ROYAL GLOBAL UNIVERSITY

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E-MAGAZINE

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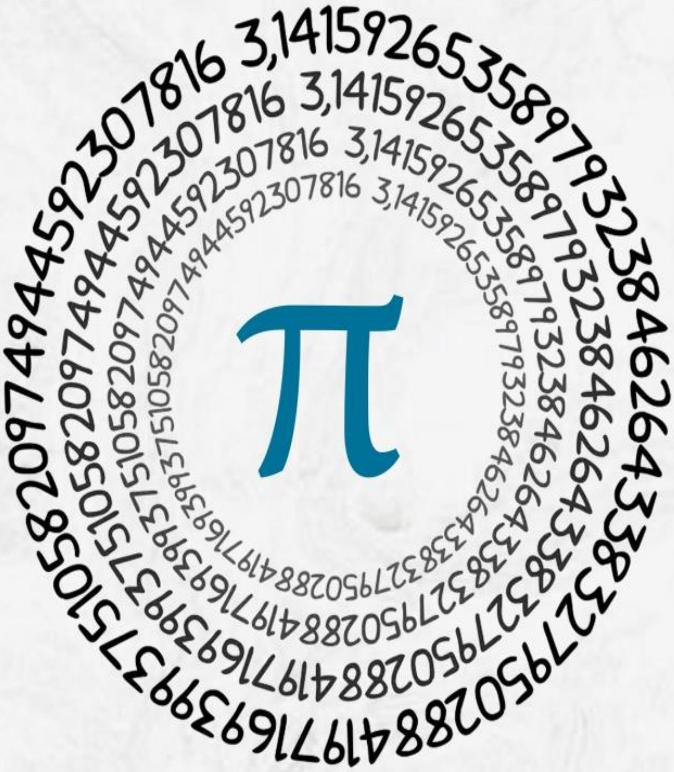

DEPARTMENT OF MATHEMATICS
ROYAL SCHOOL OF APPLIED & PURE SCIENCES

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The primary objective of the Pi Magazine is to showcase recent developments, well-known mathematical areas, students' creative endeavours, academic activities within the department, and faculty research work. This magazine features a compilation of articles sourced from various outlets, offering a diverse perspective on mathematical exploration.

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ABOUT THE DEPARTMENT OF MATHEMATICS

Department of Mathematics is a constituent part of Royal School of Applied & Pure Sciences was formed in July, 2017 under The Assam Royal Global University, Guwahati. The department is offering courses on Mathematics at UG and PG level. The department has also started the Ph.D. program from July 2018. Besides these the department is also offering allied teaching in other schools of the university.

The department is blessed with 3 senior experienced faculty members along with 9 young, energetic and dedicated faculty members who leave no stone unturned to present the aspiring students, the principles and concepts of mathematics. All the faculty members of the department are actively involved in teaching and research.

As per UGC guidelines, the learning outcomes-based curriculum framework for both undergraduate and postgraduate courses are followed. The course learning outcomes of Mathematics are aimed at fascinating the learners to acquire knowledge, skills, understanding, values, attributes and academic standards. Besides imparting regular courses, the department is also preparing the student for higher study in reputed institutions like IIT by providing JAM coaching to UG students and NET/Gate coaching to PG students. For the betterment of the students, the department often organized seminar, workshop, conference, webinar, motivational talk, guest lectures by renowned mathematician, field trips, annual events like National Mathematics Day, National Science Day, Pi-Day and also involve the students in sports, club activities and corporate interaction.

Functional Equations

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An equation in which unknowns are functions is called a *functional equation.*

Consider the question: find all functions f satisfying the equation $f(-x) = -f(x)$. The immediate doubt that crosses our mind is: where is f defined and what are the values it takes? Thus, the above problem is not well posed. We must specify domain and the range of f before seeking any answer to the question. If we modify our problem to: find all $f: \mathbb{R} \to \mathbb{R}$ such that $f(-x) = -f(x)$, then the problem make sense. Any solution to this problem is called odd function on the real line. $f(x) = x^{2n+1}$ for any natural number n is a solution or, $f(x) = \sin x$ is a solution. Thus, a functional equation may posses large number of solutions. To narrow down the number of solutions, we may need to impose additional conditions on the nature of f in terms of either equations or properties of the function. The above problem can be reframed as: find all functions $f: \mathbb{R} \to \mathbb{R}$ which satisfy $f(-x) = -f(x)$ and $f(xy) = x^2 f(y)$ for all $x, y \in \mathbb{R}$.

