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An inspirational sight, these giant dish antennas of the Karl G. Jansky Very Large Array (VLA) rise above the New Mexico desert at moonset. Mounted on piers but transportable on railroad tracks to change the VLA's configuration, its 27 operating antennas are each house-sized (25 meters across) and can be organized into an array spanning the size of a city (35 km). A prolific radio astronomy workhorse, the VLA has been used to discover water on planet Mercury, radio-bright coronae around stars, micro-quasars in our Galaxy, gravitationally-induced Einstein rings around distant galaxies, and radio counterparts to cosmologically distant gamma-ray bursts. Its vast size has allowed astronomers to study the details of radio galaxies, super-fast cosmic jets, and map the centre of our own Milky Way. Now 40 years since its dedication the VLA has been used in more than 14,000 observing projects and contributed to more than 500 Ph.D. dissertations. On October 10, the National Radio Astronomy Observatory will host a day-long online celebration of the VLA at 40 featuring virtual tours and presentations on the history, operations, science, and future of the Very Large Array. https://apod.nasa.gov/apod/ap201009.html

PHYSICS NEWS

Time crystals lead researchers to future computational work

Producing Time crystals sound like something out of science fiction, but they may be the next major leap in quantum network research. A team based in Japan has proposed a method to use time crystals to simulate massive networks with very little computing power. Normal crystals, such as diamonds or salt, repeat their atomic self-organization in space, but do not show any regularity in time. Time crystals self-organize and repeat their patterns in time, meaning their structure changes periodically as time progresses. Paper author Kae Nemoto, professor in the principles of informatics research division at the National Institute of Informatics and her team specifically examined how the quantum nature of time crystals - how they shift from moment to moment in a predictable, repeating pattern - can be used to simulate large, specialized networks, such as communication systems or artificial intelligence.

Read more at : https://phys.org/news/2020-10-crystals-future.html

Original paper : *Science Advances (2020).* DOI: 10.1126/sciadv.aay8892

Pump down the volume: Study finds noise-cancelling formula

Noisy, open-plan offices full of workers hunched over desks while wearing noise canceling headphones could soon be a thing of the past, thanks to new research from The Australian National University (ANU). The ANU researchers have developed a new formula to show how effective noise cancelation technology can be in different spaces. Lead researcher Dr. Aimee Zhang says the ultimate goal is to achieve a noise-free environment without the use of headphones. "Our formula allows us to calculate the best level of cancelation we can achieve in a certain area - for example, an office with a basic desk set-up, windows and doors," Dr. Zhang said.

Read more at : https://phys.org/news/2020-10-volume-noise-cancelling-formula.html

Original paper: *The Journal of the Acoustical Society of America (2020).* DOI: 10.1121/10.0001938

This white paint keeps surfaces cooler than surroundings, even under direct sunlight

Scientists have developed a white paint that cools below the temperature of its ambient surroundings even under direct sunlight. Their research demonstrates a radiative cooling technology that could be used in commercial paints, that could be less expensive to manufacture, and that passively reflects 95.5% of sunlight that reaches its surface back into outer space. In contrast, commercial "heat rejecting paints" currently on the market only reflect 80%-90% of solar irradiation and cannot achieve below-ambient temperatures. During the summer months and in regions with warm climates, most buildings rely on conventional air conditioning systems to transfer heat from the inside environment to the outdoors. These systems require energy, emit excess heat that transforms cities into "heat islands," and contribute to the climate crisis. But while scientists have sought to develop radiative cooling paints since the 1970s, previously developed paints have not been capable of reflecting enough sunlight to function as viable, commercializable alternatives to traditional air conditioners.

Read more at : https://phys.org/news/2020-10-white-surfaces-cooler-sunlight.html

Original paper: Cell Reports Physical Science. DOI: 10.1016/j.xcrp.2020.100221

Researchers are working on tech so machines can thermally 'breathe'

In the era of electric cars, machine learning and ultra-efficient vehicles for space travel, computers and hardware are operating faster and more efficiently. But this increase in power comes with a trade-off: They get superhot. To counter this, University of Central Florida researchers are developing a way for large machines to "breathe" in and out cooling blasts of water to keep their systems from overheating. The process is much like how humans and some animals breath in air to cool their bodies down, except in this case, the machines would be breathing in cool blasts of water, says Khan Rabbi, a doctoral candidate in UCF's Department of Mechanical and Aerospace Engineering and lead author of the study.

Read more at : https://phys.org/news/2020-10-tech-machines-thermally.html

Original paper: Physical Review Fluids (2020). DOI: 10.1103/PhysRevFluids.5.094003

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Editorial

Remembering Prof D P Khandelwal in Birth Centenary Year

Oct. 1, 2020 marked the beginning of Birth Centenary Year of Prof D P Khandelwal. RC-15 & CSC Midnapore have done well by holding a Curtain Raiser Programme on this day in which several senior members of IAPT participated online. A report of the same is carried in this issue.

CSC Midnapore is the dream child of Prof. Khandelwal. He wanted to start such centers at 3 places, but only Midnapore centre could fructify, thanks to the zeal of IAPT enthusiasts there - Prof. Samanta and colleagues.

Physics laboratory was very dear to Prof. Khandelwal. In mid seventies, the Physics Department of Panjab University was granted a project , COSIP (College Science Improvement Programme) by UGC. In fact, 13 such projects were given to physics departments of various universities all over India. A similar number was given in other science subjects too. In this project we were supposed to revamp the physics syllabi of undergraduate classes, run refresher courses and workshops, develop new experiments and write text books. We invited Prof. Khandelwal for one workshop. He stayed for two days with us and spent almost the whole time in laboratory, examining and discussing what we were doing. Needless to say we were immensely benefitted.

An incident which I recall relates to my student days. I did my post graduation from Agra College, Agra, where Prof Khandelwal had joined the faculty only a few years ago. He taught us a theory paper and was also in our lab to guide us in our optics and spectroscopy experiments. The young Khandelwal was not satisfied with this only. He spent a lot of time in performing and studying other experiments too. While doing the experiment of finding the viscosity of air, he found some lacuna somewhere. He invited senior faculty member (who had been assigned that experiment) to discuss the matter. The discussion went on and on - we, the students also gathered there. Ultimately the matter was postponed for the next day. Next day, the senior faculty came and conceded that his stand was not correct and that Khandelwal was right.

This issue also carries an interesting and readable article by A Saifee in which he tells us' the Ptolemy's geostatic model and the Copernicus's heliocentric model are equivalent not only kinematically but also dynamically '.

U S Kushwaha

Dr. Tushar C. Pandya No More

Dr. Tushar C. Pandya of St. Xavier's College, Ahemedabad, past secretary of RC-07 (Gujarat) passed away on October 26th , fell victim to corona.

Obituary on page no. 229

MAILBOX

1. Comments on the article
"Measurement of Surface Tension of Water"
by V. Srinivasan
(IAPT bulletin August-September 2020, page 172-173)

It was disappointing to read the above article. It assumes that every home has windows having bars of square cross section , exactly 1cm*1cm. This is not at all realistic. The author simply ' feels ' that the water drops are hemispherical. In reality, there is no guarantee that the rain drops have exactly hemispherical shape. One has to believe this shape of rain drops because using t=1cm, the equation

T= (t square)(rho)g/12 gives a value of T (80 mN/m) reasonably close to the known value. Somebody can have window bars with any value of 't' , for example 5mm to 20mm. If one tries to substitute such value of 't' in the above equation, he/she can get any any value of T from 40 mN/m to 160 mN/m . This is because the very assumption that the rain drops are hemispherical , is NOT true for a window bar of any size. And what can be said (about size and shape of rain drops) if the window bars are cylindrical in shape ? The author does not mention assumptions used and limitations of the experiment he has described. I think this is harmful for the scientific culture.

M.L.Ogalapurkar
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Editor's note : We tried to contact the author , could not succeed. These comments were then sent to the referee who wrote

"... regarding the article pertaining to surface tension, I must admit that while reviewing the contribution, I presumed everything to be correct and did not apply my mind much for which I feel bad. Few days back, when I read this article in print, I felt the same way as has been pointed out in the present letter. So, I think that his letter be published as such. Of course, being always alert, you can view the problem in proper perspective. It seems that the author has also not replied as he must be realizing the mistake committed."

We thank Prof. Ogalapurkar for pointing out the error. -Ed

2. A Tribute to Professor D. P. Khandelwal
through dedication of
NGPE PART C-2020 to him in his Birth Centenary year

Prof. Khandelwal inaugurated, in 1993, the Centre for Scientific Culture (CSC), an open laboratory for Physical Sciences, at Midnapore College Midnapore, West Bengal. The objective of the CSC is to help people to make them understand the basics of Science through experimental workshops and exhibits. Experimental Physics can be practiced from grass-root level to higher level of learning at this centre. Dr Samanta has been looking after CSC since the beginning.

This year, NGPE Part C (an examination in experimental skill) was conducted online at the students' own desk on August 23, 2020. The report of this activity was published in October 2020 issue of the Bulletin.

Dr Samanta has had a first-hand experience of working and interacting with Prof. Khandelwal who had frequently visited Midnapore to inaugurate and nurture IAPT Midnapore College Center for Scientific Culture in the last few years of his life.

He suggested to dedicate this unique, innovative online strategy of conducting NGPE Part C in pandemic situation to the memory of Prof. D. P. Khandelwal, when we are in the midst of celebrating his Birth Centenary. Indeed, we made an announcement to this effect just before the commencement of the NGPE Part C.

Now we formalize this announcement through the publication of this write up in the bulletin so that each and every member of the IAPT family is aware of this great event.

Anil Kumar Singh and B P Tyagi
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OBITUARY

Dr, Tushar C. Pandya
(19.8.1961 – 26.10.2020)

Tushar completed B.Sc. from M.G. Science college, Ahmedabad in 1981, M.Sc. from Gujarat University, Ahmadabad in 1983 and Ph.D. under the Guidance of Prof. V.B. Gohel in the field of Condensed Matter Physics from Guj. Univ. Ahmadabad.

He published more than twenty-five research papers in various National, International journals and conference proceedings. His recent research interests were in the field of High-pressure behaviour of certain solids and Nano materials and his last paper was on Role of Information Technology in Physics Education.

Dr.Tushar Pandya was an Associate Professor in the Physics and Electronics Department, St.Xavier's College, Ahmadabad. He had deep interest in teaching and writing about physics at under graduate and High school level. He was an outstanding teacher-mentor, very much popular among students.

A recipient of the prestigious INSA Teacher Award for the year 2015, he had also been awarded a summer research fellowship by the Indian Academy of Sciences. He was a past secretary of Gujarat Regional council (RC-7) of IAPT , a fellow of Gujarat Science Academy(GSA) and a former senate member of the Gujarat University.

He was actively engaged in popularizing science under the banner of GSA and IAPT. Very much devoted to IAPT, very recently he worked for NAEST and NGPE Part C.

Besides IAPT, he was also associated with several other organizations - Gujarat Science Academy, Indian Physics Association, Gujarat Science City, GUJCOST and Shodh Incubation Center .

Tushar has left behind his mother, wife and only son who works in Gujarat Gas Petroleum Corporation at Ahmadabad. It is double tragedy for the family as his father had expired just 26 days before him.

May his SOUL rest in peace and may the Almighty grant strength to his family members and all those associated with him, to bear the sudden loss.

R. B. Jotania
(Secretary, RC-7 Gujarat)

DATE EXTENDED FOR ESSAY SUBMISSION

In view of the current Covid-19 pandemic situation, it has now been decided to **extend the essay submission deadline to 30th Nov. 2020**. This deadline is final and applicable for both 'Teacher' & 'Student' categories. Rest of the details/information for NCEWP, that appeared earlier in the bulletin and was also published on the IAPT website, remains unchanged.

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How far the neo-Tychonian system of the Universe conforms to the known principles of Physics

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Abstract: *In the neo-Tychonian system, static Earth is at the center of the Universe and the rest of the Universe has a diurnal motion around it with an annual component. Using 'Relational Mechanics' which is based on the Mach's principle and Weber's gravitational force, A.K.T. Assis of the University of Campinas, Brazil and using Newtonian-Machiananalysis L. Popov of the University of Zagreb, Croatia have proved that the Ptolemy's geostatic model and the Copernicus's heliocentric model are equivalent not only kinematically but also dynamically. This article is a bird's eye view on their works and to find out the extent to which the neo-Tychonian model can explain the different related phenomena of Physics and Astronomy.*

As we all know, in all the models of the Universe described in astronomy and cosmology today, the Earth is considered as a planet of the Sun with the Sun moving around the center of the Milky Way galaxy and all the galaxies in the Universe including the Milky Way galaxy moving away from each other in an expanding Universe. However—while describing the explanation for the microwave background radiation—the celebrated physicist Stephen Hawking had mentioned in his best seller book 'A brief history of time', "...all this evidence that the universe looks the same whichever direction we look in might seem to suggest there is something special about our place in the universe. In particular, it might seem that if we observe all other galaxies to be moving away from us, then we must be at the center of the universe. There is, however, an alternate explanation: the universe might look the same in every direction as seen from any other galaxy, too. We have no scientific evidence for, or against, this assumption. We believe it only on grounds of modesty." [1]. For an ordinary believer of Aristotelian philosophy, the above statement from a scientist who had profound knowledge of astrophysics is sufficient to justify the vice versa i.e. as an alternative to currently accepted model of the Universe, insisting for a model in which the Earth is at the center of the Universe might be logical, but for a science-oriented person that model must be based on principles of Physics. Incidentally, two scientists A.K.T. Assis of Brazil and using a different method L. Popov of Croatia have worked on this subject in recent years. As will be described later in this article, the model is known as neo-Tychonian system. Before briefly exploring the underlying principles of Physics for this model and trying to know how far their work can explain different related phenomena, let us first describe the currently accepted model and its history in brief.

