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The jellyfish galaxy JO206 trails across this image from the NASA/ESA Hubble Space Telescope, showcasing a colourful star-forming disk surrounded by a pale, luminous cloud of dust. A handful of foreground bright stars with crisscross diffraction spikes stands out against an inky black backdrop at the bottom of the image. JO206 lies over 700 million light-years from Earth in the constellation Aquarius.

Jellyfish galaxies are so-called because of their resemblance to their aquatic namesakes. In the bottom right of this image, long tendrils of bright star formation trail the disk of JO206, just as jellyfish trail tentacles behind them.The tentacles of jellyfish galaxies give astronomers a unique opportunity to study star formation under extreme conditions, far from the influence of the galaxy's main disk. Surprisingly, Hubble revealed that there are no striking differences between star formation in the disks of jellyfish galaxies and star formation in their tentacles, which suggests the environment of newly formed stars has only a minor influence on their formation.

(Link: https://www.nasa.gov/image-feature/goddard/2023/hubble-observes-a-cosmic-sea-creature)

The Story Of Cosmology Through Post Stamps 53

MOON

CULTURAL REFERENCES

Moons natural prominence in the earthly sky and its phases have provided cultural references and greatly influenced the human society and culture since time immemorial such cultural influence can be found in language, calendar system, arts and mythologies.

Greeting Post- pre-stamped cover and card-illustrate artist's imagination in personification of the Moon

Moon Mask-used by performing artists

Overprint with surcharge-moon crescent and stars

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From the Editor's desk……...

As editor of the Bulletin 25 years ago I had written a piece on why we need to rotate or replace the editor (myself). This exercise was part of the overall plan of refurbishing the Bulletin. Recently Prof. G. Venkatesh has made a similar plea but his is more comprehensive. I am not sure if I agree with the details of his suggestions but the spirit is one which most of us, being part of a democratic institution such as IAPT, will subscribe to.

If I understand him right every post must be time bound. We can make it 3 years or 5 or even 10. Some, who are in key posts , are important, and are fulfilling the tasks allotted to them most expeditiously. No doubt about it. But no individual is indispensable.

Further a post which is to fall vacant must be announced. I do not like the term “advertise”. This way persons who may want to serve IAPT can approach the appropriate authorities and be given a chance. A committee can be formed which includes the President and the General Secretary for a given term (say three years) which will do all such selections and get it ratified by the EC.

The above are some of my thoughts on the Prof. Venkatesh's suggestion. Perhaps the best way is to have committee which looks into Prof. Venkatesh's suggestions and comes up with solid recommendations.

For people who might frown on this I have this to say. We are a democratic, inclusive organization. Democratic processes are slow. But they are sure and enduring. As the saying goes “If you want to go fast, go alone; if you want to go far go together”. And let your peers lead by rotation.

Dr. Vijay A. Singh
Visiting Prof. CEBS, Mumbai

PHYSICS NEWS

New hope in search for dark matter as most sensitive instrument of its kind begins first science run

The search for extremely light particles which are thought to be the building blocks of dark matter is underway.An international team of scientists, led by Deutsches Elektronen-Synchrotron (DESY) and drawing on expertise from Cardiff University, have started the Any Light Particle Search (ALPS II) experiment.ALPS II or the "light shining through a wall" experiment stretches a total length of 250 meters and aims to identify a new elementary particle.According to current calculations, dark matter should be around five times as abundant as normal matter, which consists of the atoms that make up stars, planets, human beings and every other visible object in the universe.Such particles are thought to react only extremely weakly with known kinds of matter, which means they cannot be detected in experiments using accelerators.

If found to exist the particle would provide solutions to a whole series of problems currently puzzling physicists, including the composition of dark matter.

Read more at:https://phys.org/news/2023-06-dark-sensitive-instrument-kind-science.html

Original paper: Provided by Cardiff University (still not published)

Exploring gravity's effect on quantum spins

A joint research group led by Prof. Sheng Dong and Prof. Lu Zhengtianinvestigated the coupling effect between neutron spin and gravitational force via employing a high-precision xenon isotope magnetometer.This research aims to uncover the coupling strength between neutron spin and gravity by measuring the weight difference between the neutron's spin-up and spin-down states. The experimental results revealed that the weight difference between these two states was less than two sextillionths ($<2\times10^{-21}$), setting a new upper limit on the coupling strength of this effect.

The experimental results compress the upper limit of the neutron's spin-gravity coupling strength by a factor of 17, and improve the precision of various fundamental physical effects by an order of magnitude.These experiments have also investigated the fundamental spacetime symmetry in gravitational interactions and seek to identify axion-like particles that mediate monopole-dipole interactions.

Read more at:https://phys.org/news/2023-06-exploring-gravity-effect-quantum.html

Original paper: Physical Review Letters (2023). DOI: 10.1103/PhysRevLett.130.201401

Novel insights on the interplay of electromagnetism and the weak nuclear force

Outside atomic nuclei, neutrons are unstable particles, with a lifetime of about fifteen minutes. The neutron disintegrates due to the weak nuclear force, leaving behind a proton, an electron, and an antineutrino.Comparing experimental measurements of neutron decay with theoretical predictions based on the weak nuclear force can reveal as-yet undiscovered interactions.This research identified a shift in the strength with which a spinning neutron experiences the weak nuclear force. This has major implications as this research affects the search for new interactions, technically known as "right-handed currents," that, at very short distances of less than one hundred quadrillionths of a centimeter, restore the universe's mirror-reflection symmetry.

The researchers also assessed the impact on searches of right-handed current. They found that after including the new correction, experimental data and theory are in good agreement and current uncertainties still allow for new physics at a relatively low mass scale.

Read more at:https://phys.org/news/2023-06-insights-interplay-electromagnetism-weak-nuclear.html

Original paper: Physical Review Letters (2022). DOI: 10.1103/PhysRevLett.129.121801

Soumya Sarkar
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INDIA

Common Clock: A study of the angle between the Hour and Minute hands and its times of occurrences

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A close observation of the Common Wall Clock generates lot of interest in the relative motion of the Hour and Minute hands. Particularly, one wants to know the relative angle between the Hour and Minute hands, for a given time from 00:00 to 12:00 hours. Conversely, one also wants to know at what instants of time during the 12 hours period, a given angle between the Hour and Minute hands occurs. The following paragraphs, with the help of the rate of revolution of the hands and the relative rate of motion between the Hour and Minute hands, address the above observations.

It is well known that the Minute Hand makes one complete revolution of 360° in 1 hour. In other words, we can say that the Minute hand's rate of revolution is 1 rev/hour. Similarly, the Hour hand's rate of revolution is 1/12 rev/hour. **Fig-1** explains the above angular motions on a Clock. **Fig-1(a)** shows the position at 12:00. **Fig-1(b**) shows the position of the Hands after 1 hour at 01:00. It can be seen that the Minute hand has made one revolution and the Hour hand has made (1/12) revolution. Both of them are with reference to the 12:00 fixed position of the Clock. But the Clock is always viewed as a relative position between the two hands. The Minute hand can be viewed as revolving at (1-1/12) or 11/12 rev/hour with respect to the Hour hand. **Fig-1(c)** shows that the Hour and Minute hand coincide, like at 12:00 position after one relative revolution of 360°. This happens after 12/11 hours (1h 05m 27.2727s), considering the relative rate of revolution of 11/12 rev/hour.

For a given time, the relative angle **θr** of the Hour hand, measured in the clockwise direction from the Minute hand is shown in **Fig-2**. Since the relative rate is 11/12 rev/hour, we can find the angle **θr** for a given time**,** using this information. The given time is converted to time in hours (Tg). The number of revolutions in this time is given by Tg*(11/12). The decimal part of this, representing the fractional revolution, when multiplied by 360° gives the angle in degrees. Fig-2, also illustrates this for an example time of 07:30. The acute angle being 45°, **θr** is 315° with the assumed +ve direction.

It is also possible to work out the time instants during the 12 hours, where a given angle **θr** occurs. Starting from 12:00, the first time of occurrence of **θr** is given by (12/11) * (**θr**/360). (12/11) hours is the time of one relative rev, and (**θr**/360) is the fraction of the revolution required to revolve **θr**°. After this time, the same angle will be achieved after every (12/11) hours of repetition time. **Table-1** shows this computation of the 11 times occurrences in the 12 hours, for different common angles. **Fig-3** shows the pictorial clock-view of the 4 time occurrences out of the 11, for the angles θ**r** given in Table-1. This gives a visual feel of the time occurrences at the chosen angles.

This Article has tried to cover the different angular positions of the Hour and Minute hand through simple calculations based on the relative rate of motion between the Hour and Minute hand. The methodology used, may be applied to some similar observation in other related areas

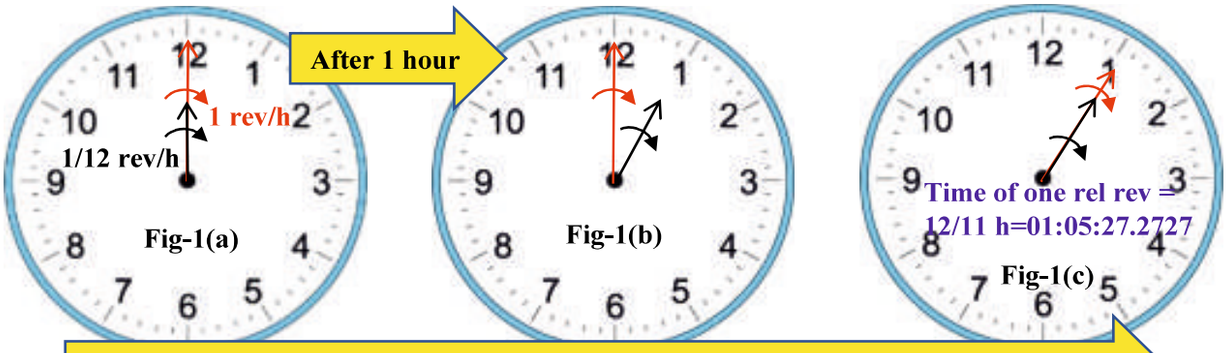

Fig-1: Relative motion of Minute hand with respect to Hour hand

To find θr for a given Time; θr = {Fraction[(Time in hrs)*11/12]}*360};
Example, 7:30, θr = {Fraction[7.5*11/12]}*360} = 0.875*360= 315°

θr = Lead angle of Minute hand with respect to Hour hand in Clockwise direction

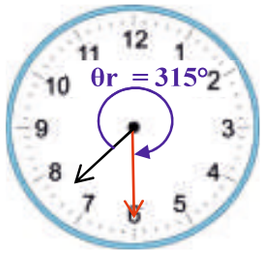

Fig-2: θr definition and time of occurrence

Occurrence Time of Rel Angle θr = (12/11)*θr/360 + N*12/11; N=0,11.
(11 relative revolutions in 12 hours)

Relative Angle θr	0°	45°	90°	135°	180°	270°
(N) 0	**12:00:00**	12:08:10.9	12:16:21.8	12:24:32.7	12:32:43.6	12:49:05.4
1	01:05:27.3	01:13:38.2	01:21:49.1	**01:30:00**	01:38:10.9	01:54:32.7
2	02:10:54.6	02:19:05.4	02:27:16.4	02:35:27.3	02:43:38.2	**03:00:00**
3	03:16:21.8	03:24:32.7	03:32:43.6	03:40:54.5	03:49:5.4	04:05:27.3
4	04:21:49.1	**04:30:00**	04:38:10.9	04:46:21.8	04:54:32.7	05:10:54.5
5	05:27:16.4	05:35:27.3	05:43:38.2	05:51:49.1	**06:00:00**	06:16:21.8
6	06:32:43.6	06:40:54.5	06:49:05.4	06:57:16.4	07:05:27.3	07:21:49.1
7	07:38:10.9	07:46:21.8	07:54:32.7	08:02:43.6	08:10:54.5	08:27:16.4
8	08:43:38.2	08:51:49.0	**09:00:00**	09:08:10.9	09:16:21.8	09:32:43.6
9	09:49:05.4	09:57:16.4	10:05:27.3	10:13:38.2	10:21:49.1	10:38:10.9
10	10:54:32.7	11:02:43.6	11:10:54.5	11:19:5.4	11:27:16.4	11:43:38.2
11	**12:00:00**	12:08:10.9	12:16:21.8	12:24:32.7	12:32:43.6	12:49:05.4