Solution: We obtain $-f(xy) = f(-xy) = f\big((-x)y\big) = (-x)^2 f(y) = x^2 f(y) = f(xy)$. It follows that $f(xy) = 0$ for all reals x, y. Taking $y = 1$, we have $f(x) = 0$ for all reals x. Thus the equations $f(-x) = -f(x)$ and $f(xy) = x^2 f(y)$ has only one solution: $f(x) = 0$ for all reals x.

A problem from International Mathematics Olympiads, 1996.

Problem: Let $\mathbb{N}_0$ denote the set of all non-negative integers. Find all $f: \mathbb{N}_0 \to \mathbb{N}_0$ satisfying the functional equation

$f\big(m + f(n)\big) = f\big(f(m)\big) + f(n)$, for all $m, n \in \mathbb{N}_0$. The solution to the problem can be found within the pages of the book [1].

Reference: [1] B. J. Venkatachala, "Functional Equations: A problem solving approach", 2nd edition, Prism Books Pvt. Ltd. 2013.

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Fractional Mathematical Modelling

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Introduction:

Fractional mathematical modelling, a growing field at the intersection of mathematics and applied sciences, provides a powerful framework for describing complex phenomena exhibiting non-local and memory-dependent behaviours. Unlike classical integer-order differential equations, fractional models incorporate derivatives of non-integer order, offering a more flexible and accurate representation of various real-world phenomena. In this article, we travel into the fundamentals of fractional calculus, explore the principles of fractional mathematical modelling, and highlight its applications across diverse disciplines. Traditional mathematical models, often based on integer-order calculus, have been instrumental in understanding and predicting phenomena ranging from population dynamics to heat diffusion. However, many real-world processes exhibit intricate dynamics and anomalous behaviours that defy conventional modelling approaches. Fractional calculus, a branch of mathematical analysis dealing with derivatives and integrals of non-integer order, provides a powerful tool for capturing such complexities. Fractional mathematical modelling influences these concepts to formulate models that more accurately represent the underlying dynamics of complex systems.

Fundamentals of Fractional Calculus:

At the heart of fractional mathematical modelling lies the concept of fractional calculus, which extends the notion of differentiation and integration to non-integer orders. The fractional derivative of a function describes its rate of change over a non-integer number of dimensions, capturing memory effects and long-range interactions. Similarly, fractional integration generalizes the concept of area under a curve to fractional orders, enabling the incorporation of memory-dependent effects into mathematical models. Fractional calculus also incorporates fractional differential equations, which involve derivatives of non-integer order and play a central role in fractional mathematical modelling.

Principles of Fractional Mathematical Modelling:

Fractional mathematical modelling involves formulating mathematical models using fractional differential equations to describe the dynamics of complex systems. These models often incorporate memory-dependent effects, anomalous diffusion, and long-range interactions, which are prevalent in various scientific and engineering disciplines. Fractional models can capture phenomena such as subdiffusion, where particles exhibit slower-than-normal diffusion due to obstacles or spatial heterogeneity, and superdiffusion, characterized by faster-than-normal diffusion due to long-range interactions or anomalous transport mechanisms.

Applications across Disciplines:

Fractional mathematical modelling finds applications across diverse fields, including physics, biology, finance, and engineering. In physics, fractional models are used to describe the dynamics of complex fluids, anomalous diffusion in porous media, and the behaviour of fractal structures. In biology, fractional models aid in understanding the dynamics of population growth, the spread of diseases, and the transport of substances in biological tissues. In finance, fractional models provide insights into the dynamics of asset prices, market volatility, and risk management. Moreover, fractional modelling is increasingly being applied in engineering disciplines such as control theory, signal processing, and materials science, where complex dynamics and memory effects play a crucial role.