Ancient History: Two celestial phenomena were known to the ancient astronomers— (i) Most of the astronomical objects are seen to move on parallel circles from the east to the west in one sidereal day (which is approximately 23 hours 56 min.)around the North-South axis passing through the center of the Earth and (ii) The positions of the certain celestial objects—the Moon, Mercury, Venus, the Sun, Mars, Jupiter and Saturn—go on changing relative to the stars. For explaining the first observation, Herakleides of Pontus (390 BCE- 310 BCE) and Ekphantus the Pythagorean (5th Century BCE) believed that the Earth rotates about its own center in one sidereal day, while Aristotle (384 BCE- 322 BCE) and hence Ptolemy (100-170) believed that the earth is static and the stars are fixed to a fully transparent celestial sphere which rotates about the Earth in one sidereal day. For the explanation of the second observation, Ptolemy believed that the Sun, the Moon and the planets are in other transparent celestial spheres which are rotating about the Earth with different periods and each of the planets is also having circular motion in its own transparent celestial sphere. This is known as the Ptolemy's Model. On the basis of the records of the angular positions of the Sun, the Moon and the five planets kept by Hipparchus (190 BCE -120 BCE) over a very long period of time as well as the records kept by him, Ptolemy had

prepared catalogues for these celestial objects. Using these catalogues, the angular position of these celestial bodies could be fairly accurately predicted for any time in future. Hence these catalogues and correspondingly the Ptolemy's model of the planetary system remained very useful for the astronomers for about 14 centuries.

Copernicus's ideas: As shown by Richard Fitzpatrick in his book [2] in detail, an important thing to be noted in the Ptolemy's Model is that the motions of the planets have certain 'bearing' on the motion of the Sun also. Hence, in the 16th century, Nicolaus Copernicus (1473-1543) conjectured that it is easier to predict the positions of the planets if the planets are considered to be moving around the Sun on different circles. He went a step further and considered that the Earth is also a planet of the Sun and also rotates on its own axis in one sidereal day. With the help of his model, he could calculate the ratios of the distances of different planets to the distance between the Earth and the Sun.

Tychonian System: It is a model of the Universe published by Tycho Brahe (1546-1601) in the late 16th century, which combines what he saw as the mathematical benefits of the Copernican system with the philosophical and 'physical' benefits of the Ptolemaic system. In Tychonian system, the Earth is at the center of the Universe; all the objects in the skies move on parallel circles from the east to the west in one sidereal day around the North-South axis passing through the center of the Earth, the planets revolve around the Sun in different periods and the Sun orbits around the Earth in one year.

Kepler's Laws and Newtonian Mechanics: Using the detailed astronomical records of Tycho Brahe, Kepler (1571-1630) showed that the orbits of the planets around the Sun are elliptical in shape. However he disagreed with Tycho Brahe on the motion of the Sun and took the Copernican view that the Earth is also a planet of the Sun. He also discovered an empirical relation between the period of revolution of the planet and its distance from the Sun. In the same century, Newton (1643-1727) derived the Kepler's laws by using the laws of motion and the law of gravitation enunciated by him. Thus the Copernican theory got a strong mathematical base and with the observation of 'stellar parallax' by Wilhelm Bessel in 1781 and its explanation on the basis of Copernican model, astronomers became confidant of considering the Earth also as a planet of the Sun.In the case of the solar system, the power of prediction for the angular positions of the planets by the Newtonian Mechanics is so great that the planet Neptune was discovered on the basis of the difference between such predictions and the observed positions of the then known planets. The general theory of relativity which predicts curvature of space-time instead of gravitational force also shows that the motion of a body having a speed much smaller than the speed of light can be described by Newtonian Mechanics.

Hubble's Discovery and the Cosmological Principle: In the early 1920s a powerful tool was invented for studying astronomy. It was 200 inch telescope at Mount Wilson observatory outside Los Angeles. Using this telescope Edwin Hubble not only studied the stars in our Milky Way Galaxy but also discovered many other galaxies. From the spectra of the light received from stars of these galaxies, he found that every ray of light has longer wavelength than the corresponding characteristic wavelength observed in a laboratory. It was explained that this change in wavelength is due to Doppler Effect produced by the motion of the Star away from the Earth. Considering this effect, a relation between the velocities of the stars and their estimated distances was derived. By 1929, Hubble concluded that the radial velocities of the galaxies increase proportionately with their distances from us. This is known as 'Hubble's Law'.

In 1923, Alexander Friedmann mathematically applied the equations of general theory of relativity to the large scale structure of the Universe. From the solutions of his equations, Friedmann had derived the Hubble's law. For this, Friedmann had made two assumptions about the Universe: (i) that the Universe looks identical in whichever direction we look, and (ii) that this would also be true if we were observing the Universe from anywhere else. These two assumptions were later on given the status of a basic principle known as 'Cosmological Principle'. The cosmological principle implies that Viewed on sufficiently large distance scales, there are no preferred directions or preferred places in the Universe. Or in other words, the Universe has no center.

The currently accepted model of the Universe: It can be summarized as follows—

1. Due to gravitational force—described by the Newton's

law of gravitation—(i) every moon moves around its planet, (ii) every planet around its star and (iii) every star around the center of its galaxy.

2. The Earth is a planet of the Sun and rotates about its own axis in one sidereal day from the west to the east.

3. The Universe consists of billions of galaxies of various shapes— elliptical, spiral, irregular etc. Each galaxy is having a billion to a trillion stars. All the galaxies are moving away from each other i.e. the Universe doesn't have any center. Each star in any galaxy must be moving in the gravitational field of all the other stars in that galaxy. However, the astrophysicists find difficulties in this explanation and therefore they have proposed the theory of 'dark matter'.

Accepted Evidences for the Acentric Model:

The experimental and the empirical observations and the philosophical concepts which are considered as evidences for this model are as described below—

1. Foucault Pendulum: In 1851, Léon Foucaultasserted to demonstrate the rotation of the Earth on its axis by his new invented pendulum, later on named after him, by suspending a 28 kg iron ball by a 67-metre long wire from the dome of the Panthéon in Paris in such a way that its plane of oscillation is capable of changing. The experiment with Foucault's pendulum can be done at any place on the Earth. But for simplicity of understanding, if the experiment is done on the North Pole or the South Pole of the Earth, the plane of oscillation of the pendulum goes on continuously changing in the west to east direction, repeating after every sidereal day.According to Foucault, since by law of conservation of angular momentum, the plane of oscillation of the pendulum must remain fixed, itdoes so with respect to the fixed stars while Earth rotates underneath it, taking one sidereal day to complete a rotation.

2. Bulging of the Earth at the equator: The other proof for the rotation of the Earth about its own axis is considered to be bulging of the Earth at the equator. Since the Earth is considered rotating about its own axis passing through the poles, a body on the equator of the Earth is moving on the biggest circle when we compare with the bodies at other latitudes. Particularly the bodies at the North and the South poles are not moving at all. Hence if a body is on the equator, the centrifugal force on it would have maximum value but if the body is at the poles the force would be zero. The bulging of the Earth at the equator is explained to be due to the 'pseudo' or 'fictitious' centrifugal force conceding that the Earth was initially in the molten state. Similarly the pseudo force acting in the Coriolis effect observed on bodies moving on the surface of the Earth is considered as a proof for the rotation of the Earth.

3. Aberration of light: The 'stellar aberration' is an astronomical phenomenon which produces an apparent motion of all celestial objects about their real locations repeated annually. It is in a direction opposite to the annual motion of the Sun as seen from the Earth. It was discovered by James Bradley in 1725. Bradley conjectured an explanationon the basis of the Copernican model according to which just as a person walking into the rain sees a raindrop hitting at a slant, similarly moving of the Earth with respect to starlight causes the starlight to appear to come at an angle to its true path.

4. Stellar Parallax: It is somewhat similar to stellar aberration but its value depends on the distance of the star from the Earth. This phenomenon first observed by Wilhelm Bessel in 1781 is explained as follows. Since we can't judge the distances of different stars even by a telescope, a nearby star appears in different directions in the background of the far away stars as the Earth moves in its orbit around the Sun. The parallax angle will be different for stars at different distances. Measuring the parallax angle, the distance of the star is calculated from the knowledge of the distance between the Earth and the Sun.

Equivalence of the two models: Richard Fitzpatrick [2] has proved that the circular motions of a planet on an 'epicycle' and a 'deferent' with the 'eccentric' and the 'equant' of the Ptolemy's system are equivalent kinematically (i.e. regarding the observed motions of the celestial bodies) to the Keplerian elliptic motion of the planet around the Sun. The dynamic equivalence (i.e. regarding the forces producing these motions) is the basic tenet of the neo-Tychonian model. In the Tycho Brahe's model, the Earth is not a planet of the Sun but static and is at the center of the Universe; all the objects in the skies move on parallel circles from the east to the west in one sidereal day around the North-South axis passing through the center of the Earth, the planets revolve around the Sun in different periods and the Sun orbits around the Earth in one year. The term neo-

Tychonian system—as used by L. Popov—refers to the assumption that the orbits of the distant masses are synchronized with the Sun's orbit around the earth [3] i.e. the 'rest' of the Universe has adiurnal rotational motion around the Earth as well as an annual component. The explanation of the neo-Tychonian system of the Universe is mainly based on the Mach's principle. Hence before discussing about the system let us have a look on the Mach's principle itself.

Mach's Principle: In the German edition (1883) of his book 'The Science of Mechanics', the famous physicist and philosopher Ernst Mach (1839-1916)argued that all so called pseudo forces (the forces resulting from an accelerated motion of frame of reference) must be real forces resulting from a relative acceleration between the bodies in the non-inertial frame and the distant masses in the Universe. In many of his other books also, Mach has discussed about the shortcomings of the Newtonian Mechanics. However for this article, the following statement by Mach as quoted by Rosser[4] is all what we need to mention. Mach wrote: "Obviously it does not matter if we think of the earth as turning round on its axis, or at rest while the fixed stars revolve round it. Geometrically these are exactly the same case of a relative rotation of the earth and the fixed stars with respect to one another. But if we think of the earth at rest and the fixed stars revolving round it, there is no flattening of the earth, no Foucault's experiment, and so on— at least according to our usual conception of the law of inertia. Now, one can solve the difficulty in two ways. Either all motion is absolute, or our law of inertia is wrongly expressed. I prefer the second way. The law of inertia must be so conceived that exactly the same thing results from the second supposition as from the first. By this it will be evident that in its expression, regard must be paid to the masses of the universe."

The basic concept developed by Mach about inertia was called the Mach's principle by Albert Einstein. The Mach's principle is stated By D.J. Raine as 'Inertial forces should be generated entirely by the motion of a body relative to the bulk of matter in the Universe.' [5].Therefore, for example,the centrifugal force acting on a 'rider' in a merry-go-round is a real force due to the motion of the 'rider' relative to the rest of the Universe; in this case, the diurnal motion of the celestial objects in neo-Tychonian system is very slow in comparison to the motion of the rider and the annual motion is much more slower and therefore the effect of the motion of the celestial objects is negligible. However the diurnal rotation of the rest of the Universe relative to the static Earth yields a real centrifugal force flatteningthe Earth at the poles and precession of the plane of oscillation of Foucault's pendulum, and produces Coriolis force on the surface of the Earth.In Newtonian analysis, centrifugal forces in both of the above examples are pseudo or fictitious forces. Hence we can say that one of the important difference by applyingMach's principle, when compared with Newtonian mechanics and with Einstein's general theory of relativity as well, is related to the force exerted by a spherical shell having gravitational mass and acting on a test body having gravitational mass inside the shell when there is a relative motion between the shell and the test body. In Newtonian theory and also in Einstein's general theory of relativity the spherical shell exerts no net force on the test body, while According to Mach's principle, there will be a non-zero force exerted by the shell on the internal test body.

The effort of applying Mach's principle to the Model of Universe started in 1898 by the German physicist, Paul Gerber. It was partially successful. Einstein's work on general theory of relativity was inspired by Mach's principle but after developing the theory, Einstein found that it doesn't include Mach's principle. Then Hans Thirring in 1918, Birkhoff in 1944, G. Burniston Brown in 1955, Moon and Spencer in 1959 and Nightingale in 1977 also tried in different ways but couldn't get exact relations for the observed effects. Assis started his work inthis field in 1988 and published the first edition of his book in1999.As described below, Assis proved the dynamical equivalence of the Ptolemy's model and the Copernican model.

A new Mechanics for implementing Mach's principle quantitatively: Assis has developed a new kind of Mechanics known as 'Relational Mechanics'. It implements Mach's principle quantitatively based on Weber's relational law and principle of dynamic equilibrium and intends to replaceNewtonian Mechanics as well as Einstein's theories of special and general relativity[6]. In his book, Assis has given a detailed account of the history of development of the Relational Mechanics from 1896 onwards. [7]. In Relational Mechanics, Assis has formulated mechanics in terms of only relative quantities and considered these three basic postulates:1. Force is a vectorial quantity describing the interaction between material bodies. 2. The force that a point particle A exerts on a point particle B is equal and opposite to the force that B exerts on A, and is directed along

the straight line connecting A to B. 3. The sum of all forces of any nature (gravitational, electric, magnetic, elastic, and nuclear, etc.) acting on any body is always zero in all frames of reference. [8]. Further, he has considered that the gravitational force between two particles depends not only on the distance between the two particles but also on the relative velocity and relative acceleration of one with respect to the other [9], andhe has used a law of gravitation analogous to Weber's law of electromagnetism.The gravitational force resulting from this law is generally known as 'gravitomagnetic' force due to its analogy with the magnetic force in electromagnetism. This kind of lawwas first proposed for gravitation by Weber himself in 1846 and by Holzmuller in 1870 and was used by Paul Gerber in1898, by Erwin Schrödinger in 1925 and by Eby in 1977 for solving the problem of the precession of the perihelion of the planets. [10]. However, the first to propose a Weber's law for gravitation in order to implement Mach's principle seems to have been Immanuel Friedlander in 1896. [11].

