The mentors Digest

JULY 2024 ISSUE NO:14

The mentors Digest

Our Founder and his Vision

Knowledge is the prime wealth among all wealths. In other words, knowledge is the best and important wealth among all wealths. Start your journey to find or explore the knowledge. Our founder and renowned scholar late Padmashri Dr Vellayani Arjunan's vision is to spread quality education to entire community and make it affordable.

Shri. Vellayani Arjunan was born on 10 February 1933 at Vellayani in the erstwhile Kingdom of Travancore. After receiving a Master of Arts degree in Malayalam, he went on to teach Malayalam Language and Literature at Sree Narayana College in Kollam. He later became the first Malayalam lecturer in Aligarh Muslim University, from which he gained his PhD degree in 1964.After leaving Aligarh Muslim University, he was appointed director of the State Institute of Encyclopaedic Publications in Kerala

Degree	Topic	Awarding Institution
D.Litt.	Influence of Sree Narayana Guru on Malayalam Poetry.	Aligarh Muslim University
D.Litt.	A Comparative Study of the Mutual Relations and Uniformity of Hindi and Malayalam Languages.	Agra University
D.Litt.	The influence of Hindi Vocabularies on the South Indian Languages: A Linguistic study.	Jabalpur University
Ph.D.	A Comparative Linguistic Study of Common Vocables of Hindi and Malayalam Languages.	Aligarh Muslim University

Other degrees

Degree	Subject
B.A. Hons	Malayalam Language and Literature
M.A.	Malayalam Language and Literature
M.A.	Hindi Language and Literature
M.A.	Hindi Special
P.G. Diploma	Tamil, Telugu, Kannada

He was honoured with the Padma Shri award by the nation in 2008. Dr Arjun, who was the first Professor of Malayalam at the Aligarh University and head of the Department of Modern Indian Languages. He supervised 20 research scholars and published more than 100 research papers and articles. He had authored 40 books in different genres including poetry, short story, essays and literary criticism, and his books were prescribed as textbooks in Kerala schools from 1959 onwards.

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From the Editor's Desk.....

Congratulations TEAM India

India won the men's Cricket World Cup on Saturday, defeating South Africa to end a dry spell in tournament victories that had lasted over a decade, even as the nation was dominating the sport globally in other measures like talent, cash and influence.

The tournament was played across several Caribbean islands, with a few of the matches hosted in the United States, including at a pop-up stadium in New York. When the final, in Barbados, ended with India declared the champion, it was close to midnight back home, where joyful crowds poured into the streets across several cities.

"Maybe in a couple hours it will sink in, but it is a great feeling," said Rohit Sharma, India's captain, who took a tour of the stadium with his daughter propped on his shoulders to thank the crowd. "To cross the line — it feels great for everyone."

WHAT IS SPECIAL ABOUT THE MONTH OF JULY ?

JULY 28 : World Nature Conservation Day, observed annually on July 28th, is a crucial global event that emphasizes the importance of preserving our natural environment. It serves as a powerful reminder of the need to protect our planet's precious resources, biodiversity, and ecosystems, which are vital for sustaining life on Earth. By raising awareness about environmental issues such as climate change, deforestation, pollution, and the loss of biodiversity, this day educates the public and encourages individuals and communities to take proactive steps towards environmental conservation. The celebration promotes sustainable practices, urging people to reduce their carbon footprint, conserve water, recycle, and support eco-friendly products and initiatives. Furthermore, it fosters a sense of global responsibility, highlighting that the health of our planet is a shared concern that transcends borders. By uniting people worldwide in the common goal of nature conservation, World Nature Conservation Day inspires collective action and long-term commitment to protecting and preserving our environment for future generations.

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MOLLUSK EYES REVEAL HOW FUTURE EVOLUTION DEPENDS ON THE PAST

Researchers studied chitons, a group of mollusks, to understand how evolution depends on past events. They discovered that chitons evolved two different types of eyes — eyespots and shell eyes — but each type evolved independently twice. This finding highlights "path-dependent evolution," where a lineage's history influences its future evolution. Specifically, the type of eyes a chiton develops is linked to the number of slits in its shell armor.

Did You Know ?
Light from the Sun takes about 8 minutes and 20 seconds to reach Earth.

