs. extension graph and find the area of the hysteresis

IV)Compare the results with part A

Excitements in my academic journey

Personal Interactions with Nobel- and near- Nobel Scientists

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This has come about in my informal conversations with colleagues and friends. The conversations usually ended with a suggestion to me as `Eh, why don't you write down all this stuff and experiences for others also to enjoy?' This has now tempted me to write down as much of it as I recall. Indeed, Prof. R V Kulkarni, former Professor of Chemistry of Abasaheb Garware College, Pune, once invited me to tell my experiences of interactions I had with Nobel Laureates during my academic career so far. I very much enjoyed giving the lecture, as much as the audience who told me so after the lecture.

It all started with my Ph.D. degree in Physics which I earned in the year 1963. I worked for my Ph.D. in nuclear theory with the renowned (young and very pleasant person) Dr. Sudhir Pandya at the Physical Research Laboratory, started by one of the great visionaries of Indian Science, the industrialist-cum-scientist, Dr. Vikram Sarabhai (fondly called `Vikrambhai' by everybody). How I landed as a student of Sudhir bhai is an interesting and exciting story in itself. I come from Baroda (present Vadoddara) in Gujarat State. I got my B.Sc. degree in Physics from Faculty of Science, M.S. University of Baroda. There was a good chance that I could have ended as an engineering graduate from `Kalabhuvan' (Faculty of Technology) after my inter-science. However, my discussions with Physics Professor (late) H.N. Patil, changed my entire academic life – I decided to become a nuclear scientist and enrolled as a physics student in MSU, Baroda itself. I got my B.Sc. degree in 1956.

Baroda University did not have nuclear physics as a specialized curriculum in Master's programme. So I had to shift (1956) to Ram Narain Ruia College, Matunga, Bombay (Mumbai) where I had a very illuminating professor Prof. R.D. Godbole who had just returned from MIT, USA with an M.S. degree in Nuclear Physics. Those two years were thrilling for my interest in the subject of nuclear science per se. We had excellent teachers in every subject; however, I may say that the teachers who inspired me most were Prof. Godbole (NP) and Prof. Gatha (Quantum mechanics). I got my M.Sc. degree in 1958 from Bombay University.

I met the first Nobel laureate in my life, the famous Danish scientist Niels Bohr (responsible for the development of the new science of Quantum Mechanics, and also propounding the theory of nuclear fission, in collaboration with John Wheeler of Princeton University), during the National Science Congress held in Bombay in 1957. Bohr was accompanied by the great Indian scientist Homi J. Bhabha, the doyen of Indian nuclear science program. I was lucky to get an opportunity to shake hands with both of them. It was a great fascinating event for me to meet Prof. Bohr in person and also to listen to his lecture. I was a student volunteer for the National Science Congress.

In 1958 summer I joined as a student with Prof. Sudhir Pandya for my Ph.D. For technical reasons I registered for the degree in University of Bombay in the year 1959. Though by early 1961 I had done enough work for the thesis, because of the (Bombay) university rules I could not submit my thesis prior to 1962. For the academic years ,1961-62 and 1962-63, I taught at Physics Department, Panjab University, Chandigarh. During this time, I had the privilege of collaborating in a series of research papers with Prof. P.C. Sood, an eminent nuclear theorist of Panjab University, Chandigarh.

I submitted my Ph.D. thesis to Univ. of Bombay, in early 1962. In those days there was a rule in Bombay Univ. to have two examiners, one ‘internal’(meaning from India) and one ‘external’(from abroad). The candidate was not supposed to know the identity of these examiners. At this time Sudhir bhai asked me to explore a post-doctoral position with the eminent nuclear scientist Mrs. Maria Goeppert Mayer, who was a distinguished professor at the University of California, La Jolla (San Diego), USA. I wrote to Mrs Mayer, around August or September '62. I received a favorable response from her around February 1963. She offered me a fellowship starting September 1963. I was indeed thrilled by this offer as I knew that Mrs. Mayer had also participated in the famous `Manhatten Project' under the leadership of Dr. Robert Oppenheimer, which fabricated the world's first atomic bomb). The year of 1963 was going to prove the most memorable start of my career as a nuclear scientist.

I had still not heard about the result of evaluation of my thesis from the external examiner (who-so- ever, he/she was). I was now very anxious to know about it. I had a latent fear that it may be rejected as `insufficient' (as it contained only about 87 typed pages with copies of my published research works), By God's grace I did not have to wait for too long. Most of my research work was in the form of explanations of experimental works of Prof. Robert Hofstadter (and collaborators) of Stanford University, on investigations of dynamics of `nucleons' ((nuclear particles such as neutrons and protons), using high energy electrons as probes. A part of the thesis also involved works based upon Mrs. Mayer's original idea of *nuclear shell structure*.

In February 1963, while I was teaching at Chandigarh, I received a letter from Prof. Hofstadter (who had received Nobel Prize in Physics just a year earlier (1961) which shot me into `cloud nine'. It was for the first time I was going to interact with a Nobel Prize winner. I was thrilled to read the letter, which was indeed an invitation for me to participate in the International Conference on `Electron Scattering and Nuclear Structure' which was going to be held in Stanford University in June 1963. Besides invitation to participate, Prof. Hofstadter also offered me travel expenses, registration expense, and all expenses during stay at Stanford. He also asked me if I could give a lecture to the august audience (which was going to include many more Nobel Laureates) on two of the chapters in my thesis. WOW! I could not believe all this. This letter also revealed that Prof. Hofstadter was also my *external* examiner.

I revealed all this to Sudhir bhai, my mentor. He asked me to write to Mrs Mayer and see if she could pre-pone appointment at UCSD starting June (instead of September). [That would save my travelling expenses to La Jolla/SD]. I immediately wrote to Mrs. Mayer and revealed all details of Prof. Hofstadter's letter. Another pleasant news for me - Mrs. Mayer wrote to me that UCSD will bear all the expenses offered by Stanford and that I should join UCSD immediately after the end of the conference. And yes! I was to participate in the conference as a delegate from UCSD. What a thrill! I gladly accepted Mrs Mayer's offer(joined UCSD in June 1963 after the conference). Still the `sword' of Ph.D. was hanging on my head. Now that I knew that Prof. Hofstadter was my external examiner (and it was also obvious that he was impressed by my work) I requested Bombay Univ. to have my viva-voce also at Stanford with Prof. Robert Hofstadter as my examiner. The University agreed to my request and informed Prof. Hofstadter accordingly. Prof. Hofstadter also agreed. It was now clear that I shall have my Ph.D. degree before I reach UCSD (though it was not a necessary requirement).

When I reached San Francisco ,on my way to Paolo Alto where Stanford University was located, I was most pleasantly surprised to meet Prof. Hofstadter who had come to receive me at the airport. What a unique and magnificent gesture on part of such a renowned scientist. I was indeed overwhelmed. Prof. Hofstadter drove me to Stanford and settled me in a room in their Guest House to refresh myself. In the evening he took me round the Campus, and on the way, discussed physics problems connected with my work. Next two

days were the conference days and he was busy in welcoming guests and taking care of them. However, he did find an evening for me to take me to dinner.

Indeed, Prof Hofstadter was an extremely pleasant and hospitable person. At the time of dinner I asked him about my Ph.D. viva. He smiled and said "Yashwant, you have done so much excellent work in such a short time. We do not expect so much from our students. I have already sent your Viva Report to Bombay University and recommended that you should be awarded the Ph.D. degree". I expressed my sincere gratitude to him. On the conference days I met several luminaries whose names I could pronounce with highest respect. One such person was Dr. C.N. Yang who shared his Nobel with Dr,T.D.Lee in 1957. I soon realized that all these great scientists are so humble and wonderful persons.