With the above mentioned assumptions and the law of gravitation and considering that the restof the Universe is rotating around static Earth, Assis—after a detailed mathematics—has derived equation of motion for a body moving on the surface of the Earth. He has shown that such a body experiences a centrifugal force as well as a Coriolis force and the magnitudes of these forces are exactly same as what are observed experimentally. Assis has also mathematically shown that why his predecessors in this field could not succeed in implementing Mach's principle. In Assis's words: "This is in almost complete agreement with Mach's ideas, as we have shown that 'when the heaven of galaxies is rotated, centrifugal forces arise!' The only difference is that Mach knew only the existence of the set of fixed stars. It was in 1924 that Hubble established the existence of external galaxies. This came after Mach's death in 1916. Here we have shown that rotating only our own galaxy (i.e., the set of fixed stars) relative to an observer does not yield enough sensible centrifugal force. On the other hand, the rotation of the whole known universe (the set of distant galaxies) will yield exactly the full centrifugal force observed to exist in frames relative to which the set of galaxies is rotating." [12].At other place in his book, he has stated, "There is also an annual component of this rotation with a period of 1 year = 3.156×10^7 s. In relational mechanics this rotation of distant matter yields the inertial force in the Earth's frame of reference. This force has a gravitational origin. Now the gravitational attraction of the Sun is balanced by a real gravitational centrifugal force due to the annual rotation of the distant masses around the Earth (with a component having a period of one year). In this way the Earth can remain at rest and at an essentially constant distance from the Sun." [13].Thus Assis has established the dynamical equivalence of the Ptolemaic and the Copernican models.

Another approach for the scientific basis of the Geostatic Model: Instead of developing any new kind of mechanics, L. Popov has considered motions of the celestial bodies in the framework of Newtonian mechanics with the assumption of Mach's principle. For discussing the diurnal motion of the celestial bodies around the Earth, Popov has used Lagrangian formulation with a vector potential produced by a relative motion of a body inside the Universe with respect to the 'rest' of the Universe (whereinhe has applied Mach's principle) and compared it with a Lagrangian formulation in a rotating frame of reference (meaning rotating Earth) in Newtonian Mechanics. [14]. Hence Popov has demonstrated mathematically that if the Earth is stationary and the rest of the Universe is having diurnal motion around the Earth then in that case each body of the rest of the Universe would have a diurnal motion with the same angular velocity around the North-South axis passing through the centre of the Earth i.e. the motion of the rest of the Universe is self-sustaining. Another conclusion from this analysis is that the rotating Earth in the Copernican system and the rotating Universe in the neo-Tychonian system would produce dynamically equivalent effects, i.e. the same centrifugal force and Coriolis force as are observed experimentally.

Previously, in a paper written for the European Journal of Physics [15], Popov has also shown the dynamical equivalence of motion of the planets in the Copernican and the Ptolemy's models. Popov's method of analysis is as follows. In heliocentric model, the Earth moves with a centripetal accelerationaround the Sun. According to Mach's ideas, the centripetal acceleration is a relative quantity.Hence in geostatic model, the Sun moves with the samecentripetal acceleration around the Earth. In the neo-Tychonian model, every body in the 'rest' of the Universe is moving parallel to the Sun's annual orbit around the Earth. This motion of the rest of the Universe must be producing

the centripetal acceleration of the Sun around the Earth. Considering this, Popov has derived the relation for the scalar potential which produces the centripetal acceleration of the Sun and thus he has derived the Lagrangian and the equation of motion of the Sun around the Earth and shown that the equation of motion is exactly same as the equation of 'apparent' motionof the Sun around the Earth in a heliocentric model. Similarly he has written the Lagrangianfor the motion of a planet around the Earth in both the heliocentric and the neo-Tychonian models and—since the Euler-Lagrange equations for this motion are too complicated to be solved analytically—he has solved them numerically with the help of *Wolfram Mathematica package*for the case of Mars and shown that the results are same in both the models. He has also concluded that the annual motion of the distance masses is also self-consistent.

Status Report of the neo-Tychonian Model: The main task of proving that the Ptolemaic system is equivalent dynamically to the Copernican model is accomplished by Assis's as well Popov's work. Now let us see how the related phenomena are explained in the neo-Tychonian system.

1. The centrifugal force explaining the bulging of the Earth as well as the Coriolis force on the surface of the Earth are explicitly shown in the Assis's work as real forces due to the 'gravitomagnetic' interaction of the particles on the static Earth with the rotating Universe and are equal to their observed values. In the work by Popov, these forces are inherently real forces and equal to their observed values.

2. Popov has mentioned that the equation of motion derived by him for the neo-Tychonian system can easily be used to explain the satellites of the Earth particularly the geostationary satellites.

3. Motions of the satellites of planets and that of planets of other stars are explained by the local scalar potential in Popov's analysis.

4. It was assumed in the Maxwell theory of electromagnetism that light propagates through an all pervading medium called luminiferous ether. The famous Michelson Morley interferometer experiment was performed in 1887 to find the velocity of the Earth relative to luminiferous ether. The result was negative. The experiment has been repeated later on many a times but every time the result is negative. Negative result of Michelson Morley experiment goes in favor of proving that the Earth is at rest and hence the experiment is naturally explained in the neo-Tychonian system. In the currently accepted model of the Universe, the negative result of the Michelson Morley experiment is explained with the help of the Special Theory of Relativity.

5. Microwave background radiation from all directions on the surface of the Earth goes in favor of proving that the Earth is at the centre of the Universe and hence it is naturally explained in the neo-Tychonian system. In the currently accepted model, it is explained with the help of the Cosmological Principle.

6. In the 18th century Boscovich had suggested filling a telescope with water and measuring the aberration angle for any fixed star. If the angle in this manner obtained is larger than the one measured by Bradley, the Earth indeed orbits relative to the Sun. If no different value is registered, then the starry sphere swings with the Sun around the Earth. In 1871, George Biddel Airy filled a telescope tube with water and looked to see if the angle of aberration changed. It turned out that the addition of the water did not change the amount by which the telescope had to be tilted, thus proving that the Earth is not having any orbital motion. This experiment is known as Airy's Failure. Thus this also is naturally explained in the neo-Tychonian system. In the currently accepted model of the Universe, this failure is explained in terms of a phenomenon known as the Fresnel Drag.

7. Popov has also shown that the experimentally observed

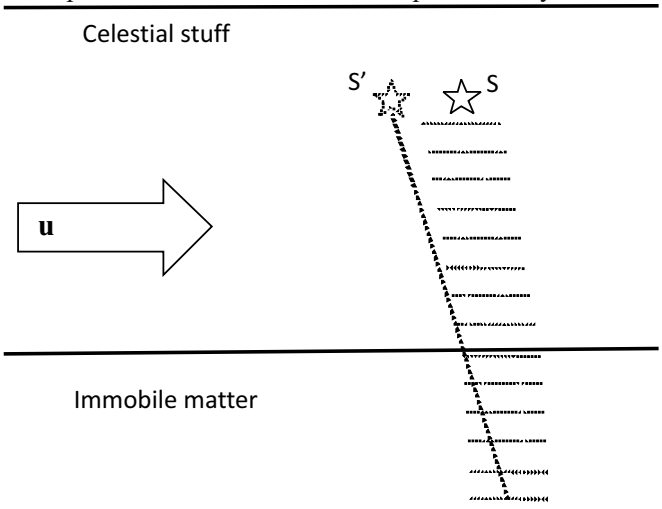

Fig.1.Explanation of the stellar aberration by shifting of the wavefront of light in a moving medium

stellar parallax can be theoretically deduced in the neo-Tychonian system. In aarticle published in the European Journal of Physics [16], Popov has shown mathematically that the real annual movement of a star in neo-Tychonian model can be attributed for the observed stellar parallax of the star. Using Lagrangian for the star in the scalar potential due to the annual movement of the 'rest' of the Universe and solving the Euler-Lagrange equation numerically by *Wolfram Mathematica package* for the star Proxima Centauri, Popov has shown that the calculated parallax is perfectly consistent with the corresponding astronomical data.

8. Although in the neo-Tychonian model no explanation has been put forward till now for the stellar aberration, it can be shown that a method used by Janssen and Satchel in some other context [17] can be used here to precisely explain the aberration but it is with a serious implication. Before describing the explanation and its implication, we require to know about the 'quantum vacuum'.

According to Heisenberg's uncertainty principle, a body can't simultaneously have well-defined values of position and momentum. Hence logically there can't be any point devoid of 'matter' of one kind or the other because in that case the position of that point would have a well-defined value with zero momentum which is also well-defined. In this connection, Robert B. Laughlin, a Nobel Laureate says "About the time relativity was becoming accepted, studies of radioactivity began showing that the empty vacuum of space had spectroscopic structure similar to that of ordinary quantum solids and fluids. Subsequent studies with large particle accelerators have now led us to understand that space is more like a piece of window glass than ideal Newtonian emptiness. It is filled with 'stuff' that is normally transparent but can be made visible by hitting it sufficiently hard to knock out a part. The modern concept of the vacuum of space, confirmed every day by experiment, is relativistic ether. But we do not call it this because it is taboo." [18].

Now we can use the Janssen and Stachel's method. In the Fig.1, the rays of light coming from the star S pass through the 'celestial stuff', moving with velocity **u**, having a motion synchronized with the motion of the Sun around the Earth. In the Fig., the movement of the waves of light is shown by a wavefront represented by a dotted horizontal line. The wavefront from the star,goes on continuously shifting in the direction of motion of the celestial matter. As shown in the Fig., when the wavefront moves in immobile matter near the earth, it doesn't shift. The resultant effect would be that the Star would be visible at S'. Thus the telescopes have to be continuously tilted in the direction opposite to the direction of motion of the Sun to keep on observing a particular star. The relation for the angle of aberration can be easily obtained by simple trigonometry.

Now let us see the implication of this explanation. It is that in the diurnal rotation of the rest of the Universe in the neo-Tychonian model, the speed of the celestial stuff would be very large in comparison to the annual motion and different for different layers of the stuff. Hence the diurnal stellar aberration would be very large and different for different stars. However, since the diurnal motion of every celestial object is on almost a circle, the apparent motion would also be on a circle of greater radius but without any change in the angular speed. The ray of light would pass through layers moving at decreasing speeds and the real distance of the star would have to be worked out accordingly. The real distance of the star would be much smaller than the apparent distance; the astrometry would have to be changed accordingly and probably there would be no need to hypothesize 'dark matter' in the neo-Tychonian system.

9.The Mach's principle and the Weber's gravitational force are both based on relative quantities. Hence,as has been done by some scientist including Assis and Popov, if Mach's principleis applied to currently-accepted model of the Universeit will also yield centrifugal and Coriolis forces as 'real' forces instead of 'pseudo' forces. Up to this extent and for explaining the satellite motion around planets and planetary motion around stars, the two different world views—Ptolemaic and Copernican—are completely equivalent but for certain explanations like negative result of Michelson Morley Experiment, Microwave background radiation and Airy's failure etc., the neo-Tychonian model has an edge over the currently accepted model while in certain other explanations, it can be shown that the currently

accepted model is better. Hence the choice between the two models, as is also clear from the statement of Stephen Hawking mentioned in the beginning of the article, rather depends more on the philosophical considerations— on the Aristotelian philosophy based on the special place of the Earth in the Universe or on the Copernican philosophy which leads to the Cosmological principlein which the Earth is a random planet of a random star.

10. From the point of view of the believers in a geostatic Universe, A.K.T. Assis by first-ever proving the dynamical equivalence of the Ptolemaic and Copernican models and L. Popov by proving of the same and giving explanation for the stellar parallax in the neo-Tychonian model have done a commendable job. Now what is needed is a comprehensive work which encompasses all the related phenomena of Physics, Astronomy and Astrophysics in detail from the perspective of a geostatic Universe, and what might be looked forward to is an acknowledgement of the neo-Tychonian system in the astronomy books.

Conclusions:A.K.T. Assis has used a new Mechanics, known as 'Relational Mechanics', which has a law of gravitation analogous to Weber's law of electrodynamics and L. Popov has considered vector and scalar potentials produced by the diurnal and annual motion of the rest of the Universe around the static Earth with the consideration of the Mach's principle in the framework of the Newtonian Mechanics and both of them have proved the dynamical equivalence of the Copernican Model and the Ptolemy's Model. Popov has also shown that the stellar parallax is due to real movement of the stars. Bulging of the Erath, Coriolis force on the Earth, negative result of the Michelson Morley experiment, microwave background radiation, Airy'sfailure are self-evident in the neo-Tychonian model. Explanation for stellar aberration is not available till now; an explanation reminiscent of nineteenth century Physicsalongwith the modern concept of quantum vacuumandtheimplication of the explanationare mentioned in this article. The choice between the neo-Tychonian system and the currently accepted model of the Universe is rather based on philosophical considerations. With all these,it can be said that a comprehensive work for the neo-Tychonian systemwith related phenomena of Physics, Astronomy and Astrophysics in detail is what is now needed and an acknowledgement of the neo-Tychonian system in astronomy books is what might be looked forward to.

