

The mentors Digest



FEBRUARY 2024

ISSUE NO. 09





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

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

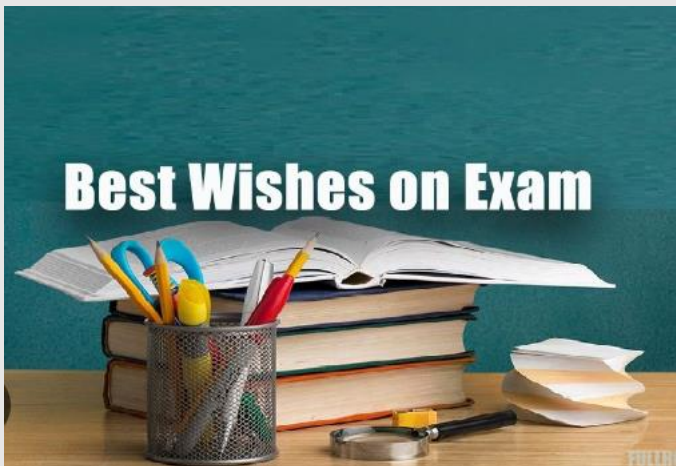
Degree	Subject
B.A. Hons	Malayalam Language and Literature
M.A.	Malayalam Language and Literature
M.A.	Hindi Language and Literature
M.A.	Hindi Special
P.G. Diploma	Tamil, Telugu, Kannada





From the Editor's Desk.....

Dear Students & future leaders,



it's that time of year again! With the exam season right around the corner, it can be tricky to find just the right words for your loved ones who are about to sit an important test.

WHAT IS SPECIAL ABOUT THE MONTH OF FEBRUARY ?

FEBRUARY 04 :World Cancer Day is observed globally on February 4th every year. It is an initiative that aims to raise awareness about cancer, encourage its prevention, detection, and treatment, and unite people worldwide in the fight against this devastating disease. The day provides an opportunity for individuals, communities, governments, and organizations to come together against cancer. The main goals of World Cancer Day include promoting understanding and awareness of cancer, dispelling myths and misconceptions surrounding the disease, and encouraging governments and individuals to take steps toward preventing and controlling it. The day is also a platform for highlighting the importance of early detection, access to treatment, and the need for ongoing research to improve cancer outcomes. Several organizations, including the Union for International Cancer Control (UICC), play a significant role in coordinating global efforts for World Cancer Day. "Close the care gap" is the theme from 2022 to 2024. Events and activities on World Cancer Day include educational programs, fundraising initiatives, support group meetings, and public awareness campaigns. These efforts aim to inspire individuals to take proactive steps in reducing their cancer risk, promote healthy lifestyles, and advocate for policies that enhance cancer prevention and control.

All the best for exam

Wishing you all the best on your exam. You got this!" "Remember, the harder you study, the luckier you'll get!" "Don't stress, just do your best and let the results speak for you.

Try not to worry about how others are preparing for exams and focus on what you can do. You might think that other people are doing better, revising more or just not stressing out as much. But we're all different and that's okay. Remember, your friends are coping with exam stress too. They might be feeling just as worried as you are.





SYNTHETIC BIOLOGY AIMS TO TACKLE DISEASE AND GIVE CELLS SUPERPOWERS

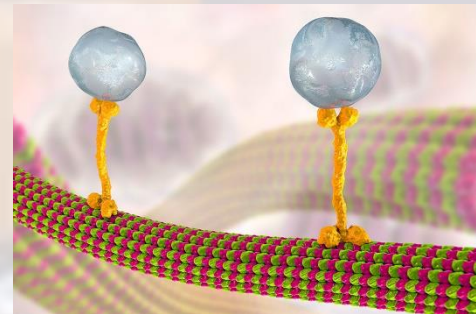
Synthetic biology, a field focused on engineering life, aims to address diseases and enhance cellular capabilities. Researchers are creating nanomachines to replace or augment natural proteins, as natural proteins can be fragile and challenging to reproduce in a lab. This approach falls under the umbrella of synthetic biology, which involves modifying or creating life.

Scientists envision a future where synthetic biology can repair or replace damaged body parts, such as growing replacement organs or limbs. While fully synthetic animals are a distant goal, small-scale synthetic biology fixes have been achieved. For example, synthetic biology has been used to address eye diseases like retinitis pigmentosa by introducing light-sensitive nanoparticles.

