The mentors Digest

APRIL 2025 ISSUE NO:23

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,

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“Embrace the Journey: A Fresh Start to a Bright Academic Year”

As a new academic year begins, it’s the perfect time to start fresh—with energy, enthusiasm, and a mindset ready to grow. Each year brings new opportunities to learn, explore your interests, and build the foundation for your future. Remember, success doesn’t come from always being perfect; it comes from showing up, staying curious, and being willing to try again when things get tough. This is your time to challenge yourself, to ask bold questions, and to believe in your ability to make a difference—not just in your studies, but in the world around you. Every assignment you complete, every class you attend, and every effort you put in is a step toward your dreams. Stay organized, stay positive, and surround yourself with people who uplift and inspire you. Celebrate your wins—big or small—and don’t be afraid to ask for help when you need it. Growth happens when you’re willing to step outside your comfort zone. So, take a deep breath and dive into this academic year with confidence. You’ve got what it takes to make this your best year yet. Believe in yourself, stay focused, and most of all—enjoy the journey. The future is yours to create!

WHAT IS SPECIAL ABOUT THE MONTH OF APRIL ?

April 07 : World Health Day is celebrated annually on April 7th to raise awareness about global health issues and promote initiatives that improve well-being worldwide. Established by the World Health Organization (WHO) in 1948, this day highlights a specific health theme each year, addressing challenges such as mental health, universal healthcare, and disease prevention. Governments, healthcare professionals, and organizations use this occasion to educate the public, advocate for policy changes, and encourage healthy lifestyles. Events like health screenings, fitness campaigns, and discussions on healthcare accessibility are commonly organized to engage communities in taking proactive steps toward better health. Beyond its immediate focus, World Health Day serves as a reminder of the importance of sustainable healthcare systems and the need for global collaboration in tackling health crises. The COVID-19 pandemic, for example, reinforced the significance of investing in medical research, strengthening healthcare infrastructure, and ensuring equitable access to vaccines and treatments. As new health challenges emerge, World Health Day continues to be a platform for innovation, awareness, and action. The day also emphasizes the connection between health and other global issues .

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THE SCIENCE OF INVISIBILITY: ADVANCEMENTS IN STEALTH TECHNOLOGY

Scientists are making strides in developing stealth technology that could make people, planes, and even cities invisible. The idea of invisibility dates back centuries, with hunters and soldiers using camouflage, but modern advancements focus on manipulating light, heat, and sound to conceal objects.

Early breakthroughs in cloaking technology began in 2006 when engineers at Duke University created a device using metamaterials to redirect microwaves around an object, making it disappear to microwave detectors. However, achieving true invisibility to visible light remains challenging due to the complexity of bending all wavelengths of light and maintaining flexibility. In 2018, researchers at Harvard and the University of Waterloo developed metalenses that bend visible light more effectively, but wearable invisibility cloaks are still out of reach.

Stealth aircraft, such as the F-117 Nighthawk, use radar-absorbing materials and specialized shapes to minimize detection. Techniques like "iron ball paint" and cool air injection into exhaust systems help reduce radar and infrared visibility. However, advancing detection technology continues to challenge stealth methods.

Infrared invisibility is another focus, as human bodies emit detectable heat. While aluminum foil blankets provide temporary IR camouflage, more sophisticated solutions, like graphene-based adaptive materials, allow surfaces to change optical properties to blend with the environment. In 2022, researchers developed a graphene-infused jacket that adjusts its thermal radiation, offering potential for battlefield applications.

Sound-based stealth is also advancing, inspired by the African cabbage tree emperor moth, which absorbs bat echolocation to avoid detection. Acoustic metamaterials can manipulate sound waves, offering applications in noise reduction, earthquake protection, and energy harvesting from vibrations.

While true invisibility is still a work in progress, these advances bring us closer to making the impossible a reality.

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THE GROWING THREAT OF ANTIBIOTIC RESISTANCE: LIVESTOCK USE COULD SKYROCKET BY 2040

A new study published in Nature Communications warns that antibiotic use in livestock could rise by nearly 30% by 2040, exacerbating the global antibiotic resistance crisis. Antibiotics have long been used to boost productivity in agriculture by preventing infections and enhancing growth rates. However, their overuse and misuse in both animals and humans have contributed to the alarming spread of antimicrobial resistance (AMR).