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National Anveshika Experimental Skill Test (NAEST) Students' Experiences

H. C. Verma

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The Prelims round of NAEST was conducted in a novel fashion. The participants had to do 3 experiments for which the write ups were sent to them. The novelty was that students had to assemble the experimental set up on their own from the household items and perform the experiments. They were given 3 days for each experiment and send the reports electronically. The help and involvement of the family members was encouraged. The details of the experiments will be submitted to the bulletin as a separate article. We have gotten experiences from many participants which validate the IAPT philosophy of making Physics part of life to best learn it. In this issue I am sending 5 of these. As each such experience has a message for us, the teachers, educators and policy makers, I will continue with more experiences in coming issues of the Bulletin.

Student Experiences - 1

I first came to know about this examination while surfing the YouTube randomly through a video by Sir H.C. Verma. My dream is to become a scientist. In that video, the details of this examination and the idea of experimentation pleased me a lot. I signed up in the website and enjoyed reading other candidates' topics and discussions as well as generating my own topics.

I appeared in the mock tests of screening round and finally in the screening round. It was rather a good refreshment for me breaking the iterations of orthodox ways of evaluation. It is itself a good innovation. I cleared screening round and got selected for the prelims round which gave me a lot of joy.

Performing in the prelims round made me feel very close to my dream of being a scientist someday. I used to wait dotingly for the 2nd and 3rd experiments to arrive after the 1st experiment. It was like fresh air for me. The entire course of chalking out the plan, arranging for materials from here and there, taking readings, proper photography, sometimes going through trial and error, tensing about the time left was really dear to me. I felt at home with physics. Twisted my brain as much as possible for something new: be it explorations, or new observations or as a whole something new, made me feel alive, active, conscious, happy and very much one with physics. Then the computer work of typing reports, attaching videos and photographs, graphs, diagrams was tiring and not as thrilling as doing experiments but after its completion, it was a beautiful piece of artwork to me, like my struggles bringing infinite joy.

Last but not the least I would like to thank Sir H.C. Verma for gifting us with this opportunity of polishing our skills. Sir you are a great inspiration for me, your books have guided me a lot. I will be really overjoyed if I meet you someday to obtain your blessings. Thank you to the other NANI coordinators for their cooperation and support. Hope for the best in the prelims round and I would really enjoy the journey of these exams if I get selected for the next rounds as well.

Sreeja Datta
Bethune College,
Kolkata

Student Experiences - 2

It was very fun doing the experiment. I loved the innovative way of designing experiments with the homely appliances. The way, the thought, the detailing involved while designing the experiment is appreciable.

I involved my brother in the experiment. He helped me in taking some good pictures and also in arranging the desired things to carry the experiment.

The struggle was real but not too much. In the 1st experiment, the demo one, I struggled to arrange the Jharna as the required Jharna was not in my home. I arranged it from my neighbor's house. Then the next struggle was to balance it on the match stick. The balance with concave downward was comparatively easy but the balance with concave upwards blew my mind. I was struggling hard to balance it and my brother to capture it. It took almost half an hour to balance it. But the struggle didn't end here. The photo which my brother captured was not clear enough. So I had to struggle for another 10 minutes.

The 25th Sept experiment was also challenging. I had to find the tumbler from the storage which was not opened from many years. I finally found the desired one. Then comes the next task

to make a slit in the cardboard. I almost cut my finger while making the slit. Finally, after lots of struggle I managed somehow.
While making the report, I put hours into it. The main struggle was to draw the 1/u-1/v graph. That was really very difficult to present those small decimals on the graph paper. I don't get the desired graph but I had to manage with what I got as I had spent 2 hours on that single graph and more than 10 graph papers.
Despite of the struggle, the fun was real. I don't think in my life I will again get to do such fun experiments that too with home appliances in my home.

Sarfraj md juned Fency
Bsc. Physics 5th semester
Gangadhar Meher University
Sambalpur,
Odisha

Student Experiences - 3

I feel extremely delighted to inform you the National Anveshika Experimental Skills Test is an extremely well planned initiative by the Indian Association of Physics Teachers in order to inculcate the values of experimenting with the materials easily available at our homes which shall help us a lot in our academics as well. It focuses on teaching the concepts of physics through an extremely joyful and a very novel method of experimenting.

Here, I would like to provide my feedback of Experiment 1, NAEST, 2020. The experiment was an innovative and a novel one that demanded good experimental skills and understanding of the concept of optics from the student. I, personally, have gained a lot of knowledge during the experiment.
I also faced a few difficulties during the conduction of the experiment. I couldn't find a vessel that was perfectly cylindrical and hence I took a nearly cylindrical glass vessel and took the mean of its upper and lower radii for the value of radius in the formulae.
In a nutshell, experiment 1 of NAEST, 2020 was very educative and innovative and I look forward to the next experiment with positivity.

Abhisek Saidarsan
Class 12, DAV Public School, Unit 8
Bhubaneswar

Student Experiences - 4

First of all I want to thank the whole team of NAEST for giving me such opportunity. It was a wonderful experience while performing the experiments. Earlier I had a **phobia from the experiments** like most of the high school students have. It is considered that EXPERIMENTS are very difficult tasks and it requires a lot of expensive and complicated instruments to do experiments but that's not true at all. I realised this while doing the NAEST experiments. Like we can use Belan as a cylinder, mobile torch can be used to make a beam and it is not important that we require proper lenses while doing experiments of optics but we can use glass tumbler as lenses. All these things are unbelievable. I realised that our home is the real lab and doing experiments is a very interesting and joyful task. I really appreciate this initiative of IAPT which is developing deep interest of physics among the students.
Thanks a lot once again for helping me to understand what really physics is.

Vaibhav Adhlakha
Haryana

Student Experiences - 5

Participating in the Prelims of NAEST 2020, has been very educative as well as enlightening in my quest for learning. The experiments have been simple yet interesting and thought-provoking. While conducting the experiments, I not only learnt more about physics, but also about planning, organizing, and presenting skills, which I can concur will help me in my learning and my career ahead.

As far as core learning on physics is concerned, it was interesting to note that physical phenomena are always occurring around us and there is always a lot of learning to be acquired if one has a curious and scientific bent of mind.
One of my personal learnings is that we can always find methods to measure physical quantities using improvised tools at hand and, calculating the inherent errors in these tools and methods. In any physical experiment an awareness of such errors and limitations is essential for observation and drawing inferences.

Sakhi Saswat Panda
Class XI, Delhi Public School
Bangalore, North

EXAMINATION	IOQP 2020-21 Part I (NSEP)	IOQC 2020-21 Part I (NSEC)	IOQB 2020-21 Part I (NSEB)
Day & Date	Sunday (February 07, 2021)	Saturday (February 06, 2021)	Sunday (February 07, 2021)
Time of Exam (both Part I & II)	09.00 am to 12.15 pm	02.30 pm to 5.45 pm	02.30 pm to 5.45 pm
Venue	Designated IOQP centre	Designated IOQC centre	Designated IOQB centre
Eligibility (i.e) who can appear for	1. Must be eligible to hold an Indian passport. 2. Date of birth between July 1, 2001 and June 30, 2006, both days inclusive. 3. Must be residing and studying in India since 30 November 2018 or earlier. OR Must be studying in an Indian school system since 30 November 2018 or earlier. 4. Must not have passed (or scheduled to complete) class XII board examination or equivalent earlier than November 30, 2020. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by June 1, 2021. 6. Must not be appearing for NSEJS 2020.	1. Must be eligible to hold an Indian passport. 2. Date of birth between July 1, 2001 and June 30, 2006, both days inclusive. 3. Must be residing and studying in India since 30 November 2018 or earlier. OR Must be studying in an Indian school system since 30 November 2018or earlier. 4. Must not have passed (or scheduled to complete) class XII board examination or equivalent earlier than November 30, 2020. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by June 1, 2021. 6. Must not be appearing for NSEJS 2020.	1. Must be eligible to hold an Indian passport. 2. Date of birth between July 1, 2001 and June 30, 2006, both days inclusive. 3. Must be residing and studying in India since 30 November 2018 or earlier. OR Must be studying in an Indian school system since 30 November 2018or earlier. 4. Must not have passed (or scheduled to complete) class XII board examination or equivalent earlier than November 30, 2020. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by June 1, 2021. 6. Must not be appearing for NSEJS 2020.
Level of **Question Paper**	Syllabus is specified on the website https://www.iapt.org.in	Syllabus is specified on the website https://www.iapt.org.in	Syllabus is specified on the website https://www.iapt.org.in
Language of **Question Paper**	Question paper will be in English, Hindi, Gujarati, Bangla & Tamil (option during enrolment)	Question paper will be in English & Hindi (option during enrolment)	Question paper will be in English & Hindi (option during enrolment)
Question Paper Pattern of IOQ Part I	A) 24 multiple choice questions with one alternative correct. +3 marks credit for correct choice. -1 mark penalty for incorrect choice. B) 08 multiple choice questions with one or more than one correct alternatives. To get credit, all the correct option(s) and no incorrect option(s) should be marked.	A) 24 multiple choice questions with one alternative correct. +3 marks credit for correct choice. -1 mark penalty for incorrect choice. B) 08 multiple choice questions with one or more than one correct alternatives. To get credit, all the correct option(s) and no incorrect option(s) should be marked.	A) 24 multiple choice questions with one alternative correct. +3 marks credit for correct choice. -1 mark penalty for incorrect choice. B) 08 multiple choice questions with one or more than one correct alternatives. To get credit, all the correct option(s) and no incorrect option(s) should be marked.
For IOQ (Part II)	**See HBCSE Website www.hbcse.tifr.res.in**		
Total Marks of IOQ Part I	**120**	**120**	**120**

Please Note:

1. The eligibility criteria are laid down by authorities (not by IAPT). IOQ Part I (60 minutes) and Part II (2 hours) both will commence in a single sitting for each subject.
2. It is your (the students) responsibility to ensure that you satisfy the eligibility norms. If at some later stage it is found that you do not satisfy the norms you will be immediately disqualified without any refund of fees.
3. Legal matters (If Any) pertaining to all these examination will be subject to the jurisdiction of Dehradun District Court only (the location of central examination office and the office of chief coordinator of IAPT examination) and no other court in India.

IOQA 2020-21 Part I (NSEA)	IOQJS 2020-21 Part I (NSEJS)
Saturday (February 06, 2021)	Sunday (January 17, 2021)
09.00 am to 12.15 pm	02.30 pm to 05.45 pm
Designated IOQA centre	Designated IOQJS centre
1. Must be eligible to hold an Indian passport. 2. Date of birth between July 1, 2001 and June 30, 2006, both days inclusive. 3. Must be residing and studying in India since 30 November 2018 or earlier. OR Must be studying in an Indian school system since 30 November 2018or earlier. 4. Must not have passed (or scheduled to complete) class XII board examination or equivalent earlier than November 30, 2020. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by June 1, 2021. 6. Must not be appearing for NSEJS 2020.	1. Must be eligible to hold an Indian passport. 2. Date of birth between January 1, 2006 and December 31, 2007, both days inclusive. 3. Must be residing and studying in India since November 30, 2018 or earlier. OR Must be studying in an Indian school system since November 30, 2018 or earlier. 4. Must not have passed (or scheduled to complete) class X board examination or equivalent earlier than November 30, 2020. 5. Must not be appearing for any of NSEA, NSEB, NSEC or NSEP 2020.
Syllabus is specified on the website https://www.iapt.org.in	Syllabus is specified on the website https://www.iapt.org.in
Question paper will be in English & Hindi (option during enrolment)	Question paper will be in English & Hindi (option during enrolment)
A) 24 multiple choice questions with one alternative correct. +3 marks credit for correct choice. -1 mark penalty for incorrect choice. B) 08 multiple choice questions with one or more than one correct alternatives. To get credit, all the correct option(s) and no incorrect option(s) should be marked.	A) 24 multiple choice questions with one alternative correct. +3 marks credit for correct choice. -1 mark penalty for incorrect choice. B) 08 multiple choice questions with one or more than one correct alternatives. To get credit, all the correct option(s) and no incorrect option(s) should be marked.
120	**120**

For Students

(Student's Brochure)

INDIAN ASSOCIATION OF PHYSICS TEACHERS

206, Adarsh Complex, Awas Vikas - 1,
Keshavpuram, Kalyanpur, Kanpur-208 017

International Olympiad Qualifier (Part I) (in place of NSE) in

Physics	- IOQP 2020-21 Part I (NSEP)
Chemistry	- IOQC 2020-21 Part I (NSEC)
Biology	- IOQB 2020-21 Part I (NSEB)
Astronomy	- IOQA 2020-21 Part I (NSEA)
Junior Science	- IOQJS 2020-21 Part I (NSEJS)

2020 - 21 EXAMINATION

What is IAPT?

IAPT (Indian Association of Physics Teachers) is an association of Physics Teachers spread throughout the country. It was started by Late Dr. D.P. Khandelwal in 1984 and today it has nearly 8000 life members. All the work of this (our) organization is voluntary in character-thus NOBODY is paid any Honorarium or remuneration for ANY WORK of IAPT.

What is International Olympiad Qualifier

IOQ is the pre-requisite for the selection in the team for International Olympiad from India. This year IOQ Part I (2020-21) is in place of NSE and the IOQ Part II is in place of INO in respective subject, IOQJS is for students upto class X. While all the others IOQP, IOQC, IOQB and IOQA is for students of upto class XII.

What are International Science Olympiads?

Olympiads are internationally recognized competitions in various fields of knowledge at the school level. They are the highest level examination and are hosted by different countries every year. Participation in any of the Olympiads has world wide recognition and is considered as a great achievement. International Olympiads are held every year in Mathematics, Physics, Chemistry, Biology, Astronomy and Junior Science.