During the Stanford conference I met some Indian students who were working for their Ph.D. degree at UCSD. To name a few, I met Chindhu Warke and Ram Varma. They were surprised to see the UCSD tag on me. I told them my whole story and we became close friends .This friendship continues…They took care of me, a freshman in every respect, from the moment I landed at La Holla. It was the month of June 1963.

The next morning they took me to Mrs Maria Mayer, a very pleasant elderly lady. We discussed some problems, and she advised me to concentrate on some specific ones. Thus, I started my long cherished research work in theoretical nuclear physics with gusto. One fine morning, in October (1963) I was woken up by one of our friends, most likely Warke, who excitedly told me " Eh, Yeshwant, you are now working with a Nobel Laureate". "What?" I said, without realizing the full impact of what I had heard. Then he revealed that it was announced on the radio that Mrs Mayer was awarded the Nobel Prize in Physics for the year 1963. Even to hear those words of Warke was a thrilling experience! Mrs. Mayer had shared the Nobel prize with J.H.D. Jensen and Eugene Wigner, two other nuclear scientists (whom I subsequently met).

My office was next to Mrs Mayer's, on the fifth floor, and it was our daily habit to greet each other with `Good Morning', when she would pass by my office. I was curious to know if there would be any change that morning. But when I alighted from the elevator on the fifth floor it was hard for me to even go to my office. The whole pathway was full of journalists and photographers who wanted to take early pictures of Mrs. Mayer and also seek an interview with her, if possible. In that commotion I had difficulty in reaching my office. I waited for the celebrity Mrs Mayer to arrive. From the stampede outside my office door I could imagine the situation. When Mrs Mayer would arrive, It was her style of wishing me first by opening my office door. As soon as she opened the door I used to get up from my chair and wish her. I was curious to observe if we followed the same process today, because of the changed circumstances in the laurels of Mrs. Mayer. But that did not happen, and, as every morning there was the familiar knock on my office door, I got up instantly and congratulated my esteemed professor. She just said `thank you' and closed the door.

As soon as her office door closed I could hear many knocks on her door and heard the door opened. There was lot of commotion and I heard a knock on my door. I said "yes, please come in!". The door opened and a group of journalists entered and told me that `I was needed by Prof. Mayer'. Mrs Mayer told me `Yeshwant, these people want me tell them "how I thought of the earth shaking idea which has revolutionized nuclear science. I suggest that you ask me appropriate questions leading me to give them the essence of my fundamental idea!" It was not an easy task, but I agreed to do it. All the media people adjusted themselves appropriately for the recording and live transmission. After the session was over I received several calls from my friends and acquaintances all over the world that they were thrilled to see the `live coverage'. It was indeed an unforgettable experience for me.

In the afternoon I was summoned by Mrs. Mayer to assist her in sorting out the telegraphic messages sent by scientists and other dignitaries. She seemed anxious

to receive a telegram from John F. Kennedy, President of the United States of America. However, we had to wait for several hours to receive it. Among all the interesting messages there was one telegram which caught my attention. It read “I want to bit you!”. It was signed by something like `John'(?) or some such name (I have forgotten that!). I could realize that there was some personal joke involved and I gave that telegram to Mrs. Mayer. She had a good look at it and tried to decode it, but without success. In the meantime her husband, the famous Prof. Joseph Mayer walked in. Mrs. Mayer handed over the intriguing telegram to him and asked if he could decifer it. Prof. Joseph Mayer also had a close look at the telegram turned it round a few times and finally returned the telegram to Mrs. Mayer, who once again kept on looking at it for several minutes.

And suddenly, Mrs. Mayer burst into laughter. Yes, she had the telegram finally. “Can we share the joke madam?” I enquired. She laughed, looked at Joseph and said ” Joseph, this telegram is from Willard Libby. Do you remember the party he gave when he received the Nobel Prize for Chemistry? ” Now it was Joseph's turn to laugh. He said, “Oh yes, I remember”. “Can you please share it with me!“ I urged. “yes, it is worth telling you Yeshwant” Mrs Mayer said and narrated me the incident in detail, as follows: “You know, Willard Libby was awarded the Nobel Prize for Chemistry in 1960. All of us, his friends asked him to give a party. He organized such a party on his home lawn. Libby had a small pretty dog whose name was this John (or whatever). The dog was very much attached to his master. and floated around his master's legs. But somehow, by mistake, Libby's foot fell on the dog's tail, and so it bit him.

This stunned Libby who always thought that a dog will at most cry but not bite his master. This was Libby's conviction and so he was upset when the dog bit him. Libby was so much upset that he put the serving tray in his hand down and just sat in a chair, completely non-communicative. Every one tried to cheer him up, saying things like `after all, dog is an animal, and animals are sometimes unpredictable' and things like that. However, none of these consolations had any effect on Libby. Then I got up and whispered in Libby's ear, “ You know Libby, the little fellow did not bite his master, but he has bitten someone who got Nobel Prize”. This cheered him up and he once again became his normal-self. Now he wants that dog to bite me for the same reason”. Indeed, this was most amusing.

In this span of about five/six months I had already worked out two research papers ready for publication. Mrs. Mayer was always appreciative of my works and encouraged me to take up more challenging problems. She kept me on toes all the time and kept on suggesting more and more challenging problems. Because of her constant appreciation I kept on working hard. By the end of the year, my position was changed from Research Associate to Assistant Research Physicist. In fact I was overwhelmed when she asked me if I would like to take up permanent position in a US university and consequently settle down. She also, in fact, indicated if I liked the La Jolla ambience. This was the time when I had to express what was always in my mind. I told her that “ I had the best academic environment here. I am learning a lot from discussions and suggestions with scientists such as Prof. Walter Kohn (who was awarded the Nobel Prize in Chemistry in 1998, though he was basically a physicist), Prof. Harold Urey (who had already won the Nobel Prize in chemistry, as early as in the year 1934, for isotope separation works), Prof. Carl Eckart (the genius who developed lot of mathematical frame work related to angular momentum algebra),and others. However, when I planned to spend a few years in USA to gain further knowledge I had decided to spend about two years on the west coast and about two years on the east coast, then return to India to teach our students there”. She was surprised to hear my thoughts. She said so and mentioned that `to get a position on the faculty at UCSD was not easy, and one would jump at the offer. However, knowing my thoughts and insistence she said “If you really wish to return to India after spending about four years in U.S then I would suggest that you go to the Indian Institute of Technology (IIT) at Kanpur”. I was puzzled to hear that, as I had never heard of existence of such an Institute, nor had heard

about Kanpur. I exposed my ignorance and enquired about IIT Kanpur `I have never heard of IIT Kanpur. What is so great about it?'

She told me " IITK was sponsored by a consortium of nine best U.S. institutions such as University of California, Stanford, MIT. CalTech, Carnegie Instituteof Technology, Harvard, Princeton, Purdue and Johns Hopkins. We collectively will make sure that it will be the Best academic institute in science and technology, in India." I was thrilled to hear this. I told her that "I shall keep this mind". Interestingly, after a few weeks I received a letter from Prof P.K.Kelkar, Director of IITK offering me a position (to which I had not formally applied). I replied to that letter mentioning that I would return to India after about two years. Then I approached Mrs Mayer and requested `If I do join IIT Kanpur, would you visit us?' After a few moments she replied "yes, I will". I felt very happy to hear this. We left the topic at that!

While at UCSD I had a good deal of interaction, on personal level, with the Kohn family. Walter used to take me home for a chat and coffee, and also played flute. On one occasion Prof. Freeman Dyson (who succeeded Einstein as Director of Institute of Advance Studies, Princeton, NJ) was visiting UCSD. Walter and Freeman were great friends. Walter also knew that Freeman was a good piano player. So they decided to have a good evening recital. I was a lucky witness for the occasion and I enjoyed the program (as well as the dinner that followed) very much. Mr & Mrs Kohn also used to take me with them for some other events, I recall Walter taking me to the famous Shakespeare play `Tempest' in which the famous British actor Richard Burton acted. It was very enjoyable.