One commonly used fractional order mathematical model is the Caputo fractional-order SIR model, given by the following system of fractional differential equations:

$$D_t^{\alpha} S(t) = -\beta S(t) I(t)$$

$$D_t^{\alpha} I(t) = \beta S(t) I(t) - \gamma I(t)$$

$$D_t^{\alpha} R(t) = \gamma I(t)$$

where $S(t)$ is the number of susceptible individuals at time t,

$I(t)$ is the number of infectious individuals at time t,

$R(t)$ is the number of recovered individuals at time t,

$\beta$is the transmission rate,

γ is the recovery rate,

D_t^{α} denotes the Caputo fractional derivative of order α.

The fractional order epidemic model has been applied to various infectious diseases, including COVID-19, influenza, and Ebola, to better understand and predict their transmission dynamics. By accounting for non-local interactions and memory effects, fractional order models can capture phenomena such as spatial dispersal, long-term persistence, and heterogeneous mixing patterns, which are often overlooked in traditional models.

Furthermore, fractional order models have been used to assess the effectiveness of control measures, such as vaccination campaigns, social distancing policies, and travel restrictions, in mitigating the spread of infectious diseases. By simulating different intervention strategies and their impact on epidemic dynamics, policymakers can make informed decisions to minimize disease transmission and reduce the burden on healthcare systems.

Conclusion:

Fractional mathematical modelling offers a versatile framework for describing complex phenomena exhibiting non-local, memory-dependent, and anomalous behaviours. By extending the principles of fractional calculus to mathematical modelling, researchers can better capture the complexities of real-world systems across diverse disciplines. As the field

continues to evolve, fractional modelling promises to unlock new insights into complex phenomena, driving innovations in science, engineering, and technology.

References:

1. Podlubny, I. (1998). Fractional Differential Equations. Academic Press.

2. Kilbas, A. A., Srivastava, H. M., & Trujillo, J. J. (2006). Theory and Applications of Fractional Differential Equations. Elsevier.

3. Tarasov, V. E. (2017). Fractional Dynamics: Applications of Fractional Calculus to Dynamics of Particles, Fields and Media. Springer.

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A symphony of love transcending all spaces

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2nd Semester

Hilbert Harmony

Oh, Hilbert Space, where inner products sing,
Orthogonal vectors in a symphony ring.
A treasure trove of analysis grace,
Infinite dimensions, an elegant embrace.

Banach Space Ballad

In realms of math where norms hold sway,
Lies Banach Space where vectors play.
Complete and bound, they dance in grace,
Infinite dimensions, a wondrous space.

Metric Space Melody

In Metric Space, distances decree,
Defined by metrics with scrutiny.
Closer or distant, the points race,
Topology's whispers in this spatial chase.

Topology Tango

Topology Space, where closeness defines,
Neighborhoods and limits intertwine.
Connected, compact, a topological place,

Infinite variety in its boundless embrace

So let us wander, in mathematical delight,
Through Banach, Hilbert, metric's might,
In topology's embrace, we find,
A universe of spaces, to expand the mind.

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ALGEBRAIC DESIGN THEORY

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Algebraic design theory is a mathematical subject that deals with the combinatorial configurations of objects and their relationships. It has applications in diverse fields such as coding theory, cryptography, network design, error-correcting codes, and experimental design. The underlying principles of algebraic design theory can be utilized in various practical and theoretical scenarios to optimize the design of experiments, network structures, and error-correcting systems.

In the context of experimental design, algebraic design theory helps in constructing efficient experiments by arranging treatments and their combinations to efficiently estimate the effects of the factors involved. This is particularly important in fields such as agriculture, engineering, and social sciences where experiments are conducted to understand the impact of various factors on the outcome of interest. Algebraic design theory provides a systematic approach to creating experimental designs that minimize the number of experimental runs required while providing accurate and reliable estimates of the effects being studied.

In the realm of network design, algebraic design theory plays a crucial role in constructing networks with desirable properties such as fault tolerance, connectivity, and robustness. By employing algebraic methods, network designers can create efficient network topologies that are resilient to failures and can optimize data transmission and communication efficiency. This has practical applications in the design of communication networks, distributed systems, and infrastructure planning.