Table-1: Time of occurrences in 12 hours for a given **θr**

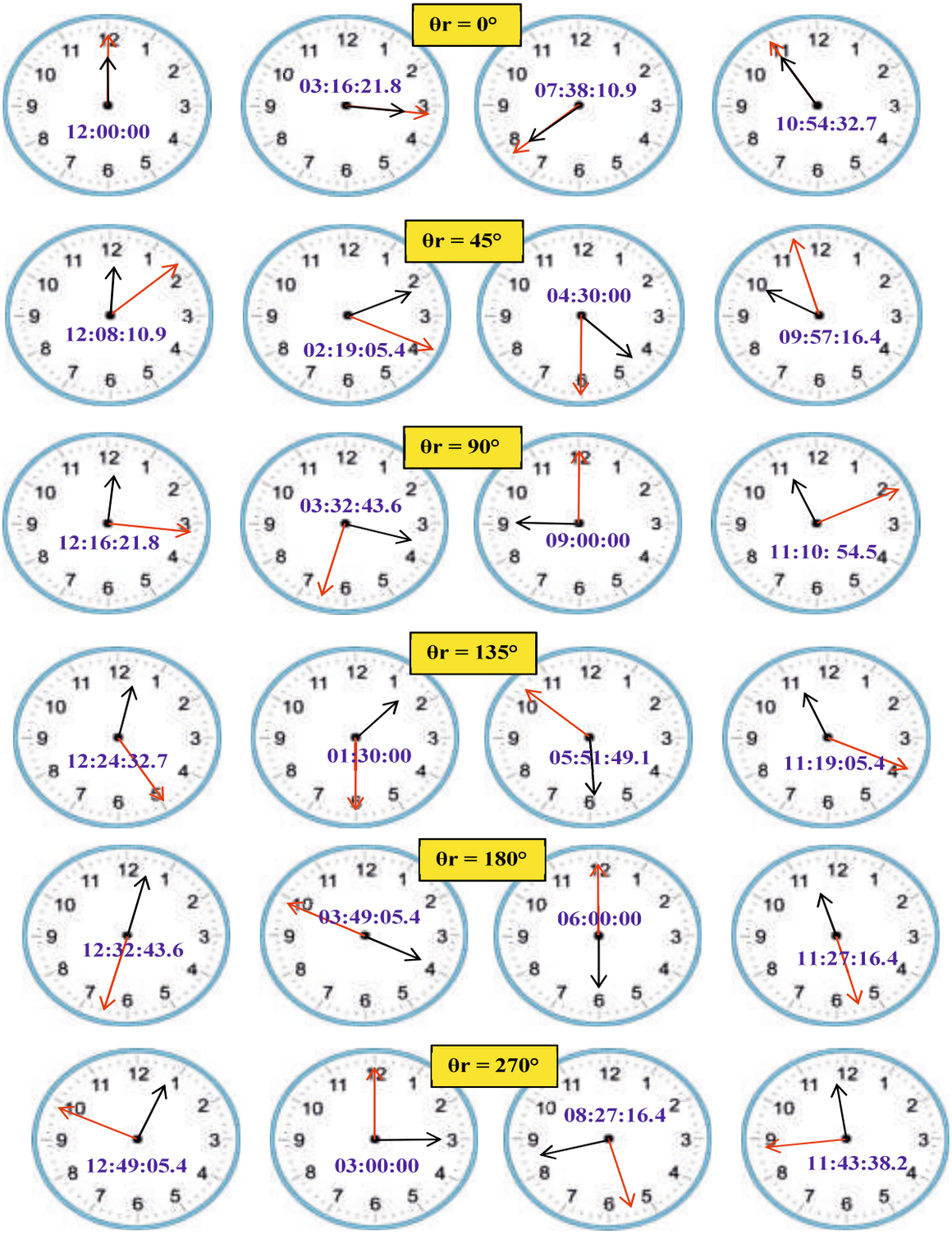

Fig-3: Clock view of the Time of occurrences in 12 hours for a **θr** = 0°,45°,90°,135°,180°,270°

ARTICLE

An apparently simple problem in electrostatics and its rather complicated solution

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Abstract: This article is about the solution of an apparently easy problem in electrostatics. There are two point charges q_1 and q_2 located at P and Q respectively, on the Z-axis. The point P is in a medium having permittivity $\varepsilon_1$and Q is in another medium having permittivity ε_2. The interface between the two media is parallel to the X-Y plane with $z = Z$. The problem concerns the force of interaction between the two point charges. We present a solution of the problem.

Introduction

Some problems can be stated very simply; their solutions may run for pages. The problem we are going to analyse (which incidentally was proposed by a Senior Secondary student) belongs roughly to this category. The question asked is this: Find the force of interaction between point charges q_1 and q_2 when they are located in two different media separated by an interfacial plane perpendicular to the line joining the two charges. The arrangement is depicted in Fig.1, where, by choice, the charges lie on the Z-axis of a coordinate system and the $z = Z$ plane defines the interface between the two media. As we shall see in what follows, the answer involves the use of the electrostatic boundary conditions at the interface and the solution of Laplace's equation in cylindrical polar coordinates.Theconcept of boundary conditions as well as the properties of Bessel functions, which arise as a consequence of using cylindrical polar coordinates, are beyond the reach of Senior Secondary students. Even undergraduate students may find the method used somewhat difficult to comprehend; hopefully they would be benefitted in the end.

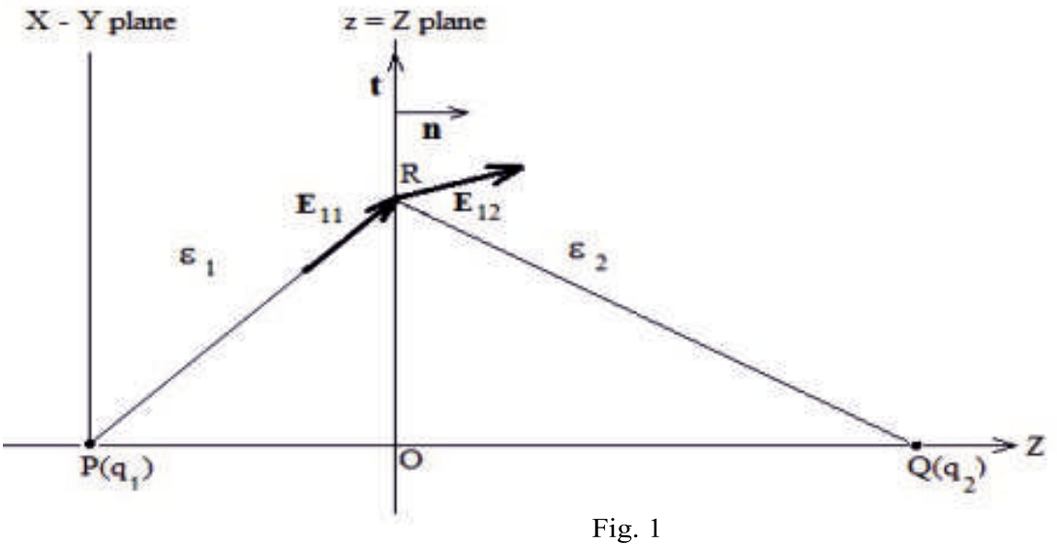

Fig. 1

Evaluation

We are required to find the force $\boldsymbol{F}$ of point charge q_1 on point charge q_2 .Let $\boldsymbol{E}_1(Q)$ be the electric field due to q_1 at the point Q. Then

$$\boldsymbol{F} = q_2\boldsymbol{E}_1(Q)$$

Now, at any arbitrary point, R , on the interface between the two media, the following boundary conditions hold:

$$E_{11}^{(t)} = E_{12}^{(t)} \tag{1}$$

$$\varepsilon_1 E_{11}^{(n)} = \varepsilon_2 E_{12}^{(n)} \tag{2}$$

where $E_{11}^{(t)}$ is the tangential component of the electric field of q_1 in the first medium while $E_{12}^{(t)}$ is the corresponding component in the second medium. The relation between the normal components $E_{11}^{(n)}$ and $E_{12}^{(n)}$ is also given above.

Let $\phi\,(\rho, \theta, z)$, where ρ, θ and z have their usual meanings, be the electrostatic potential due to the charge q_1. Due to the axial symmetry of the problem, ϕ actually has no θ dependence.

Now, <u>at the point R</u> on the interface,

$$(\nabla\phi)\ |_{med.2} = -\boldsymbol{E}_{12} = -E_{12}^{(t)}\boldsymbol{t} - E_{12}^{(n)}\boldsymbol{n}$$

where $\boldsymbol{t}$and$\boldsymbol{n}$are, respectively,the unit vector in the tangential and the normal direction (to the $z = Z$ plane).Note that$\boldsymbol{n} = \boldsymbol{k}$, the unit vector in the Z-direction.

Similarly

$$(\nabla\phi)\ |_{med.1} = -\boldsymbol{E}_{11} = -E_{11}^{(t)}\boldsymbol{t} - E_{11}^{(n)}\boldsymbol{n}$$

The continuity ofϕacross the z = Z plane is also one of the boundary conditions. Again

$$\boldsymbol{E}_1(Q) = [-\nabla\phi]_Q.$$

We choose P as the origin of the cylindrical polar coordinate system. The z-coordinate of O, by assumption, is $Z\ (> 0)$ and suppose the z-coordinate of Q is$z_Q\ (> 0)$.<u>We confine our analysis to the region $z > 0$.</u>

Now, Laplace's equation

$$\nabla^2\phi = 0$$

when ϕ has no θ dependence, can be written as [See: H. Lass – Vector and Tensor Analysis]:

$$\frac{1}{\rho}\frac{\partial}{\partial\rho}\left(\rho\frac{\partial\phi}{\partial\rho}\right) + \frac{\partial^2\phi}{\partial z^2} = 0$$

Assuming separation of variables is possible, we write $\phi = f(\rho)g(z)$. This leads to the equation

$$\frac{1}{f}\cdot\frac{1}{\rho}\frac{d}{d\rho}\left(\rho\frac{df}{d\rho}\right) + \frac{1}{g}\cdot\frac{d^2g}{dz^2} = 0$$

As the two terms are independent of each other, we may set

$$\frac{1}{g}\cdot\frac{\partial^2 g}{\partial z^2} = k^2\ (k > 0 \text{ is an arbitrary number})$$

The general solution of the last equation is

$$g = Ae^{-k} + Be^{kz}.$$

$A$and B are two constants, which may have different values in the two media. Since the solution (g) must remain finite in both media for all allowed values of z, we must have $B = 0$ in the second medium.

We also have (after a little algebraic manipulation)

$$\rho^2 \frac{d^2f}{d\rho^2} + \rho \frac{df}{d\rho} + k^2\rho^2 f = 0$$

Rewrite this as

$$(k\rho)^2 \frac{d^2f}{d(k\rho)^2} + (\rho k) \frac{df}{d(\rho k)} + (k\rho)^2 f = 0$$

whose solution, regular both at $\rho = 0$ and when $\rho \to \infty$, is given by $J_0(k\rho)$: the Bessel function of order zero.

Ask is an arbitrary non-negative real number, the general solution for ϕ at any point C$(\rho, \theta, z)$is

$$\phi = \int_0^\infty J_0(k\rho)[A(k)e^{-kz} + B(k)e^{kz}]dk \quad (3)$$

The lower limit of integration is to be understood in the sense $k \to 0$. We shall use the result [see: W. W. Bell – Special Functions] that, for $z > 0$,

$$\int_0^\infty J_0(k\rho)e^{-kz}dk = \frac{1}{\sqrt{\rho^2+z^2}} = \frac{1}{r} (r \text{ being the distance of C from P})$$

If we choose $A(k) = \frac{q_1}{4\pi\varepsilon_1}$ and $B(k) = 0$, then

$$\phi = \frac{q_1}{4\pi\varepsilon_1} \cdot \frac{1}{r}$$

This is, of course, the solution when $\varepsilon_2 = \varepsilon_1$. We are therefore prompted to write

$$A(k) = \frac{q_1}{4\pi\varepsilon_1}; B(k) = \frac{q_1}{4\pi\varepsilon_1} \cdot \Delta(k)$$

with the understanding that $\Delta(k) = 0$ when $\varepsilon_2 = \varepsilon_1$.