According to the World Health Organization (WHO), AMR is one of the most pressing public health and development threats. In 2019, drug-resistant infections caused 1.27 million deaths directly, with 4.95 million deaths linked to AMR. If left unchecked, bacterial AMR alone could be responsible for up to 39 million deaths between 2025 and 2050. In response, global leaders at the 2024 High-Level Meeting on AMR during the 79th UN General Assembly pledged to curb antimicrobial use in the agri-food sector. However, recent projections indicate that, without intervention, antibiotic use in livestock could reach over 143,000 US tons annually by 2040.

The study, led by Alejandro Acosta from the UN's Food and Agriculture Organization, suggests that reducing antibiotic use intensity by 30%—paired with improved farming productivity—could offset the anticipated increase. In a more ambitious scenario, cutting antibiotic use intensity by 50% could reduce total antibiotic consumption in livestock to around 62,000 tons per year. The study also highlights stark regional differences, with Asia and the Pacific accounting for 65% of projected antibiotic use, South America contributing 19%, and Africa experiencing the fastest growth due to rising meat consumption.

Acosta stresses that the solution isn't just about restricting antibiotics but improving livestock productivity through better animal health, nutrition, and overall efficiency. Sustainable practices, such as optimizing livestock biomass and enhancing farm management, are crucial—especially in low- and middle-income countries where food security depends on livestock. The challenge remains: how to ensure antibiotics remain effective while maintaining affordable food production. Without action, AMR could spiral out of control, threatening both human health and global food security.

Did you know ?

The Earth's rotation is slowing down. This means that days are getting slightly longer, though the change is very gradual.

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THE BERMUDA TRIANGLE OF SPACE: THE SOUTH ATLANTIC ANOMALY

High above Earth, at around 480km over Brazil, lies a hazardous zone known as the South Atlantic Anomaly (SAA), where satellites malfunction, astronauts avoid spacewalks, and scientific instruments experience disruptions. This region, often referred to as the "Bermuda Triangle of Space," is caused by a dent in Earth's magnetic field, allowing charged particles to come closer to the planet and interfere with electronics.

The Cause and Impact of the Anomaly

The SAA is a weak point in the Van Allen radiation belts—two protective layers of energetic particles held by Earth's magnetic field. Due to this weakness, charged particles, including energetic protons and electrons, penetrate closer to Earth's surface. These interactions can corrupt data, damage electronic components, or cause permanent failures in spacecraft. As a precaution, space agencies power down satellites passing through the anomaly and avoid scheduling spacewalks in this region.

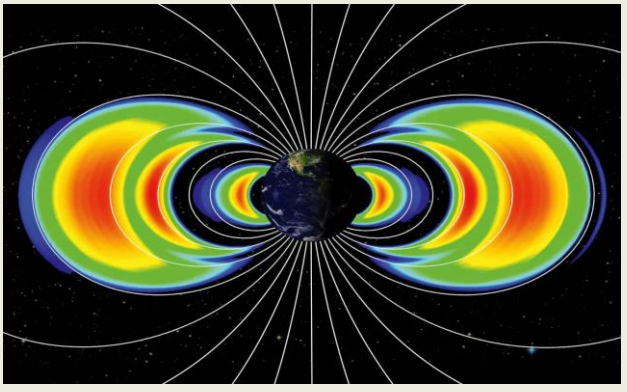
Despite its challenges, the SAA plays a vital role in maintaining overall space safety by drawing in these energetic particles, preventing broader radiation exposure.

A Moving Anomaly

The anomaly originates from Earth's core, where convection currents in liquid iron and nickel generate the planet's magnetic field. However, this process is not uniform. Patches of reversed magnetic flux beneath the SAA weaken the field, allowing charged particles to intrude. The anomaly has been shifting westward, initially forming in Namibia around 1500, migrating to South America in the 20th century, and continuing to expand.