How do I go to (or participate in) the Physics (or Chemistry or Biology or Astronomy or Jr. Science) Olympiad?

You will have to appear for IOQ 2020-21 (IOQP / IOQC / IOQB / IOQA / IOQJS) both Part I and Part II in a single sitting. The selected students will be eligible for attending Orientation Cum Selection Camp-2021, the next stage for International Olympiad.

Is there any other way to go to International Olympiads in these subjects?

No! There is none.

How do I enroll myself for any of these?

Any students satisfying the eligibility conditions for IOQ may enroll himself / her self online on the web https://www.iapt.org.in w.e.f October 15, 2020 to November 10, 2020. For all relevant informations be in touch with the same website.

NO DIRECT ENROLMENT.

What is the fee?

Fee is ₹200/- per student per subject each student is responsible to deposit his fee online on the given bank portal.

What are the details of the entire selection procedure?

The aim of the first stage examination is to have a wide reach. To progressively increase this reach and to attain nationwide representation for Stage II without over all compromising on merit, the selection for the Stage II examination, i.e., International Olympiad Qualifier (Part II) the following scheme (Points (a) to (f)) is adopted.

(a) **Minimum Admissible Score (MAS) Clause:** To be eligible among 300 students for the evaluation of International Olympiad Qualifier (Part II) leading to the International Olympiad, a candidate must secure a score equal to or greater than a Minimum Admissible Score (MAS). The MAS for a given subject will be 50% of the average of the top ten scores in that subject rounded off to the nearest lower integer.

(b) **Merit Index Clause:** There will be a high score called the Merit Index (MI) associated with each subject in IOQ (Part I). The MI in a subject is defined as 80% of the average of the top ten scores in that subject rounded off to the nearest lower integer. All students with a score equal to or greater than merit index MI for the subject will automatically qualify for the IOQ (Part II) in that subject. For example, if the average of top ten scores in a certain subject is 92, then 80% of this is 73.6. Then the MI in that subject will be 73. All candidates with a score equal to or above 73 in IOQ (Part I) of that subject will automatically qualify for the evaluation of IOQ (Part II).

(c) **Proportional Representation Clause:** Students from all States and UTs in India need to be encouraged to appear for the first stage examination and a nationwide representation for IOQ (Part II) is desirable. The quota for each State/UT used in National Talent Search Examination (NTSE) 2013-14, a nationwide competitive examination is used as the baseline for calculating the number of students qualifying for IOQ (Part II) in every subject from centres in that State or UT. Suppose the NTSE quota is S for a State, and the total for all States and UTs is T, then the total number of students to be selected for IOQ (Part II) from that State would be S/T times 300, rounded off to the nearest higher integer. This number will include those selected on the basis of the Merit Index. In the event of tie at the last position in the list, all students with same marks at this position will qualify for the evaluation of IOQ (Part II). The selected students must nevertheless satisfy the eligibility clause. The number to be selected from all the centres in each State or UT will be displayed on the IAPT and HBCSE websites. (https://www.iapt.org.in; http://olympiads.hbcse.tifr.res.in)

(d) **Minimum Representation Clause:** Notwithstanding the proportional representation clause the number of students selected for evaluation of IOQ (Part II) from each State and UT must be at least five, provided that the eligibility clause is satisfied.

The above criteria are illustrated with the following examples:

(i) Let the quota on the basis of the Proportional Representation Clause (c) for a State S_1 be 20. Suppose the number of students satisfying the Merit Index Clause (b) in a subject is 10. These 10 students will qualify for the evaluation of IOQ (Part II) in the given subject and an additional 10 students from the State S_1 in the given subject will be selected merit-wise, provided they satisfy the Eligibility Clause (a).

(ii) Let the quota on the basis of the Proportional Representation Clause (c) for a State S_1 be 20. Suppose

the number of students satisfying the Merit Index Clause (b) in a subject is 30. In this case, all 30 students will qualify for the evaluation of IOQ (Part II) in the given subject, and there will be no further selection from the State S_1.

(e) **Previous International Representation Clause:** Candidates who have represented India in the International Olympiad on a previous occasion (IOAA, IBO, IChO, IJSO, IPhO, APhO and IAO-Jr.) will qualify for evaluation of IOQ part II in the respective subjects (irrespective of their score in IOQ part I). Such student shell be required to make a written request for the same to the National Coordinator Science Olympiads (nc_olympiad@hbcse.tifr.res.in).

(f) **Minimum Total Number Clause:** In each subject, after all the above criteria have been applied, it is possible that the target number of 300 students to be selected for the evaluation of IOQ (Part II) is not reached (due to non-availability of enough number of students in some states who satisfy Minimum Admissible Score Clause (a). In such an event, additional students will be selected purely merit-wise, provided Eligibility Clause (a) is satisfied, till the target number of 300 is reached. Other clauses will not apply for these students. In case of a tie at the last position, all students with the same marks at this position will qualify for the evaluation of IOQ (Part II).

There will be no other criterion or provision for the evaluation of IOQ (Part II).

Eligibility for IOQA and OCSC-Astronomy in 2021

In order to encourage younger students to participate in Astronomy olympiad. The rules are as below:

1. The eligibility criterian for IOQA (Part I) has been given above.
2. The student pool of IOQA (Part I) will be divided into two groups:
   (i). Group A: Students who are in Class XII as of Nov. 30, 2020.
   (ii). Group B: Students who are in Class XI or lower as of November 30, 2020.
3. For the evaluation of IOQA (Part II), a target number of 250 students will be selected from each group. Thus, a total of 500 students will be selected.
4. The MI and MAS will be calculated separately for each of these groups.
5. All the clauses [(a) to (f) above)] of selection will be applied separately to each group.
6. The question papers of IOQA (Part I) and IOQA (Part II) will be identical for the two groups.

There will be no other criterion or provision for the evaluation of IOQA (Part II).

All these IOQ (Part II) are to be organized by HOMI BHABHA CENTRE for SCIENCE EDUCATION (HBCSE) Mumbai. For the next stage students are chosen on the basis of their performance at these IOQ. These students in each subject attend Orientation Cum Selection Camp (OCSC) in respective discipline for about 2 weeks at HOMI BHABHA CENTRE for SCIENCE EDUCATION (HBCSE) Mumbai. Indian team to participate in International Olympiad is selected from the OCSC in respective subjects.

For more details visit www.hbcse.tifr.res.in / www.iapt.org.in

Are there any other fees for these INOs or camps?

None! You pay only once at the time of enrolment for IOQ.

What is the time schedule?

ONLINE STUDENT ENROLLMENT BEGINS: October 15, 2020

LAST DATE OF ENROLMENT: NOVEMBER 10, 2020

Examination schedule:

IOQJS 2020-21 (NSEJS)	Sunday, January 17, 2021	2.30 pm to 5.30 pm
IOQA 2020-21 (NSEA)	Saturday, February 06, 2021	09.00 am to 12.00 N
IOQC 2020-21(NSEC)	Saturday, February 06, 2021	2.30 pm to 5.30 pm
IOQP 2020-21 (NSEP)	Sunday, February 07, 2021	09.00 am to 12.00 N
IOQB 2020-21 (NSEB)	Sunday, February 07, 2021	2.30 pm to 5.30 pm
Expected date of result of IOQ Part II (INO)	Monday, March 15, 2021	
OCSCs	May-June 2021	

Previous Years Question Papers: Yes, separate booklets containing question papers with solution/answers for past five years each in Physics, Chemistry, Biology, Astronomy and Junior Science are available at a cost of ₹ 50/- per booklet.

To obtain the previous year papers of NSE deposit the amount online or by NEFT in the account given below. Send the details with proof along with your address on email: iaptknp@rediffmail.com The booklet will be sent to you by registered post from Kanpur IAPT Registered office.

Account Name: Indian Association of Physics Teachers

Account Number: 20768203191

Bank: Indian Bank, **Branch:** Kakadeo Kanpur (UP)

IFSC Code: ALLA0210490

Phone: 0512 2500075, 9935432990

Are there any CERTIFICATES / AWARDS?

Yes, in each subject,

i) Report card will be generated to all the candidates above (MAS) and can be downloaded by the enrolled students.

ii) Certificates are given to 'top 10%' students of every centre.

iii) Merit Certificates are awarded to 'top 1%' students in each state, in each subject.

iv) Special Merit Certificates and a prize (book) will be awarded to 'National top 1%' students in Physics, Astronomy & Junior Science.

v) Gold Medals are awarded to the students attending OCSC in Physics, Chemistry, Biology, Astronomy & Junior Science.

Prof. B.P. Tyagi (9837123716)
Chief Coordinator IAPT Examination
NSE Coordinators:
DR. Anand Singh Rana (9412954316) Dehradun
DR. Vijay V. Soman (9822107522) NAGPUR
IAPT Central Examination Office:
15, Block II Rispana Road Dehradun - 248001
Help Line No: 9632221945, 9411530162, 8533993332
Email: iapt.nse@gmail.com, iaptddn@gmail.com
Website: https://www.iapt.org.in

For all queries regarding the IOQ (Part I) students should contact the IAPT Examination Office, Dehradun

The Missing Culture of Error Analysis: Experience from NAEST Evaluation

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Amity International School, Noida

Abstract

Error analysis is an important part of any experiment which involves measurements of certain quantity and then calculating a physical parameter from these measured values. However in our school/college education this aspect is least emphasized and that is reflected in the reports of students who performed NAEST Prelims Center.

1. Introduction

The students selected from the NAEST screening round -2020 participated in the next round –NAEST Prelims round. For conducting this round, very innovative four experiments were designed by the NANI co-ordinator Dr. H.C.Verma. The equipment required for doing the experiment were very common household items. The designed experimental write up was sent to the participants. Each student participating in this round was expected to perform the experiment and send the experimental report with the observed data, photos and videos within the assigned time of two days. After the submission of his/her report another experiment was sent to the student after a gap of about a week. Three such experiments were sent. 33 centres were created all over India to evaluate the experimental reports sent by the students. Evaluation strategy was decided in various meetings of the co-ordinators and evaluators of these centres.

As an evaluator of one of the centres, I got to evaluate many reports sent by students. These reports were sent by school students as well as college students. It was an entirely new experience to check these reports. To do justice in the evaluation, I first performed these experiments myself, analysed the results and discussed them with the other evaluators and Dr. H.C. Verma in the meetings. A suggestive marking scheme was made, based on the discussions and results of these experiments done by the various evaluators.

2. The 1st Experiment

The first experiment was sent on 25th September in our centre. This experiment required a study of the u-v relationship for a thick lens. Water in a transparent cylindrical beaker served as the thick lens. The light source to be used was the mobile torch whose light was made to pass through a narrow slit cut in a cardboard or some other material. The light from the slit falling on the paper resembled a light beam. Object was taken at the intersection of two such beams. The position of the image was to be located at the intersection of the beams after refraction from the water lens.

The reports received showed a lot of creativity. Photos of the reports revealed finely cut slits in cardboards from which light from the variously placed mobile torch was passed through. Glasses and transparent plastic containers were used to make the thick lens. Most of the time the readings of u and v were meticulously taken and focal length was found using the thin lens formula. The focal length was also found from the lens makers formula. The large difference in the two values was pointed out by the students and they tried to analyse the same. Some of them realised that the thin lens formula was not valid here and tried to use a formula which took into account the thickness of the lens. The effect of spherical aberration was kept in mind in some of the reports and it was evident in their data of u and v. In some cases the value of v for the same u showed a huge difference. In these cases the ray diagrams shared by the students revealed that they did not try to keep angle between the incident beams same.

3. Missing Error analysis

But in spite of doing the experiment with so much of creativity and meticulousness, the error reported in the readings was only the least count error and which was invariably taken as 1mm. While doing the experiments most of the students must

have encountered other sources of error also for instance in this case the width of the beam itself must have been more than 1mm at some places. Moreover only one reading was taken for one value of u. The concept of taking multiple values of v for the same setting and same value of u was almost totally missing. So the statistical error calculations were not done in any of the reports received.

4. Educating the students on error analysis and the 2nd Experiment

It was then decided that we educate the students regarding the method and importance of statistical error calculation in the observed readings. Dr. Verma made a short video on error analysis and it was sent along with the write up of the second experiment.

The second experiment involved the study of refraction of a thin rod placed at various positions in a cylindrical vessel filled with a liquid. The image positions, their magnification and the refractive index of the liquid used was to be found. Again the reports received showed a lot of creativity by the students. The various ways in which they set up the apparatus was really intriguing. They used various arrangements with the rubber bands, threads, cardboard, pen etc. to make bridges from which they hung the object (thin rod)) using pen caps, clay, glue inside the cylindrical beaker filled with the liquid. They made the observations and most of them carefully tabulated the readings of the various parameters. Some even tried to analyse the results of their experiment and came up with some conclusions.

But again the error reported in most of the parameters was just the least count error most of the time. Other sources of errors were ignored most of the time. Some attempted to do the random error calculations but they did it on the basis of only two or three readings of the same parameter. No one measured the required quantity sufficient times to get any credible values of random errors.

5. 3rd Experiment

For the third experiment which required a study of hysteresis in a rubber band, the creativity shown by the students in making the setup was amazing. They used various types of containers and devised ingenious ways to measure the capacity of the containers. They used curtain hangers, utensil hangers and other rods as the rigid support from which they hung the rubber band. They made a standard measure of a step very creatively to increase and decrease the load on the rubber band in the standard steps. They plotted graphs in which the hysteresis loss in the rubber band was quite evident. But yet again the error reported in the measurement was just equal to the least count error. Other sources of error were totally ignored. They used thick pen tips to make marks on the wall, they used the tailoring tape for measurements and the pointers used for measuring were not perfectly horizontal. Moreover there must have been a parallax while taking the measurement but none of these sources of errors were accounted for.