Researchers are exploring alternatives to electronic implants for repairing damaged signaling networks in the body. One approach involves growing synthetic nerves inside the body using carbon-based chemistry. In experiments with leeches, synthetic nerves created through chemical reactions successfully triggered muscle contractions.

Synthetic biology is also employed to mimic and enhance cellular functions. By creating nanomachines that imitate cellular processes, scientists aim to

develop artificial cells capable of reproduction and performing new functions. These synthetic cells have demonstrated abilities such as division triggered by light and responding to external signals.



The applications of synthetic biology extend to controlling cell behavior for medical purposes. Carbon nanotubes are used to create membrane channels in cells, allowing researchers to target and destroy specific cells, such as cancer cells. In one study, electrical currents induced cancer cells to self-destruct. Another application involves enhancing immune cells to target and remove plaque build-ups in blood vessels, potentially mitigating heart disease.

Synthetic biology is not only addressing existing challenges but also pushing the boundaries of what is possible, opening up new tools and ideas for scientific exploration beyond the constraints of natural biology.



OFFSHORE WIND FARMS COULD DO FAR MORE THAN JUST MAKE CLEAN POWER.

Canadian researchers are exploring innovative ways to maximize the potential of offshore wind farms by incorporating two additional functions: the production of green hydrogen through electrolysis and the capture of carbon dioxide (CO₂) from the atmosphere using direct air capture (DAC) technology. The vast Canadian coastline, particularly along the Pacific, offers ideal conditions for offshore wind farms, harnessing the power of strong and consistent ocean breezes.

The proposed approach involves the utilization of electrolyzers, devices capable of splitting seawater into hydrogen and oxygen through hydrolysis. To address the challenge of saltwater, the researchers suggest employing reverse osmosis to remove sea salt and obtain fresh water for the electrolysis process. The resulting hydrogen can be used for various purposes, including the production of ammonia for fertilizers or supplying clean electricity through gas turbines. In addition to green hydrogen production, the researchers propose integrating DAC systems into offshore wind farms to capture CO₂ from the air. DAC devices, resembling large vacuum cleaners, require electricity to operate fans that move air across a solid material, capturing CO₂. To address the challenge of providing heat for CO₂ release from the material, the researchers suggest using electricity generated by wind

turbines to power electric boilers or heat pumps. Another innovative proposal involves storing some of the produced hydrogen and burning it later to provide the necessary heat. Furthermore, the researchers suggest storing the captured CO₂ in deep-sea basalt formations, where it reacts with the rock over time, transforming into a stable mineral state. This geological storage solution could effectively sequester CO₂ for 10 to 25 years, contributing to carbon neutrality goals.

In summary, this multifaceted approach aims to enhance the value and sustainability of offshore wind farms by integrating green hydrogen production, carbon capture, and utilization of renewable energy for various applications, thereby contributing to a more comprehensive and eco-friendly energy ecosystem.



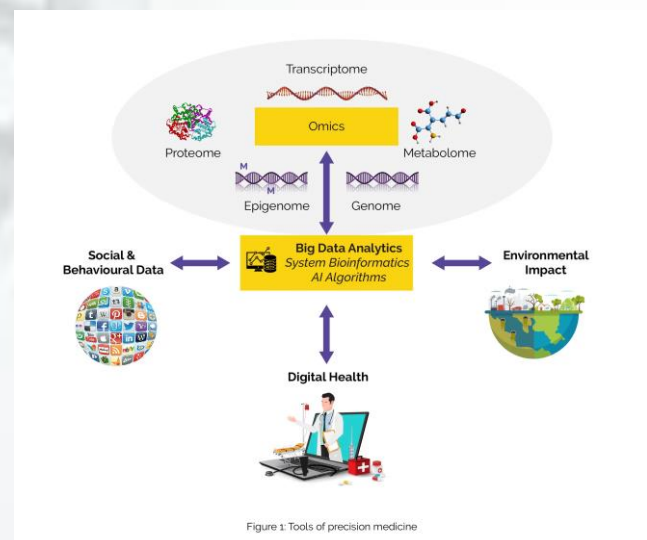


PRECISION AND PERSONALIZED MEDICINE: UNLOCKING THE FUTURE OF HEALTHCARE

In recent years, medicine has shifted towards precision and personalized approaches, leveraging advancements in genomics, electronic health records, and data analytics. Precision medicine tailors treatments based on specific patient characteristics, emphasizing genomics and targeted therapies. On the other hand, personalized medicine takes a holistic approach, considering individual preferences and values.