There was one most unpleasant occasion I recall. Prof. Kohn had invited the famous scientist Edward Teller (nick-named `father of the hydrogen bomb'). I did not have any idea of the animosity Prof. Harold Urey had with Teller. I later came to know the origin of this animosity as a consequence of what happened during the Manhatten Project. When Teller finished his lecture Prof Kohn asked the audience if anyone had any question to ask or would like to make any remark. At this juncture Prof. Urey got up and blasted Teller in most hostile words. Everyone was stunned. Prof Kohn was embarrassed, and he stopped the discussion immediately.

The American Physical Society (APS) used to have two meetings every year, one at Washington D.C. and another in New York. I usually attended one of them, mostly D.C. meeting. On one occasion Prof Paul Dirac (who received Nobel in 1933) gave a lecture on `Quantum Mechanics'. During the lecture he made a sweeping statement "Schroedinger's quantum mechanics is wrong and should be scrapped from the textbooks; only Heisenberg Quantum Mechanics is right". I was shocked to hear such a statement coming from one of the founders of Quantum Mechanics. After his lecture I met Prof Dirac and argued with him. However, he convinced me that context (referring to reality in Nature) to which he was referring to was fine.

As the time of my two year period at UCSD was getting over I asked Mrs Mayer "I now wish to go to the east coast for two years. Where would you suggest I apply?", "I would still like you to consider continue here. But if you really want to adhere to your decision then I suggest that you go to MIT. There is no substitute for MIT". So I wrote to Prof Herman Feshbach, Chairman, Physics Dept, accordingly. I had already known about Prof. Feshbach from his two volume book on `Methods of Theoretical Physics', in collaboration with his colleague Prof. Philip Morse.

I was pleasantly surprised when, just in about two weeks' time I received a phone call from Prof. Feshbach offering me a research position. I had a feeling that he may have had discussion about me with Mrs Mayer. I informed Mrs Mayer about the MIT offer. She was very happy to know about it and asked me to write to Prof. Feshbach accepting the offer. At the same time she asked me to visit La Jolla after a few months when her student Arnold Sherwood would be completing his thesis, which I did.

At MIT I indeed had a wonderful time. I got a good colleague and friend, young Assistant Professor Carl Shakin. Carl was brilliant and our collaboration in nuclear research domain was very fruitful. Our

temperaments also matched and soon came up with one of the best research of the time. Our works on `unitary model approach to nuclear structure physics' hit headlines in the frontline international journals, Physical Review Letters and Physical Reviews. We felt very happy and decided to have a good discussion with Professor Victor Weisskopf, Institute Professor and the leading light of MIT. Every one called, as was the custom in all American academic institutions, Prof Weisskopf, fondly, `Vicky'. Prof Weisskopf was also the `Director-General' of CERN, Geneva laboratories. Vicky was very much impressed by our new approach and (probably to encourage us) remarked `You deserve a Nobel Prize for this work'. He also asked me to give a colloquium. As we already had the blessings of Prof Weisskopf I got the courage of giving the talk, my first colloquium ever, and that too in front of the MIT audience. The audience appreciated my lecture, and I was relieved.

My next `test' was when I was asked to give an `invited talk' at the international Conference in Gatlinburg (?), New Mexico (USA). I almost repeated the talk I had given at MIT. After the talk there were some questions from the audience which, I think, I handled pretty well. However, one ` raised finger' made me nervous. It was by the Nobel Laureate Hans Bethe. He asked me some pertinent question. I answered it to the best of my understanding. However, he was not convinced. Our discussion went on for a few minutes, but Bethe was not convinced. Suddenly, Prof. Weisskopf got up and clarified all arguments, which satisfied all of us. Let me tell you frankly, it was after Vicky's elaborate explanation that I understood what we had actually done. Something more about Weisskopf Family! Mrs Weisskopf was a great cook and enjoyed making a variety of delicious dishes of different countries. Whenever she made any Indian recipe, Vicky would take me home to taste it. It was always so tasty! Incidentally, Prof Weisskopf later invited me to CERN for few lecture-discussions and we spent about a week in Geneva.

Prof. Norman Dahl of Mechanical Engg. department at MIT was the `Program Leader' of the Kanpur Indo-American Program (KIAP). He called me for an informal meeting in his office. When I went to his office I found someone else also sitting with him. Prof. Dahl introduced me to Prof. P.K. Kelkar, IIT, Kanpur Director and I felt relaxed. We recalled each other's email messages. Prof Kelkar told all the future plans of the Institute and urged me to join in as early as possible. Prof Dahl then called Prof Feshbach and explained him the situation, and MIT's responsible sponsorship. Prof Feshbach allowed me to go to Kanpur even before completing my stipulated two years at MIT. I also told all the three about Mrs Mayer's promise of visiting IITK after I join. Everyone felt very happy and excited about it.

I joined IIT Kanpur in October 1966. Mrs. Mayer and Joseph Mayer kept their word and followed soon. They were in Kanpur for about two months. Mrs. Mayer started teaching the nuclear physics course assigned to me. Prof Kelkar also attended all her lectures. I also felt very happy to get the opportunity of meeting Sir C.V. Raman, the first Indian Nobel Prize winner (1930)) in Physics, almost soon after I joined IITK. Thus, I continued my aspirations of meeting Nobel Laureates afloat. In the year 1970 I was an invited `state guest' visitor at Weizmann Institute, Rehovoth, Israel, courtesy Professors Igal Talmi and Amos de Shalit. On one occasion we had a dinner with dignitaries such as Prime Minister, Defense minister Moshe Dayan, Chemistry Nobel Laureate of yester years Prof. I.I. Rabi, and others.

The last Nobel Laureate I met was Prof. Abdus Salam (Nobel in 1979) at International Centre of Theoretical Physics (ICTP), Trieste which I happened to visit four times. I had a good rapport with Prof. Salam whom I gave some assistance in formulating rules governing visits of young scientists from developing countries.

Obituary

Prof. R. M. Dharkar - an IAPT veteran

We have received with a big shock and grief, on December 8, the sad news of the sudden demise of Prof. R. M. Dharkar a senior respected member of our IAPT family, at his residence in Pune.

He was a veteran and our legacy to the times of Dr. D. P. Khandelwal. Prof. Dharkar devoted his life to IAPT and worked with zeal and zest for the voluntary exams, in those days when conducting exams and evaluation etc used to be a much more laborious task. He continued to provide encouragement in the Olympiad programmes actively and also worked as a leading member of our Finance Committee, providing a valuable guidance always. We all last saw him online in the EC and the other Meetings, about six months back. It is indeed a great loss to our Organization. Prof. Dharkar will continue to inspire us in times to come.

We offer our heartfelt condolences to the bereaved family, and pray for the eternal peace of the departed soul.

K N Joshipura
General Secretary IAPT

Prof. R. M. Dharkar - an Obituary

The passing away of Prof. R. M. Dharkar was sudden, shocking and saddening. For the past year he was an advisor to Prof Joshipura ji and me on many aspects of IAPT: NSE, Finance, the Constitution etc. His advice was, as ever, friendly, frank and forthright. I spoke with him around December first. Some IAPT colleagues spoke to him the very morning a few hours before he passed away. The news came to us a bolt from the blue. It was devastating.

My happiest memories with him was our visit to Padua, Italy in 1999 as leaders of the Indian team. It was India's second foray to the International Physics Olympiad. We all, students and myself, looked up to him with respect. He gave sage advice. The experimental test involved a torsional pendulum. The theory of this experiment was involved and interesting. It resonated with Landau's theory of second order phase transition since the energy profile had a double minima. I was excited. However the experiment involved a hands on knowledge of all kinds of things - bolts, screws, allen nuts etc. I was completely lost. It was Prof. Dharkar who explained it all to me. We had a great time visiting various places in Padua, eating Italian food and meeting leaders from other countries including Prof. Abdulla Sadiq from Pakistan.