6. Significant figures

One more problem which surfaced from the analysis of the reports was their complete ignorance of the significant figures and their connection with the errors. For instance, the object and the image distance were measured up to one decimal place but the focal length was reported to 3 and 4 decimal places. Similarly the height and radius of the cylinder was measured up to 1 decimal place while the volume of the cylinder obtained from it was up to 3 – 4 decimal places. They did not realise that a calculated value cannot be more precise than a measured value.

7. Conclusion

Perhaps this is the result of the training we give our students in the laboratories in the school. Generally the experiments done in labs require just the verification of an already known value of the parameter. For example, finding the speed of sound, the value of g or the coefficient of viscosity of a liquid. In these experiments the students just take three to four readings in the time given to them. From these few readings they arrive at the conclusion. Reporting the errors involved in the experiment after a careful analysis is generally not expected from the students.

Importance of accounting for various errors in an experiment and minimizing it has to be stressed upon at all levels because without a true knowledge of the uncertainties involved in an experiment, the observations of the experiment lose their credibility.

A Curtain Raiser Programme

To mark the beginning of the yearlong commemoration of the Birth centenary of Prof D P Khandelwal

Last year (2019) the Executive Council of IAPT took a decision to observe the birth centenary of its founder Prof D.P. Khandelwal in 2020-2021 in a befitting manner and plans started pouring in. We at RC 15 were no exception and we planned to have a programme at Midnapore college, where the IAPT-Midnapore College Centre for Scientific Culture was established in 1993 with the initiative of Prof Khandelwal and the very encouraging role of the Midnapore College in hosting and providing support for the centre.

Prof Khandelwal was born on October 01, 1921 and his centenary year began on October 01, 2020. Unfortunately, due to the prevailing pandemic situation that all of us are passing through; all plans of holding face-to-face programmes have come to a scratching halt. However, the encouragement provided by the IAPT fraternity kept our spirits alive and gave us the impetus to make a beginning.

For most of us in IAPT Prof Khandelwal was the founder President of IAPT that came into being in 1984. But it is possibly the tip of the iceberg so far his wider activities and dedication for physics and physics education in the country and his vision as an educationist are concerned. With some of his close colleagues and dedicated physics teachers, Prof Khandelwal nurtured IAPT till 1996 when he passed away. For the members of the organisation that he established, his centenary year brings in an opportunity to look back to this great teacher and follow his thoughts and vision in letter and spirit. With this backdrop in mind the RC-15, Midnapore College (Autonomous), West Bengal and the IAPT-Midnapore College Centre for Scientific Culture (CSC) jointly organised one web based programme to pay tribute to the memory of Prof Khandelwal on October 01, 2020 where senior IAPT members, who have closely interacted with Prof Khandelwal, would reminisce about him from different parts of India.

Dr PradiptaPanchadhyayee of P.K.College, Kanthi, was the administrator of the meeting and ran the entire programme with aplomb by providing the necessary technical support .The programme was anchored by Dr Bhupati Chakrabarti, Former General Secretary of IAPT. Prof G.P.Das, Faculty IIT Kharagpur and the President of IAPT RC 15 presided over the function.

After a few introductory comments by Dr Chakrabarti, the shared screen showed the garlanded photo of Prof Khandelwal. The welcome address was delivered by Prof G C Bera, the Principal of Midnapore College (Autonomous). Prof Bera a

member of IAPT is actively involved in the activities of CSC since its inception. He talked about the role of the College in hosting and supporting the Centre that is conducting various types of Workshops for teachers and students particularly highlighting the role of the experiments in physics for better learning of the subject. He praisedDr Samanta who not only shouldered the responsibility for providing shape to the Centre,encouraged and inspired the students into getting passionately involved in experimental physics. Prof G P Das in his presidential remarks spoke briefly about Prof Khandelwal's vision and how IAPT is thriving to follow his footsteps. He felt that the thoughts of Prof Khandelwal are still relevant though we possibly have to go a long way to achieve them so far as the teaching- learning of physics in the country is concerned.

IAPT President Prof Vijay Singh was the first speaker to follow. Since he was occupied at the time of the programme he sent us an audio message that was played. Prof Singh as a very young faculty in IIT Kanpur in 1984 actually attended the first meeting convened by Prof Khandelwal in Kanpur to formally launch the IAPTand he fondly narrated his experience. Next speaker was Prof SLokanathan, a retired faculty from Rajasthan University and a former faculty of IIT Delhi. Prof Lokanathan being a very senior professor had the opportunity of meeting Prof Khandelwal before the IAPT was formed and knew Prof Khandelwal as a very sincere teacher who liked to do experiments in the laboratory by himself like a student to get the real feel of it. The third speaker of the evening was Prof P N Ghosh, Professor at the Department of Physics in Calcutta University and former VC of Jadavpur University. Prof Ghosh talked about his association with IAPT from its beginning when Prof Khandelwal not only took him into the fold but put on some academic responsibilities for the organisation. He was actually among the first set of members of IAPT from West Bengal along with Late Prof Chanchal Kumar Majumdar.

Prof H.C.Pradhan, Former President of IAPT and the former Centre Director, HBCSE spoke from Mumbai. He specially underlined the thoughts of Prof Khandelwal not only on physics education but science education in general and identified him as a 'karmayogi'. He pointed out that one would find the relevance of the vision of Prof Khandelwal even today if one takes a closer look at the New Education Policy 2020. The next two speakers Prof R MDharkar and Prof M L Ogalapurkarspoke from Pune. Prof Dharkar was given the charge of Chief Coordinator of IAPT Exams by Prof Khandelwal in early 1990s and he was looking after both the NSEP and NGPE at that time. He told the audience how Prof Khandelwal used to instil confidence in the persons once he or she has been given an important responsibility. Prof Dharkar in his reminiscence brought out the hallmark of an experimental physicist in Prof Khandelwal by mentioning how he used to differentiate an active lab from a passive one when he visited Wilson College, Mumbai where Prof Dharkar was the HOD Physics. Prof M.L. Ogalapurkar who was also the Chief Coordinator of IAPT Exams at a later stage, talked about his personal experience of interacting with Prof Khandelwal as he was staying in Pune for about one year or so before his demise in 1996. Since Prof Ogalapurkar organised the IAPT Convention in his college in Pune in 1995 he had the opportunity of meeting Prof Khandelwal and taking his valuable advice.

The recollections of these eminent speakers, was the narration of a unique experience which perhaps turned out to be the biggest tribute to Prof Khandelwal. The background was that this year the conduction of NGPE Part C (Practical) proved to be quite challenging due to the pandemic scenario. Although the theory exam was over and top 27 students were identified it was difficult to conduct the exam in any college or university department by bringing in all the eligible students from different parts of India. Under the leadership of Prof Samanta and with the support from IAPT-Midnapore College CSC quite a few IAPT members from this region took up the challenge of developing suitable experiments for the conduction of the practical exam in distance mode. Prof B.P.Tyagi, Chief Coordinator of IAPT Examinations encouraged this approach and accordingly made arrangements for its delivery with the help of Dr PradiptaPanchadhyayee and a few more from different parts of the country. Dr Panchadhadhyayee shared the screen to tell the audience about this experience of developing the experiments and conducting the examination by sending designated kits to the students' home by courier. No doubt this approach is a special tribute to Prof Khandelwal who had a very strong inclination for experiments and the way the entire work was planned and executed is an experiment by itself.

Dr Samanta the real anchor person for the CSC from its inception talked about Prof Khandlewal and his vision about experimental physics. He also shared some of his experiences with the present scenario related to practical classes in schools and stressed the need for the improvement.

The General Secretary, Prof K N Joshipura sent an audio message as he was not available at the time of the function. He talked about his experience of meeting Prof Khandelwal and

his interest in experiments.

After the speeches by all the speakers the RC 15 President took over to sum up the discussions. He presented the salient features of the observations made by all speakers. The deliberations were unanimous about the fact that there is no way of learning good physics by neglecting the laboratory. Very unfortunately now the lab work has taken a backseat not only in the schools but this is gradually spreading at other levels as well. IAPT as an organisation should take a more proactive role to change this scenario by following the thoughts of Prof D.P.Khandelwal. Dr Achintya Pal, Secretary, RC-15 proposed the vote of thanks. He appreciated all the speakers for the interesting and encouraging memoirs and extended gratitude to all IAPT members and everyone in the audience.

Video of the recorded programme is available in the following link

https://drive.google.com/file/d/1Ikc8bP_ITrklk38jLIZJPm0JumRp4ddn/view?usp=sharing

The full text of speeches of Prof Lokanathan and Prof Pradhsn are given in appendix.

Prepared by Bhupati Chakrabarti, with inputs from Pradipta Panchadhyayee & C.K. Ghosh

Appendix

1 Speech by Prof S. Lokanathan on October 1, 2020 in the web based curtain raiser programme to mark the birth centenary of Prof D. P. Khandelwal

Principal, Prof. Bera, Prof. Das, Prof. Ghosh, Prof. Dharkar, Prof. Joshipura, Prof. Samantha, Prof. Ogalapurkar, Prof. Panchadhyayee.

We celebrate today the centenary birth anniversary of Prof. D.P. Khandelwal, doyen of the teaching profession and the founder of IAPT. Many of us have aspirations, dreams of serving causes dear to us but few have the sustained strength and ability to achieve their goals. Prof. Khandelwal was that rare breed who could create an institution. The IAPT has caught the spirit and imagination of teachers throughout the country.

I first met Prof. Khandelwal in 1965 when he and Prof. Babulal Saraf visited I.I.T, Delhi where I was teaching. He immediately struck me as a person with a purpose. He wanted information about some laboratory equipment he needed and came straight to the point. Later, in 1969, when I had joined Rajasthan University, Jaipur, he was a frequent visitor. My senior colleague and friend, Babulal Saraf had decided views on the diminution of teaching standards and the decline of the Laboratory in Physics. Prof. Khandelwal invited us to a workshop he was organising at Agra College where he was Professor and Head of the department of Physics. Such was his organised life that he would participate in every session even if he was not the speaker, find time to give instructions about the mundane but necessary arrangements for putting up the participants. Later in the evening he would even participate for an hour of playing Bridge but would still find time for preparing for the next day's proceedings before retiring for the night.

It was during one of his visits to Jaipur that he mooted his idea of a National Institution of Physics Teachers. He was advising us on the University Leadership program (ULP) under the direction of Babulal Saraf. Not for Prof. Khandelwal, just his advice during discussions! He would find time to sit in the laboratory and perform an experiment or two, like a student, to get a feel for the impact on its education. His vision for a wider awakening among teachers around the country was now gathering a focus and it was unflagging work that led to birth and flourishing of the IAPT. As I see now the enthusiasm and vigour of teachers around the country participating in the various activities of IAPT, I feel a tinge of sadness that he is not with us to savour the fruits of his creation.

In honouring him, you are honouring the entire teaching profession. It us most appropriate that the Midnapore College Centre for Scientific Culture is hosting this program.

My best wishes for a very successful Webinar.

S. Lokanathan

2. **Speech by Prof H. C. Pradhan: A Tribute to Professor D.P. Khandelwal – Founder of IAPT**

Indian Association of Physics was established in 1984 by Prof. Khandelwal and his colleagues. He nurtured it for almost 12 years and then departed from the scene rather too early in the life of IAPT. The organization is now 36 years old; not only has

it survived all these years but grown. This indeed is a testimony to the strength of the foundation of the organization that Prof. Khandelwal laid in the initial years, the team of selfless volunteers that he built, and the tradition and culture of the organization that he created.

Although I became a member of IAPT in the late eighties, I was not a very active member until late nineties. I had met Prof. Khandelwal, but did not know him closely. What I have known about him is from my colleagues and friends in IAPT and from his writings. The picture of him that has emerged in my mind is of an excellent teacher who cared his utmost for students and colleagues, a passionate scientist who loved science and in particular physics, a visionary who always thought of the country's future and a Karma yogi who constantly strove for the vision to come true through the organization that he founded and nurtured.

Thanks to the literature made kindly available to me by Prof. Subhas Samanta, I happened to read one of Prof. Khandelwal's articles which was published in the IAPT Bulletin, sometime in 1993-94. It was about Physics Education in India. What struck me is the relevance of his views even today. He would have been in tune with the vision of higher education expounded in National Education Policy 2020. For him the purpose of higher education in science went well beyond making students merely job-worthy; it is to make them true scientists in spirit and pursuit of their profession. He also gave examples of how teachers can make physics classroom lively and exciting. He advocated, again by giving appropriate examples, effective use of history of science to deepen students' understanding of science. He always stressed on the importance of experiments in science as they are an integral part of science. Three of his favourite ideas were science stage shows, model school and undergraduate college laboratories, and of course centres of science culture (CSC). For him a CSC was not a museum, a passive collection of exhibits and demonstrations, but an active place conducted by science teachers as a living-pulsating model of the teaching-learning process and of teacher development. He expected a CSC to be engaged in a continuous process of design and development of new demonstrations and experiments, curricula and supporting materials, in-house as well as through collaborations. He actively pursued the project of setting up CSCs and obtained aid from the Central Government for it. Unfortunately only one of the several CSCs planned actually took good shape; it is the Midnapore Centre so dedicatedly nurtured by Prof. Samanta. The Midnapore CSC is a living memorial to Prof. Khandelwal.