Future Implications and Magnetic Reversals

Some scientists speculate that the SAA's growth could be linked to Earth's magnetic field reversals, where the planet's north and south poles swap. These reversals occur sporadically over millions of years, affecting global electromagnetic conditions. However, current data suggests a pole reversal is not imminent. The SAA is part of Earth's natural magnetic fluctuations, and while it poses challenges to spacecraft, it does not currently indicate a drastic shift in Earth's geomagnetic stability.



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MATHEMATICS TOPIC OF THE MONTH:

CONCEPT MAP

LIMITS

Class XI

Some Standard Limits

- $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, n being a positive integer
- $\lim_{x\to 0}\frac{\sin x}{x}=1$
- $\lim_{x\to a}\frac{\sin(x-a)}{x-a}=1$
- $\lim_{x\to 0}\cos x=1$
- $\lim_{x\to 0}\frac{\tan x}{x}=1$
- $\lim_{x\to a}\frac{\tan(x-a)}{x-a}=1$
- $\lim_{x\to 0}\frac{1-\cos x}{x}=0$

Limits of Trigonometric Functions

Let f and g be two real valued functions with the same domain such that $f(x)\le g(x)$ for all x in the domain of f and g. For some a, if both $\lim_{x\to a} f(x)$ and $\lim_{x\to a} g(x)$ exist, then $\lim_{x\to a} f(x)\le \lim_{x\to a} g(x)$.

Sandwich Theorem : Let f, g and h be real functions such that $f(x)\le g(x)\le h(x)$ for all $x\in\{\text{dom } f(x)\cap \text{dom } g(x)\cap \text{dom } h(x)\}$. For some real number a, if $\lim_{x\to a} f(x)=l=\lim_{x\to a} h(x)$, then $\lim_{x\to a} g(x)=l$.

Algebra of Limits

Let $\lim_{x\to a} f(x)=l$, $\lim_{x\to a} g(x)=m$. Then

- $\lim_{x\to a}(f(x)\pm g(x))=l\pm m$
- $\lim_{x\to a} kf(x)=kl$
- $\lim_{x\to a} f(x)g(x)=lm$
- $\lim_{x\to a}\frac{f(x)}{g(x)}=\frac{l}{m}, m\neq 0$
- $\lim_{x\to a}|f(x)|=|l|$
- $\lim_{x\to a} f(x)^{g(x)}=l^m$
- $\lim_{x\to a} e^{f(x)}=e^l$
- $\lim_{x\to a}(\ln f(x))=\ln l, l>0$

L' Hospital's Rule

Let $f(a)=0$, $g(a)=0$ and $f(x)$, $g(x)$ are differentiable functions with derivatives $f'(x)$, $g'(x)$, then $\lim_{x\to a}\frac{f(x)}{g(x)}=\lim_{x\to a}\frac{f(x)-f(a)}{g(x)-g(a)}$

$$=\lim_{x\to a}\frac{\frac{f(x)-f(a)}{x-a}}{\frac{g(x)-g(a)}{x-a}}=\frac{\lim_{x\to a}\frac{f(x)-f(a)}{x-a}}{\lim_{x\to a}\frac{g(x)-g(a)}{x-a}}=\frac{f'(a)}{g'(a)}$$

or $\lim_{x\to a}\frac{f(x)}{g(x)}=\frac{f'(a)}{g'(a)}=\frac{f''(a)}{g''(a)}$ if $f'(a)=g'(a)=0$ and so on.

Definition

Limit of a function $y=f(x)$ exists iff L.H.L = R.H.L. $=f(a)$ where L.H.L = $\lim_{x\to a^-} f(x)$ means limit approaching curve at $x=a$ to the left of a and R.H.L = $\lim_{x\to a^+} f(x)$ means limit approaching curve at $x=a$ to the right of a.

Limit of a function at a point

Limit of a function at $x=a$ is the value of $f(x)$ at $x=a$ *i.e.*, $\lim_{x\to a} f(x)$.

Limit of a function at an interval

Let $f: R\to R$ be a function and $a\in R$, then we say that $\lim_{x\to a} f(x)=l$ *if* $|f(x)-l|\to 0$ as $|x-a|\to 0$, where l is some real number.

