The mentors Digest

MARCH 2025 ISSUE NO:22

The mentors Digest

Our Founder & 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

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.

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

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From the Editors Desk…..

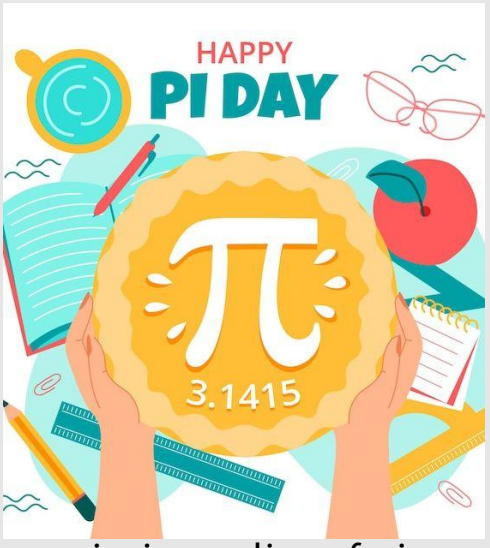
Dear Students & future leaders,

As you stand on the threshold of your public and competitive exams, remember that this is not just a test of knowledge, but of perseverance, dedication, and self-belief. Trust in the hard work and effort you've put in so far, and know that every challenge you've faced has prepared you for this moment.

Take a deep breath, stay focused, and approach each exam with calm and confidence. Remember, exams are only one part of your journey—no matter the outcome, your worth is not defined by a single test. Be kind to yourself, manage your time wisely, and most importantly, believe in your abilities. You've got this! Wishing you all the best of luck, and may success follow your every step.

Keep pushing forward, and remember: the best is yet to come!

WHAT IS SPECIAL ABOUT THE MONTH OF MARCH ?



March 14 : Pi Day is celebrated on March 14th (3/14) in honor of the mathematical constant π (pi), which represents the ratio of a circle's circumference to its diameter. The date reflects the first three digits of pi (3.14), making it a fun occasion for math enthusiasts, students, and educators to engage in activities related to mathematics and geometry. Many people celebrate by eating pie, participating in pi recitation contests, and learning about the significance of pi in various fields of science and engineering. Pi Day also serves as a reminder of the beauty and mystery of mathematics, as pi is an irrational number with an infinite number of non-repeating decimal places. Whether through solving complex equations, enjoying a slice of pie, or simply marveling at the infinite nature of π, Pi Day is a fun and meaningful way to celebrate the wonders of mathematics. Additionally, Pi Day has inspired discussions on the importance of mathematical literacy in everyday life. Some organizations use the occasion to promote STEM (Science, Technology, Engineering, and Mathematics) education and encourage young students to explore careers in these fields.Over time, Pi Day has evolved beyond just a mathematical celebration, becoming a cultural phenomenon that unites math lovers across the world.