The research team, led by Rebecca Varney, used DNA sequencing to build an evolutionary tree for chitons. They found that an increase in the density of sensory organs called aesthetes on the shell was necessary before more complex eyes could evolve. This density increase allowed eyespots and shell eyes to develop independently in different lineages. This rapid evolution of visual systems challenged the traditional view of gradual complexity increase.

A critical finding was that chitons with 14 or more shell slits evolved eyespots, while those with 10 or fewer slits evolved shell eyes. The slits function as organizers for sensory nerves, and their number influences the type of eyes that can form. This shows that past features, like the number of shell slits, can constrain future evolutionary paths.

The study raises new questions about why the number of slits limits eye evolution and how the optic nerves process signals from different eye types. Future research will need to explore these aspects further. Despite these questions, this study provides a clear example of path-dependent evolution, demonstrating how historical features shape the evolutionary possibilities of a species. Chitons' eyes are now likely to be highlighted in evolutionary biology as a prime example of this concept.

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HOW THE SQUARE ROOT OF 2 BECAME A NUMBER!!

The concept of the square root of 2 has a long history in mathematics. The ancient Greeks believed the universe could be described using whole numbers and their ratios (rational numbers). However, they discovered that the diagonal of a square with sides of length 1 could not be expressed as a fraction, revealing the existence of irrational numbers. This was a significant crisis in mathematics, attributed to Pythagoras.

For centuries, irrational numbers were used but not rigorously defined. It wasn't until the mid-1800s that Richard Dedekind addressed this issue. Dedekind realized that a proper understanding of numbers was necessary for defining continuous functions in calculus. He introduced "Dedekind cuts," a method to define irrational numbers using rational numbers. By dividing rational numbers into two sets based on their squares, Dedekind filled the gaps in the number line, providing a rigorous definition of irrational numbers like the square root of 2.

Around the same time, Georg Cantor developed a different but equivalent method to define irrational numbers using sequences of rational numbers that converge to an irrational value. Cantor's work also showed that there are more irrational numbers than rational ones, introducing the concept of different sizes of infinity.

These developments allowed mathematicians to rigorously define numbers and prove key theorems in calculus. Dedekind's contributions laid the foundation for modern mathematics, influencing various fields and expanding the scope of mathematical exploration. His work demonstrated that new mathematical concepts could be invented and defined, opening new horizons for discovery.

What Are Irrational Numbers?

Mathematicians have used irrational numbers for millennia, but didn't come up with a rigorous definition until the 19th century.

Rational Numbers
can be written as a fraction of two integers

$\frac{7}{9} = 0.777777...$ repeats

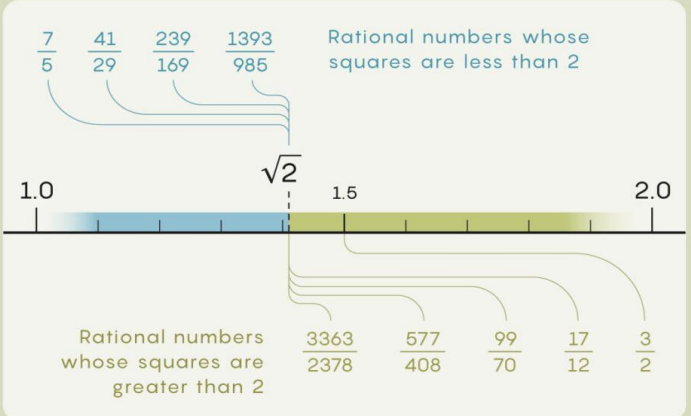
Irrational Numbers
cannot be written as a fraction of two integers

$\sqrt{2} = 1.41421356237...$ doesn't repeat

But can you define an irrational number by what it is, rather than by what it's not?

DEDEKIND CUT

Irrational numbers can be defined as the objects between two sets of rational numbers. For $\sqrt{2}$, the first set is all rational numbers whose squares are less than 2. The second set is all rational numbers whose squares are greater than 2. $\sqrt{2}$ is the cut that divides them.



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INSECTS AND OTHER ANIMALS HAVE CONSCIOUSNESS, EXPERTS DECLARE

In 2022, researchers observed bumblebees playing with wooden balls, an activity not tied to survival or reproduction. This study is part of growing evidence suggesting that many animals, including insects, crustaceans, and fish, might experience consciousness.