I had the longest association with him, with me, as the National Coordinator of the Olympiad program and him, as the Chief Coordinator NSE. We had long discussions, differences and disagreements. He often stood his ground and protected the interests of the IAPT. What I noticed, and repeatedly, is that after an acrimonious session, he would put aside any bitterness. He would go out of his way to help me with some personal problem I had in spite of the fact that we had had an acrimonious session a few hours ago. He was magnanimous. There is an incident in the Mahabharata when the Yaksha asks Yudhistir, ``What is the most difficult thing?" The reply was ``To know when to stop". When Prof. Dharkar found that the task of NSE was demanding and age was catching up he took a back seat and groomed Prof .Ogalapurkar for the task. He knew when to step down.

Almost all of us have memories of him. He was a stalwart of our organization. He was pillar of strength to IAPT. In the past two years I have turned to him for advice and help many a time. Our deepest condolence to the family. Condolences also to many of you who knew him well and have lost a critic, counsellor and comrade. He gave his best to IAPT. We should strive to emulate him.

Vijay A Singh
President IAPT

Prof R. M. DHARKAR
A Tribute

M L Ogalapurkar
Ex-Chief Co-ordinator (Exams)
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December 8, 2020 at 2.40 p.m. Suddenly my cell phone indicated an incoming call; its screen displayed RMD ; habitually I said hello sir. The response was-I am Saurabh (grand son of Prof. Dharkar) speaking: ' Dadu ' has passed away, about two hours ago. I was stunned to listen to this shocking and tragic news.For a few minutes, I was in a sort of senseless state. Then I realized that now it becomes my painful duty to pass on this sad news to IAPT colleagues. I immediately posted it on whatsup group and telephoned a number of senior members.

My association with Prof. Dharkar

I was introduced to Prof. Dharkar in 1995 when the 10th IAPT Convention was held in my college (Garware College, Pune). We came closer when I worked as an NSEP evaluator in Jan. 1998 and he entrusted more and more responsibilities to me. In 1999 I was made the paper setter of NSEP. The question paper was printed in Pune and dispatched to centres in my supervision. From 2002 to 2015 I worked as the NSEP Coordinator and Prof. Dharkar was the Chief Co-ordinator (Exams). With his guidance and support I could organize in my college, several activities for the students preparing for Olympiads, successfully.

On numerous occasions (I think, more than 20) we travelled together to different cities all over the country for IAPT meetings, conventions etc. During such tours, we shared the same room. In discharging my duties as NSE coordinator, sometimes I had to face adverse situations .But with the support of Prof. Dharkar, I could always successfully overcome such oddities. We used to talk on telephone very frequently – almost daily. Till 2008, Prof. Dharkar was staying in Thane and used to come to Pune every fortnight. After coming to his sister's house in Pune, he would put his suit case on the floor and before removing the shoes, would call me on telephone (mobiles were rare then). Once his sister, Nanda, said to him - why do you come to my house, better go to Ogalapurkar.

I would always cherish the memories of my long friendship with Prof Dharkar. While there were long sessions of joyful chit-chat, there were occasions when we disagreed and debated hotly - on rare occasions he got angry too.

Prof. Dharkar was a disciplined person – was particular in keeping correct timings at all occasions. He inherited this trait from his father who was a police inspector. His working as an NCC officer for some years in Wilson College where he was employed, helped him in that. A religious person, he spent about one hour in "dev-pooja" every day. Prof. Dharkar had a very sharp memory, phone numbers of many colleagues were on the tip of his tongue. Fond of reading Marathi books and English too, he had deep understanding of Sanskrit also.

Prof. Dharkar stayed and worked in Mumbai till 2008. After that his entire family shifted to Pune, because his son Sameer joined a new job in Pune. Clearly, he lived in a joint family consisting of wife Sarita, son Sameer, daughter- in- law Vaishali and grandson Saurabh.

Dharkar, the Physics Teacher

Prof.Dharkar studied for his B.Sc. and M.Sc. in Wilson

College, Mumbai. Then he worked as a lecturer in physics in the same college till his retirement. It is one of the oldest and prestigious colleges In Mumbai. He was a famous teacher, quite popular among the students. Almost every lecture of his was accompanied by some demonstration. He had deep interest in experimental physics and had an excellent practical hand. He had given a number of popular talks in different colleges. I remember his lecture " Do we live Physics ?" delivered to physics teachers at some programme in Garware college, Pune. It was well received and teachers were deeply impressed by this lecture.

Prof. Dharkar played important role in some activities of Bombay University College Teachers' Union. He was the founder and secretary of Mumbai University Physics Teachers' Association. For many years, he was a member of the Board of Studies in Physics of the Mumbai University. After his retirement in 1996, he worked as a post graduate visiting professor in Ruparel college, Mumbai for two years.

Contribution to IAPT

He joined IAPT in 1985 shortly after it was founded by Prof. D. P. Khandelwal. He became more dynamic in 1995 when the then general secretary Dr. P. H. Umadikar appointed him as the chief coordinator of IAPT examinations. In those days, financial status of our organization was not satisfactory. Sometimes Prof. Dharkar spared personal money for the exam work till the collection of exam fee. Since 1998, NSEP has been linked with the International Physics Olympiad and the prestige of this exam has increased considerably. In subsequent years, HBCSE introduced similar examinations in chemistry, biology, astronomy and junior science, in collaboration with IAPT. Prof. Dharkar played important role in starting the national level exams, NSEC, NSEB, NSEA and NSEJS and conduct them along with NSEP. He was instrumental in founding organizations of chemistry and biology teachers viz. ACT and ATBS. Due to continued efforts of Prof. Dharkar and his team, these NSEs reached to about 1500 centers with about 150000 students, all over the country. As the Chief Coordinator of IAPT exams, Prof. Dharkar had set up an excellent liaison with HBCSE which continues till this date.

For many years, NGPE (National Graduate Physics Examination) was handled by Prof. Dharkar. NGPE part C exam consisting of experimental component was organized in different cities in every part of the country. Prof. Dharkar identified about 150 IAPT members (including myself) and trained them for different examination tasks such as paper setting, local coordinators, observers, distribution officers of exam material etc.

In 1997 and 1998, IAPT conducted an ambitious programme" Operation Physics Through Experiments " . It was supported by MHRD. Prof. Dharkar had taken keen interest in implementing this programme at about 16 different centres.

Prof. Dharkar was a member of Finance Committee of IAPT for several years. He had thorough understanding of the financial status of the organization

Key person behind the Olympiad Programme

Prof. Dharkar is really the pioneer of the National Science Olympiad Programme. The history behind this is as follows -India was participating in International Mathematics Olympiad only, since 1989. Founder and president of IAPT, Prof. D.P.Khandelwal thought why do we not participate in Physics Olympiad ? In 1992 Prof. Khandelwal attempted to approach the Govt. of India with a draft plan of participating in International Physics Olympiad (IPhO). Unfortunately this dream of Prof. Khandelwal, could not be realized till his death in 1996. In 1997, IAPT secretary Dr.P.H.Umadikar sent a proposal to DAE regarding physics Olympiad. To discuss this proposal, a high level meeting was called on 12th March 1997. Dr. Umadikar requested Prof. Dharkar to attend this meeting as the representative of IAPT. It was chaired by Dr. R. Chidambaram, secretary of DAE and chairman of Atomic Energy Commission. IAPT proposal was accepted and NSEP is since regarded as the first level entrance test for the physics Olympiad programme. A National Steering Committee

(NSC) was set up as the apex body responsible for organizing the Olympiad programme. Dr. Arvind Kumar, Director of HBCSE, was accepted as the convener of NSC and Prof. Dharkar was a member of NSC for first 15 years as the nominee of IAPT.