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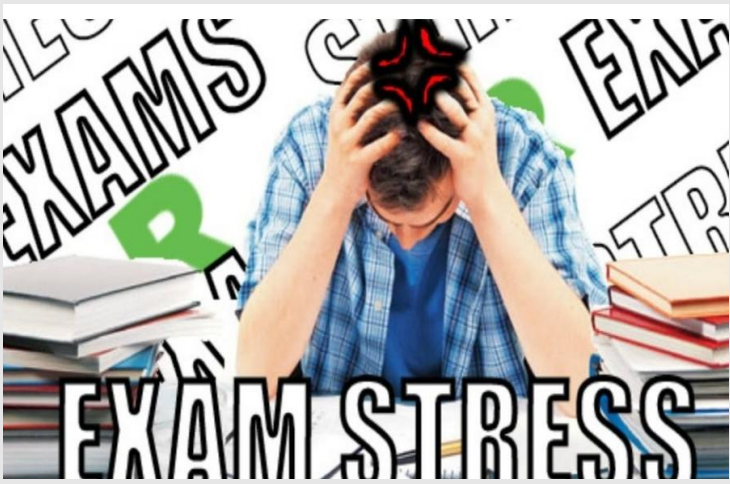
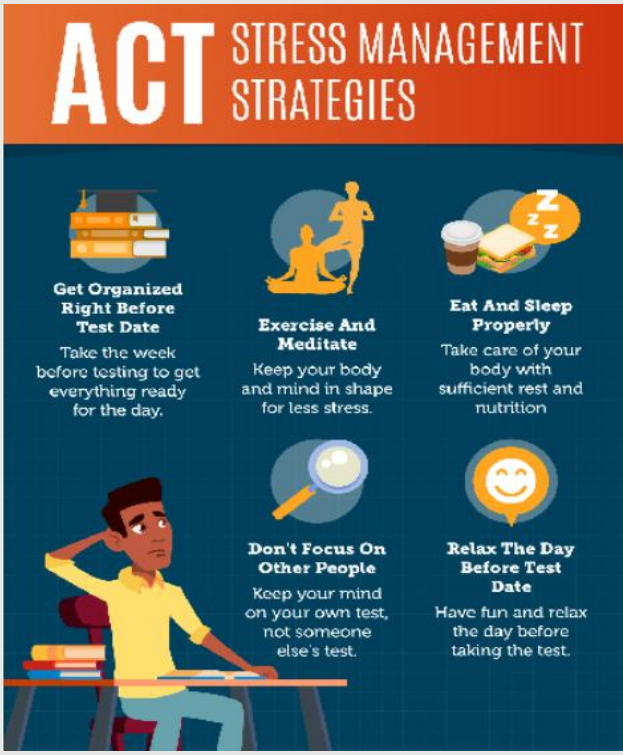
Helping your children through stressful exams

Examination periods can be an incredibly stressful time for both students and their parents. As children prepare for these crucial assessments, the entire household can become tense and filled with negative energy. Parents often find themselves worrying about how well their children will perform, whether they are studying enough, and the potential impacts their results may have on their future prospects.



However, there are strategies that families can employ to navigate this challenging time more effectively and create a supportive environment for their children.

1. Make sure your child eats well
2. Prioritize Adequate Sleep During Examination
3. Minimize Study Distractions
4. Seek Professional Tutoring Support
5. Develop an Exam Schedule
6. Maintain a Calm Demeanor



In conclusion, exam stress is a common experience that many students face, and it can significantly impact their performance and well-being. The pressure to perform well, combined with time constraints and high expectations, often leads to feelings of anxiety and overwhelm. However, addressing exam stress involves a multi-faceted approach

Developing healthy study habits, such as creating a balanced study schedule, prioritizing sleep, and incorporating relaxation techniques like mindfulness or exercise, can help alleviate stress. Additionally, seeking support from peers, family, or a counsellor can provide emotional relief. By fostering a positive mindset and recognizing the importance of self-care, students can manage stress more effectively and approach exams with confidence and clarity.

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IS YOUR BRAIN OLDER THAN YOU? AI CAN NOW MEASURE YOUR BRAIN'S 'TRUE' AGE!

We all know our actual age, but what if your brain is ageing faster than the rest of you? Scientists have discovered a new way to measure brain age using MRI scans and artificial intelligence (AI). This breakthrough could help detect and even prevent dementia and Alzheimer's in the future!

How Old Is Your Brain?

Your chronological age is simply the number of years you've been alive, but your biological age depends on how healthy your body is. Two people of the same age can have very different biological ages—one might have a youthful, sharp brain, while the other's brain might be ageing quickly.

Most biological age tests look at DNA changes in blood samples, but this method doesn't work for the brain. That's because the blood-brain barrier stops blood from crossing into the brain. Without direct access, scientists needed a new way to measure brain ageing—so they turned to AI.