In coding theory and cryptography, algebraic design theory is fundamental to the construction of error-correcting codes and secure cryptographic protocols. Error-correcting codes are essential in digital communication systems to detect and correct errors that occur during the transmission of data. Algebraic design theory provides tools for the construction of codes with desirable properties, such as high error-correcting capability and efficient encoding and decoding algorithms. Likewise, in cryptography, algebraic design theory is utilized to devise secure cryptographic schemes and protocols that resist attacks and ensure the confidentiality and integrity of digital communications.

Additionally, algebraic design theory has applications in the design and analysis of computer algorithms, particularly in the areas of optimization, machine learning, and artificial intelligence. By leveraging algebraic design principles, researchers and engineers can develop algorithms that efficiently solve complex optimization problems, learn from data, and make intelligent decisions.

The applications of algebraic design theory are widespread and continue to expand as new challenges emerge in diverse fields such as information technology, telecommunications, manufacturing, and scientific research. The ability to systematically design, analyze, and optimize configurations and structures using algebraic methods provides a powerful toolset for addressing complex real-world problems and advancing the frontiers of science and technology.

Reference: https://www.ams.org/books/surv/175/surv175-endmatter.pdf

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Motion of a simple pendulum using Mathematical modelling

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Mathematical modelling is an attempt to study some part (or form) of the real-life problem in mathematical terms. The conversion of a physical situation into mathematical systems with some suitable conditions is known as mathematical modelling.

The process of mathematical modelling through an example where the modelling is done to study- *the motion of a simple pendulum*.

Understanding the problem

A pendulum is simply a mass (known as bob) attached to one end of a string whose other end is fixed at a point. We know that the motion of the simple pendulum is periodic. The period depends upon the length of the string and acceleration due to gravity. So, what we need to find is the period of oscillation.

*Statement***:** How do we find the period of oscillation of the simple pendulum?

Formulation

It consists of two main steps.

1. Identifying the relevant factors

   In this, find out what are the factors/parameters involved in the problem. For example, in the case of pendulum, the factors are period of oscillation (T), the mass of the bob (m),

effective length (l) of the pendulum which is the distance between the point of suspension to the centre of mass of the bob. Consider the length of string as effective length of the pendulum and acceleration due to gravity (g), which is assumed to be constant at a place.

2. Mathematical description

This involves finding an equation, inequality or a geometric figure using the parameters already identified. In the case of simple pendulum, experiments were conducted in which the values of period 'T' were measured for different values of l.

The relation between 'T' and 'l' could be expressed as

$$T^2 = kl, \text{ where } k = 4\pi^2 / g .$$

This gives the equation $T = 2\pi \left(\frac{l}{g}\right)^{\frac{1}{2}}$ ... (2)

Equation (2) gives us the mathematical formulation of the problem.

Finding the solution

In the case of simple pendulums, the solution involves applying the formula given in Equation (2). The period of oscillation calculated for two different pendulums having different lengths is given in Table 1.

l	225cm	275cm
T	3.04 sec	3.36 sec

Validation:

A mathematical model is an attempt to study, the essential characteristic of a real-life problem. We measure the effectiveness of the model by comparing the results obtained from the mathematical model, with the known facts about the real problem. This process is called *validation of the model*.

In the case of simple pendulum, we conduct some experiments on the pendulum and find out period of oscillation. The results of the experiment are given in Table 2.

Periods obtained experimentally for four different pendulums

Mass (gms)	Length (cms)	Time (secs)
385	275 225	3.371 3.056
280	275 225	3.352 3.072

Now, compare the measured values in Table 2 with the calculated values given in Table 1. The difference in the observed values and calculated values gives the error. For example, for l = 275 cm, and mass m = 385 gm, error = (3.371 – 3.36) = 0.011, which is small and therefore, model is accepted.

Interpretation

The process of describing the solution in the context of the real situation is called *interpretation of the model.*

In this case, interpret the solution in the following way:

(a) The period is directly proportional to the square root of the length of the pendulum.

(b) It is inversely proportional to the square root of the acceleration due to gravity.

Conclusion

Validation and interpretation of this model shows that the mathematical model is in good agreement with the practical (or observed) values.

Reference: Mathematics Textbook for Class XI. New Delhi : National Council of Educational Research and Training. November 2022, pp. 327-330.