In the second medium (where $z \geq Z$), we shall write the solution as

$$\phi = \int_0^\infty J_0(k'\rho)[C(k')e^{-k'z}]dk' \quad (4)$$

<u>Boundary conditions on the plane$z = Z$:</u>

Continuity of ϕ gives:

$$\int_0^\infty J_0(k'\rho)[C(k')e^{-k'Z}]dk' = \frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty J_0(k\rho)[e^{-kZ} + \Delta(k)e^{kZ}]dk \quad (5)$$

Relation between normal components of $\boldsymbol{E_1}$:

$$\varepsilon_2 \cdot \left(\frac{\partial\phi}{\partial z}\right)_{med.2} = \varepsilon_1 \cdot \left(\frac{\partial\phi}{\partial z}\right)_{med.1}$$

Or

$$-\varepsilon_2 \cdot \int_0^\infty k' J_0(k'\rho)[C(k')e^{-k'Z}]dk' = -\varepsilon_1 \cdot \frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty kJ_0(k\rho)[e^{-k} - \Delta(k)e^{kZ}]dk \quad (6)$$

Relation between tangential components of $\boldsymbol{E_1}$:

$$\left(\frac{\partial\phi}{\partial\rho}\right)_{med.2} = \left(\frac{\partial\phi}{\partial\rho}\right)_{med.1}$$

Or

$$-\int_0^\infty k' J_1(k'\rho)[C(k')e^{-k'Z}]dk' = -\frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty kJ_1(k\rho)[e^{-kZ} + \Delta(k)e^{kZ}]dk \quad (7)$$

where we have used the formula [see: W. W. Bell – Special Functions],

$$\frac{dJ_0(t)}{dt} = -J_1(t).$$

Our aim is now to find the value of the quantities $C(k')$ and $\delta(k)$. To this end we shall use the formula [see:Gradshteyn and Ryzhik, p 661]:

$$\int_0^\infty kJ_n(ka)J_n(kb)dk = \frac{1}{a} \cdot \delta(b-a)[n = 0,1,2,\dots]$$

From the equation expressing the continuity of ϕ:

$$\int_0^\infty \rho J_0(\lambda\rho)[\int_0^\infty J_0(k'\rho)\left[C(k')e^{-k'Z}\right]dk']d\rho = \int_0^\infty C(k')e^{-k'Z}[\int_0^\infty \rho J_0(\lambda\rho)J_0(k'\rho)d\rho]dk'$$

$$= \int_0^\infty C(k')e^{-k'Z}[\frac{1}{\lambda}\delta(k'-\lambda)]dk'$$

$$= C(\lambda)e^{-\lambda Z} \cdot \frac{1}{\lambda} \quad (8)$$

$$\int_0^\infty \rho J_0(\lambda\rho)[\frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty J_0(k\rho)[e^{-kZ} + \Delta(k)e^{kZ}]dk]d\rho$$

$$= \frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty [e^{-kZ} + \Delta(k)e^{kZ}][\int_0^\infty \rho J_0(\lambda\rho)J_0(k'\rho)d\rho]dk$$

$$= \frac{q_1}{4\pi\varepsilon_1} \cdot \int_0^\infty [e^{-kZ} + \Delta(k)e^{kZ}] \cdot \frac{1}{\lambda}\delta(k-\lambda)dk$$

$$= \frac{q_1}{4\pi\varepsilon_1} \cdot \frac{1}{\lambda} \cdot \left[e^{-\lambda Z} + \Delta(\lambda)e^{\lambda Z}\right] \quad (9)$$

Equating (8) and (9),

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_1} \cdot \left[1 + \Delta(\lambda)e^{2\lambda Z}\right] \quad (10)$$

From the relation between the normal components of the electric field, we have:

$$-\varepsilon_2 \int_0^\infty \rho J_0(\lambda\rho)\left[\int_0^\infty k' J_0(k'\rho)\left[C(k')e^{-k'Z}\right]dk'\right]d\rho$$

$$= -\varepsilon_2 \int_0^\infty k' C(k') e^{-k'Z}\left[\int_0^\infty \rho J_0(\lambda\rho) J_0(k'\rho)d\rho\right]dk'$$

$$= -\varepsilon_2 C(\lambda) e^{-\lambda Z} \qquad (11)$$

$$-\varepsilon_1 \int_0^\infty \rho J_0(\lambda\rho)\left[\frac{q_1}{4\pi\varepsilon_1}\cdot\int_0^\infty k J_0(k\rho)\left[e^{-k} - \Delta(k)e^{kZ}\right]dk\right]d\rho$$

$$= -\varepsilon_1 \cdot \frac{q_1}{4\pi\varepsilon_1}\cdot\int_0^\infty k\left[e^{-kZ} - \Delta(k)e^{kZ}\right]\left[\int_0^\infty \rho J_0(\lambda\rho) J_0(k'\rho)d\rho\right]dk$$

$$= -\frac{q_1}{4\pi}\cdot\left[e^{-\lambda Z} - \Delta(\lambda)e^{\lambda Z}\right] \qquad (12)$$

Equations (11) and (12) give

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_2}\cdot\left[1 - \Delta(\lambda)e^{2\lambda Z}\right] \qquad (13)$$

Again, the equation relating the tangential components of the electric field gives:

$$-\int_0^\infty \rho J_1(\lambda\rho)\left[\int_0^\infty k' J_1(k'\rho)\left[C(k')e^{-k'Z}\right]dk'\right]d\rho = -\int_0^\infty k' C(k') e^{-k'Z}\left[\int_0^\infty \rho J_1(\lambda\rho) J_1(k'\rho)d\rho\right]dk'$$

$$= -C(\lambda)e^{-\lambda Z} \quad (14)$$

$$-\int_0^\infty \rho J_1(\lambda\rho)\left[\frac{q_1}{4\pi\varepsilon_1}\cdot\int_0^\infty k J_1(k\rho)\left[e^{-kZ} + \Delta(k)e^{kZ}\right]dk\right]d\rho$$

$$= -\frac{q_1}{4\pi\varepsilon_1}\cdot\int_0^\infty k\left[e^{-kZ} + \Delta(k)e^{kZ}\right]\left[\int_0^\infty \rho J_1(\lambda\rho) J_1(k'\rho)d\rho\right]dk$$

$$= -\frac{q_1}{4\pi\varepsilon_1}\cdot\left[e^{-\lambda Z} + \Delta(\lambda)e^{\lambda Z}\right] \qquad (15)$$

From (13) and (14) we get

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_1}\cdot\left[1 + \Delta(\lambda)e^{2\lambda Z}\right] (16)$$

Equation (16) is identical to Eq. (10).

Independent relations:

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_1}\cdot\left[1 + \Delta(\lambda)e^{2\lambda Z}\right]$$

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_2}\cdot\left[1 - \Delta(\lambda)e^{2\lambda Z}\right]$$

Thus

$$\left(\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2}\right)\Delta(\lambda) = \left(\frac{1}{\varepsilon_2} - \frac{1}{\varepsilon_1}\right)e^{-2\lambda Z}$$

Or

$$\Delta(\lambda) = \left(\frac{\varepsilon_1 - \varepsilon_2}{\varepsilon_1 + \varepsilon_2}\right) e^{-2\lambda Z} \qquad (17)$$

And

$$C(\lambda) = \frac{q_1}{4\pi\varepsilon_1} \cdot \left[\frac{2\varepsilon_1}{\varepsilon_1 + \varepsilon_2}\right] = \frac{q_1}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \qquad (18)$$

At any arbitrary point in the second medium

$$E_{12}^{(n)} = \int_0^\infty k' J_0(k'\rho)[C(k')e^{-k'z}]dk' = \frac{q_1}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \cdot \int_0^\infty k' J_0(k'\rho) e^{-k'z} dk' \qquad (19)$$

In particular, at Q,$z = z_Q$ and $\rho = 0$. Thus

$$E_{12}^{(n)}(Q) = \frac{q_1}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \cdot \int_0^\infty k' J_0(0) e^{-k' z_Q} dk' = \frac{q_1}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \cdot \frac{1}{z_Q^2} \cdot \Gamma(2) = \frac{q_1}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \cdot \frac{1}{z_Q^2}$$

So, the required force is given by

$$\boldsymbol{F} = \frac{q_1 q_2}{4\pi} \cdot \left[\frac{2}{\varepsilon_1 + \varepsilon_2}\right] \cdot \frac{1}{z_Q^2} \boldsymbol{k} \qquad (20)$$

Conclusion

We have presented a solution of the proposed problem. The use of cylindrical polar coordinates, which is compatible with the axial symmetry of the arrangement, helped us to implement the boundary conditions in a simple and straight forward manner. The solution is in accord with our expectations for the two special cases: (i) $\varepsilon_1 = \varepsilon_2$ and (ii) $\varepsilon_2 \to \infty$ (i.e. the second medium is a metal).

Acknowledgment

We thank Ms. ShatarupaBandopadhyay, a Senior Secondary student of one of us (RB), for asking the question that led to this work. We are pleased to acknowledge the receipt of some helpful suggestions from Dr. Kolahal Bhattacharyya of St. Xavier's College, Kolkata.

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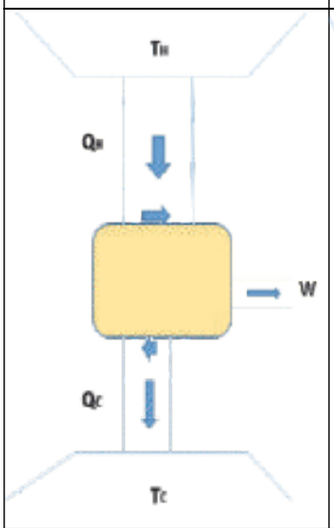
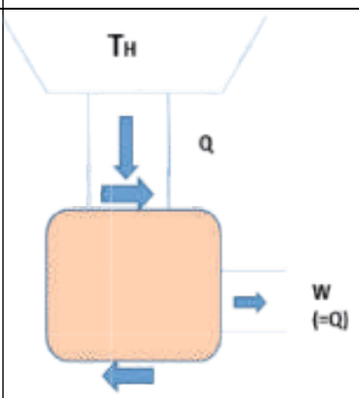
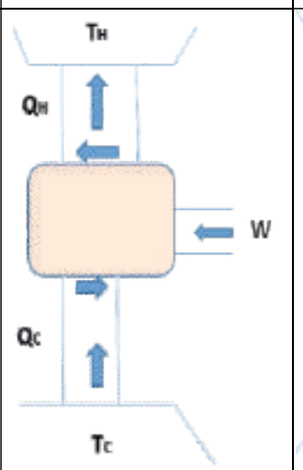
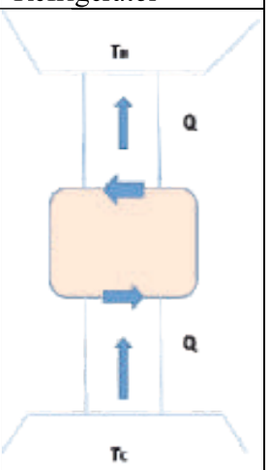
'A Perfect Engine is Equivalent to a Perfect Refrigerator And Vice-Versa'

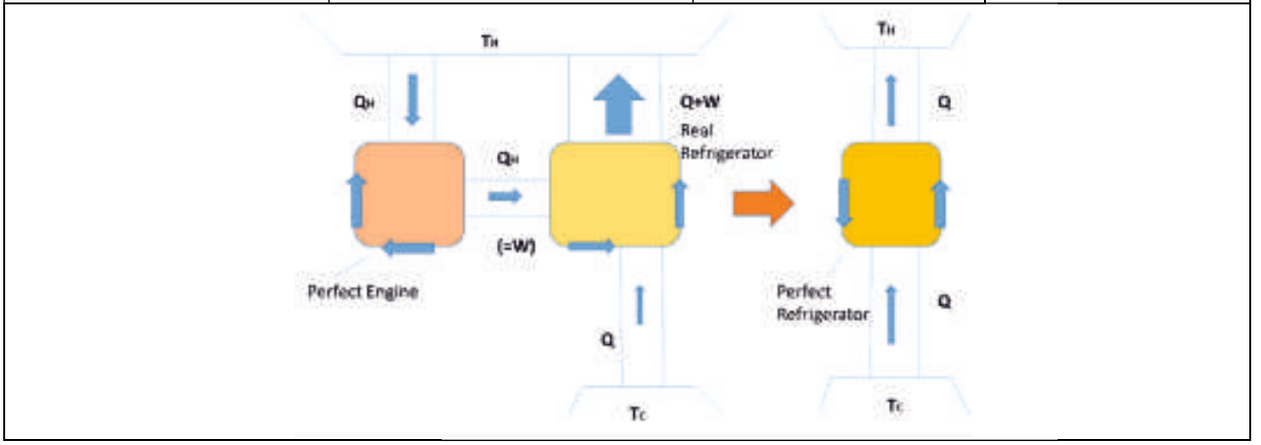
Dulli Chandra Agrawal
Banaras Hindu University
dca_bh@yahoo.com

There are two diagrams where the first one contains subject material and a question based on them. The second one displays the answer as well.