How AI Tracks Brain Ageing

Researchers from the University of Southern California developed a non-invasive method using MRI scans and AI. They trained an AI system by analyzing thousands of brain scans from people of different ages.

At first, the AI could only estimate how old a brain looked, but scientists wanted to track how fast it was ageing. To do this, they built a 3D Convolutional Neural Network (3D-CNN), which compares multiple brain scans over time and spots areas that are ageing faster than normal.

What Did Scientists Discover?

The AI was tested on 104 healthy adults and 140 Alzheimer's patients, and the results were fascinating:

- Faster brain ageing was linked to weaker memory and slower thinking skills.
- The AI could detect early signs of cognitive decline before symptoms appeared.
- It could predict how brain health would change over time, helping doctors choose the best treatments.

Why This Matters

Scientists believe this AI could one day predict a person's risk of Alzheimer's. Imagine knowing if you had a 30% chance of developing memory problems! This could allow doctors to recommend lifestyle changes or treatments before serious damage happens. While we can't stop ageing, this discovery could help keep our brains younger for longer—and that's a future worth thinking about!

Did you know ?
Googol means 1 followed by 100 zeroes. A googolplex equivalent to ten raised to the power of a googol.

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NUCLEAR CLOCKS: THE FUTURE OF TIMEKEEPING AND UNLOCKING THE UNIVERSE

Imagine a clock so precise that it could uncover the secrets of the Universe. Scientists are developing nuclear clocks, an advanced version of atomic clocks, that could redefine how we measure time and help us understand the fundamental forces of nature.

The Limits of Atomic Clocks

Currently, the most accurate clocks are atomic clocks, which use the energy transitions of electrons in atoms, such as cesium, to measure time. These clocks are extremely precise—accurate to one second in millions of years—but their precision is limited by external electromagnetic fields that can distort the electron's energy levels.

Why Nuclear Clocks Are Better

Nuclear clocks, on the other hand, use protons and neutrons in an atom's nucleus, which are far less affected by these external fields. Since the nucleus is much smaller than the atom itself, this results in greater stability and precision. A nuclear clock would, in theory, be much more accurate than an atomic clock.

The Thorium-229 Breakthrough

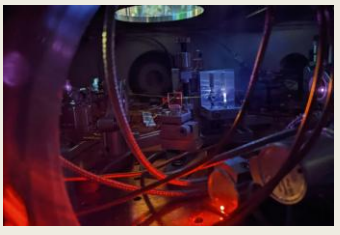
The key to this innovation is thorium-229, a rare isotope that has two energy levels that are very close together. This allows the nucleus to transition at a frequency that's low enough for lasers to interact with, unlike other elements. In 2023, scientists confirmed these transitions, and in 2024, they used a laser to shift thorium-229's nucleus between its energy levels, marking a major step toward building a nuclear clock.

How Nuclear Clocks Could Transform Science

🚀 Unmatched Precision – Nuclear clocks would surpass atomic clocks in accuracy, improving technologies like GPS, navigation, and communication systems.
🌌 Testing Einstein's Theories – They could help refine our understanding of General Relativity, where time behaves differently depending on speed and gravity.
🟣 Unlocking Dark Matter – Nuclear clocks could also help detect dark matter, a mysterious substance that makes up most of the Universe.

What's Next?

The challenge now is to make thorium-229 clocks practical and reliable. Scientists are exploring ways to stabilize the thorium atoms using lasers or embed them in solid-state crystals. If successful, nuclear clocks could revolutionize how we measure time and deepen our understanding of the Universe!



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THE PHYSICIST WORKING TO BUILD SCIENCE-LITERATE AI

Miles Cranmer, a physicist at the University of Cambridge, has a bold vision: he believes artificial intelligence (AI) can accelerate scientific breakthroughs, particularly in physics. His journey began when he was inspired by a Scientific American interview with theoretical physicist Lee Smolin, who suggested that reconciling quantum theory and relativity could take generations. Cranmer, eager to speed up the pace of scientific progress, decided that AI was the answer.