A new declaration, endorsed by biologists and philosophers, suggests that there is a "realistic possibility" of conscious experience in all vertebrates and many invertebrates like cephalopods, crustaceans, and insects. This announcement reflects a consensus that the neural complexity required for consciousness may have been underestimated.

The declaration, presented at a New York University conference, emphasizes the basic form of consciousness known as phenomenal consciousness, which involves the capacity to experience sensations like pain or pleasure. It aims to raise awareness and influence policy regarding animal welfare.

Recent studies have shown complex behaviors in various animals, indicating possible conscious experiences. For instance, octopuses solve problems and play, while some fish display curiosity and self-recognition. Insects like bees and fruit flies exhibit play behavior and distinct sleep patterns, respectively.

Updating the 2012 Cambridge Declaration on Consciousness, this new declaration expands its scope and stresses the importance of considering animal consciousness in ethical decisions. It suggests that less neural complexity than previously thought may suffice for conscious experiences, challenging the notion that only animals with complex brains, like mammals, can be conscious.

The declaration aims to inspire further research into animal consciousness, including in species like insects and nematode worms, potentially broadening our understanding of consciousness in the animal kingdom.

Unlike most substances, water expands by about 9% when it freezes..

A sugar-cube-sized amount of neutron star material would weigh about a billion tons on Earth.

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MATHEMATICS TOPIC OF THE MONTH:

CONCEPT MAP

STATISTICS

Class XI

STATISTICS

Measures of Dispersion

Mean Deviation

It is the arithmetic mean of the absolute values of deviations about some point (mean or median or mode).

$$\text{Mean Deviation} = \frac{\text{Sum of Deviations}}{\text{Number of Observations}}$$

For Ungrouped Data

Let $x_1, x_2, \ldots, x_n$ be n observations, then mean deviation about mean is given by $\text{M.D.}(\bar{x}) = \frac{1}{n}\sum_{i=1}^{n}|x_i - \bar{x}|$;

Mean deviation about median is given by,

$$\text{M.D. } (M) = \frac{1}{n}\sum_{i=1}^{n}|x_i - M|$$

For Grouped Data

Let $x_1, x_2, \ldots, x_n$ be a set of n observations occurring with frequencies $f_1, f_2, \ldots, f_n$ respectively, then mean deviation about mean is given by $\text{M.D.}(\bar{x}) = \frac{1}{N}\sum_{i=1}^{n} f_i |x_i - \bar{x}|$;

Mean deviation about median is given by $\text{M.D.}(M) = \frac{1}{N}\sum_{i=1}^{n} f_i |x_i - M|$

Here, x_i are the mid-points of classes and $N = \sum_{i=1}^{n} f_i$ = Sum of frequencies

Shortcut Method

- **About mean :** $\text{M.D.}(\bar{x}) = \frac{1}{N}\cdot\sum_{i=1}^{n} f_i |x_i - \bar{x}|$, where mean, $\bar{x} = a + \frac{\sum_{i=1}^{n} f_i d_i}{N} \times h$, a is assumed mean, $d_i = \frac{x_i - a}{h}$ and h = size of interval.
- **About median :** $\text{M.D.}(M) = \frac{1}{N}\sum_{i=1}^{n} f_i |x_i - M|$, where median, $M = l + \frac{\frac{N}{2} - cf}{f} \times h$,

N is sum of frequencies, l, f, h and cf are respectively the lower limit, the frequency of the median class, the width of the class interval and the cumulative frequency of the class just preceding the median class.

Analysis of Frequency Distributions

If the given data has mean $(\bar{x})$ and standard deviation (σ), then

Coefficient of variation (C.V.) $= \frac{\sigma}{\bar{x}} \times 100, \bar{x} \neq 0$

The data whose C.V. is less is said to be more consistent.

Variance and Standard Deviation

Mean of the squares of the deviations from mean is called variance and is denoted by σ^2.

The positive square root of variance is known as standard deviation. It is denoted by σ.