The Question

The second law of thermodynamics can also be expressed as 'engine has to be real and one cannot have a perfect engine; also the refrigerator has to be a real one and it can never be a perfect refrigerator'.If a perfect engine could be designed then it is equivalent to having designed a perfect refrigerator and vice-versa. We demonstrate below through diagram in second rowthe former statement and students are supposed to come out with the latter one.

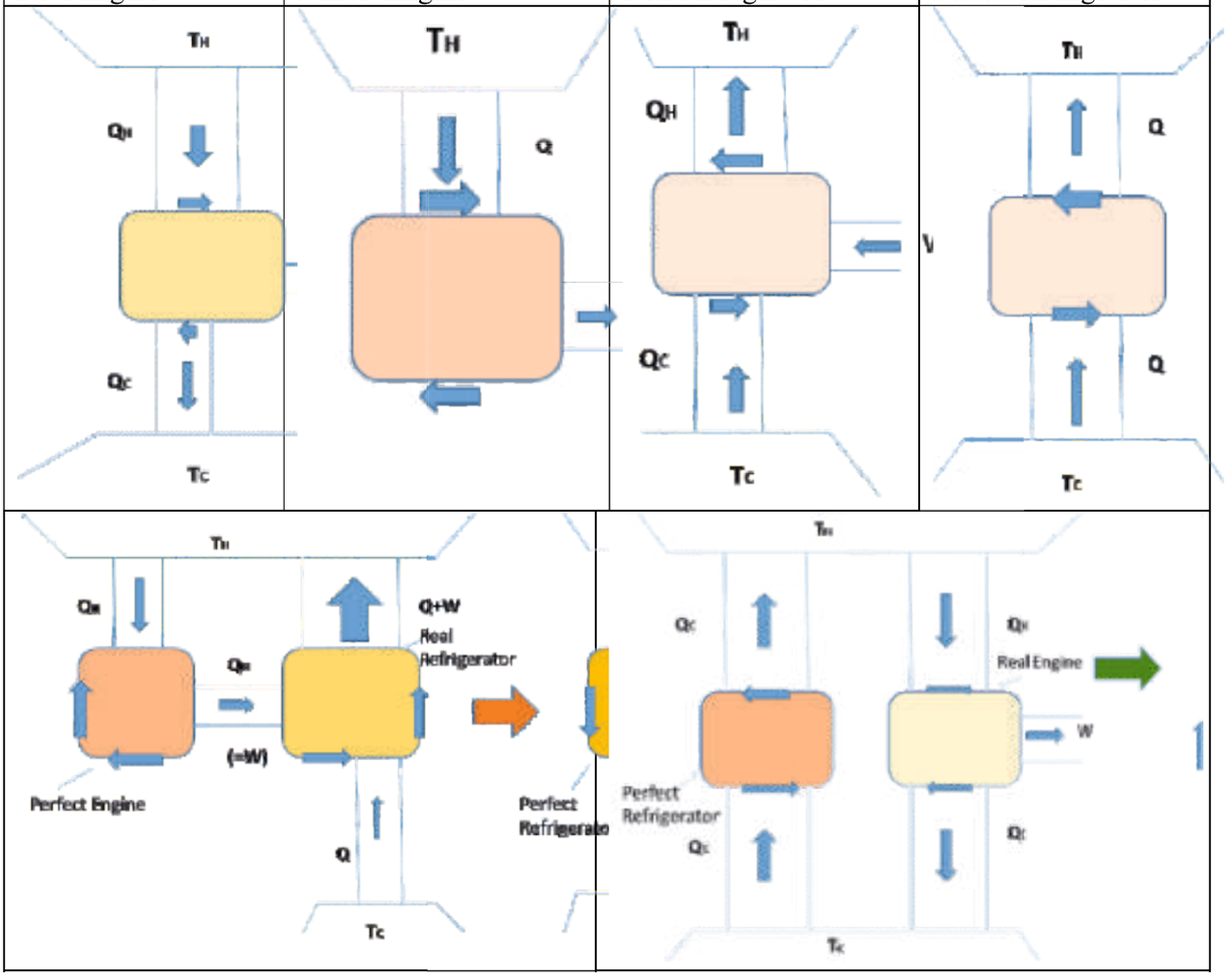
Real Engine	Perfect Engine	Real Refrigerator	Perfect Refrigerator
			



Find the Answer

The second law of thermodynamics can also be expressed as 'engine has to be real and one cannot have a perfect engine; also the refrigerator has to be a real one and it can never be a perfect refrigerator'. If a perfect engine could be designed then it is equivalent to having designed a perfect refrigerator and vice-versa. Here we demonstrate below in second row through diagrams the equivalence of each statement.

Real Engine	Perfect Engine	Real Refrigerator	Perfect Refrigerator



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Soft Expression Physics

Learning and Project Tools for Schools and Colleges

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Physics is a highly mathematical subject. Mathematical modelling is a fundamental tool for physicists. They are used to describe and predict physical phenomena, and to analyse data from experiments and observations.

Computer simulation is also the process of mathematical modeling, performed on a computer. A simulation uses a mathematical description of a real system in the form of a computer program. This model is composed of equations that duplicate the functional relationships within the real system. A simulation can also take the form of a computer graphics image that represents dynamic processes in an animated sequence.

Computer simulations are applications of special interest in physics teaching because they can support powerful modeling environments involving physics concepts and processes. Studies strongly support that computer simulations may be used as an alternative instructional tool, to help students confront their thinking, reasoning, remembering constraints, and develop a functional understanding of physics.

The applications in **Soft Expression Physics** are graphics-based full-screen desktop apps that run on Windows 11, presently free. The current list is seen on the above site. The community can download and install them through the site or directly from the Microsoft store.

Joy Stephen
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ARTICLE

Application of Parseval's Theorem to CalculateRipple Factor of a Rectifier Output

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Abstract

The ripple factor is a very important performance parameter of a rectifier circuit. Most basic physics and electronics textbooks, discuss its evaluation using integral calculus method and the same is usually followed in classroom teaching. Though, this method gives the results quickly, it does not throw light on the details of the composition of the output and their contribution to ripple factor. In this article, I have discussed the Fourier analysis of output of a single phase, full-wave uncontrolled rectifier with resistive load and the evaluation of ripple factor by application of Parseval's Theorem. The advantages of employing this method over the usual methods are also discussed.

I. INTRODUCTION

The output voltage of a single phase, full-wave uncontrolled rectifier with resistive load [1] is not a 'pure' dc. It is rather a 'pulsating' dc containing ac components (harmonics),which gives rise to ripple at the output**.** This ripple is quantified and is measured as ripple factor. The ripple factor is one of the important performance parameters of a rectifier circuit and its computation is an importantundergraduate physics classroom activity. It is defined as the ratio of the ratio of the *rms* value of the accomponent voltage to the value of dcvoltage at the output of a rectifier. The average or dcvalue of voltage (or current) and the *rms* value of accomponents of voltage (or current) at the output is evaluated by using the usual integral calculus methods. Though, this method gives the results quickly, it does not throw light on the composition of the output, with respect to the amplitudes, phases of harmonics and their relative contribution to the ripple at the output. This discussion shows the Fourier analysis of rectified output from a full-wave rectifier and evaluation of ripple factor by application of Parseval's Theorem.

II. FOURIER ANALYSIS

Most phenomena that we come across inreal world are periodic in nature and areusually complicated. They can be analyzed using the mathematical technique calledFourier Analysis. While studying the heatflow through material, Baron Jean BaptisteJoseph Fourier (*1768-1830*) discovered thatany periodic function in general can be expressedas infinite sum of simple *sine* and*cosine* functions (called *Fourier mode functions*),which is referred to as Fourier TrignometricSeries. The process of calculating all the sine and cosine terms, which when expressedinfinite sum, converges to the actual function is referred to as *Fourier Analysis* and the recipes for computing these terms is provided by Fourier Theorem. Fourier analysisis widely used in applied mathematics, physics and electronics.

III. FOURIER THEOREM AND FOURIER SERIES

If $f(t)$ is a real-valued periodic function in time, (with fundamental period T), then according to Fourier theorem, $f(t)$can be expanded as a series of trignometicfunctions with appropriate frequency and amplitude [2,3] in the form,

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} \left(a_n \cos\frac{2\pi nt}{T} + b_n \sin\frac{2\pi n}{T} \right) \quad (1)$$

The expression (1) represents the Trigonometric Fourier Series of $f\ (t)$. The real-valued terms a_o , a_n and b_n in the Fourier series have specific *'amplitudes'* and are known as Fourier Coefficients and areare given by,

$$a_n = \frac{2}{T}\int_0^T f(t) cos\left(\frac{2\pi nt}{T}\right) dt \text{and} b_n = \frac{2}{T}\int_0^T f(t) sin\left(\frac{2\pi nt}{T}\right) dt \quad (2)$$

The Fourier coefficients can be evaluated by solving the definite integrals in (2) making use of the orthogonal properties of Fourier mode functions [1]. The factor of $\frac{1}{2}$ is included for ao in $Eq(1)$ so that the $Eq(2)$ holds for $n = 0$ also.

$Eq(1)$ can also be written in the form,

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} (a_n \cos n\omega t + b_n \sin n\omega t) \quad ; \quad \omega = \frac{2\pi n}{T} \quad (3)$$

Fourier series can also be expressed in terms of frequency as shown in $Eq(3)$. Here,ω is the fundamental angular frequency and ω is related to time period as $\omega = \frac{2\pi n}{T}$. The terms$cosn\omega t$ and $sinn\omega t$ are referred to as the n^{th} harmonics of $f(t)$. Thus, Fourier series involves the process of writing the magnitudes (Fourier coefficients) and phases of the fundamentaland higher order harmonics of the periodic functions. We notice that it establishes a relation between a function in the time-domain and a function in the frequency-domain.
Some of the interesting facts about FourierSeries are :

1. Almost *any* periodic function can be approximatedas a Fourier series whichconverges to actual periodic functions when specific criteria known as the Dirichlet conditions [2,4] (named after Peter Gustav Lejeune Dirichlet) are met.
2. As the number of calculated terms in aFourier series increases, better is the approximationto the actual function.
3. When the series representing the functionconverges, it tends to convergevery quickly.

IV. EVEN AND ODD FUNCTIONS

While expanding an *even* function or an *odd* function, we can simplify Fourier expansion. If a function is even i.e., $f(t) = f(-t)$, then $f(t)sin(n\omega t)$ will be odd and in such cases it can be easily verified [2,3,4] that, $b_n = 0$ for all values of n. Similarly, if a function is odd i.e., $f(-t) = -f(t)$, then $f(t)cos(n\omega t)$ will be odd and therefore, $a_n = 0$for all values of n.

V. FOURIER EXPANSION OF FULL WAVE RECTIFIER OUTPUT

A first step in converting acpower from the power-grid to the dcpower that most devicesneed is to utilize a full-wave rectifier, which converts a sinusoidal input to an output that is the absolute value of the input voltage. The output voltage of a single phase, full-wave uncontrolled rectifier with resistive load, supplied with a sinusoidal voltage in time

$$v_i(t) = V_m sin\frac{2\pi t}{T} = V_m sin\omega t \quad (4)$$

can be mathematically expressed as,

$$v_o(t) = \left|V_m sin\frac{2\pi t}{T}\right| = |V_m sin\omega t| \quad (5)$$

Here,$V_m$is the peak voltage. This is graphically depicted in Figure-1.