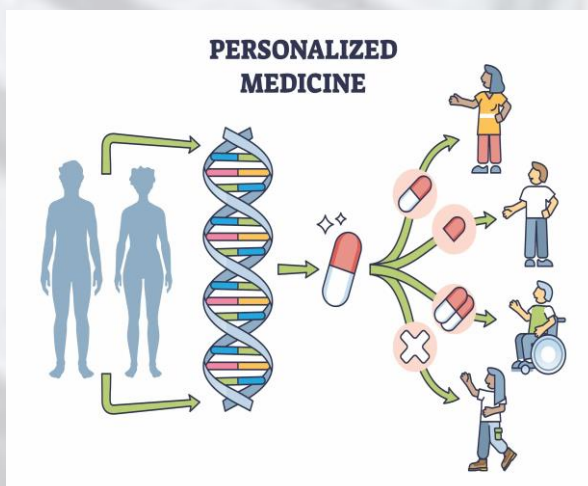
These approaches play key roles in disease prediction, prevention, and treatment across various conditions. In cancer, for instance, targeted therapies focus on specific vulnerabilities, and genetic testing guides preventive measures. Precision medicine is also beneficial in chronic diseases like asthma, where genetic markers aid in subtype classification for effective treatment.

predictive risk assessment, enhanced drug development, and increased patient engagement. However, challenges include data integration and privacy, cost, ethical considerations,



limited evidence, and implementation hurdles.

Despite challenges, precision and personalized medicine offer transformative potential, allowing tailored interventions for individual patients. As technology advances and understanding of genetics deepens, these approaches are expected to shape the future of healthcare by offering more precise, predictable, and potent treatment options. Ongoing research and clinical trials are essential to validate the efficacy of personalized approaches across various disorders.



The benefits include targeted treatment, improved diagnosis,



CONCEPT MAP

MATHEMATICS CHAPTER OF THE MONTH:

SEQUENCES AND SERIES

Class XI

Sum of n terms of special series

- Sum of n natural numbers $\sum n = \frac{n(n+1)}{2}$
- Sum of squares of n natural numbers $\sum n^2 = \frac{n(n+1)(2n+1)}{6}$
- Sum of cubes of n natural numbers $\sum n^3 = \frac{n^2(n+1)^2}{4} = (\sum n)^2$

Basic Properties

- If a constant is added / subtracted / multiplied / divided to each term of an A.P., then the resulting sequence is also an A.P.
- Selection of terms in an A.P.
 - Any three numbers in A.P. can be taken as $a - d, a, a + d$.
 - Any four numbers in A.P. can be taken as $a - 3d, a - d, a + d, a + 3d$.
- If each term of a G.P. is multiplied / divided by a same non-zero number, then the resulting sequence is also in G.P.
- Selection of terms in a G.P.
 - Any three numbers in G.P. can be taken as $a/r, a, ar$.
 - Any four numbers in G.P. can be taken as $a/r^3, a/r, ar, ar^3$.

Arithmetic Mean (A.M.)

- For two numbers a and b , A.M. is $a+b/2$.
- $A_k = a + k \left(\frac{b-a}{n+1} \right)$, $\forall k = 1, 2, \dots, n$
where A_1, \dots, A_n are n arithmetic means inserted between two numbers a and b .

Geometric Mean (G.M.)

- For two numbers a and b , G.M. is \sqrt{ab} .
- $G_k = a \left(\frac{b}{a} \right)^{k/n+1}$ $\forall k = 1, 2, 3, \dots, n$
where G_1, \dots, G_n are n geometric means inserted between two numbers a and b .

Harmonic Mean (H.M.)

- For two numbers a and b , H.M. is $2ab/a + b$.
- $H_n = \frac{(n+1)ab}{an+b}$ $\forall n = 1, 2, \dots$
where a and b are two numbers and H_1, H_2, \dots, H_n are n harmonic means inserted between them.

SERIES

If a_1, a_2, \dots, a_n is a sequence, then the expansion $a_1 + a_2 + \dots + a_n + \dots$ is called the series.