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BROKE THE FUNDAMENTAL OF MATHEMATICS

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In 1931, Kurt Friedrich Gödel shattered the belief that mathematics was a complete and consistent discipline with the introduction of his Incompleteness Theorems. Before Gödel's work, mathematicians aimed to establish a comprehensive framework, like Hilbert's program, that would serve as a blueprint for complete and non-contradictory framework of mathematics. However, Gödel's theorems demonstrated that inherent limitations of such framework. Gödel's incompleteness theorem are two theorems of mathematical logic that are concerned with the limits of provability in formal axiomatic theories. These results, published by Kurt Gödel in 1931, are important both in mathematical logic and in the philosophy of mathematics. The theorems are widely, but not universally, interpreted as showing that Hilbert's Program to find a complete and consistent set of axioms for all mathematics is impossible.

The first incompleteness theorem states that no consistent system of axioms whose theorems can be listed by an effective procedure is capable of proving all truths about the arithmetic of natural numbers. For any such consistent formal system, there will always be statements about natural numbers that are true, but that are unprovable within the system. The second incomplete theorem, an extension of the first, shows that the system cannot demonstrate its own consistency. The incompleteness theorems apply to formal systems that are of sufficient complexity to express the basic arithmetic of the natural numbers and which are consistent and effectively axiomatized. One example of such a system is first-order Peano arithmetic, a system in which all variables are intended to denote natural numbers. There are several properties that a formal system may have, including completeness, consistency, and the existence of an effective axiomatization. The incompleteness theorems show that systems which contain a sufficient amount of arithmetic cannot possess all three of these properties.

A formal system is said to be effectively axiomatized if its set of theorems is recursively enumerable. This means that there is a computer program that, in principle, could enumerate all the theorems of the system without listing any statements that are not theorems. Examples of effectively generated theories include Peano arithmetic and Zermelo-Fraenkel set theory (ZFC). A set of axioms is complete if, for any statement in the axiom's language, that statement or its negation is provable from the axioms. In his completeness theorem, Gödel proved that first order logic is semantically complete. A formal system might be syntactically incomplete by design, as logic generally are or it may be incomplete simply because not all the necessary axioms have been discovered or included. For example, Euclidean geometry without the parallel postulate is incomplete, because some statements in the language cannot be proven from the remaining axioms. A set of axioms is consistent if there is no statement such that both the statement and its negation are provable from the axioms, and inconsistent otherwise. A consistent axiomatic system is one that is free from contradiction.

Gödel's Incompleteness Theorems have profound implications for the nature of mathematical truth, the relationship between mathematics and logic, and the epistemological status of mathematical knowledge. They challenge the view that mathematics is purely deductive science that can be fully formalized within a complete and consistent system. No matter how rich and comprehensive a formal system is, there will always be true statements that lie beyond its reach. This result challenges the notion of absolute certainty and completeness in mathematics and highlights the role of intuition and creativity in mathematical discovery.

Reference: Wikipedia.

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ADVANCING MATHEMATICS BY GUIDING HUMAN INTUITION WITH AI

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The practice of mathematics involves discovering patterns and using those patterns to formulate and prove conjectures, which results in theorem. Since the 60s, mathematicians have used computers to assist in the discovery of new patterns and formulations of conjectures, most famously in the Birch and Swinnerton-Dyer conjecture, which is a Millenium Prize Problem. In the latest research done by Google Deep Mind, London, it has been shown that they are proposing a process of using machine learning to discover potential patterns and relations between mathematical objects, understanding them with attribution techniques and using these observations to guide intuition and propose conjectures. In each case of its application, it shows how it led to meaningful mathematical contributions on important open problems: a new connection between the algebraic and geometric structure of knots, and a candidate algorithm predicted by the combinational invariance conjecture for symmetric groups. Their work may serve as a model for collaboration between the fields of mathematics and artificial intelligence **(AI)** that can achieve surprising results by leveraging the respective strengths of mathematicians and machine learning.

In the field of mathematics, the introduction of computers to generate data and test conjectures afforded mathematicians a new understanding of problems that were previously inaccessible, but while computational techniques have become consistently useful in other parts of the mathematical process, artificial intelligence systems have not yet established a similar place. Prior systems for generating conjectures have either contributed genuinely useful research conjectures via methods that do not easily generalize to other mathematical areas, or have demonstrated general methods for finding conjectures that have not yet yielded mathematically valuable results.