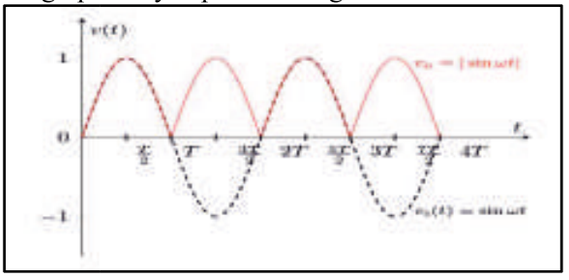

Figure 1

We notice that for a sinusoidal input, the output of the rectifier is periodic with half of the period of the input or the fundamental frequency of the output is twice the input frequency. The presence of diodes in a typical full-wave rectifier makes it a non-linear circuit, which shifts the output power from fundamental to twice its value. The output also has contributions to power from other frequencies.
Since, the output is aeven function, terms of the form$sin(n\omega t)$ will not appear in the Fourier expansion of the output and therefore it is sufficient if we determine only the coefficients a_n. Thus the output voltage of from a full-wave rectifier can be expanded as a Fourier series as shown below,

$$v_o(t) = |V_m sin\omega t| = v_{dc} + \sum_{n=1}^{\infty} v' cos\, n\omega t \quad (6)$$

Evaluating the Fourier coefficients $v_{dc}$and v' in the expansion, it can be shown that,

$$v_o(t) = \frac{2V_m}{\pi} - \frac{4V_m}{\pi}\left[\frac{cos2\omega t}{1.3} + \frac{cos4\omega t}{3.5} + \frac{cos6\omega t}{5.7} + \cdots\right] \quad (7)$$

We notice that, the output voltage $vo(t)$ at the load will have two components; $(i)\ dc$ component - $v_{dc}$and $(ii)ac$components (or ripple) - v_{ac} . The term $\frac{2V_m}{\pi}$ represents the average or $d.c$ component and the infinite sum $\frac{4V_m}{\pi}\left[\frac{cos\ \omega t}{1.3} + \frac{cos4\omega t}{3.5} + \frac{cos6\omega t}{5.7} + \cdots\right]$represents the sum ofa.c components (or harmonics at the output).

For an input with frequency corresponding to ω, the output has a dc-offset, v_{dc} which is of practical importance. We find contributions to output at frequencies corresponding to $2\omega, 4\omega, 6\omega$ ...to$v_{ac}$and there is no contribution at the input frequency ω.The output may be written in a compact form as

$$v_o(t) = \frac{2V_m}{\pi} - \frac{4V_m}{\pi}\sum_{n=2,4,6}^{\infty}\left[\frac{cosn\omega t}{(n^2-1)}\right] \quad (8)$$

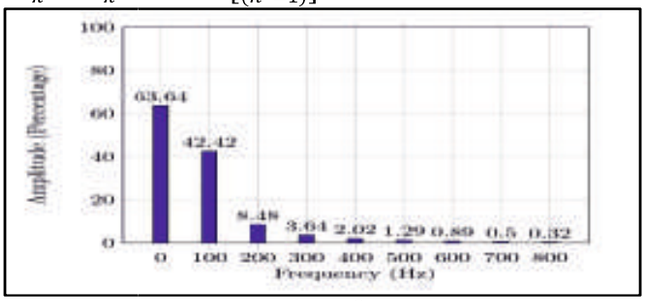

Figure 2

A plot of the relative amplitudes of the harmonics versus their corresponding frequenciesshown in Figure-2 is called the Amplitude Spectrum. It is clear from the spectrum that the contribution to the output due to higher order harmonics fall off quite rapidly, as n^{th}coefficient decreases as $\frac{1}{n^2}$

VI. PARSEVAL'S THEOREM

If $f(t)$ represents a periodic function in time,which can be expanded as a Fourier Trigonometric Series in interval 0 to T, then the mean square of $f(t)$ is given by

$$|f(t)|^2_{rms} = \left(\frac{a_o}{2}\right)^2 + \frac{1}{2}\sum_{n=1}^{\infty}({a_n}^2 + {b_n}^2) \quad (9)$$

This important result is known as Parseval's Theorem [1]. Since by definition of the rmsvalue,

$$|f(t)|^2_{rms} = \frac{1}{T}\int_0^T [f(t)]^2 (10)$$

Therefore,

$$\frac{1}{T}\int_0^T [f(t)]^2 = \left(\frac{a_o}{2}\right)^2 + \frac{1}{2}\sum_{n=1}^{\infty}({a_n}^2 + {b_n}^2) (11)$$

This is a very useful relationship between the mean square value of the function $f(t)$ and the Fourier coefficients.

VII. APPLICATION TO ELECTRICAL CIRCUITS

In general, the voltages $v(t)$ and currents $i(t)$in an ac circuit are periodic waveforms containing energy at harmonic frequencies which are integral multiples of the fundamental frequency. The proportion of energy at various harmonic frequencies, compared with the energy at the fundamental depends on the waveform. If the load is purely resistive, then the average power of a periodic voltage over one period interval $(0, T)$ is defined as the mean power dissipated by the signal in a unit resistance over the period. Mathematically,

$$P_{avg} = \frac{1}{T}\int_0^T [v(t)]^2 (12)$$

By analogy with electrical circuits, $|f(t)|^2_{rms}$in is like the average power,and$RHS$of shows how this power iscontributed by the different fourier modes. We notice that${a_o}^2$is the contribution due to the dccomponent, while ${a_n}^2 + {b_n}^2$is the contribution due to accomponent in the n^{th}harmonic. Thus, the average power in a periodic signal is the sum of the averagepower in its d.c component and the average power in its harmonics.

Parseval's theorem is basically energy conservation theorem and tells us that whenever we map a Fourier series of a periodic signal to its Fourier coefficients and vice-versa then the total energy of the signal is conserved.

VIII. APPLICATION TO FULL-WAVE RECTIFIER

For a full wave rectifier with purely resistive load of resistance$R$, the average power dissipated across the load is given by,

$$P_{avg} = \frac{(v_{rms})^2}{R} = \frac{1}{R}\left[\frac{1}{T}\int_0^T [v(t)]^2\right] (13)$$

If $R = 1\Omega$, then

$$(v_{rms})^2 = \frac{1}{T}\int_0^T [v(t)]^2 (14)$$

Using Parseval's theorem , this average power over one period in terms of Fourier coefficients can be expressed as

$$(v_{rms})^2 = \frac{{a_o}^2}{4} + \frac{1}{2}\sum_{n=1}^{\infty}({a_n}^2 + {b_n}^2) \quad (15)$$

By substituting the values for the Fourier coefficients from expansion for the output of a full-wave rectifier$Eq(8)$,we get

$$(v_{rms})^2 = \frac{16{v_m}^2}{4\pi^2} + \frac{1}{2}\left[\frac{16{v_m}^2}{9\pi^2} + \frac{16\ {m}^2}{225\pi^2} + \frac{16{v_m}^2}{1225} + \frac{16{v_m}^2}{3969\pi^2} + \cdots\right] \quad (16)$$

It is clear that, the contribution to ripple and hence from higher order terms becomes smaller and smaller. Therefore, we can get a good approximation by considering only the first three terms in summation and neglecting higher order terms and simplifying we get,

$$(v_{rms})^2 = \frac{4{v_m}^2}{\pi^2} + \frac{8{v_m}^2}{\pi^2}\left(\frac{1}{9} + \frac{1}{225} + \frac{1}{1225}\right) \quad (17)$$

In this expression,$\frac{4{v_m}^2}{\pi^2}$ represents the power contributed by the dc component and alone and $\frac{8{v_m}^2}{\pi^2}\left(\frac{1}{9} + \frac{1}{225} + \frac{1}{1225}\right)$ is that contribution due to the ripples of ac components present at the output.

Figure -3 shows the graphical representation of output considering only first three ac terms in the expansion in $Eq(17)$. It is quite evident that plot produces a very close approximation to the actual theoretical output of a full-wave rectifier.

Thus,

$$(v_{rms})^2 = (v_{dc})^2 + \left(v_{ac[rms]}\right)^2 \quad (18)$$

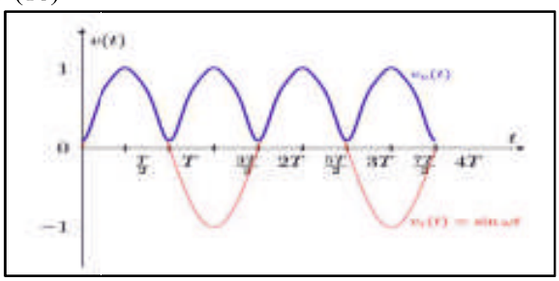

Figure 3

IX. CALCULATION OF RIPPLE FACTOR

By definition of Ripple factor (r),

$$r = \frac{rms\ value\ of\ voltage\ due\ to\ ac\ component/ripples}{dc\ or\ average\ voltage} = \frac{v_{ac[rms]}}{v_{dc}} \quad (19)$$

$$r = \sqrt{\frac{\frac{8{v_m}^2}{\pi^2}\left(\frac{1}{9} + \frac{1}{225} + \frac{1}{1225}\right)}{\frac{4{v_m}^2}{\pi^2}}} \approx 0.482$$

By comparison, we find that this value is same as that we get by usual method.

X. CONCLUSION

In this discussion, we find that Fourier series and Parseval's theorem are very useful in electrical signal analysis. They can be used to express periodic functions in terms of fundamental and harmonics. They provide a foundation to understand the time domain and frequency-domain relationship with electrical signals. It is quite evident that using these powerful mathematical techniques, we can arrive at some simple, yet important results related to electrical circuits like rectifiers, which provide a more meaningful insight into various aspects involved.

ACKNOWLEDGMENT

I am extremely grateful for insightful suggestions and comments offered byProf.SarmistaSahu, Associate Prof of Physics (Rtd), MLACW, Bangalore and Prof.Narasimha.S.A, Assistant Prof. of Physics, GFGC, Thirthahalli in preparing this article. I wish to thank all my colleagues for their support and encouragement.

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Feedback on NGPE

'Heerak Sharma to B.P. Tyagi, the ExaminationCoordinator'

Heerak Sharma
(Gold Medallist)

I am Heerak Sharma, student at IISER Pune who has completed his second year of BS-MS dual degree course. I took part in NGPE Part C and have written this email to share my feedback with you. I apologise for being late in sending this email. I was attending Madhava Nurture Camp immediately after NGPE Part C and then was traveling back home.

Part C of NGPE was simply amazing. Some points I would like to share are:

- The problems were original and thought provoking. The problems in the exams gave insights into how cleverly experiments are designed to verify theories and how challenging they can get sometimes. A request: I could not solve all problems completely in the exam. Would it be possible for me to get the question paper for Part C?
- Personally, I believe that the time limit of 50-minutes per problem was perfect. It was a bit harsh but not impossible to do all the problems in that time limit. It was popular consensus that if 5 to 10 more minutes would have been provided per problem, then it would be possible to complete all of them – this makes the 50-minute time limit a challenge and good for separating students based on their skill.
- The problem in which we were supposed to compare the emissivity of colours black, grey and white, the apparatus used to heat the cube was not proper. There was a big lag between changing the voltage supplied to the heating element and the heating element getting heated which made it hard to keep the temperature of the cube steady, which was essential to the experiment, making the experiment very hard to complete. Rest all other experiments were flawless.
- I am happy with the accommodation provided and satisfied with the event. Shri Vaishnav Vidyapeeth Vishwavidyalaya organised the exam really well.

Some reasons I think for less participation in the exam:

- There is less awareness about the exam. I was lucky that my institute was a centre for the exam and had announced about it. Students in general are not aware of IAPT and its activities.
- The timing of Part C of the exam, being in the middle of summer break may be a reason that we got less participants as many students at that time are doing an internship or a project.
- Also, I think that people believe that the competition is not hard enough and take it lightly (which is completely wrong) and do not participate in it thinking that it's not worth it.

I was one of the gold medallists this year. When will we get more details about the IAPT annual convention 2023 where we would be awarded our medals? Will we be allowed to attend the complete annual convention or would only be allowed in the prize distribution ceremony? Regarding the prize money, what procedure do I have to follow to get that?

Another request: I want to volunteer for IAPT activities specially with conduction of Olympiads and creating awareness about Olympiads. When I was in my high school, I was not aware of various

Olympiads and exams, and that NSE's are conducted to select the Indian team for IJSO, IPhO, IChO, etc. I got to know about them very late and I feel unhappy that I could never participate in them properly. I have been interested in physics and mathematics since I was small and the Olympiads and exams could have been a life changing experience for me. Now I can't participate in them because I am no longer in high school but I would like to help out with organising them.

Looking forward to your response. Thank you for your time.