Another ambitious programme of IAPT is the Asian Physics Olympiad (APhO). In 2005, NSC decided that it will look after only the international olympiads and not regional olympiads. Clearly, APhO could not be under the control of NSC. Prof. Dharkar confidently proposed that IAPT could take the responsibility of APhO. At this, NSC readily accepted and consented to the same. In the subsequent EC meeting of IAPT, APhO cell was set up. Dr. Ravi Bhattacharjee is the convener while myself and Prof. Dharkar are the members of this cell from 2005 till this date. In 2012,India hosted, the APhO in Delhi. It was a herculean task to organize such a prestigious international event. The APhO cell successfully managed the event.

Peaceful departure

Except for the hereditary defect in eye sight resulting from old age, Prof. Dharkar never suffered from any disease. He never had any sickness and did not require to take medicines. Before his last breath he did not have any pain whatever. Thus he had a calm and quiet death. This is very rare.

I had talked to him on 8th morning also, how would I know that I was talking to him for the last time.

By the sudden unexpected exit of Prof. Dharkar, I have lost a close friend, a sincere well wisher, an advisor and an elder brother too.

As a proper homage to the departed soul, let us resolve to continue the dedicated work of Prof. Dharkar to upgrade physics education in our country so that IAPT will flourish in the years to come.

Announcement

Call for Science Stage Show Videos

As a part of Prof. Khandelwal Centenary Programs of IAPT, entries from Individuals are invited.
One entry per person will be accepted. A formal inauguration of the program is planned by IAPT soon. The videos will be uploaded on IAPT website

SSS: Science Stage Show.

Prepare a video of your SSS
Time duration: 20 minutes
First Part: Title of Theme/Your name & Address, with mobile number & email ID.
Second part: A very brief profile about you.
Third part: The Video.

Send by e mail to
trananthan@yahoo.com

Ananthakrishnan
+91 9447243054
Convener, SSS Program-IAPT

NGPE – 2021

This is for all concerned to note that the **National Graduate Physics Examination 2021** shall be held on Sunday 24.01.2021 at 10:00 AM at the respective examination centres in the **offline mode** with pen and paper.

B. P. Tyagi
Chief Coordinator (Examinations)

Prof D P Khandelwal Birth Centenary Celebrations Committee
First meeting

IAPT has formed a Committee to plan for Prof D P Khandelwal Birth Centenary Celebrations. The first meeting of this Committee was held on Google meet platform on 6th December, 2020 at 7pm and continued on 8thDecember, 2020 at 7pm. Members present were, President Prof Vijay Singh (as the Chair), GS Prof K N Joshipura, Dr S C Samanta, (Convener), Prof T Ananthakrishnan, Prof S B Welankar, Prof Ravi Bhattacharjee, Prof Y K Vijay, Prof Rekha Ghorpade and Dr Sanjay Kr Sharma. President, Prof Singh initiated the meeting through his welcome address. The GS also made introductory comments on the birth centenary celebrations. The following decisions have been taken after considering the different proposals received by the DPK-BCC Committee.

1(a) The committee has accepted the proposal for writing a Biography of Dr Khandelwal. The following Implementation Committee (**IC1**) has been formed for this purpose.

Prof R N Kapoor, Dr. Madhuben Shah, Prof U S Kushwaha, Prof Vijay Singh, Prof A P Mehta, Prof B A Patki, Prof Y K Vijay (Coordinator), Prof. B K Shrivastava (Editor), Prof H D Bist, Mr Anil Khandelwal, Dr C K Ghosh, Dr B Chakraborti and Dr S C Samanta.

(b) Commemorative Volume: As in 1997, a Commemorative Volume of our Bulletin on DPK would be published.

(c) Collected Works of DPK: Review Books, Text Books, Articles etc authored by Prof Khandelwal and scattered in different journals, will be published as 'Collected Works'. The above committee (IC1) would also look after the publications in the above two items (b) and (c). Biography and Commemorative Volume would be published in the Bulletin of the year 2022. Collected Works would be uploaded in the website of IAPT. Printed volumes would be available only on demand.

(d) A 5- minute video would be prepared on the important events of the life and works of DPK. This video would be played in each centenary celebration programme. Prof R Ghorpade, Dr S K Sharma and Prof Y K Vijay would take the initiative to prepare it.

2(a)*i* Science Stage Shows (SSS) as a Centenary Celebration Activity: Each of at least 10 senior IAPT members, who have the experience of organising science demonstration activity and stage shows will be requested to prepare a 20-minute video on a science topic of his/ her choice for popularization of Physics/science. In this way a repository of these videos of physics/science Demos will be created and will be uploaded in the IAPT website. Any educational institution would be able to use these videos for attracting their students in the science fields. The SSS activity will be inaugurated during the online programme (see below) on the National Science Day, February 28, 2021.

(a)*ii* There will be a special programme on the National Science Day, February 28, 2021, as a part of the DPK birth centenary celebrations. In this activity senior IAPT members, who are known to organise/present science Demos, will be requested to deliver their experiment/Demo through a 20-25 minute presentation each either live/online or through their videos.

These two programmes 2*a(i)* and 2*a(ii)* will be managed and monitored by the Implementation Committee (**IC2**) consisting of: Prof. Ananthakrishnan (Coordinator), Prof. S B Welankar, Dr S C Samanta and Prof. K N Joshipura.

(a)*iii* To organize Popular Lectures on DPK's theme on *Physics and Physics Education*: This will be essentially

an RC level programme. Prof. Y K Vijay is requested to illustrate and enlist the themes of lectures. Along with him, Prof. Arun Kulkarni, Prof. Rekha Ghorpade and Prof. Arundhati Mishra will motivate the RCs in this regard.

The meeting was adjourned for the day, and was held again at 7pm on December 8. Unfortunately on 8th December Prof RM Dharkar, a stalwart in our IAPT family, breathed his last. With Prof. Joshipura in the Chair, in absence of Prof. Vijay Singh, the meeting began with a 1-minute silence as homage to him. Thereafter, the following decisions were taken.

2(b)*i* A national level survey work will be conducted to understand the exact status of lab based physics education at the +2 and the UG levels in the country .

(b)*ii* We will plan to organize an online competition on physics experiments for +2 students: This also is essentially an RC level activity, and the RC-15 is conducting it right now: it would be extended to all the RCs. To execute both the programmes2b(*i*) and b(*ii*), a committee (**IC3**) has been formed with members as follows: Prof B P Tyagi, Dr Himanshu Kr Pandey, Prof Rekha Ghorpade, Prof B K Naidu, Prof P V Ramani, Dr. Swapan K Majumdar, Prof Mita Chowdhury, Dr Kishore C Dash, Prof H C Verma, Prof. J D Dubey, Dr M Gulati, Prof S B Welankar, Dr B Chakraborti, Dr Saswati Dasgupta, Dr R Chattopadhyay, Dr P Panchadhyayee, Dr S M Hossain, Dr S K Sharma, Dr Arundhati Misra, Sri Puspendu Ponda and Dr S C Samanta (Coordinator).Afterwards, different subcommittees would be formed out of the main committee.

(b)*iii* We will approach the (Ministry of education) Union Government for conducting a similar survey work through the Government channels, as it is consistent with NEP 2020, a proposal for "National Survey Work: Enhancement of Lab Education" may be submitted. Prof Ravi Bhattacharjee is requested to pursue the Government after preparing a questionnaire along with Dr M Gulati. If needed, a committee may be formed after inducting other members, with Prof. Bhattacharjee as the coordinator.

3 The DPK-BCC Committee has not accepted, on financial grounds, the proposal of Dr V Ghughe, NisargaVidnyan Mandal, Nagpur, for setting up of a study centre on Astronomy and Atmospheric physics, and a museum on toys in their Chandrapura land at the outskirts of Nagpur. Any such proposal may first be discussed with RC-8 Maharashtra.