Evaluation of Limits by Series

Sometimes, $\lim_{x\to a} f(x)$ can be evaluated by using the following series:

- $e^x=1+\frac{x}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots$
- $a^x=1+(\ln a)\frac{x}{1!}+(\ln a)^2\frac{x^2}{2!}+(\ln a)^3\frac{x^3}{3!}+\ldots$
- $\ln(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots, -1<x<1$
- $\sin x=\frac{x}{1!}-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+\ldots$
- $\cos x=1-\frac{x^2}{2!}+\frac{x^4}{4!}-\frac{x^6}{6!}+\ldots$
- $\tan x=x+\frac{x^3}{3}+\frac{2}{15}x^5+\ldots$
- $x\cot x=1-\frac{x^2}{3}-\frac{x^4}{45}-\ldots.$
- $\sec x=1+\frac{x^2}{2}+\frac{5}{24}x^4+\ldots$
- $x\,\text{cosec}\,x=1+\frac{x^2}{6}+\frac{7x^4}{360}+\ldots$
- $\sin^{-1}x=x+\frac{1}{2}\cdot\frac{x^3}{3}+\frac{1}{2}\cdot\frac{3}{4}\cdot\frac{x^5}{5}+\frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{x^7}{7}+\ldots$
- $\tan^{-1}x=x-\frac{x^3}{3}+\frac{x^5}{5}-\frac{x^7}{7}+\ldots$
- $(1+x)^{1/x}=e^{\left(1-\frac{x}{2}+\frac{11x^2}{24}-\ldots\right)}$

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SCIENCE TOPIC OF THE MONTH:

STEREOCHEMISTRY

Class XII

CONCEPT MAP

Stereochemistry is a unique part of chemistry concerned with the study of the spatial arrangement of atoms and molecules in the compound, its effect on chemical reaction and relations to the properties of compounds. It is also known as 3D chemistry. Different enantiomers have different selectivity for biological targets and have different biological actions. Hence, stereochemistry have great importance in pharmaceutical industry.

Stereoisomers

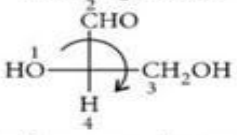
The isomers that are different from each other only in the way the atoms are oriented in space are called *stereoisomers*.

Absolute Configuration (*R* and *S* system of nomenclature)

In order to designate absolute configurations a system of nomenclature called *Cahn-Ingold-Prelog system* has been developed.

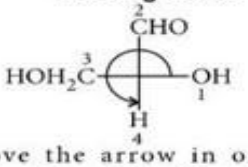
- Assign priority to the groups attached. Higher atomic number will get higher priority.
- The H atom or group of lowest priority is brought vertically in Fischer projection.

R-configuration



Move the arrow in order of decreasing priority. If it rotates clockwise, configuration is *R* (*rectus*) configuration.

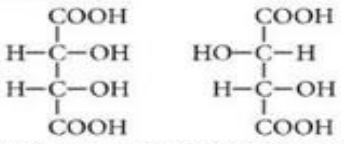
S-configuration



Move the arrow in order of decreasing priority. If it rotates anti-clockwise, then the configuration is *S* (*sinister*) configuration.

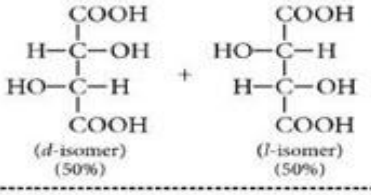
Diastereomers

Stereoisomers that are not mirror images of each other are called *diastereomers*.



Racemic mixture

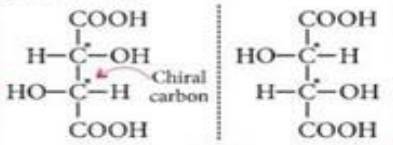
If both *d* and *l* enantiomers present in equal amount (50-50%) then the mixture is optically inactive due to external compensation, the mixture is known as *racemic mixture*.



(*d*-isomer) (50%) (*l*-isomer) (50%)

Enantiomers

Stereoisomers having non superimposable mirror images are optically active and these are called *enantiomers*.



(dextrorotatory) *d*-enantiomer — Rotates the plane polarised light towards right.

(laevorotatory) *l*-enantiomer — Rotates the plane polarised light towards left.

Number of stereoisomers

The number of stereoisomers depends on structure and number of asymmetric carbon atoms present in the molecule.