Having fused machine learning with his doctoral research in astrophysics at Princeton University, Cranmer has become a pioneer in developing AI systems for scientific discovery. While AI has already transformed science, tools like AlphaFold are still limited to specific tasks. Cranmer's ambition is to create foundation models, AI systems capable of making predictions and simulations across multiple scientific fields, much like a scientifically accurate version of ChatGPT.

The challenge, Cranmer explains, is that machine learning models are not equipped with scientific memory, meaning they struggle to make extrapolations or predictions that generalize across fields. For instance, while Einstein's math can predict black holes, machine learning currently cannot handle this kind of extrapolation. To bridge this gap, Cranmer is working on symbolic regression—a method to teach AI models to generate equations in a form scientists can understand, thereby giving the models "memory" of established scientific knowledge.

However, AI models are limited by the availability of high-quality scientific data. Cranmer's team is addressing this by using datasets like the Well (for numerical physics) and Multimodal Universe (for astronomical observations). These datasets, publicly available in uniform formats, serve as the foundation for training machine learning models that can generate scientifically valid predictions.

While Cranmer believes AI will automate many scientific tasks, he emphasizes that it will augment human capabilities, allowing scientists to accomplish more with their time. His ultimate goal is to create tools that enable scientists to tackle low-data problems, such as the ones that occur in areas like astrophysics, with just a few real-world data points.

Cranmer is optimistic that AI can empower scientists to continue their quest to understand the universe, pushing the boundaries of human knowledge in ways we can't yet fully imagine.

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MATHEMATICS TOPIC OF THE MONTH:

APPLICATION OF DERIVATIVES

CONCEPT MAP

Class XII

Rate of Change of Quantities

- Let $y = f(x)$ then $\frac{dy}{dx}$ or $f'(x)$ denotes the rate of change of y w.r.t. x and its value at $x = a$ is denoted as $\left[\frac{dy}{dx}\right]_{x=a}$.

Marginal Cost and Marginal Revenue

- Let C be the total cost of producing and marketing x units of a product, then marginal cost (MC), is $MC = \frac{dC}{dx}$.
- The rate of change of total revenue with respect to the quantity sold is the marginal revenue, $MR = \frac{dR}{dx}$.

Errors and Approximations

Let $y = f(x)$, Δx be the small change in x and Δy be the corresponding change in y. Then, $\Delta y = \frac{dy}{dx}(\Delta x)$

These small values Δx and Δy are called differentials.

(i) Absolute Error : Δx (ii) Relative Error : $\frac{\Delta x}{x}$

(iii) Percentage Error : $\left(\frac{\Delta x}{x} \times 100\right)$

Increasing and Decreasing Functions

Increasing Function

Increasing Function	without derivative test	If $x_1 < x_2 \Rightarrow f(x_1) \le f(x_2)\ \forall\ x_1, x_2 \in (a, b)$
	with derivative test	If $f'(x) \ge 0$ for each $x \in (a, b)$
Strictly Increasing Function	without derivative test	If $x_1 < x_2 \Rightarrow f(x_1) < f(x_2)\ \forall\ x_1, x_2 \in (a, b)$
	with derivative test	If $f'(x) > 0$ for each $x \in (a, b)$

Decreasing Function

Decreasing Function	without derivative test	If $x_1 < x_2 \Rightarrow f(x_1) \ge f(x_2)\ \forall\ x_1, x_2 \in (a, b)$
	with derivative test	If $f'(x) \le 0$ for each $x \in (a, b)$
Strictly Decreasing Function	without derivative test	If $x_1 < x_2 \Rightarrow f(x_1) > f(x_2)\ \forall\ x_1, x_2 \in (a, b)$
	with derivative test	If $f'(x) < 0$ for each $x \in (a, b)$

Maxima And Minima

They exist at critical points only.