Heerak Sharma
IISER Pune

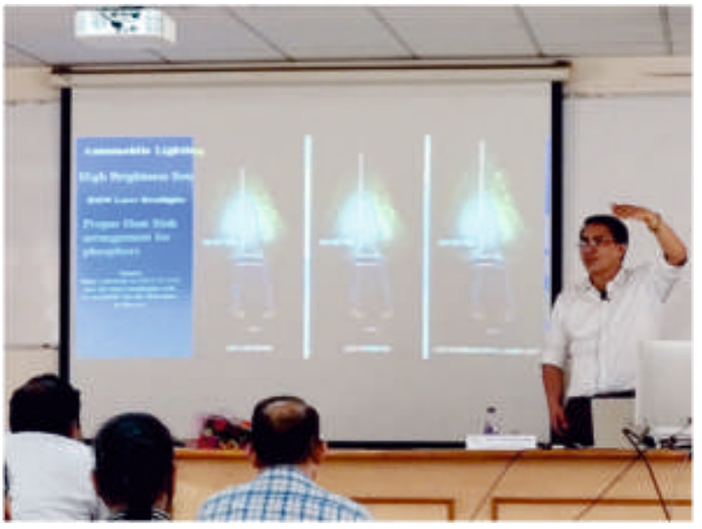
International Day of Light celebrations under Scientific Social Responsibility

The Physics Department, Aligarh Muslim University, Aligarh organized a commemorative event to celebrate the “International Day of Light”, adhering to COVID-19 protocols, on May 14th, 2022. The event was arranged as part of the "Scientific Social Responsibility" initiative of the Department of Science and Technology (DST),New Delhi. The initiative is an integral component of the project led by Prof. B.P. Singh. The International Day of Light is observed annually on May 16th and marks the momentous achievement of physicist and engineer, Theodore Maiman, who successfully operated the laser in 1960. This special day aims to foster scientific collaboration and harness its potential for promoting peace and sustainable development. By commemorating this event, the Physics Department sought to emphasize the importance of light-based technologies and their role in advancing various fields of science and society. The day holds tremendous significance as it provides a platform to recognize and appreciate the profound impact that light has on numerous facets of society. From its pivotal role in scientific advancements to its influence on culture, art, education, and sustainable development, light permeates our lives in multifaceted ways. It is a driving force behind transformative innovations in fields such as medicine, communications, and energy, revolutionizing the way we live and interact with the world.The event served as an opportunity to inspire, and engage a diverse range of individuals and sectors worldwide. By bringing together the realms of science, technology, art, and culture, the event aimed to underscore the potential of these interconnected domains in fostering UNESCO's vision of building peaceful and inclusive societies. Through interactive workshops, engaging presentations, and thought-provoking discussions, participants gained a deeper understanding of the intricate relationship between light and different spheres of human endeavor. From showcasing cutting-edge scientific research to celebrating artistic expressions inspired by light, the event created a vibrant tapestry of knowledge, creativity, and inspiration. By recognizing the far-reaching implications of light and its multifaceted applications, the event aimed to inspire individuals and communities to harness the power of light in their respective fields and contribute to the betterment of society.

Prof. B.P. Singh welcomes Prof. D. S. Mehta

The commencement of the program was marked by a gracious welcome from Prof. B.P. Singh, the Chairperson of the Physics Department. With warmth and enthusiasm, he extended his heartfelt greetings to the Chief Guest, faculty members, and all participants in attendance. Prof. Singh underscored the profound significance of commemorating the International Day of Light and expressed pride in the department's illustrious heritage. In his opening remarks, Prof. Singh emphasized the vital role of fostering a scientific temperament and cultivating a spirit of inquiry within the academic community. He stressed the importance of nurturing a deep understanding of scientific principles and their practical applications, recognizing their potential to shape technological

advancements that can benefit society at large. By encouraging curiosity and innovation, the department aims to contribute to the development and progress of various fields, further cementing its commitment to excellence in education and research. Through his words, Prof. Singh sought to inspire and motivate the participants, reminding them of the rich legacy and tradition of the Physics Department. He encouraged them to embrace the spirit of scientific inquiry, explore new frontiers, and make significant contributions to the world of science and technology. Prof. Singh's warm welcome set the tone for a captivating and intellectually stimulating event, where knowledge, collaboration, and innovation would intertwine to create a memorable and impactful experience. By celebrating the International Day of Light, the Physics Department showcased its commitment to nurturing a scientific community that can shape the future through innovative applications and contribute to the betterment of society.



Prof. D.S. Mehta, delivereda talk on “Laser based solid state lighting and illumination engineering with visible light communication/Li-Fi.”

During the program, the esteemed presence of Prof. D.S. Mehta, a distinguished keynote speaker and Chief Guest from the renowned Indian Institute of Technology (IIT) Delhi, added tremendous value to the event. Prof. Mehta delivered an enthralling and enlightening talk titled "Laser-based solid-state lighting and illumination engineering with visible light communication/Li-Fi," which resonated deeply with the audience due to its utmost relevance and significance.In his talk, Prof. Mehta embarked on a journey through time, tracing the evolution of light technologies across centuries. He began by highlighting the groundbreaking work of Ibn Al-Haytham, a pioneering scholar who laid the foundation of modern optics in 1015. By shedding light on this historical milestone, Prof. Mehta emphasized the rich legacy upon which contemporary light technologies have been built. Prof. Mehta delved into the remarkable advancements in LED (Light Emitting Diode) and OLED (Organic Light Emitting Diode) technologies. He provided a comprehensive overview of the remarkable efficiency and versatility offered by OLEDs, capturing the audience's attention with the myriad possibilities that arise from this cutting-edge technology. He discussed the unparalleled advantages of OLEDs, including their energy efficiency, flexibility, and vibrant color reproduction, which have revolutionized the field of lighting.The centerpiece of Prof. Mehta's talk revolved around laser-based solid-state lighting, which stands at the forefront of the lighting industry. He elaborated on the diverse applications of this technology, particularly in sectors such as automobile and stadium lighting. By harnessing the power of lasers, solid-state lighting offers remarkable advantages in terms of efficiency, durability, and precision. Prof. Mehta highlighted how laser-based lighting solutions are transforming the automotive industry by enhancing safety, aesthetics, and energy efficiency in vehicles. Furthermore, he underscored the pivotal role of solid-state lighting in providing superior illumination for stadiums and sports arenas, creating immersive experiences for spectators while minimizing energy consumption.Throughout his presentation, Prof. Mehta's passion for the subject matter shown through, with his depth of knowledge and insightful perspectives. Attendees were enthralled by his ability to seamlessly bridge the gap between theoretical concepts and practical applications, making complex ideas accessible and relatable to diverse audiences.By focusing on laser-based solid-state lighting and its diverse applications.

Prof. Mehta instilled a sense of awe and excitement in the audience, inspiring them to explore the transformative possibilities of this cutting-edge technology. His expertise and insights left an indelible impact, fostering a deeper understanding of the immense potential of light-based technologies in shaping a brighter and more sustainable future.

Dr. M. Wasi Khan provided a comprehensive overview of the event's objectives and important aspects. Dr. Jai Prakash, ensured the seamless execution of all activities throughout the program.A key highlight of the event was the special visit organized for approximately 50 students from Range Hills Public School, G. T. Road, Aligarh. These enthusiastic students, of grades 9 to 12, had the opportunity to explore the Physics department's basic science laboratories. Engaging in hands-on experiments and witnessing scientific phenomena firsthand, the students were immersed in a world of discovery and learning.

Prof. D.S. Mehta presenting participation certificates

The esteemed Chief Guest of the event, Professor Mehta from IIT Delhi, presented certificates of participation to each student. The recognition served as a testament to their active involvement and commitment to embracing the spirit of scientific inquiry and exploration.By incorporating the visit of young and aspiring minds, the event aimed to inspire the next generation of scientists and innovators.

The interaction with the Physics department's laboratories and the recognition bestowed upon the students by the esteemed Chief Guest fostered a sense of motivation and enthusiasm among the budding scientists, encouraging them to pursue their scientific passions and make a positive impact on the world.This event, with its emphasis on nurturing young minds, exemplified the commitment of the Physics department to inspire the young scientists and innovators of tomorrow.

B. P. Singh
Physics Department
Aligarh Muslim University,
Aligarh

Space research through optical window

5th PRL-IAPT Dr. Vikram Sarabhai Lecture is a flagship annual activity of RC-07(Gujarat) being organized since 2019, the birth centenary year of our visionary scientist Dr. Vikram Sarabhai, the father of India's Space Programmes. The 5th annual lecture of the series was organized at K. R. Ramanathan auditorium of the Physical Research Laboratory Ahmedabad,at 6 pm on March 22nd, along with a live streaming on the PRL youtube channel. The audience included the IAPT members, participants of the Indian Planetary Science Conference (held at PRL), students, PRL scientists and others.

The invited speaker of the lecture this time was Prof. D. Pallamraju, senior Professor Space & Atmospheric Sciences division and Dean PRL. He did his Ph. D. from PRL in 1996, and after a year as PDF there, he went to Boston University USA and worked as a senior associate for over 10 years. His research interest includes Space weather effect on geospace, coupling phenomena in our atmosphere, plasma-neutral interactions during geomagnetic storms etc, and he focuses on new methods of exploration in upper atmosphere dynamics. He has the rare distinction of carrying out daytime auroral experiments from both the Antarctica and the Arctic region. Prof. Pallamraju has actively participated in a number of international scientific programmes, and is currently serving as an elected Vice-Chair of the COSPAR (*Committee on Space Research*), among his other assignments.

The lecture programme began with opening remarks by Prof. P. C. Vinodkumar, president RC-07, who gave a short introduction of IAPT, and also introduced the Speaker.

Prof. Pallamraju began by asking, “Who has not wondered at the wonders of the night sky, the stars and planets and galaxies that inspire awe and curiosity…?!” Telescopes and other instruments have added immensely to our knowledge of these objects. But there exists a very faint light near earth which the naked eye cannot 'see', while it bears importance in terms of the physics of the sun-earth interaction processes. The faint light is revealed to us in two phenomena, the *airglow* and the *aurora*. The speaker explained the meaning of the term 'optical window', which indicates the visible light or the range of wavelengths not blocked by the earth's atmosphere. The optical window emissions – airglow and aurora – tell us about the 'weather' at high altitudes in terms of the wave propagations, temperatures, winds, etc. The faint airglow is present not only in the night but also in the daytime. Observing daytime airglow is akin to seeing the stars planets etc in the broad daylight… quite difficult and challenging, isn't it…?! PRL Ahmedabad has pioneered the development of innovative techniques for the measurement of airglow in the daytime, and the study has resulted in several new insights on the behaviour of the near-earth space. The study helps us in understanding the interactions or coupling phenomena among the different atmospheric regions. The nicely illustrated Talk give a flavour of the recent developments made in the measurement techniques and the discoveries made in the understanding of solar-terrestrial interaction processes. Some such optical techniques are being developed for space based research of not only the earth's upper atmosphere but also of the atmospheres of several other planets in the forthcoming ISRO's space missions, like the one to planet Venus. Thus this is one of the frontier areas of research for the young physicists who are planning on taking up research as their career.

The airglow, exhibited in different wavelengths from UV to IR, is caused by various photochemical and chemi-luminescent processes occurring in the upper atmosphere of Earth, and special instrumentation techniques are required for its measurement and analysis from the ground based laboratories. It is a kind of optical remote sensing of the upper atmosphere.

The speaker, Prof. D. Pallamraju

Different emissions appear at different altitudes, depending on the concentrations of reactants like O-atoms, N_2^+ ions, OH radicals etc. Prof. Pallamraju highlighted the measurement techniques, as he reminded the students in the audience of the elementary optical instruments like prism, grating and the Fabry-Perot interferometer. He gave a simple outline with a schematic of the optical system used in the studies. The speaker outlined the day-glow photometer and other instrumental arrangements, and pointed out the important findings resulting from these investigations. As a result of these investigations a new field of daytime optical aeronomy was born in PRL.“I invite young students/researchers to book their seats in this adventurous journey into future.”- Prof. Pallamraju said in conclusion.After the talk the question-answer session was conducted by Dr. Chetan Limbachiya from MSU Vadodara. One of the interesting questions posed by a student was about the difference betweenAurora and rainbow. Prof. Pallamraju explained the difference in terms of the basic features and the origin of the two phenomena. Dr. K. Durgaprasadof PRL conducted the QA session for the you tube viewers.

Among the mementos presented to the speaker Prof. Pallamraju and to the PRL Director Prof. Anil Bhardwaj were coffee mugs with the programme-title carved beautifully in the faint background of the colourful aurora lights. The programme was anchored by Dr. Bhushit Vaishnav of PRL. In the end, Dr. Pruthul Desai, secretary RC-07, extended the vote of thanks to PRL and to all those who made the programme a big success.