For ungrouped data	$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$
For grouped data	$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}$
Shortcut method	$\sigma = \frac{h}{N}\left[\sqrt{N\sum_{i=1}^{n} f_i u_i^2 - \left(\sum_{i=1}^{n} f_i u_i\right)^2}\right]$ where $u_i = \frac{x_i - a}{h}$, a = assumed mean, h = width of class-intervals

Properties of Standard Deviation

- S.D. is independent of change of origin.
- S.D. is not independent of change of scale.

Combined Variance of Two Series

If n_1, n_2 are the number of elements, $\bar{x}_1$, $\bar{x}_2$ are the means and σ_1, σ_2 are the standard deviations of two series respectively, then variance of combined series is

$$\sigma^2 = (\text{S.D.})^2 = \frac{n_1\left(\sigma_1^2 + d_1^2\right) + n_2\left(\sigma_2^2 + d_2^2\right)}{n_1 + n_2}$$

where $d_1 = \bar{x}_1 - \bar{x}$, $d_2 = \bar{x}_2 - \bar{x}$ and $\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

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SCIENCE TOPIC OF THE MONTH:

ELECTRIC FLUX AND GAUSS'S LAW

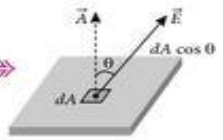
BRAIN MAP

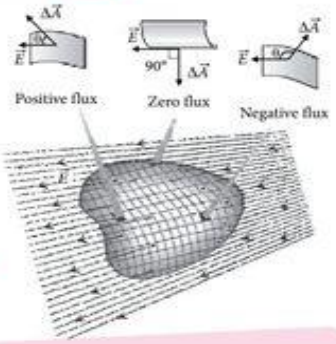
CLASS XII

ELECTRIC FLUX

Electric flux is a measure of flow of electric field through a surface. It is equal to the dot product of an area vector and electric field

- Flux of electric field E through any area A: $\phi = EA\cos\theta$ or $\phi = \vec{E}\cdot\vec{A}$
- For variable electric field or curved area $\phi = \int \vec{E}\cdot d\vec{A}$





- For a closed surface outward flux is taken to be positive while inward flux is taken to be negative.

To get a direct connection between the electric flux through closed surface and the total charge inside it.

Problem Solving Strategies

- *Select a symmetric gaussian surface as per the charge distribution.*
- *Calculate total electric charge inside the gaussian surface.*
- *For uniform charge density, simply multiply it by length, area and volume of surface.*
- *For non uniform charge density integrate it over the region enclosed the surface.*
- *Calculate electric field on the gaussians surface as per the given uniform charge distribution.*

GAUSS'S LAW

The total flux linked with a closed Gaussian surface is $(1/\varepsilon_0)$ times the charge enclosed by the closed surface *i.e.*,

$$\phi = \int_S \vec{E}\cdot d\vec{A} = \frac{1}{\varepsilon_0}(Q_{enc})$$

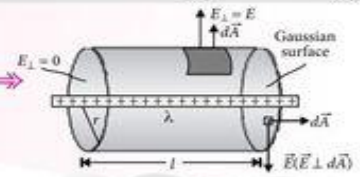
APPLICATIONS OF GAUSS'S LAW

Flux across some definite symmetric closed surfaces

- **Hemispherical body**
  In uniform electric field $\phi_{circular} = -\phi_{curved}; |\phi_{circular}| = \pi R^2 E$
  In non uniform electric field $\phi_{circular} = -\phi_{curved}; |\phi_{curved}| = 2\pi R^2 E$
- **Gaussian Cube**
  Charge kept at corner $\phi_{cube} = \frac{Q}{8\varepsilon_0}$ $\phi_{face} = \frac{Q}{24\varepsilon_0}$ $\phi_{total} = \frac{Q}{\varepsilon_0}$
  Charge kept at centre of face $\phi_{cube} = \frac{Q}{2\varepsilon_0}(5\,faces)$ $\phi_{total} = \frac{Q}{\varepsilon_0}$