4(a) Committee has accepted the two RC-15 proposals: (i) for conducting online competition on physics practicals for +2 students and (ii) the production of a documentary on IAPT - Midnapore College Centre for Scientific Culture; the RC would provide the required fund.

(b) The Committee has resolved that a similar documentary should be produced for Anveshikas also. Dr Samanta has been entrusted to contact Prof. H C Verma in this regard.

5 The Committee has proposed for an award to one RC every year, for undertaking quality activities and publish the report in the Bulletin.

6*i* As mentioned by Prof Ravi Bhattacharjee, the APhO 2022, to be hosted by India, will be dedicated to the memory of Dr D P Khandelwal. Other academic programmes as planned above will continue till early 2022.

(*ii*) The DPK-BCC Committee has resolved that if necessary then it can suitably extend any implementation committee/sub-committee, as created above.

As there was no other agenda to discuss, the DPK-BCC Committee meeting ended with thanks to the chair.

Subhash Chandra Samanta

Convener

PEE KAY JAIPURIA & CO.
CHARTERED ACCOUNTANTS
Acharya Kuti, 1st Floor, 26/53, Birhana Road, Kanpur – 208 001
Telephone: (0512) 2315178, email: peekayjaipuria_co@rediffmail.com

FORM NO. 10 – B (See Rule 17 – B)

AUDIT REPORT UNDER SECTION 12A(B) OF THE INCOME TAX ACT – 1961 IN THE CASE OF CHARITABLE OR RELIGIOUS TRUST OR INSTITUTIONS

We have examined the Balance Sheet of INDIAN ASSOCIATION OF PHYSICS TEACHERS, KANPUR as at 31st March, 2020 and the Income and Expenditure Account for the year ended on that date, which are in agreement with the books of accounts maintained by the said trust or institution.

We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of the audit. In our opinion, proper books of accounts have been kept by the Head Office and the Branches/Regional Councils /Sub Regional Councils of the above named trust/institution so far as appears from our examination of the books and proper returns adequate for the purposes of Audit have been received from Branches not visited by us, subject to the comments/notes given below: -

as per "Annexure AR –10B"

A) That the accounts as shown under the heads "Advances due from" and under the head "Balances with Regional councils/ Centers / Offices" in the Balance Sheet are being operated by the In-charge and/or the authorized signatories of Respective Regional Councils/ Centers / Offices and same represents the total outstanding Balances due from the respective Regional Councils / Centers / Offices. The aforesaid due outstanding Balances includes Cash on Hand, Advances, etc and may also include Bank Balances, if any, being maintained by them which are stated to be in the name of trust or institution as well as may be in the name of the in charge/authorized signatory for the purpose of the institution.

B) That the following periods accounts and/or utilizations of grants have been incorporated by us which have been audited by other chartered Accountants and received by the head office during the year:-

1. *Regional Council-04 Uttar Pradesh* for 2019-20 which have been audited by Sharad Nigam & Co., Chartered Accountants, Kanpur, Uttar Pradesh.
2. Regional Council-12 Karnataka for period 2019-20 which have been signed by R.P. Bijaspur & Co. Chartered Accountant, Kalaburagi, Karnataka.
3. Regional Council-15 West Bengal for the period 2019-20 which have been audited by N. Saha & Associates Chartered Accountants, Hooghly ,West Bengal.
4. Regional Council-18 Tripura, for the period 2019-20 which have been audited by Saikat Datta & Associates , Chartered Accountants, Agartala, Tripura.
5. Regional Council-19 Bihar, for the period 2019-20 which have been audited by Ankit Dokania & Co., Chartered Accountant, Munger, Bihar.
6. *Regional Council-20 - Jharkhand* for the period 2019-20 which have been Audited by Goenka Patodia & Co. Chartered Accountant ,Ranchi, Jharkhand .
7. Regional Council-22 Telangana for the period 2019-20 which have been audited by Pasunuri Raghuveer Chartered Accountants, Hanamkonda, Telangana.

C) That the following periods accounts and/or utilizations of grants have been incorporated by us which have been signed (without any report thereon) by other Chartered Accountants and received by the head office during the year:-

1. Regional Council-01 Delhi & Haryana for 2019-20 which have been signed by Jiwan Singh Mehta & Associates , Chartered Accountants, Ghaziabad Uttar Pradesh.
2. Regional Council-02 Punjab & Jammu Kashmir for 2019-20 which have been signed by Gupta Rajnesh Kumar & Co. Chartered Accountants, Ludhiana, Punjab.
3. Regional Council-03 Chandigarh & Himachal Pradesh for 2019-20 which have been signed by A. Kumar Verma & Co. Chartered Accountants, Chandigarh.
4. Regional Council-05 Uttarakhand for 2019-20 which have been signed by Saurabh Kishan & Co. Chartered Accountant, Dehradun Uttarakhand.
5. Regional Council-06 Rajasthan for 2019-20 which have been signed by Ajay Kumar Vijay Vergia & Associate, Chartered Accountants, Jaipur , Rajasthan.
6. Regional Council- 08 Maharashtra for period 2019-20 which have been signed by Sushant Phadnis & Co. , Chartered Accountants, Shahupuri Kolhapur, Maharashtra.

7. Sub Regional council-08 C Pune for 2019-20 which have been audited by M.G. Kuldudharan Certified Auditor , Pune Maharashtra.
8. Sub Regional Council-08 D Kolhapur & Sangli for 2019-20 which have been signed by Amol Madiwal & Associates. Chartered Accountants ,Kolhapur , Maharahtra.
9. Regional Council-09 Madhya Pradesh for period 2019-20 which have been signed by Swapnil Jain & Co. Chartered Accountants, Indore, Madhya Pradesh.
10. Sub Regional Council-12 A Bangalore for period 2019-20 which have been signed by M.C.Shekar & Co. Chartered Accountants , Bangalore, Karnataka.
11. Regional Council-16 Odisa for period 2019-20 which have been signed by Chinmay Nanda & Associates , Bhubaneswar, Odisha.

D) That the accounts and/or receipt and payment in respect of following branches have been incorporated by us which are un audited and taken from the statements submitted by the respective in-charge and received by the head office during the year:-
   1. Chandigarh, Branch
   2. Bangalore , Branch
   3. Nagpur ,Branch
   4. Pune ,Branch
   5. Dehradun, Branch
   6. Anveshika Kanpur, Centre
   7. IAPT-Nani , Centre

E) That like earlier year grant received, if any , from any Government Departments to the extent they were utilized during the period have been shown in the Income & Expenditure Account and Expenditure incurred against receivable grant has been carried forward for adjustment there of on receipt of grant.

F) That as the income of the respective Endowment Fund and/or Corpus Fund is to be utilized for the purpose specified by the respective fund's/Corpus creators, hence to the extent the received income is utilized the same has been shown as contribution from respective Funds/ Corpus. The income and expenditure account and balance utilized during the year under review have been disclosed in the Balance Sheet only.

G) Interest earned on investment made for Endowment Fund created under the name and style as DD Pant, Sultan Chand Trust, Omega Trust, Murli Laj Chugani is being accounted for on receipt basis. Utilization thereof for the purpose mentioned by the creators thereof and sundry expenses incurred if any there for are being accounted for on actual payment basis.

H) Interest earned on investment made for corpus Fund created under the name and style as ISRO, INFOSYS, PRL, DAE, Students Education Edu, Dinabandhu Sahu Memorial, Pragaami Tarang Gujarati Publication, Shilpa Nandkumar & Midnapur College CSC D.P Khandelwal is being accounted for on receipt basis. Utilization thereof for the purpose mentioned by the creators thereof and sundry expenses incurred if any there for are being accounted for on actual payment basis.