Now, as per our tradition, the Speaker has been requested to write an article based on his lecture topic. The article will be published in the annual Physics magazine *Pragaami Tarang*, vol/issue 15, to come out in October 2023.

K. N. Joshipura
for RC-07

Physics Experiments and Demonstrations

Topic: Competition for UG Students on Physics Experiments & Demonstrations

Schedule: 10:00 AM onwards on 18/04/2023

Sponsored: DBT Star College Scheme and IAPT (RC-02)

Participants: B.Sc. students (Non-Medical streams)

Beneficiaries: Students of UG classes

Program Coordinator: Dr. Kulwinder Singh Mann

Email: ksmann6268@gmail.com, **Mobile: 08837510727**

The Department of Physics at DAV College Bathinda, under the DBT Star College Scheme, hosted a competition aimed at emphasizing the significance of practical applications in Physics. The competition was dedicated to centenary celebrations of Prof. Babulal Saraf and it was open to undergraduate students, who presented a total of 11 projects related to various Physics concepts. These included practical demonstrations on topics such as temperature sensing, automatic energy conservation, electric generator functionality, Lorentz pendulum, wavelength measurement of light using He-Ne laser, motion on racing tracks, vortex formation, Polaroid principles, and Faraday's laws using electromagnet. The live demonstrations and hands-on experiments proved to be quite popular, attracting a large number of students and faculty members from different departments.

The projects showcased the importance of technology in daily life, and their relatability was appreciated by everyone. The students were guided by Dr. Gurpreet Singh, Head of Department of Physics, Dr. Kulwinder Singh Mann, Coordinator of DBT Star College Scheme, and other faculty members including Prof. Harpreet Kaur Brar and Dr. Vikas Duggal. The best projects were selected for awards, and the winners included Sarita and Akanksha of B.Sc. I, Sarthak and Sahil of B.Sc. II, and Harpreet Kaur and Akki Kaur of B.Sc. III. Dr. Rajeev Kr. Sharma, the college principal, congratulated the Department of Physics on the success of the event and emphasized the importance of learning Physics through practical applications. He stated that theoretical concepts are best understood when demonstrated practically, and it is the College's goal to promote a scientific temperament among students. Dr. Sharma also praised the winning project on "Solar Power driven portable mobile charger," as it highlights the need for using renewable energy resources.

NATIONAL COMPETITION FOR INNOVATIVE EXPERIMENTS IN PHYSICS (NCIEP) – 2023

National competition for innovative experiments in Physics (NCIEP) is being held since 2003, to encourage Physics Teachers, students and Physics educators to conceive and set up original innovative experiments in Physics. The Competition is held every year at the venue of the Annual Convention of IAPT. Innovation rather than sophistication is the main theme and therefore the use of computers for data acquisition and display is not allowed.

Please read the following guidelines: There are three categories.

1. (A) The participant can be a teacher at any level or M. Phil. / Ph. D. awarded /Ph.D. pursuing student or a Scientist from national laboratories or a science communicator working in science centres, etc. He/she need not be an IAPT member.
   (B) The participant can be a student pursuing UG/PG course
   (C) The participant can be a High School student Studying in 9-12 standard.
   For all categories participants themselves have to demonstrate the experiment.
2. The experiment should be an original one, designed by the participant himself/ herself. It can be even a demonstration type experiment.
   For category 'C' students can work under the guidance of a teacher.
3. Top 3 experiments from each category A, B and C are awarded cash prizes.

Category	Participants	First prize	Second prize	Third prize
A	Teachers/scientists/science communicators/ Students pursuing M.Phil/Ph.D	Rs 7000/-	Rs 5000/-	Rs 4000/-
B	Students pursuing UG/PG course	Rs 7000/-	Rs 5000/-	Rs 4000/-
C	Students studying from 9-12 standard	Rs 7000/-	Rs 5000/-	Rs 4000/-

4. The covering letter in the form of an email must contain: Title of the experiment, name of the participant (s) with age, category A / B /C, institutional affiliation of each participant, address for correspondence, email address and mobile number along with the following declaration:
   "The proposed experiment is original, designed and developed by the participant(s) and not published / submitted elsewhere". Format given at the end.
5. Please submit the write-up of experiment as an email attachment (word & PDF file) to the coordinator at the email id: **nciepiapt03@gmail.com** in the following format: ***Times New Roman, font size 12, line spacing1.5, justified, sufficient margins on all sides. It should contain title of the experiment, abstract of the experiment (not exceeding 300 words), detailed theory with necessary diagrams, procedure, observations, calculations, graphs, results and references. There is no limit for the number of pages. The participant should not write his / her name, name of college / school, etc. anywhere. This may reveal his/her identity.***

6. Selected entries from each category will be invited for demonstration at the 37th IAPT convention. Exact dates and venue will be notified later. Convention is likely to be held at Jaipur during the first-second week of October 2023. The invited participants will be paid railway fare from work place to convention place as per IAPT rules. In case of joint authors only one of the participants is eligible to receive TA (as per IAPT rules). Top ten student participant entries (for category B and C) may be given an amount of Rs 1000/- each towards expenditure incurred towards setting up the experiment. The selected participant has to come with his/her own setup for final demonstration.
7. Please feel free for any query at e mail **nciepiapt03@gmail.com**
8. Decision of the judges will be final.
9. The abstracts of all the selected experiments will be published in IAPT bulletin after the competition. IAPT bulletin has ISSN number 2277-8950.
10. **Closing date to receive the entries is 30th August , 2023.**

All participants after submission of the experiment, register at the following link
https://forms.gle/fF61yAiwK8cLQzn1A

Dr Geetha R S
National Coordinator, NCIEP
(m) 8088812890 WhatsA
Email : **nciepiapt03@gmail.com**

Declaration letter

Title of the experiment:

Name(s)of participants	1.
	2.
	3.
Institution address	
Category of participation (A, B or C)	
Class in which studying	
Date of birth	
Mentor name (in case it is applicable) and address	
Mobile number	
E mail for communication	
Address for communication	

"The proposed experiment is original, designed and developed by the participant(s) and not published / submitted elsewhere".

Signature of participants Signature of mentor (if applicable)

EXAM	NSEP	NSEC	NSEB	NSEA	NSEJS
Day & Date	**Sunday** November 26, 2023	**Sunday** November 26, 2023	**Sunday** November 26, 2023	**Saturday** November 25, 2023	**Sunday** November 26, 2023
Time of Exam	08.30 am to 10.30 am	11.30 am to 1.30 pm	02.30 pm to 4.30 pm	02.30 pm to 4.30 pm	02.30 pm to 4.30 pm
Venue	Respective NSE centre	Respective NSE centre	Respective NSE centre	Respective NSE centre	Respective NSE centre
Eligibility (i.e) who can appear for	1. Must be eligible to hold an Indian passport. 2. Date of birth between 1 July 2004 and 30 June 2009, both days inclusive. 3. Must be residing and studying in India since 30 November 2021 or earlier. **OR** Must be studying in an Indian school system since 30 November 2021 or earlier. 4. Must not have completed (or scheduled to complete) class 12 board examination earlier than 30 November 2023. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by 1 June, 2023. 6. Must not be appearing in NSEJS 2023.	1. Must be eligible to hold an Indian passport. 2. Date of birth between 1 July 2004 and 30 June 2009, both days inclusive. 3. Must be residing and studying in India since 30 November 2021 or earlier. **OR** Must be studying in an Indian school system since 30 November 2021 or earlier. 4. Must not have completed (or scheduled to complete) class 12 board examination earlier than 30 November 2023. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by 1 June, 2023. 6. Must not be appearing in NSEJS 2023.	1. Must be eligible to hold an Indian passport. 2. Date of birth between 1 July 2004 and 30 June 2009, both days inclusive. 3. Must be residing and studying in India since 30 November 2021 or earlier. **OR** Must be studying in an Indian school system since 30 November 2021 or earlier. 4. Must not have completed (or scheduled to complete) class 12 board examination earlier than 30 November 2023. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by 1 June, 2023. 6. Must not be appearing in NSEJS 2023.	1. Must be eligible to hold an Indian passport. 2. Date of birth between 1 July 2004 and 30 June 2009, both days inclusive. 3. Must be residing and studying in India since 30 November 2021 or earlier. **OR** Must be studying in an Indian school system since 30 November 2021 or earlier. 4. Must not have completed (or scheduled to complete) class 12 board examination earlier than 30 November 2023. 5. Must not have commenced (or planning to commence) studies in a university or equivalent institution by 1 June, 2023. 6. Must not be appearing in NSEJS 2023.	1. Must be eligible to hold an Indian passport. 2. Date of birth between 1 Jan 2009 and 31 Dec 2010, both days inclusive. 3. Must be residing and studying in India since 30 November 2021 or earlier. **OR** Must be studying in an Indian school system since 30 November 2021 or earlier. 4. Must not have completed (or scheduled to complete) class 10 board examination earlier than 30 November 2023. 5. Must not be appearing in any of NSEA, NSEB, NSEC or NSEP 2023.
Level of **Question Paper**	Is broadly equivalent to senior secondary level (up to and including Class XII) of CBSE India.	Is broadly equivalent to senior secondary level (up to and including Class XII) of CBSE India	Is broadly equivalent to senior secondary level (up to and including Class XII) of CBSE India.	Is broadly equivalent to senior secondary level (up to and including Class XII) of CBSE India. There will be greater emphasis on Physics, Mathematics and Elementary Astronomy.	Is broadly equivalent to Secondary school level (up to and including Class X) of CBSE India. All the basic subjects of science (Biology, Chemistry and Physics) with equal emphasis.
Language of **Question Paper**	Question paper will be in English, Hindi, Gujarati, Bangla, Tamil & Telugu or any Indian Language provided 300 students **OPT** for it (option during registration)	Question paper will be in English, Hindi, Gujarati, Bangla, Tamil & Telugu or any Indian Language provided 300 students **OPT** for it (option during registration)	Question paper will be in English & Hindi (option during registration)	Question paper will be in English & Hindi (option during registration)	Question paper will be in English & Hindi (Option during registration)
Question Paper Pattern	A) 48 multiple choice questions with one alternative correct. +3 marks credit for correct choice. --1 mark penalty for incorrect choice. B) 12 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) 48 multiple choice questions with one alternative correct. +3 marks credit for correct choice. --1 mark penalty for incorrect choice. B) 12 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) 48 multiple choice questions with one alternative correct. +3 marks credit for correct choice. --1 mark penalty for incorrect choice. B) 12 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) 48 multiple choice questions with one alternative correct. +3 marks credit for correct choice. --1 mark penalty for incorrect choice. B) 12 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) 48 multiple choice questions with one alternative correct. +3 marks credit for correct choice. --1 mark penalty for incorrect choice. B) 12 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.
Total Marks	**216**	**216**	**216**	**216**	**216**

Please Note:

1. The eligibility criteria's are laid down by authorities (not by IAPT)
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. Any case of unfair means will be delt with very strictly. The Chief Coordinator (Examination) has a right to cancel the examination of any student or any centre if reported by the invigilator or the evaluator.
4. Legal matters (If Any) pertaining to all these examinations will be subject to the jurisdiction of Dehradun District Court only (the location of IAPT examination office and the office of chief coordinator of IAPT examina and no other court in India

For Students

(Student's Brochure)

INDIAN ASSOCIATION OF PHYSICS TEACHERS

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

National Standard Examination in

Physics - NSEP 2023
Chemistry - NSEC 2023
Biology - NSEB 2023
Astronomy - NSEA 2023
Junior Science- NSEJS 2023

2023 - 24 EXAMINATION

What is IAPT?

Indian Association of Physics Teachers (IAPT) is an organization of Physics Teachers spread throughout the country. It was started by Late Dr. D.P. Khandelwal in 1984 and today it has 9000 life members. All the work of this (our) organization is voluntary in character-thus NOBODY is paid any Honorarium or Remuneration for ANYWORK of IAPT.

What is NSEP? NSEC? NSEB? NSEA? or NSEJS?

National Standard Examinations (NSEP in Physics, NSEC in Chemistry, NSEB in Biology, NSEA in Astronomy and NSEJS in Junior Science) are nationwide examinations organized by IAPT. We have been conducting NSEP for last 35 years by now. NSEP, NSEC, NSEB and NSEA are at CBSE class XII level while NSEJS is at CBSE class X level. These NSEs are the First stage and THE ONLY SCREENING TESTS in India leading towards International Olympiads in the respective science subjects.