Critical Points

1. $f(x)$ doesn't exist
2. $f'(x)$ doesn't exist
3. $f'(x) = 0$

Global Max., Global Min.

Global Max. : Max. value of $f(x)$ in domain.

Global Min. : Least value of $f(x)$ in domain.

Local Maxima And Local Minima

Local Maxima : At $x = a$

$f(a - h) < f(a) > f(a + h)$ $(h \to 0)$

Local Minima : At $x = a$

$f(a - h) > f(a) < f(a + h)$ $(h \to 0)$

First derivative test

1. $x = a$ is local max. if $f'(a) = 0$ and $f'(x)$ changes from +ve to –ve.
2. $x = a$ is local min. if $f'(a) = 0$ and $f'(x)$ changes from –ve to +ve.

Second derivative test

1. Find the roots of $f'(x) = 0$
2. Suppose $x = a$ is one of the roots.
3. At those points, if $f''(x) < 0 \Rightarrow f(x)$ is maximum at $x = a$, or if $f''(x) > 0 \Rightarrow f(x)$ is minimum at $x = a$.

Higher order derivative test

1. If $f''(a) = 0$ check $f'''(x)$ at $x = a$ If $f'''(a) = 0$, neither max. nor min.
2. $f'''(a) = 0$ repeat process considering $f'(x)$ as $g(x)$.

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SCIENCE TOPIC OF THE MONTH:

BRAIN MAP

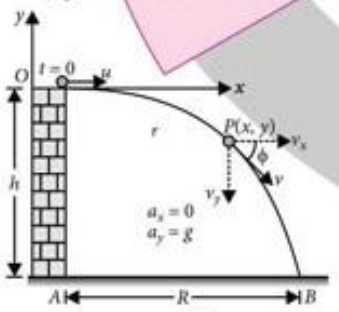
CLASS XI

PROJECTILE MOTION

PROJECTILE Motion

A body which is in flight through the atmosphere under the effect of gravity alone and is not being propelled by any fuel is called projectile and its motion is called projectile motion.

Horizontal Projectile Motion



- **Equation of Trajectory**

$$y = \frac{1}{2}\frac{gx^2}{u^2}$$

- **Time of Descent**

$$T = \sqrt{\frac{2h}{g}}$$

- **Horizontal Range**

$$R = u\sqrt{\frac{2h}{g}}$$

- **Instantaneous Velocity**

$$v = \sqrt{u^2 + 2gy} = \sqrt{u^2 + g^2t^2}$$

$$\tan\phi = \frac{v_y}{v_x} = \tan^{-1}\left(\frac{gt}{u}\right)$$

- Projectile passing through two different points on same height at time t_1 and t_2

$$y = \frac{gt_1t_2}{2}$$

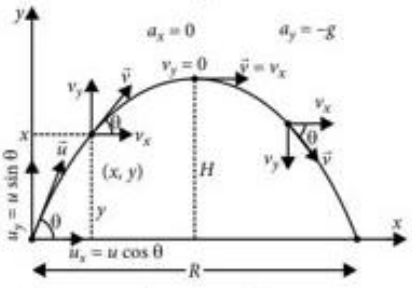
$$t_2 = \frac{u\sin\theta}{g}\left[1 + \sqrt{1 - \left(\frac{2gy}{u\sin\theta}\right)^2}\right]$$

Oblique Projectile Motion

- **Equation of Trajectory**

$$y = x\tan\theta - \frac{1}{2}\frac{gx^2}{u^2\cos^2\theta}$$

This represents the parabolic path.