AI, in particular the field of machine learning, offers a collection of techniques that can effectively detect patterns in data and has increasingly demonstrated utility in scientific disciplines. In mathematics, it has been shown that AI can be used as a valuable tool by finding counter-examples to existing conjectures, accelerating calculations, generating symbolic solutions and detecting the existence of structure in mathematical objects. In this work, ML Engineers demonstrate that AI can also be used to assist in the discovery of theorems and conjectures at the forefront of mathematical research. This extends work using

supervised learning to find patterns by focusing on enabling mathematicians to understand the learned functions and derive useful mathematical insight.

The case studies done by Goggle DeepMind demonstrate how a foundational connection in a well-studied and mathematically intersecting area can go unnoticed, and how the framework allows mathematicians to better understand the behavior of objects that are too large for them to otherwise patterns in. It can be proven in many areas that could benefit from the methodology of ML and AI. More broadly, let's hope that this framework is an effective mechanism to allow for the introduction of machine learning into mathematicians' work, and encourage further collaboration between the two fields.

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A Review Paper on Raspberry Pi and its Applications

-[International Journal of Advances in Engineering and Management (IJAEM)
Volume 2, Issue 12, pp: 225-227] www.ijaem.net

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INTRODUCTION

The Raspberry Pi is a smaller version of a modern-day computer capable of performing task effectively. The module utilizes various kinds of the processor; therefore, it can only install open-source operating systems and apps on it. Pi also enables the user to browse the internet, send emails, write documents using a word processor, and much more. Raspberry Pi support various programming languages such as Python, C, C++, BASIC.

HISTORY

The foundation stone for the development of Raspberry Pi was laid back in 2006 when researchers of University of Cambridge came forward within aim to raise the number of A level students opting for Computer Science domain. The four researchers behind the development of the first model are Eben Upton, Jack Lang, Rob Mullins, and Alan Mycroft. Raspberry Pi was incorporated in 2009 with the mission and vision of manufacturing an affordable computer so that the young generation could use it to learn basic computer programming. The first Raspberry Pi, model B was launched back in 2012 by the United Kingdom Raspberry Pi foundation. Initially, it used a Broadcom BCM2835 Soc which is integrated with 512 Mb memory storage, 700 MHz ARM ARM1176JZF-S processor and VideoCore IV graphics processing unit (GPU) . The foundation, later on, launched a cheaper model which had lower memory storage, single USB port and no

ethernet controller. As of 2019, the company has sold over more than 19 million units making it a 3rd best-selling "general-purpose computer".

TECHNICAL SPECIFICATIONS

The below specifications are of the latest Raspberry Pi 4 Model B

#**Processor**: Broadcom BCM2711, Quad core

Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz

#**RAM**: 8GB LPDDR4-3200 SDRAM

#**Bluetooth**: Bluetooth 5.0, BLE

#**Wi-Fi**: 2.4 GHz and 5.0 GHz IEEE 802.11ac

wireless

#**USB**: 2 USB 3.0 ports; 2 USB 2.0 ports

#**Ethernet**: Gigabit Ethernet

#**HDMI**: 2 × micro-HDMI ports (up to 4kp60

supported)

#**Storage**: MicroSD Card Slot

#**Power Supply**: 5.1V 3A USB Type C Power

(Recommended)

#**Dimensions**: 85.6mm × 56.5mm

Raspberry Pi initially has its own operating system previously called Raspbian based on Linux. In the emerging software world, there are few non-Linux based OS options available in the market . The preferred OS for the Pi are Linux distribution (Debian, Puppy Linux, Arch Linux, Fedora Remix and OpenELEC) as they are easily available at no cost, but majorly owing to their capability to function on the Raspberry Pi's ARM processor.

APPLICATIONS

Raspberry Pi's main aim is to fascinate people towards computing and programming and even to solve their complex mathematical problems. Some of the applications are mentioned below.

#**Home Automation System**: The system can easily host some of the home automation applications with the interfacing of relays, sensors and lights with smartphones or computers. The operator can easily operate the system remotely.