SEQUENCE

A sequence is a function from natural number N (domain) to real numbers (codomain)

Progression

If the terms of a sequence are written under specific conditions, then the sequence is called progression.

Types

Arithmetic Progression (A.P.)

A sequence whose terms increases or decreases by a fixed number.

- n^{th} term: $T_n = a + (n-1)d$ where d (common difference) $= T_n - T_{n-1}$, a = first term,
- n^{th} term from end: $T_n' = l - (n-1)d$, where l = last term
- Sum of n terms: $S_n = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}[a + l]$

Geometric Progression (G.P.)

A sequence of non-zero numbers for which the ratio of a term to its just preceding term is always constant.

- n^{th} term: $T_n = ar^{n-1}$,
where r (common ratio) $= T_n/T_{n-1}$, a = first term
- n^{th} term from end: $T_n' = l/r^{n-1}$, l = last term
- Sum of n terms: $S_n = \begin{cases} \frac{a(r^n - 1)}{r - 1}, & r > 1 \\ \frac{a(1 - r^n)}{1 - r}, & r < 1 \\ an, & r = 1 \end{cases}$; $S_\infty = \frac{a}{1-r}$, $|r| < 1$

Harmonic Progression (H.P.)

A sequence a_1, a_2, a_3, \dots in which reciprocal of terms form an A.P.

- n^{th} term: $T_n = \frac{1}{\frac{1}{a_1} + (n-1)\left(\frac{1}{a_2} - \frac{1}{a_1}\right)} = \frac{a_1 a_2}{a_2 + (n-1)(a_1 - a_2)}$

Note: No term of an H.P. can be zero.



SCIENCE CHAPTER OF THE MONTH:

ELECTROMAGNETIC INDUCTION

BRAIN MAP

CLASS XII

Magnetic Energy

- Energy stored in an inductor, $U_B = \frac{1}{2} LI^2$
- Energy stored in the solenoid, $U_B = \frac{1}{2\mu_0} B^2 Al$
- Magnetic energy density, $u_B = \frac{U_B}{V} = \frac{B^2}{2\mu_0}$

Combination of Inductors

- Inductors in series, $L_S = L_1 + L_2 \pm 2M$
- Inductors in parallel, $L_P = \frac{L_1 L_2 - M^2}{L_1 + L_2 + 2M}$
- If coils are far away, then $M = 0$.
So, $L_S = L_1 + L_2$ and $L_P = \frac{L_1 L_2}{L_1 + L_2}$

L-R Circuit

- Current growth in L-R circuit $I = I_0(1 - e^{-t/\tau_L})$
- Current decay in L-R circuit, $I = I_0(e^{-t/\tau_L})$
Here, $\tau_L = \text{Time constant} = \frac{L}{R}$
 $I_0 = \frac{\mathcal{E}}{R}$

Inductance

- Emf induced in the coil/conductor, $\mathcal{E} = -L \frac{dI}{dt}$
- Coefficient of self induction, $L = \frac{N}{I} \phi_B = \frac{-\mathcal{E}}{dI/dt}$
- Self inductance of a long solenoid, $L = \mu_0 \mu_r n^2 Al = \frac{\mu_0 \mu_r N^2 A}{l}$
- Mutual inductance, $M = \frac{N_2 \phi_2}{I_1} = \frac{-\mathcal{E}_2}{(dI_1/dt)} = \frac{-\mathcal{E}_1}{(dI_2/dt)}$
- Mutual inductance of two long coaxial solenoids,
 $M = \mu_0 \mu_r \pi r_1^2 n_1 n_2 l = \frac{\mu_0 \mu_r N_1 N_2 A_1}{l}$
- Coefficient of coupling, $k = \frac{M}{\sqrt{L_1 L_2}}$
For perfect coupling, $k = 1$ so, $M = \sqrt{L_1 L_2}$

Lenz's Law

- The direction of the induced current is such that it opposes the change that has produced it.
- If a current is induced by an increasing(decreasing) flux, it will weaken (strengthen) the original flux.
- It is a consequence of the law of conservation of energy.

Induced Electric Field

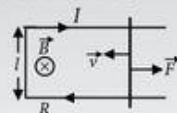
- It is produced by change in magnetic field in a region. This is non-conservative in nature.
 $\oint \vec{E} \cdot d\vec{l} = -\frac{d\phi_B}{dt} = -A \frac{dB}{dt} \neq 0$
- This is also known as integral form of Faraday's law.