In unsymmetrical molecule

Number of enantiomers = 2^n

Meso forms = 0

Total optical isomers = 2^n

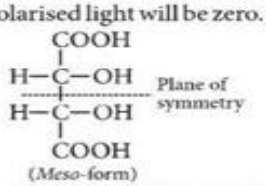
where, n = number of chiral or asymmetric carbon atoms.

In symmetrical molecule

- When n is odd,
  Number of enantiomers $= 2^{(n-1)} - 2^{(0.5n - 0.5)}$
  Meso forms = $2^{(0.5n - 0.5)}$
  Total optical isomers = $2^{(n-1)}$
- When n is even,
  Number of enantiomers = $2^{(n-1)}$
  Meso forms = $2^{(n/2 - 1)}$
  Total optical isomers $= 2^{(n-1)} + 2^{(n/2 - 1)}$

Meso form

If plane of symmetry is present in the molecule then, one of the isomer will be optically inactive due to internal compensation because half of the molecule will rotate the plane polarised light towards right and another half towards left. So, total rotation of plane polarised light will be zero.



(*Meso*-form)

Resolution of racemic mixture

The process of separation of a racemic mixture into *d*- and *l*-forms is called *resolution*.

Following are the methods by which a racemic mixture can be resolved:

- Mechanical separation
- Biochemical separation
- Chemical separation
- Chromatographic method
- Selective adsorption method

Racemisation

Conversion of (+) or (–) isomer into its racemic mixture (±) is known as *racemisation*. It is reverse of resolution and can be carried out either by heat, light or use of chemical reagents, etc.

The mentors Digest

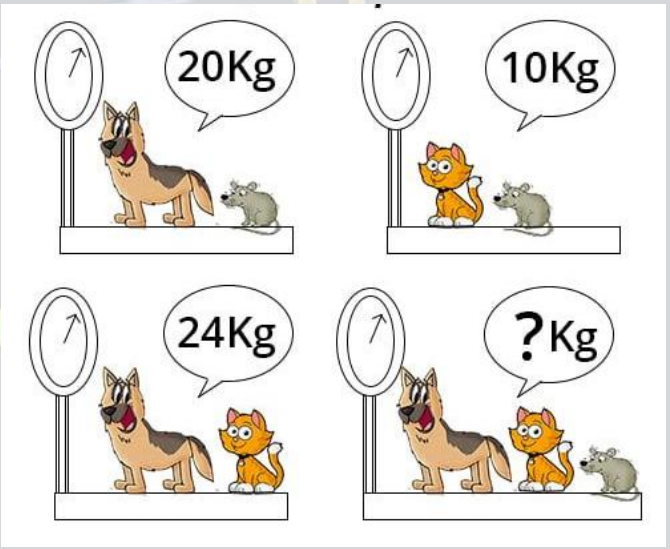
TWIST YOUR MIND

(Answers will be given in the May 2025 digest)

RIDDLLES

1. What is always in front of you but can't be seen?
2. A man who was outside in the rain without an umbrella or hat didn't get a single hair on his head wet. Why?

PUZZLE



Bright Spots: Positive Events from MARCH 2025

1.India and China agree to resume direct flights and Kailash Manasarovar Yatra, fostering bilateral ties 4.

2.Sudan's army recaptures key paramilitary base in Khartoum, advancing stability in the region 4.

3.U.S. imposes 25% auto tariffs to boost domestic manufacturing, aiming to spur economic growth 4.

4.Global petrochemical demand remains resilient, with India emerging as a key growth driver 5.

5.TV9 WITT 2025 highlights India's sustainability progress, with companies like Danfoss India achieving 90% carbon neutrality in Chennai 1.

6.UPI outage resolved swiftly, showcasing India's robust digital payment resilience 4.

word of the month

Ephemeral : Lasting for a very short time.

MARCH ANSWERS

RIDDLES : 1.A road 2.The man's son.