Subject to above,

And also non incorporation of receipt and / or application of fund received/ applied Regional Councils for Financial Year 2019-20 in respect Regional Regional Council-7 Gujarat, Sub Regional Council-08 B Mumbai, Regional Council – 10 Chhattisgarh, Regional Council-11 Andhra Pradesh, Regional Council-13 Tamil Nadu , Regional Council-14 Kerala , Regional Council-17 Assam & Regional Council-21 Goa.

In our opinion and to the best of our information, and according to information given to us, the said accounts subject to above give a true and fair view :

I. In the case of Balance Sheet of the State of affairs of the above named Trust Institution as at 31st March, 2020 and

II. In the case of Income and Expenditure account of the excess of Income over Expenditure of the trust/society/institution for the accounting year ended on 31/03/2020

The prescribed particulars are annexed hereto.

For PEE KAY JAIPURIA & CO.
CHARTERED ACCOUNTANTS
Firm Registration No. 001335C

RADHA KANODIA
PARTNER
M.No.073806
Place : Kanpur
Date : 23.Dec-2020

Working Note Annexed to Annexure to from 10 (B) for the year ended 31st March, 2020 In the Matter of Indian Association of Physics Teachers

Gross Receipt			31314965	
Less Grant Received & Utilized			1009680	
Balance Net Receipts			30305285	
Less: 15% of Net Receipts			4545793	
To be Utillised				25759492
Total Application		10393287	20907032	
Less Depriciation	97450	-244092		
Less Fixed Asset W/o				
Less Grant Exp.	1009680		1107130	
Revenue Application			19799902	
Capital Application for Purchase of fixed asset	206593		206593	
	206593			
Total application for Current Year				20006495
Capital Application Flat Kanpur				
(+) Short Utilization / (-) Utilization in respect of earlier year				5752997

BALANCES WITH REGIONAL COUNCIL / CENTRE / OFFICE

Regional Council-01 Delhi Haryana	80767.00
Regional Council-02 Punjab, Jammu & Kashmir	2277.00
Regional Council-03 Chandigarh & H.P	38109.00
Regional Council-04 Uttar Pradesh	38373.00
Regional Council-05 Uttarakhand	24090.00
Regional Council-06 Rajasthan	96997.00
Regional Council-07 Gujrat	106928.00
Regional Council-08 Maharastra	11095.50
Sub regional Council-08 B Mumbai	47696.00
Sub Regional Council-08 C Pune	33399.00
Sub Regional Council-08 D Kolhapur Sangli	6374.50
Regional Council-09 Madhya Pradesh	68371.00
Regional Council-10 Chattisgarh	44473.53
Regional Council-11 Andhra Pradesh	54093.00
Regional Council-12 Karnataka	2180.56
Sub Regional Council-12 A Bangalore	28557.60
Regional council-13 Tamil Nadu	125838.15
Regional Council-14 Kerala	38601.00
Regional Council-15 West Bengal	220275.00
Regional Council-16 Orissa	21821.40
Regional Council-17 Assam	40493.00
Regional Council-18 Tripura	57473.00
Regional council-19 Bihar	1183.00
Regional Council-20 Jharkhand	23776.50
Regional Council-21 Goa	337840.36
Regional Council-22, Telangana	42113.24
Bangalore Office	423803.50
Chandigarh Office	48258.95
Dehradun Office	5270360.72
Speed Post Office, Nagpur	105681.00
Nagpur Office	822176.00
Pune office	201982.46
NANI-IAPT Kanpur	64652.52
Anveshika Kanpur	10393.64
	8540505.13

INDIAN ASSOCIATION OF PHYSICS TEACHERS, KANPUR

Statement of Fixed Assets as at 31st March-2020

FIXED ASSETS Schedule "A"

Particulars	Rate	WDV as on 01-04-2019	Addition		Deduction	Total	Depreciation of the Year	WDV as on 31-03-2020
			More than 180 days	Less than 180 days				
		Rs	Rs	Rs	Rs	Rs	Rs	Rs
COMPUTER (KANPUR)	40%	23162.14	44400.00		-	67562.14	27025.00	40537.14
FURNITURE (KANPUR)	10%	155486.58	45850.00		-	201336.58	20134.00	181202.58
ELECTRIC ITEM (KANPUR)	15%	7550.72	9794.00		-	17344.72	2602.00	14742.72
MOBILE KANPUR	15%	10626.53			-	10626.53	1594.00	9032.53
FURNITURE (DEHRADUN)	10%	2735.79	3100	9500	-	15335.79	1059.00	14276.79
PRINTER (DEHRADUN)	40%	1254.88			-	1254.88	502.00	752.88
COMPUTER (DEHRADUN)	40%	23507.64	37000.00		-	60507.64	24203.00	36304.64
COMPUTER (CHANDIGARH)	40%	221.17			-	221.17	88.00	133.17
FURNITURE (CHANDIGARH)	10%	8107.14			-	8107.14	811.00	7296.14
FURNITURE (RC-17)	10%	6791.81				6791.81	679.00	6112.81
PRINTER (BANGALORE)	40%	50.00				50.00	20.00	30.00
COMPUTER (BANGALORE)	40%	6189.22				6189.22	2476.00	3713.22
FURNITURE (BANGALORE)	10%	41480.28				41480.28	4148.00	37332.28
PRINTER (NAGPUR)	40%	5313.60				5313.60	2125.00	3188.60
FURNITURE (NAGPUR)	10%	7006.50				7006.50	701.00	6305.50
MOBILE (NAGPUR)	15%	4942.00				4942.00	741.00	4201.00
MOBILE (DEHRADUN)	15%		56949.00			56949.00	8542.00	48407.00
TOTAL		**304426.00**	**197093.00**	**9500.00**	**0.00**	**511019.00**	**97450.00**	**413569.00**

INDIAN ASSOCIATION OF PHYSICS TEACHERS,KANPUR

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH-2020

EXPENDITURE	AMOUNT	INCOME		AMOUNT
Stationery, Conveyance,Postage		**SUBSCRIPTION,DONATION,**		
Telephone, Remuneration,Misc Exp.		Annual Member Ship	2000.00	
Computer Maintenance,Office Rent		Student Membership	1000.00	
Legal Exp, Audit Fee			0.00	
Electric Bill, Bank Charges	543781.00		0.00	**3000.00**
Depriciation	97450.00			
Bulletin Publication & Distribution		**Bulletin Receipt**		
		Advertisment	1999.64	
Printing , Postage,Telephone		Library Subscription	9050.00	
Address Pasting,Remuniration		Contribution from ISRO Corpus Fund	70000.00	
Software Maintenance,Misc.	1996075.00	Contribution from DAE Corpus Fund	48000.00	
		Contribution from Infosys Corpus Fund	6000.00	
		Contribution from PRL Corpus Fund	3000.00	**138049.64**
		INTEREST		
		On Saving Bank Account	219309.00	
		On Fixed Deposited	1324178.00	**1543487.00**
ELCB Opening Stock of Books	87170.81	ELCB Receipt From Members	271994.00	
Books Purchase, Postage,Freight	244336.00	Books in Stock	109487.70	**381481.70**
NGPE- Exp.-2019	404420.98	**NGPE -2020**		
		Fee	1391330.00	
		Contribution From Omega Endow Fund	4000.00	
		Sale of Raddi	2170.00	
		Old Q Paper	2466.00	**1399966.00**
National Standared Exam EXP. 2019 - 2020	11513691.40	**National Standared Exam**		
		Fee Received	24247598.00	
		Contribution from Murli Laj Chugani Fund	18000.00	
		Contribution from Sultan Chand Fund	5000.00	
		Q Paper Sale	60380.00	**24330978.00**
IAPT National Student Symposium	283996.00	IAPT National Student Symposium		89400.00
National Anveshika Network of India	538823.59			
E C Meeting Exp.	589297.00			
NCIEP Award & TA-EXP.	34873.00			
Essey Competion -EXP.	31492.00			
NCIECP	43719.00			
Paper & Postar TA Exp.	153549.00	Receipt From IIIT Allahabad		155334.00
Convention Allahabad Exp.	706420.00	Convention Receipt		606420.00
Anveshika Kanpur Exp.	251994.36	Anveshika Kanpur Income		55195.00