Magnetic Flux and Faraday's Law

- Magnetic flux $\phi_B = \vec{B} \cdot \vec{A} = BA \cos \theta$
- Faraday's law : Whenever magnetic flux linked with a coil changes, an emf is induced in the coil.
 - Induced emf, $\mathcal{E} = -N \frac{d\phi_B}{dt}$
 - Induced current, $I = \frac{\mathcal{E}}{R} = N \frac{(-d\phi_B/dt)}{R}$
 - Induced charge flow, $\Delta Q = I \Delta t = -N \frac{\Delta \phi_B}{R}$

Energy Consideration in Motional emf

- Emf in the wire, $\mathcal{E} = Bvl$
- Induced current, $I = \frac{\mathcal{E}}{R} = \frac{Bvl}{R}$
- Force exerted on the wire,
 $F = \frac{B^2 l^2 v}{R}$
- Power required to move the wire, $P = \frac{B^2 l^2 v^2}{R}$
It is dissipated as Joule's heat.



Motional emf

- On a straight conducting wire, $\mathcal{E} = Bvl$
- On a rotating conducting wire about one end, $\mathcal{E} = \frac{B\omega l^2}{2}$
Here, $\vec{B}, \vec{v} (= \omega r \hat{\phi})$ and \vec{l} are perpendicular to each other.

Electric Generator

- Mechanical energy is converted into electrical energy by virtue of electromagnetic induction.
- Induced emf, $\mathcal{E} = NAB\omega \sin \omega t = \mathcal{E}_0 \sin \omega t$
- Induced current,
 $I = \frac{NBA\omega}{R} \sin \omega t = I_0 \sin \omega t$



TWIST YOUR MIND

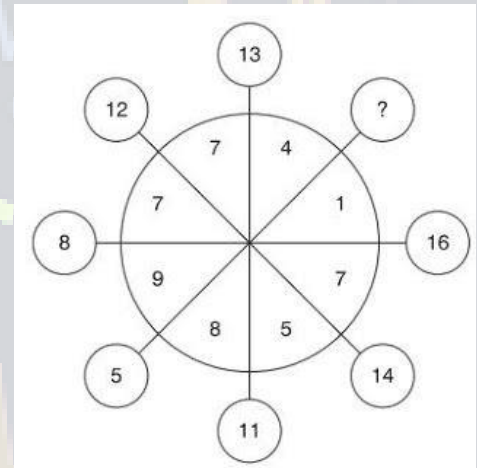
(Answers will be given in the February 2024 digest)

RIDDLES

1. What 5-letter word typed in all capital letters can be read the same upside down?
2. Four cars come to a four-way stop, each coming from a different direction. They can't decide who got there first, so they all go forward at the same time. All 4 cars go, but none crash into each other. How is this possible?

PUZZLE

Find the missing number .



Bright Spots: Positive Events from January 2024

In January 2024, there were many major positive events around the world, including:

- 1.Science: James Webb Telescope captures stunning image of "Cosmic Cliffs," revealing details about star formation.
- 2.Energy: Breakthrough in nuclear fusion research promises cleaner energy in the future.
- 3.Brazil: Luiz Inácio Lula da Silva inaugurated as President, marking a political shift.
- 4.Peru: Protests erupt after Pedro Castillo's inauguration as President amidst accusations of election fraud.
- 5.Global: Climate change concerns rise with extreme weather events in Australia and the US, while the humanitarian crisis in Ukraine worsens.

These events are a sign of progress and hope in the world, and they remind us that there is still good to be found.

**word
of the
month**

Serendipity: The occurrence and development of events by chance in a happy or beneficial way. A touch of the unexpected that brings joy and fortune.

JANUARY ANSWERS

RIDDLES: 1. Footsteps 2. Eye.

PUZZLE: 5 , The numbers in the grid are arranged in a way that follows a certain rule. In this puzzle, the rule is that the sum of the numbers in each of the three lines that pass through the center of the star is the same.

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ABOUT US

Affordable Quality education

By understanding the need of aspiring students, India's renowned Academic experts in the field of school education- Mr. Jaya Sankar (Son of Late Padmasree Dr Vellayani Arjunan and former Director Vivekananda group of schools) and 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 8-12), 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.

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