PUZZLE : 150cm

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

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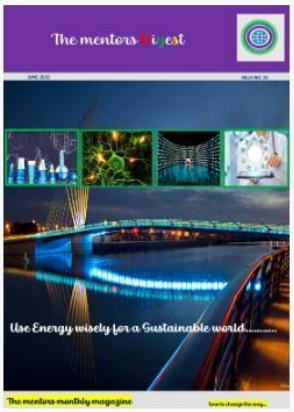
MAGAZINES

JUNE 2023



JULY 2023

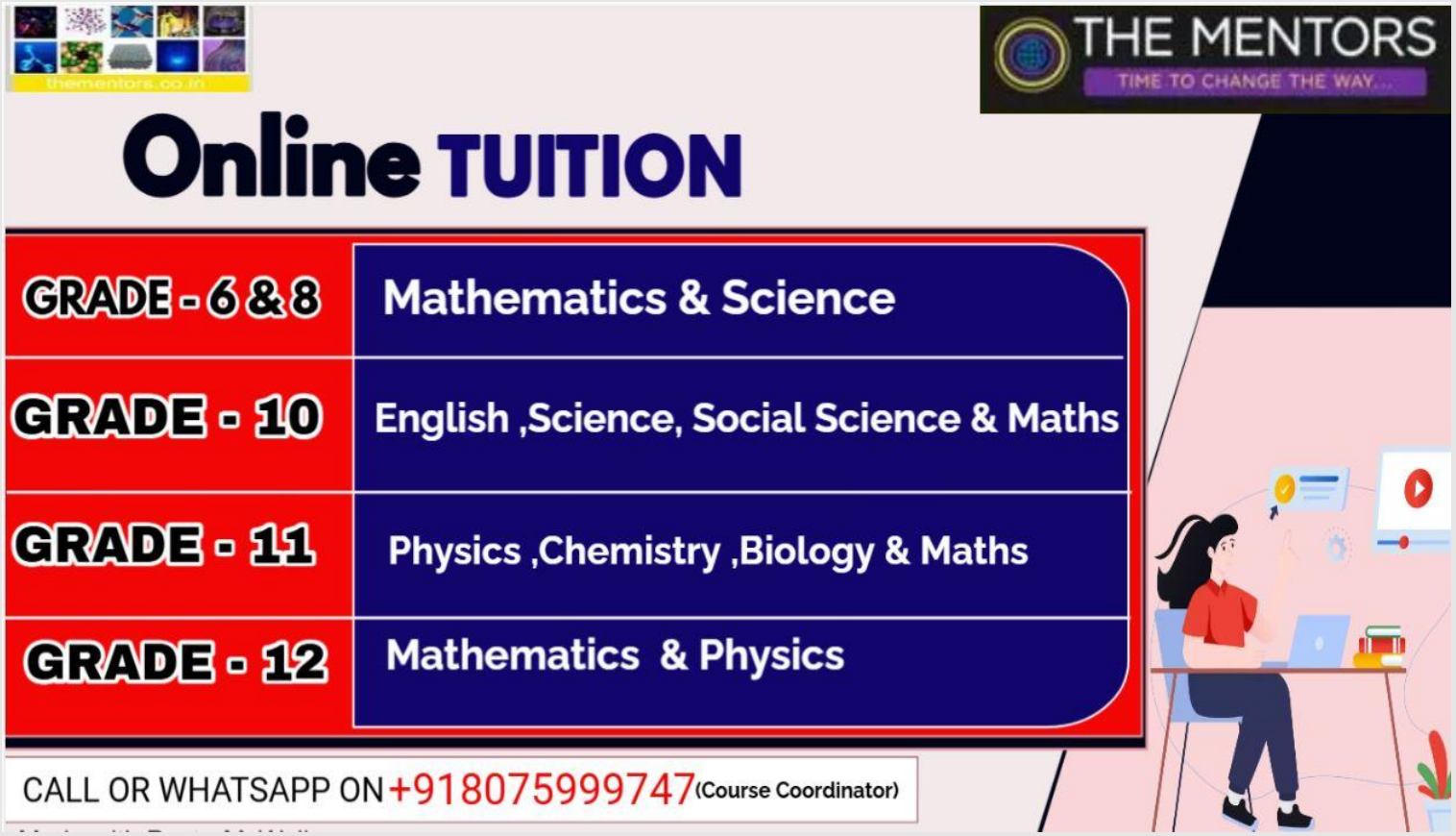
The mentors Digest

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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