In fact, not only the Midnapore CSC, but the entire IAPT organizational ethos is a memorial to Prof. Khandelwal. He was the creator of this ethos; he lived by it; and colleagues imbibed it as they saw him as a role model. IAPT in its formative years grew on this ethos in his presence, and it remained there even when he had gone. That is the kind of legacy a great leader leaves.

I humbly extend my sincerest homage to the memory of Prof. D.P. Khandelwal.

H. C. Pradhan
Former President, IAPT

Announcement
Postponement of NSSP-2020

The National Student Symposium of Physics (NSSP-2020), an annual symposium of IAPT, being organized every year in October-November, by the Physics Department, Panjab University had to be postponed due to the prevailing pandemic conditions. As soon as the situation improves, the required infrastructure, support staff and accommodation for participants becomes available, the program details will be shared and the call for participation made.

C. N. Kumar
Organising Secretary, NSSP

National Top 1% of NSEA - 2019 held on 24.11.2019 at 1590 Centres

Sr. No.	Roll No	Name of Student	Gen	Class	Marks	Centre Code	Centre Name	City
1	AP19101119	GANGULA BHUVAN REDDY	M	12	181	APS0020	SRI CHAITANYA JUNIOR KALASALA	VIJAYAWADA RURAL
2	AP19101230	LANDA JITENDRA	M	12	164	APS0020	SRI CHAITANYA JUNIOR KALASALA	VIJAYAWADA RURAL
3	AP19101265	KANDULA YASWANTH	M	12	175	APS0020	SRI CHAITANYA JUNIOR KALASALA	VIJAYAWADA RURAL
4	AP19101286	NANNAPANENI YASASWI	F	12	170	APS0020	SRI CHAITANYA JUNIOR KALASALA	VIJAYAWADA RURAL
5	AP19102127	K. SAI SRIVARDHIN	M	12	173	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
6	AP19102129	A. PRADEEP KUMAR	M	12	178	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
7	AP19102134	M. DIVYA TEJA	M	12	186	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
8	AP19102139	B. VENKATA SOMA SEKHAR	M	12	168	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
9	AP19102140	B. VAMSI KRISHNA	M	12	187	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
10	AP19102141	B. VENKATA SAI KIRAN	M	12	168	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
11	AP19102142	N. ABHILOKESH	M	12	174	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
12	AP19102145	G. RAGHAVENDRA CHOWDARY	M	12	175	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
13	AP19102146	G. MANOJ	M	12	165	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
14	AP19102147	M. S. V SAYI TEJA REDDY	M	12	164	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
15	AP19102148	B. RUTHVIK KUMAR REDDY	M	12	168	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
16	AP19102150	G. VENKATA SRAVAN KUMAR	M	12	170	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
17	AP19102151	B. AARSHA SAI	M	12	162	APS0033	NARAYANA CO SCHOOL	VIJAYAWADA
18	AP19102579	DESAI DIVYESWAR REDDY	M	12	166	APS0047	SRI CHAITANYA GIRLS JR COLLEGE	VIJAYAWADA
19	AP19102634	KAPELLI YASHWANTH SAI	M	12	186	APS0047	SRI CHAITANYA GIRLS JR COLLEGE	VIJAYAWADA
20	AP19103255	CHILUKURI MANI PRANEETH	M	12	173	APS0047	SRI CHAITANYA GIRLS JR COLLEGE	VIJAYAWADA
21	AP19174842	P CHETHAN KRISHNA	M	12	173	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
22	CH19112378	KUNWAR PREET SINGH	M	12	180	CHS0009	KENDRIYA VIDYALAYA SECTOR 31 CHANDIGARH	CHANDIGARH
23	DL19112639	ADITYA SINGH	M	12	165	DLS0002	DELHI PUBLIC SCHOOL SECTOR12 R K PURAM	NEW DELHI
24	DL19112890	ADARSH ROY	M	12	174	DLS0003	REMAL PUBLIC SCHOOL	NEW DELHI
25	DL19113146	SOUMIL AGGARWAL	M	12	179	DLS0006	LAL BAHADUR SHASTRI SENIOR SECONDARY SCHOOL	NEW DELHI
26	DL19113155	GURKIRAT SINGH	M	12	193	DLS0006	LAL BAHADUR SHASTRI SENIOR SECONDARY SCHOOL	NEW DELHI
27	DL19113759	KUMAR SATYAM	M	12	184	DLS0013	KENDRIYA VIDYALAYA DWARKA SEC.5	NEW DELHI
28	DL19114783	RTYA SAWHNEY	F	12	181	DLS0030	DELHI PUBLIC SCHOOL VASANT KUNJ	NEW DELHI
29	DL19114811	PRASENJIT ROY	M	12	158	DLS0030	DELHI PUBLIC SCHOOL VASANT KUNJ	NEW DELHI
30	DL19115154	ARNAV GUPTA	M	12	169	DLS0052	KENDRIYA VIDYALAYA SEC.12 DWARKA	DELHI
31	DL19115270	AMAN BUCHA	M	12	159	DLS0056	KENDRIYA VIDYALAYA AGCR COLONY	DELHI
32	DL19115365	DEV GUPTA	M	11	195	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
33	DL19115386	VAMSHI VANGALA	M	12	166	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
34	DL19115387	SANDEEPAN NASKAR	M	12	177	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
35	DL19115388	TUSHAR GUJRAL	M	12	174	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
36	DL19115389	ABHINAV BARNAWAL	M	12	189	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
37	DL19115390	SOORAJ SRINIVASAN	M	12	179	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
38	DL19115393	ASHUTOSH PANKAJ	M	12	158	DLS0057	PRAGATI PUBLIC SCHOOL	NEW DELHI
39	DL19115638	SAMYAK MAHAJAN	M	12	158	DLS0074	BGS INTERNATIONAL PUBLIC SCHOOL	NEW DELHI
40	DL19115695	NISHANT AGARWAL	M	12	169	DLS0076	KENDRIYA VIDYALAYA PUSHP VIHAR SAKET	DELHI
41	DL19122717	ANIRUDH SHARMA	M	12	190	HRS0044	NARAYANA ETECHNO SCHOOL	GURGAON
42	GJ19118066	DHRUV MAROO	M	12	164	GJS0023	VIKRAM A SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAD
43	GJ19118105	MEHTA NIYATI	F	12	175	GJS0023	VIKRAM A SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAD
44	GJ19118148	POOJAN SOJITRA	M	12	171	GJS0023	VIKRAM A SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAD

45	GJ19118157	ANANTH KRISHNA KIDAMBI	M	11	162	GJS0023	VIKRAMA SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAI
46	GJ19118166	HARSH SHAH	M	12	160	GJS0023	VIKRAMA SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAI
47	GJ19118169	DHRUV TARSADIYA	M	12	159	GJS0023	VIKRAMA SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAI
48	GJ19118178	RANINGA ANSH	M	12	160	GJS0023	VIKRAMA SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAI
49	GJ19118818	MIHIR KOTHARI	M	11	186	GJS0023	VIKRAMA SARABHAI COMMUNITY SCIENCE CENTRE	AHMEDABAI
50	GJ19120210	PARTH URVESH SHAH	M	12	158	GJS0069	KENDRIYA VIDYALAYA CANT. AHMEDABAD	AHMEDABAI
51	GJ19120215	SHAH DHRUV RAJENDRABHAI	M	12	162	GJS0069	KENDRIYA VIDYALAYA CANT. AHMEDABAD	AHMEDABAI
52	HR19112401	KARTIK SHARMA	M	12	173	CHS0009	KENDRIYA VIDYALAYA SECTOR 31 CHANDIGARH	CHANDIGAR
53	HR19113874	DHRUV TYAGI	M	12	183	DLS0015	S M ARYA PUBLIC SCHOOL	NEW DELHI
54	HR19113905	HARSHVARDHAN AGARWAL	M	12	172	DLS0015	S M ARYA PUBLIC SCHOOL	NEW DELHI
55	HR19121525	SUMANT PAREEK	M	12	169	HRS0005	MODERN DELHI PUBLIC SCHOOL	FARIDABAD
56	HR19121728	RISHIT SINGLA	M	11	167	HRS0007	MODERN VIDYA NIKETAN SENIOR SECONDARY SCHOOL	FARIDABAD
57	HR19122320	AMAN BANSAL	M	12	178	HRS0021	RPS PUBLIC SCHOOL SURANA NARNAUL	NARNAUL
58	HR19122537	DIVYANSHU AGARWAL	M	12	162	HRS0039	RPS PUBLIC SCHOOL HANSI	HANSI
59	HR19122712	KESHAV AGARWAL	M	12	188	HRS0044	NARAYANA ETECHNO SCHOOL	GURGAON
60	HR19123671	DHVANIT BENIWAL	M	12	203	HRS0095	KENDRIYA VIDYALAYA NO.II CHANDIMANDIR	PANCHKULA
61	HR19123703	ANUBHAV BHATLA	M	12	165	HRS0095	KENDRIYA VIDYALAYA NO.II CHANDIMANDIR	PANCHKULA
62	JH19125406	SOURADEEP DAS	M	12	159	JHS0010	RAMAKRISHNA MISSION VIDYAPITH	DEOGHAR
63	JH19125870	DAYAL KUMAR	M	12	165	JHS0019	DELHI PUBLIC SCHOOL	RANCHI
64	KA19128654	GOVIND SAJU	M	12	180	KAS0046	ALPINE PUBLIC SCHOOL	BANGALORE
65	KA19128655	UDHAV VARMA	M	11	167	KAS0046	ALPINE PUBLIC SCHOOL	BANGALORE
66	KA19128710	SHUBHAN R	M	12	168	KAS0047	BASE PU COLLEGE	BANGALAOR
67	KA19129536	GAURAV A	M	12	158	KAS0026	NARAYANA OLYMPIAD SCHOOL	BANGALORE
68	KA19129859	KALP VYAS	M	12	169	KAS0039	NATIONAL PUBLIC SCHOOL HSR LAYOUT	BANGALORE
69	KA19129866	PRANAVA SINGHAL	M	12	169	KAS0039	NATIONAL PUBLIC SCHOOL HSR LAYOUT	BANGALORE
70	KA19130449	RAMOJEET ROYCHOWDHURY	M	11	170	KAS0059	JINDAL VIDYA MANDIR	BALLARI
71	KA19131081	ABHIRAM M	M	12	171	KAS0078	RV PU COLLEGE	BENGALURU
72	KL19133189	ADITYA BYJU	M	12	159	KLS0001	KURIAKOSE ELIAS ENGLISH MEDIUM SCHOOL	KOTTAYAM
73	MH19136425	PRERAK SUNIL MESHRAM	M	12	172	MHS0004	RAMAN SCIENCE CENTRE AND PLANETARIUM	NAGPUR
74	MH19136930	KARTIK SREEKUMAR NAIR	M	11	181	MHS0007	THAKUR VIDYA MANDIR HIGH SCHOOL AND JUNIOR COLLEGE	MUMBAI
75	MH19137053	SUBARNO NATH ROY	M	12	187	MHS0007	THAKUR VIDYA MANDIR HIGH SCHOOL AND JUNIOR COLLEGE	MUMBAI
76	MH19137108	AMEYA P DESHMUKH	M	11	176	MHS0007	THAKUR VIDYA MANDIR HIGH SCHOOL AND JUNIOR COLLEGE	MUMBAI
77	MH19137167	ARYAN AJAY VORA	M	12	168	MHS0007	THAKUR VIDYA MANDIR HIGH SCHOOL AND JUNIOR COLLEGE	MUMBAI
78	MH19137321	ADITYA PRASHANT KUDRE	M	12	185	MHS0009	MES ABASAHEB GARWARE COLLEGE	PUNE
79	MH19137426	SHANTANU MENE	M	12	178	MHS0010	PMCS RAJIV GANDHI ACADEMY OF E LEARNING AND JR COLLEGE OF SCIENCE	PUNE
80	MH19137491	ANURAG ABHIJIT PENDSE	M	12	172	MHS0010	PMCS RAJIV GANDHI ACADEMY OF E LEARNING AND JR COLLEGE OF SCIENCE	PUNE
81	MH19137811	ANKYA VINOD BOBDE	M	12	165	MHS0014	AAICHI SHALA JR.SCIENCE COLLEGE	AKOLA
82	MH19140283	HARSH LULLA	M	12	172	MHS0073	RAMSHETH THAKUR PUBLIC SCHOOL	KHARGHAR
83	MH19141609	DADHICHI DATTATRAYA TELWADK/	M	12	166	MHSM19	SBES COLLEGE OF SCIENCE	AURANGAB/
84	MH19141614	GULVE VEDANT AVINASH	M	12	163	MHSM19	SBES COLLEGE OF SCIENCE	AURANGAB/
85	MH19143318	THARUN MAHESH	M	12	171	MHSM63	DAV PUBLIC SCHOOL	PUNE
86	MP19148644	SHUBH HARKAWAT	M	12	160	MPS0006	THE SHISHUKUNJ INTERNATIONAL SCHOOL	INDORE
87	MP19150932	SHREEYA MOGHE	F	12	178	MPS0095	I.B.S. GLOBAL ACADEMY	UJJAIN
88	OD19152650	SIRASISH ROUT	M	12	163	ODS0009	SAI INTERNATIONAL SCHOOL	BHUBANESW
89	OD19153254	SOURABH SOUMYAKANTA DAS	M	12	161	ODS0020	DAV PUBLIC SCHOOL	BHUBANESW
90	PB19155461	AVVAL AMOL	M	12	172	PBS0034	APEEJAY SCHOOL	JALANDHAR
91	PB19156097	GAVISH GARG	M	12	161	PBS0069	GURU NANAK PUBLIC SCHOOL	BATHINDA
92	RJ19158074	VINAMRA MAHAJAN	M	11	161	RJS0004	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA

93	RJ19158077	AARYAN KUMAR GUPTA	M	12	169	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
94	RJ19158084	ANANYA DAS	F	12	164	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
95	RJ19158088	ARIN KEDIA	M	12	194	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
96	RJ19158098	HARSH TRIVEDI	M	12	172	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
97	RJ19158103	PRAKHAR BANSAL	M	12	161	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
98	RJ19158115	ABHINAV SINHA	M	12	161	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
99	RJ19158118	ACHINTYA NATH	M	12	191	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
100	RJ19158134	SAHIL GARG	M	12	182	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
101	RJ19158142	SANKALP PARASHAR	M	12	162	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
102	RJ19158146	UTKARSH RANJAN	M	12	191	RJS0084	ST. JOHNS SENIOR SECONDARY SCHOOL	KOTA
103	RJ19158591	VISHAL BULCHANDANI	M	12	165	RJS0085	BHARATIYA VIDYA BHAVAN VIDYASHRAM	JAIPUR
104	RJ19158634	TEJAS KUMAR	M	11	160	RJS0089	JAYSHREE PERIWAL HIGH SCHOOL	JAIPUR
105	RJ19159106	AKHIL AGRAWAL	M	12	159	RJS0089	JAYSHREE PERIWAL HIGH SCHOOL	JAIPUR
106	RJ19159203	VISHWAS KALANI	M	12	175	RJS0089	JAYSHREE PERIWAL HIGH SCHOOL	JAIPUR
107	RJ19159211	VIRENDRA KABRA	M	12	170	RJS0089	JAYSHREE PERIWAL HIGH SCHOOL	JAIPUR
108	RJ19160368	MRIDUL AGARWAL	M	11	196	RJS0012	ST.XAVIERS SR.SEC.SCHOOL	JAIPUR
109	RJ19160502	VAIBHAV SAHA	M	12	162	RJS0016	LORD BUDDHA PUBLIC SCHOOL	KOTA
110	RJ19160715	NEERAJ KAMAL	M	12	161	RJS0016	LORD BUDDHA PUBLIC SCHOOL	KOTA
111	RJ19163581	BARUN PARUA	M	11	177	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
112	RJ19163586	AYAN MINHAM KHAN	M	11	158	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
113	RJ19163591	SHIVAM SOURAV	M	11	174	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
114	RJ19163623	YASHWANTH REDDY CHALLA	M	11	195	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
115	RJ19163628	VAIBHAV RAJ	M	12	194	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
116	RJ19163640	AAKASH OM TRIVEDI	M	12	171	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
117	RJ19163659	ARNAV ADITYA SINGH	M	11	158	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
118	RJ19163660	OMM AGRAWAL	M	11	164	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
119	RJ19163676	MOHIT GUPTA	M	12	170	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
120	RJ19163683	KUNAL SAMANTA	M	12	181	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
121	RJ19163687	AKHIL JAIN	M	12	189	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
122	RJ19163689	SAPTARSHI SEN	M	12	178	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
123	RJ19163695	TANMAY DOKANIA	M	12	174	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
124	RJ19163696	R. MUHENDER RAJ	M	12	161	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
125	RJ19163697	AARYAN TIWARY	M	12	167	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
126	RJ19163700	NAMAN SINGH RANA	M	12	175	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
127	RJ19163702	OJASWI JAIN	M	12	177	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
128	RJ19163705	PARTH DWIVEDI	M	12	191	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
129	RJ19163706	VIVEK VEER	M	12	176	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
130	RJ19163717	GUTTA SINDHUJA	F	12	171	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
131	RJ19163718	YUVRAJ SINGH SHEKHAWAT	M	12	195	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
132	RJ19163741	LAKSHYA GUPTA	M	12	184	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
133	RJ19163742	AADARSHRAJ SAH	M	12	177	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
134	RJ19163812	KUNAL KUNDWANI	M	12	184	RJS0052	DISHA DELPHI PUBLIC SCHOOL	KOTA
135	RJ19165985	ADITYA TANWAR	M	12	171	RJS0125	YADAV BHARTI SR. SEC SCHOOL	BIKAN
136	TN19167529	PRADEEP S	M	12	171	TNS0006	CHETTINAD VIDYASHRAM	CHENN
137	TN19167601	ADITYA S SADHU	M	12	170	TNS0009	CHENNAI PUBLIC SCHOOL	CHENN
138	TN19169817	C. ADITYA	M	12	169	TNS0041	MAHARISHI VIDYA MANDIR SENIOR SECONDARY SCHOOL	CHENN
139	TN19170082	ANAND NARASIMHAN	M	11	160	TNS0041	MAHARISHI VIDYA MANDIR SENIOR SECONDARY SCHOOL	CHENN

140	TS19173160	VISHAL RAVIPATI	M	12	173	TSS0001	FIITJEE WORLD SCHOOL	HYDERABAD
141	TS19173161	PRATHAMESH SACHIN PILKHANE	M	12	173	TSS0001	FIITJEE WORLD SCHOOL	HYDERABAD
142	TS19173244	PADAKANTI AKSHAY KIRAN	M	12	170	TSS0001	FIITJEE WORLD SCHOOL	HYDERABAD
143	TS19173256	GUNDABATHULA SASANK	M	12	165	TSS0001	FIITJEE WORLD SCHOOL	HYDERABAD
144	TS19173260	MAKAM ANISH	M	12	172	TSS0001	FIITJEE WORLD SCHOOL	HYDERABAD
145	TS19174198	SAI ADITYAK	M	10	162	TSS0018	NARAYANA OLYMPIAD SCHOOL	HYDERABAD
146	TS19174222	C V VAMSIDHAR REDDY	M	11	166	TSS0020	SRI CHAITANYA JUNIOR COLLEGE	HYDERABAD
147	TS19174250	K SAI SHREE LAASYA RAAGYNI	F	12	159	TSS0020	SRI CHAITANYA JUNIOR COLLEGE	HYDERABAD
148	TS19174267	SAI ROHAN PALUSA	M	12	160	TSS0020	SRI CHAITANYA JUNIOR COLLEGE	HYDERABAD
149	TS19174699	N SURYA PRAKASH REDDY	M	12	176	TSS0062	NARAYANA JUNIOR COLLEGE C.C. 58333	IBRAHIMPATN.
150	TS19174823	VIGNESHWAR REDDY	M	12	165	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
151	TS19174829	V V SAI KEERTHANA	F	12	166	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
152	TS19174837	BHAVANA. M	F	12	162	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
153	TS19174841	VIRINCHI MOURYA	M	12	187	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
154	TS19174844	CHUKKA TANUJA	F	12	172	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
155	TS19174861	ADITYA VIRAJ RAO PONUGOTI	M	12	183	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
156	TS19174862	SATHVIK REDDY GARLAPATI	M	12	193	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
157	TS19174868	BANNURU ROHIT KUMAR REDDY	M	11	162	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
158	TS19174872	DEETI YESHASH CHANDRA	M	12	158	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
159	TS19174934	SHASHWAT NAIDU	M	12	162	TSS0066	NARAYANA IIT ACADEMY	HYDERABAD
160	TS19175317	KRUSHNA CHANDRIL.H	M	9	168	TSS0075	SRI GURUDATH HIGH SCHOOL	HANAMKONDA
161	TS19176681	B RAJA RAVI KIRAN REDDY	M	12	167	TSS0088	SRI CHAITANYA JR KALASALA	HYDERABAD
162	TS19176899	ANNAM. SAIVARDHAN	M	12	163	TSS0088	SRI CHAITANYA JR KALASALA	HYDERABAD
163	TS19176904	C. VINAY KUMAR	M	12	158	TSS0088	SRI CHAITANYA JR KALASALA	HYDERABAD
164	TS19176914	C. CHANDRABHUSHAN REDDY	M	12	162	TSS0088	SRI CHAITANYA JR KALASALA	HYDERABAD
165	UP19180596	VAIBHAV MISHRA	M	12	159	UPS0009	VANASTHALI PUBLIC SCHOOL	GHAZIABAD
166	UP19182577	L GOKULNATH	M	12	171	UPS0073	KOTHARI INTERNATIONAL SCHOOL	NOIDA
167	UP19182596	AADI AARYA CHANDRA	M	12	173	UPS0073	KOTHARI INTERNATIONAL SCHOOL	NOIDA
168	UP19182599	MADHUR AGRAWAL	M	12	161	UPS0073	KOTHARI INTERNATIONAL SCHOOL	NOIDA
169	UP19186045	AKASH SINHA	M	12	168	UPS0203	SUNBEAM SCHOOL ANNAPURNA LAHARTARA	VARANASI
170	UP19186161	ANIMESH AWASTHI	M	11	174	UPS0209	JAWAHAR NAVODAYA VIDYALAYA BALLA	RAEBARELI
171	WB19187375	PURNENDU SEN	M	12	161	WBS0016	DAV MODEL SCHOOL DURGAPUR	DURGAPUR
172	WB19187461	DANISH JAVED	M	12	165	WBS0017	KENDRIYA VIDYALAYA BARRACKPORE ARMY	KOLKATA
173	WB19187563	RWITABRATA MALLICK	M	10	163	WBS0018	BASIRHAT HIGH SCHOOL	BASIRHAT
174	WB19188559	DIBAYAN DATTA	M	11	161	WBS0062	HEMSHEELA MODEL SCHOOL	DURGAPUR

B. P. Tyagi
Chief Coordinator (Examination)

FIRST STEP TOWARDS INTERNATIONAL OLYMPIADS

INTERNATIONAL OLYMPIAD QUALIFIER IN PHYSICS	**: IOQP 2020 - 21 (NSEP)**
INTERNATIONAL OLYMPIAD QUALIFIER IN CHEMISTRY	**: IOQC 2020 - 21 (NSEC)**
INTERNATIONAL OLYMPIAD QUALIFIER IN BIOLOGY	**: IOQB 2020 - 21 (NSEB)**
INTERNATIONAL OLYMPIAD QUALIFIER IN ASTRONOMY	**: IOQA 2020 - 21 (NSEA)**
INTERNATIONAL OLYMPIAD QUALIFIER IN JUNIOR SCIENCE	**: IOQJS 2020 - 21 (NSEJS)**

These examination IOQ replace NSE 2020-21 in corresponding subjects and are the only examination that lead to the participation of Indian students in the International Olympiads. No other examination is recognized for this purpose.

Organized by

INDIAN ASSOCIATION OF PHYSICS TEACHERS (IAPT)

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

AND

Homi Bhabha Centre for Science Education (TIFR) Mumbai

In co-ordination with

ASSOCIATION OF CHEMISTRY TEACHERS (ACT) &

ASSOCIATION OF TEACHERS IN BIOLOGICAL SCIENCES (ATBS)

Step II Toppers of these IOQP, IOQC, IOQB, IOQA & IOQJS Part I from all States/Union Territory will be eligible for evaluation of IOQ Part II in respective subjects. For details visit the website www.iapt.org.in and the student's handout. Also HBCSE website www.hbcse.tifr.res.in

Step III About 35 toppers in each of IOQP, IOQC, IOQB, IOQA and IOQJS will qualify for the **Orientation Cum Selection Camp** (OCSC) in respective subjects for about two weeks at Homi Bhabha Centre for Science Education (HBCSE) Mumbai. Indian teams to participate in International Olympiads-2021 will be selected on the basis of performance of students in respective OCSC.

In addition, about 5 toppers from IOQP may get an opportunity to participate in **Asian Physics Olympiad (APhO - 2021)**. APhO will be held in Ist week of May 2021.

Awards: Students attending **OCSC** will be awarded Gold medals and a merit certificate in all subjects.

Syllabus: All Syllabi are displayed on website : https://www.iapt.org.in

Programme: Online enrollment by the student himself / herself shall be done on www.iapt.org.in from Nov 1, 2020 till Nov 27, 2020. A fee around Rs. 200 per student per subject shall be deposited by the student through online payment gate way at his / her own login provided on the website. Examination centre will be displayed on the website by Dec 15, 2020.

DATE AND TIME OF EXAMINATION: SUNDAY, Jan 17, 2021; **Junior Science** (IOQJS) : 02:30 pm to 05:45 pm SATURDAY, Feb 06, 2021; **Astronomy** (IOQA): 09:00 am to 12:15 pm, **Chemistry** (IOQC): 02:30 pm to 05:45 pm, SUNDAY, Feb 07, 2021; **Physics** (IOQP): 09:00 am to 12:15 pm, **Biology** (IOQB): 2:30 pm to 5:45 pm

PREVIOUS 5 YEARS QUESTION PAPERS BOOKLET IN EACH SUBJECT IS AVAILABLE FOR Rs 50/- EACH FROM IAPT KANPUR OFFICE.

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Dr. Vijay V Soman (9822107522) NSEJS Co-ordinator
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Central IAPT Examination Office:
15, Block II Rispana Road, DBS College Chowk Dehradun-248001
Email: iapt.nse@gmail.com, Helpline: 9632221945/9411530162

For all queries regarding the examination students should contact the IAPT Examination Office Dehradun

The Fascinating Sky

During September to December 2020, the sly viewing is fascinating for everyone. several brighter stars are visible from evening to late night. These are not stars but planets of our solar system. During this time of the year they are very close to the earth and very bright, visible with naked eye. In early September, the Jupiter and Saturn were visible in the sky, very bright as was observed and photographed with a mobile camera around 8 pm on October 13 at Jaipur (city lights are also visible). Readers can spot them near about Diwali when nights are dark.

Jupiter's orbital ime is 12 years and Mars takes around 2 years. A similar situation is expected to occur after 13 years, when both planets will be so bright and visible with naked eyes.

Y. K. Vijay
Jaipur

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