EXPENDITURE		AMOUNT	INCOME	AMOUNT
Kendriya Vidyalaya Workshop	2055775.00			
Less Exp. Against receivable Fund	**517761.00**	**1538014.00**	Kendriya Vidyalaya Workshop	1239680.00
Vigyan Prasar Workshop Exp.	555780.00			
Less Exp. against receivable Fund	**355780.00**	**200000.00**	Vigyan Prasar Workshop	200000.00
Regional Council-01 Delhi & Haryana		22710.00	Regional Council-01 Delhi & Haryana	9947.00
Regional Council-02 Punjab & J K		41958.00	Regional Council-02 Punjab & J K	869.00
Regional Council-03 Chandigarh,HP		0.00	Regional Council-03 Chandigarh,H P	1278.00
Regional Council-04 Uttar Pradesh		1500.00	Regional Council-04 Uttar Pradesh	952.00
Regional Council-05 Uttarakhand		17718.00	Regional Council-05 Uttarakhand	827.00
Regional Council-06 Rajasthan		831251.00	Regional Council-06 Rajasthan	831610.00
Regional Council-08 Maharastra		75792.00	Regional Council -08 Maharastra	22164.00
Regional Council Sub -08 C Pune		0.00	Sub Regional Counclil-08 C Pune	1096.00
Regional Council Sub-8 D Kplhapur/ Sangli		200.00	Regional Council Sub-8 D Kplhapur/ Sangli	254.00
Regional Council-09 Madhya Pradesh		72000.00	Sub Regional Council -09 Madhya Pradesh	1402.00
Regional Council-12 Karnataka		30000.00	Regional Council-12 Karnataka	281.26
Regional Council-12 A Bangalore		67015.00	Regional Council-12 A Bangalore	930.16
Regional Council-15 West Bengal		287885.00	Regional Council-15 West Bengal	249053.00
Regional Council-16 Orissa		54313.00	Regional Council-16 Orissa	38678.00
		0.00		0.00
Regional Council-18 Tripura		500.00	Regional Council-18 Tripura	11334.00
Regional Council-19 Bihar		30217.00	Regional Council-19 Bihar	123.00
Regional Council-20 Jharkhand		11219.00	Regional Council-20 Jharkhand	1175.00
Regional Council-22 Telangana		103651.36	Regional Council-22 Telangana	0.00
Excess of Income over Expenditure Transferred to Balance Sheet		**10407932.26**		
Total Rs.		**31314964.76**		**31314964.76**

Significant Accounting Policies are as per Annexure "AP"
AUDITORS REPORT
In Terms of our Report of Even Data Attached Herewith
For PEE KEY JAIPURIA & CO
CHARTERED ACCOUNTANTS
Firm Registration No. :001335C

Sd	Sd	Sd	Sd
PARTNER : Radha Kanodia	**President**	**Secretary**	**Treasurer**

M No. 073806
Place : Kanpur
Date 23.12.2020

INDIAN ASSOCIATION OF PHYSICS TEACHERS

BALANCE SHEET AS AT 31ST MARCH-2020

LIABILITIES			AMOUNT	ASSETS	AMOUNT
CAPITAL FUND				**FIXED ASSETS**	413569.00
				Project Expenses to Nivim Nagpur	750000.00
[A] IAPT Life Members Fund				**INVENTORIES**	
As per Last Balance Sheet	5758227.00			ELCB [STOCK OF BOOKS]	109487.70
Add: Recd. During the Year	423000.00	6181227.00		SECURITY DEPOSITED	3000.00
				Univ. of Kota Under RC-06 Rajasthan	6300.00
[B] GENERAL FUND				IAPT MEMBERS FUND CASH/ BANK	6263618.50
As per Last Balance Sheet	23576358.96			**FLAT KANPUR**	**4557500.00**
Add.Excess of Income over Expenditure	10407932.26	33984291.22	**40165518.22**	**CASH /BANK BALANCE**	17749226.69
				Tax deduted at soure	501312.00
				Amount Adjusted Against Demand	268130.00
				Accrued Intt. Central Bank of India, Dehradun	166413.00
				Accrued Intt. Allahabad Bank Kakadeo, Kanpur	39311.00
				Accrued Intt. Allahabad Bank , Dehradun	149237.00
IAPT Building Fund as Per Contra			730068.50	IAPT Building Fund As Per Contra	727037.50
Advance:- Due To			771184.10	**ADVANCE DUE FROM**	630255.30
Audit Fee Regional Council-19 Bihar			1000.00	**BALANCE WITH REGIONAL COUNCIL/CENTRE /OFFICE**	8540505.13
Audit fee Sub Regional Council-08 D Kolhapur			200.00		
Allied Printer Dehradun			138.00	**Kendiriya Vidyalaya Workshop Due**	517761.00
Schamatics Minining P Ltd Dehradun			10267.00	**Vigyan Prasar Workshop Due**	355780.00
TDS Payable			32648.00		
ENDOWMENT FUND AS PER CONTRA				**ENDOWMENT FUND AS PER CONTRA**	
IAPT - DD PANT ENDOWMENT FUND			151733.60	IAPT-DD PANT FUND	150789.60
IAPT-SULTAN CHAND TRUST FUND			44440.00	IAPT-SULTAN CHAND FUND	44281.00
IAPT-OMEGA TRUST FUND			33726.00	IAPT-OMEGA TRUST ENDOWMENT FUND	33582.00
IAPT-MURLI LAJ CHUGANI FUND			132614.25	IAPT-MURLI LAJ CHUGANI ENDOWMENT FUND	132081.25
CORPUS FUND AS PER CONTRA				**CORPUS FUND AS PER CONTRA**	
IAPT- ISRO CORPUS FUND			1042579.00	IAPT-ISRO CORPUS FUND	1035855.00
IAPT-INFOSYS CORPUS FUND			105187.00	IAPT-INFOSYS CORPUS FUND	104514.00
IAPT-PRL CORPUS FUND			26389.00	IAPT-PRL CORPUS FUND	26101.00
IAPT- DAE CORPUS FUND			526099.00	IAPT- DAE CORPUS FUND	522333.00
IAPT-STUDENTS EDU. DEVELOPMENT CORPUS FUND			51864.00	IAPT-STUDENTS EDU CORPUS FUND	51660.00
IAPT- DENABANDHU SAHU MEMORIAL AWARD CORPUS FUND			493007.00	IAPT- DENABANDHU SAHU MEMORIAL AWARD CORPUS FUND	498696.00
IAPT- PRAGAANI TARANG GUJARATI PUB CORPUS FUND			1124746.00	IAPT- PRAGAANI TARANG GUJARATI PUB CORPUS FUND	1118747.00
IAPT-SHILPA NAND KUMAR CORPUS FUND			640005.00	IAPT-SHILPA NAND KUMAR CORPUS FUND	627392.00
IAPT- MIDNAPORE COLLEGE CSC D.P KHANDELWAL FUND			1830271.00	IAPT- MIDNAPORE COLLEGE CSC D.P KHANDELWAL FUND	1819209.00
TOTAL Rs.			**47913684.67**	**TOTAL Rs.**	**47913684.67**

Significant Accounting Policies are as per Annexure"AP"

AUDITORS REPORT

In Terms of our Report of Even Data Attached Herewith

For PEE KAY JAIPURIA & Co

CHARTERED ACCOUNTANT

PARTNER: Radha Kanodia — **Sd** — **President**

M No.: 073806 — **Sd.** — **Secretary** — **Sd** — **Treasurer**

Place : kanpur

Date 23 Decamber -2020

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