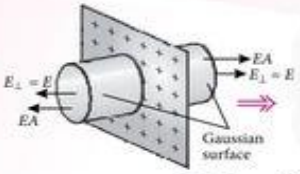
Field of a line charge

$$E_{net} = \frac{1}{2\pi\varepsilon_0}\frac{\lambda}{r}$$



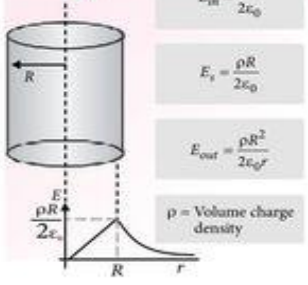
Field of an infinite plane sheet of charge

$$E = \frac{\sigma}{2\varepsilon_0}$$

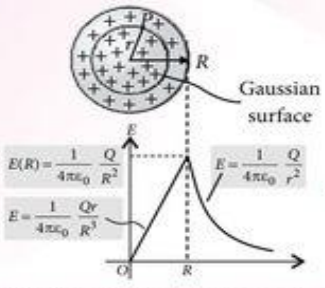


Result in field due to a sheet depends only on total charge of the sheet and independent of distribution of charge.

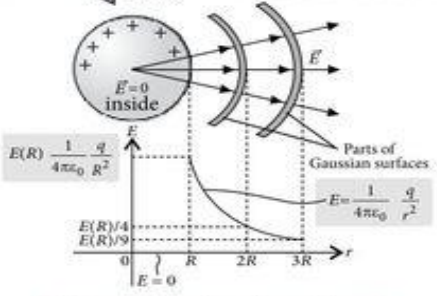
Field due to a long uniformly charged solid cylinder



Field of a uniformly charged solid sphere and charged conducting sphere



Uniformly charged sphere



Charged conducting sphere

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TWIST YOUR MIND

(Answers will be given in the August 2024 digest)

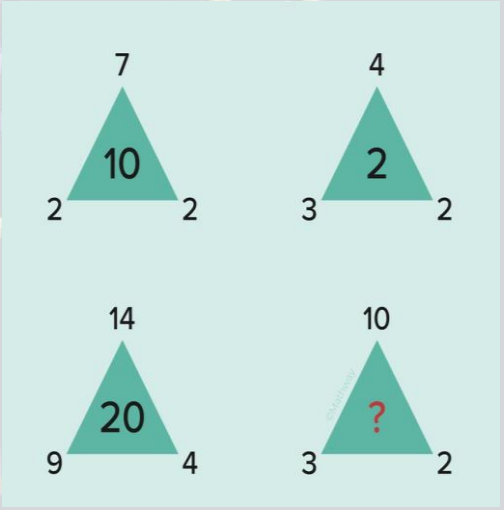
RIDDLLES

1. I can fly without wings. I can cry without eyes. Whenever I go, darkness flies. What am I?

2. I am not alive, but I grow. I don't have lungs, but I need air. I don't have a mouth, but water kills me. What am I?

PUZZLE

Find the missing number .



Bright Spots: Positive Events from JUNE 2024

- India claims T20 World Cup glory after 13 years!
- James Webb telescope peers into the early universe, discovers most distant galaxy yet.
- A heartwarming act: 5-year-old in India donates hair to a cancer patient.
- Over 160 wells revived in Tamil Nadu, India, boosting water conservation efforts.
- Australia appoints its second woman governor-general.
- Japan launches a powerful new Earth observation satellite.
- A man with locked-in syndrome completes a 50,000-word book using only his eyes to control a communication device

word of the month

Evanescent:Quickly fading or disappearing; vanishing like vapor.

JUNE ANSWERS

RIDDLES : 1. Promise 2.Stamp 3.Candle 4.Artichoke

PUZZLE : 6

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The Mentors website launched , please log onto **www.thementors.co.in**

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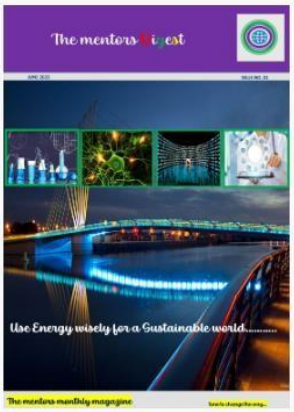
JUNE 2023