- **Maximum Height**

$$H = \frac{u^2\sin^2\theta}{2g}$$

- **Time of Flight**

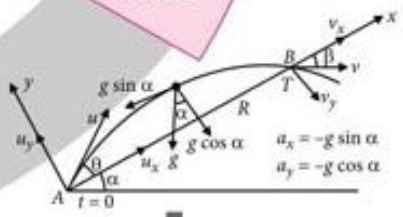
$$T = \frac{2u\sin\theta}{g}$$

- **Horizontal Range**

$$R = \frac{u^2\sin 2\theta}{g}$$

- Ratio of time of ights for projectiles at complimentary angles θ and 90 – θ

Projectile Motion on an Inclined Plane



- **Time of Flight**

$$T = \frac{2u\sin\theta}{g\cos\alpha}$$

- **Maximum Height**

$$H = \frac{u^2\sin^2\theta}{2g\cos\alpha}$$

- **Horizontal Range**

$$R = \frac{2u^2}{g}\frac{\sin\theta\cos(\theta+\alpha)}{\cos^2\alpha}$$

- Maximum range occurs when

$$\theta = \frac{\pi}{4} + \frac{\alpha}{2}$$

- Maximum range along the incline when projectile is thrown upwards

$$R_{max} = \frac{u^2}{g(1+\sin\alpha)}$$

- Maximum range along incline when the projectile thrown downwards

$$R_{max} = \frac{u^2}{g(1-\sin\alpha)}$$

- For complimentary angles θ and (90 – θ) range remains unchanged
- Relation between horizontal range and maximum height

$$R = 4H\cot\theta$$

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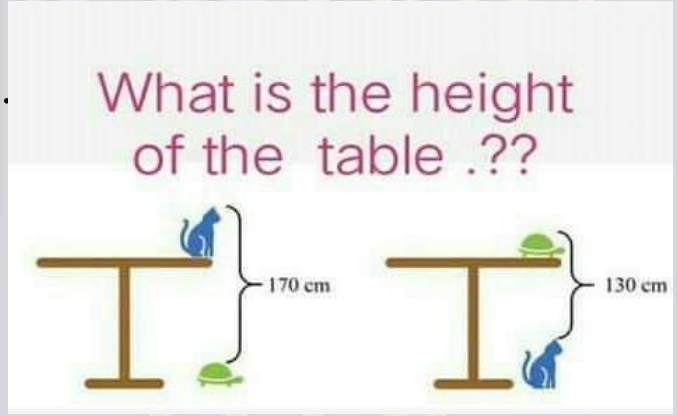
TWIST YOUR MIND

(Answers will be given in the April 2025 digest)

RIDDLLES

1. What goes through cities and fields, but never moves ?
2. A man looks at a painting in a museum and says, “Brothers and sisters I have none, but that man’s father is my father’s son.” Who is in the painting ?

PUZZLE



Bright Spots: Positive Events from FEBRUARY 2025

•Solar panel efficiency reaches 40% with breakthrough low-cost materials.
•Universal flu vaccine approved, offering lifetime protection against multiple strains.
•Israel and Palestine sign historic peace agreement, ending decades of conflict.
•NASA’s Artemis III mission successfully lands astronauts on the Moon.
•Global AI education platform launches, providing free learning to 100 million students.
•Africa’s Great Green Wall initiative hits 50% completion, restoring 100 million hectares.
•Lab-grown meat prices drop below traditional meat, revolutionizing sustainable food.
•World’s first fully electric commercial airplane completes maiden flight.
•Global plastic pollution treaty signed by 150+ countries with binding targets.

word of the month

Quip : A smart remark.

FEBRUARY ANSWERS

RIDDLES : 1.9 years 2.Both are in the middle of water.
PUZZLE : 13

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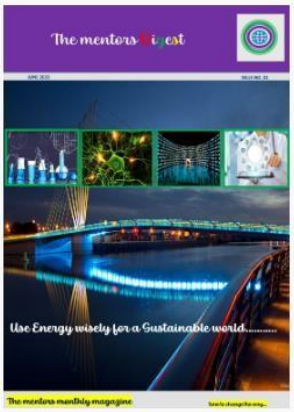