What are Science Olympiads?

Olympiads are internationally recognized competitions in various fields of knowledge. They are the highest level examinations 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 NSEP (or NSEC /NSEB/NSEA/NSEJS) and then through the Indian National Physics Olympiad (INPhO or INChO or INBO or INAO or INJSO) you may be selected for the further stages of the respective International Olympiad Programme.

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?

You may enroll yourself from your own School/College. The Principal (or Physics or Science Teacher) of your College / Jr. College / High School will enroll you. He/She will give you all further instructions. In case you have difficulty you may enroll online by paying your fee by bank transfer on the website http://www.iapt.org.in The list of registered centres will be available on the website by 21st August 2023. The name of contact person at the respective centre is also indicated.

What are the fees?

₹ 200/- per student per subject (per examination) to be paid in cash to the centre in charge. This exam fee cannot be refunded. Students enrolling online have to Pay examination fee by bank trans

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 examinations, i.e., Indian National Olympiad Examinations (INOs) the following scheme is adopted.

(a) **Eligibility Clause:** To be eligible among 300 students for the Stage II INO exam 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 NSE. 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 INO Stage II examination 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 NSE of that subject will automatically qualify for INO stage II.

© **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 INO Stage II is desirable. The quota for each State/UT used in National Talent Search Examination (NTSE) 2013-14, a nationwide competitive examination will be used as the baseline for calculating the number of students qualifying for Stage II INO 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 to INO Stage 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 to appear for the INO Stage II examination. 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 websites of IAPT **http://www.iapt.org.in;** and HBCSE http://olympiads.hbcse.tifr.res.in

(d) **Minimum Representation Clause:** Not with standing the proportional representation clause the number of students selected for INO from each State and UT must be at least five, provided that the eligibility clause (a) is satisfied.

The above criteria are illustrated with the following examples:

(i) Let the quota on the basis of the Proportional Representa Clause (c) for a State S,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 second stage INO exam in the given subject and an additional 10 students from the State S , 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 Representa Clause (c) for a State Sbe 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 second stage INO exam in the given subject, and there will be no further selection from the State,S

(e) **Previous International Representation Clause** Candidates who have represented India in the International Olympiad on a previous occasion (IOAA, IBO, IChO, IJSO and IPhO) need not appear for the first stage NSE examination in the respective subject. Candidates who have represented India in the Asian Physics Olympiad (APhO) and the International Astronomy Olympiad Junior (IAO-Jr) need not appear for the 1st stage NSEP and NSEA Examinations respectively. Those candidates who thus qualify to skip the first stage NSEs may be allowed, on written request, to the National Coordinator Science Olympiad (nc_olympiad@hbcse.tifr.res.in) to directly appear for the second stage Indian National Olympiad (INO) examination, provided they satisfy other eligibility criteria such as age, pre-college status, etc.

(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 INO is not reached (due to non-availability of enough number of students in some states who satisfy Eligibility 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 to appear for the INO Stage II examination.

There will be no other criterion or provision for selection to the Indian National Olympiad Examinations (INOs).

Eligibility for INAO and OCSC-Astronomy in 2024:

The rules for selection for Stage II (INAO) will be same as that of previous year.

1. The eligibility criterion for NSEA has been given on the sheet above.
2. The student pool of NSEA will be divided into two groups:
   (i) **Group A:** Students who are in Class XII as of November 30, 2023.
   (ii) **Group B:** Students who are in Class XI or lower as of November 30, 2023.
3. For Stage II (INAO), 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 NSEA 2023 and INAO 2024 will be identical for the two groups.

There will be no other criterion or provision for selection to the Indian National Olympiad Examination (INOs)

A complete data of students shortlisted for INO is posted on both IAPT & HBCSE websites. Shortlisted students have to register at HBCSE website for INO, in Jan 2024. This is a must.

All INOs are 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 INOs. These students in each subject attend Orientation Cum Selection Camp (OCSC) in respective discipline for about 2 weeks at HBCSE-TIFR, Mumbai. Indian team to participate in International Olympiad is selected from the students attending OCSC in respective subjects.

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

Are there any other fees for these INOs or camps?

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

What is the time schedule?

Online centre registration begins August 1, 2023

Enrolment begins: August 21, 2023

LAST DATE OF ENROLMENT: Sept. l4, 2023

Examination schedule: Kindly see the table on the above.

NSEA (2:30 pm 4.30 pm)	: Saturday, November 25, 2023
NSEP, NSEC, NSEB & NSJS	: Sunday, November 26, 2023
Expected date of results of 1st Stage	: December 25, 2023
Dates of INOs:	: First Week February 2024
Expected date of result of INOs	: Last Week February 2024
OCSCs	: May-June 2024

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 ₹ 100/- 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 IAPT Registered office Kanpur.

Account Name: Indian Association of Physics Teachers
Account Number: 20768203191
Bank: Indian Bank, Branch: Kakadeo Kanpur (UP)
IFSC Code: IDIB000K521
Phone: 09935432990

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 from iapt.org.in 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 the OCSC in Physics, Chemistry, Biology, Astronomy & Junior Science.

Prof. BP Tyagi (9837123716)
Chief Coordinator IAPT Examination
NSE Coordinators:
Dr. Anand Singh Rana (9412954316) SGRR (PG) College Dehradun
Dr. Vijay V. Soman (9822107522) SMM College, Nagpur
IAPT Central Examination Office:
15, Block II Rispana Road Dehradun - 248001
Help Line No: 9632221945, 9411190162, 8533993332
Email: iapt.nse@gmail.com
Website: https://www.iapt.org.in

FIRST STEP TOWARDS INTERNATIONAL OLYMPIADS

NATIONAL STANDARD EXAMINATION IN PHYSICS	: NSEP 2023 - 24
NATIONAL STANDARD EXAMINATION IN CHEMISTRY	: NSEC 2023 - 24
NATIONAL STANDARD EXAMINATION IN BIOLOGY	: NSEB 2023 - 24
NATIONAL STANDARD EXAMINATION IN ASTRONOMY	: NSEA 2023 - 24
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE	: NSEJS 2023 - 24

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

Organized by

INDIAN ASSOCIATION OF PHYSICS TEACHERS (IAPT)

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

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

Step II Toppers from these NSEP, NSEC, NSEB, NSEA & NSEJS from each State/Union Territory will be eligible for II stage i,e Indian National Olympiads (INOs) 2024 in respective subjects. For details see the website: www.iapt.org.in and the student's brochure.

Step III About 35 toppers in each of INPhO, INChO, INBO, INAO and INJSO will qualify for the Orientation Cum Selection Camp (OCSC) in respective subjects for about two weeks at Homi Bhabha Centre for Science Education (HBCSE), Mumbai. Indian teams to participate in International Olympiads – 2024 will be selected on the basis of performance of students in respective OCSC.

In addition, about 8 toppers from INPhO may get an opportunity to participate in **Asian Physics Olympiad (APhO).** The APhO will be held in May 2024.

Language: Question Papers are in English, Hindi, Gujrati, Bangla, Tamil and Telugu or any Indian Language provided 300 students OPT for it

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

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

Programme:

Centre registration: Aug 1, 2023 to Aug 20, 2023.
Student enrolment: Aug 21, 2023 to Sep 14, 2023

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

DATE AND TIME OF EXAMINATION: SUNDAY 26.11.23

NSEP : 8:30 AM to 10:30 AM
NSEC : 11:30 AM to 1:30 PM
NSEB : 2:30 PM to 4:30 PM
NSEJS: 2:30 PM to 4:30 PM
SATURDAY 25.11.2023
NSEA : 2:30 PM to 4:30 PM

Fee Rs. 200.00 per student per subject

PREVIOUS 5 YEARS QUESTION PAPERS BOOKLET IN EACH SUBJECT IS AVAILABLE FOR Rs 100/- EACH FROM IAPT KANPUR (iaptknp@rediffmail.com)

Prof. BP Tyagi
Chief Coordinator (Examination)
23 Adarsh Vihar, Raipur Road,
Dehradun - 248001
Ph: 9837123716, E-mail: bptyagi@gmail.com
Visit Website: www.iapt.org.in

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

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

10th IAPT NATIONAL STUDENT SYMPOSIUM ON PHYSICS
INDIAN ASSOCIATION OF PHYSICS TEACHERS
AND
DEPARTMENT OF PHYSICS, PANJAB UNIVERSITY, CHANDIGARH

27-29 OCTOBER, 2023

To foster a culture of innovation and creativity among the young students, IAPT has instituted the annual National Student Symposium on Physics (NSSP). The yearly series started in 2013 in collaboration with the Department of Physics, Panjab University, Chandigarh.

The Symposium provides a national forum to young students,to present their new ideas and innovative work at an early stage of academic career. Tenth in the series, NSSP-2023, will be held during October 27-29, 2023.

NATIONAL ORGANISING COMMITTEE

P.K. Ahluwalia (Shimla) Chairman, NSSP-2023
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Y.K. Vijay (Jaipur)
J.S.Rajput (New Delhi)
Tankeshwar Kumar (Mahendragarh)
Arvind (Patiala)

- **Invited Talks by Subject Experts**
- **Oral Presentations by the Students**
- **Poster Presentations by the Students**
- **Visit to Research Laboratories**

The undergraduate and postgraduate students with physics background can apply for the symposium latest by August 16, 2023. Local hospitality and free accommodation shall be provided to students. Limited travel support (bus or sleeper class by train) may be given to few selected participants.

Register at
https://tinyurl.com/nssp2023
or
https://www.indapt.org.in/events/8830
or Scan this QR code

LOCAL ORGANISING COMMITTEE

Rajeev K Puri (Chairperson, Dept. of Physics)
G.S.S. Saini
O.S.K.S. Sastri (Vice President IAPT-RC03)
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Manjit Kaur
Amit Goyal (Secretary)
Rajesh K. Baboria (co-Coordinator)
C.N. Kumar (Coordinator)

For more information, contact
Prof. C.N. Kumar
Department of Physics
Panjab University, Chandigarh
nssp@pu.ac.in

Department of Physics,
Panjab University, Chandigarh

IAPT Essay Competition (NCEWP-2023)

The Announcement of NCEWP-2023 appeared in the IAPT Bulletin January issue (Pages 21 and 22).The information was also uploaded on the IAPT Website on January 25,2023. All Regional Councils (RC 1 to RC 22) are requested to motivate students and Teachers for participation in NCEWP-2023. **As informed earlier the last date for Essay submission is 30th July 2023.**

S. K. JOSHI
Coordinator, NCEWP-2023
(M) 098930-84286, E-mail:joshisantoshk@yahoo.com

INDIAN ASSOCIATION OF PHYSICS TEACHERS

(Registered under Section XXI of Societies Act 1860, Regd. No. K 1448)

Membership Form

(PLEASE FILL IN CAPITAL LETTERS)

To,
Secretary IAPT
Regd. Office
Kanpur-208017

Date.....

Dear Sir,
I wish to join IAPT as a

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I am remitting a fee of Rs.....through Cheque/DD/UTR No.....

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Sincerely yours

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Secretary, IAPT
Regd. Office : Flat No. 206, Adarsh Complex,
Awas Vikas-1 Keshavpuram, Kalyanpur, Kanpur-208017
sksharma777@gmail.com, Mob. : 09415404969

The Story Of Cosmology Through Post Stamps 54

THE SUN FACTS

The sun is a G type main sequence star (*Yellow Dwarf*), which lies at the centre of our solar system, hold 99.8 percent of mass of solar system and born about 4.6 billion years ago. It is one of the more than 100 billion stars in our home galaxy Milky Way, at about 25000 LY from galactic core. It is a ball of hot Plasma heated to incandescence by nuclear fusion reaction in its core. Roughly ¾ of the Sun's mass consist of hydrogen and rest mostly helium. It is the most important source of energy for life on the Earth.

A Triptych-Se-tenant Set- depicting chromosphere of the sun in middle and planets of solar system (not on scale)

Commemorative sheet issued on IYQS 1964- depict some of the important feature of the Sun like - Sun Spot, Corona and Solar prominence

Solar surface, photographed in UV light with false colour shows areas of different temperature

Helios Mission – joint space venture of Germany and NASA to study sun

Nicolae Donici (1874-1956) astronomer to study sun and its property

Stamp and Cachet- depict Evershed Effect and shift of absorption lines in the penumbra to show radial flow of gases across the photosphere surface of the sun

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