JULY 2023

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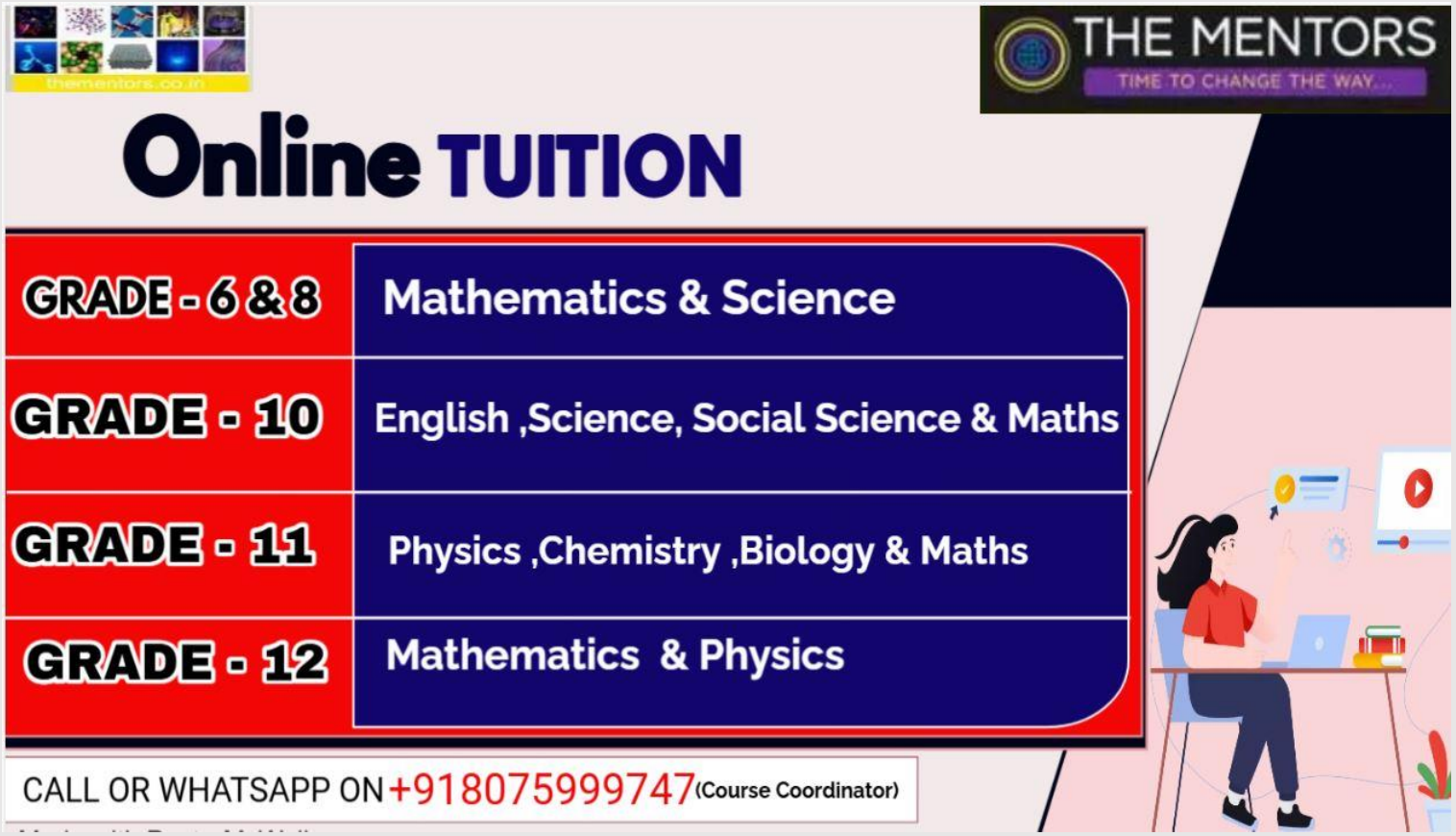
ABOUT US

Affordable Quality education …….

By understanding the need of aspiring students, India's renowned Industrial & Academic experts Mr. Manoj PL (Refining Specialist, Academician and founder Director Epinox Prompt Consulting Engineering Ltd), Ms. Chitra Jayasankar (Educational advisor, Tagore Educational trust) are there to bridge the gap of ensuring quality education for the students. We have formulated an online platform for providing significantly exceeding educational experience through online tuitions (classes 6-12), IAS bridge programs and finishing school for fresh engineers and other professionals. We will ensure excellent learning experience to students and 100% satisfaction level to parents.

Interested parents who are willing to associate with this concept are requested to contact



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