JULY 2023

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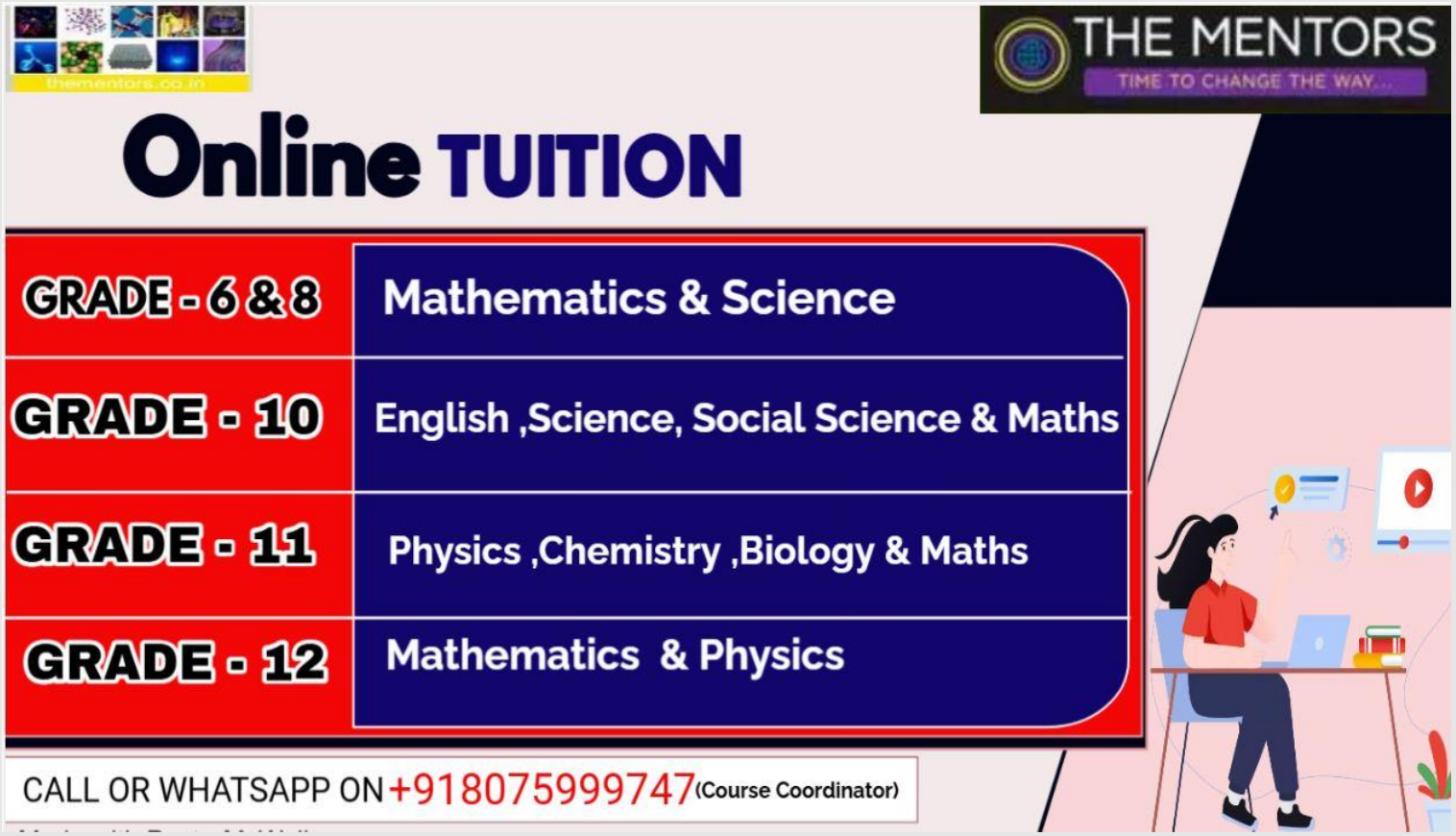
ABOUT US

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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