#**Zero-Powered Smartphone**: The developer/engineer can easily develop a homemade smartphone by assembling various electrical parts that are easily available within the vicinity.

#**AI Assistant**: It enables the user to easily integrate common language voice commands viaGoogle Assistant SDK as well as Google's Cloud Speech API.

#**Motion Capture Security Camera**: Raspberry Pi Camera module can get easily connected to a generic USB webcam to develop a motion capture security system.

Live bots: Live bot is a system that enables the user to handle/control many robots based on Pi over the internet.

CONCLUSIONS

Number of users supports the fact that the device needs some improvement in terms of availability of internal storage and integration heat sink which will further enhance the efficiency of the product.

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GOD'S PLAN

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We heard them say," science and faith cannot co-exist; the voice of reason or the voice of faith, must drown out the other". So, what to choose and what to abandon? Well, I will not discard either. Instead I will say that I need both science and religion, the former to help me invent wonders and the latter to bequeath me with moral conscience to not misuse those inventions.

What is the largest number your mind can conceive? What is the size of the universe? The answer to both these questions is the same. The answer is not infinity, it is zero. Yes! The size of the universe is zero, and so is the largest number!

I know it's difficult to comprehend but let me explain. For every positive number there exists a negative number in Mathematics. For every matter there exists an anti-matter in nature. This is the bigger picture. Therefore, when you put everything together, the size of the universe is zero. Zero is thus simultaneously everything as well as nothing. That's why it's called a whole number. You add or remove anything from this whole, it still remains a whole.

So, this is where I am reminded of a famous quote by Albert Einstein,

"Science without religion is lame, religion without science is blind."

The history of zero satisfies this quote brilliantly. In India, the Sanskrit word for "empty" or "blank" is sunya. This sunya is transliterated, within the Indian system of numerology, as the idea of zero and indeed the symbol "0" as we know it today. If we think about this circle "0", it suddenly takes on an appropriateness to the notion of nothing, even pictographically. For, at the centre of its circumference is a blank similar to the void in the centre of the sky. This

profound correlation between Mathematics and nature can be used to explain the evolution of religion.Math and religion are fundamentally similar, as they both try to seek truth and use faith to find it.Maths proofs have always lent a helping hand to explore nature allowing us to procure reasons behind religious beliefs.Therefore creating more belief in both Math and religion. Progress in each allows a person to be more patient and faith to discover more about unsolved mysteries of nature.

" AN EQUATION MEANS NOTHING TO ME UNLESS IT EXPRESSES A THOUGHT OF GOD. "

- Srinivas Ramanujan.

Reference: 1) Matheletics, Gargi College.

2) https://www.mirandahouse.ac.in/files/magazines/Mathletics-6.pdf.

★★★★★★★

Origins of Zero: A fascinating story of science and spirituality across civilisations

Imran Hossain
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★ Number zero is one of the greatest inventions in history, with a profound impact on the evolution of humanity including our digital era, which is shaped by '0' and '1'. However, little is known about the history of the number 'zero'. Its journey started in ancient India and moved worldwide via trade and early science diplomacy.

★ The concept of zero is believed to have originated in the Hindu cultural and spiritual space around the 5th century CE. In Sanskrit, the word for zero is śūnya which refers to nothingness. In scientific history, astronomer and mathematician Aryabhata is often associated with inventing the number '0'.

★ Persia was the next important step of the journey of '0' via the work of 9th century Islamic philosopher and mathematician Muḥammad ibn Mūsā al-Khwārizmī, whose name was latinised to Algorithmi. In addition to being the eponym of algorithm, one of the most used terms in artificial intelligence (AI), Al Khwarizmi is the father of algebra, Indian numbers, and '0' in its centre. His work as a librarian of the House of Wisdom in Baghdad played a critical role in spreading '0' via the Arab world towards the Mediterranean.

★ Next on our historical journey is Fibonacci, also known as Leonardo of Pisa, who carried the torch of '0' and the Hindu-Arabic decimal system of Al-Kwarizmi, and brought it to Europe. Fibonacci learnt about '0' and decimal mathematics from Arab traders he met while accompanying his father on merchant tours in Tunisia. He immediately realised the superiority of the decimal system compared to previously used Roman numbers. This new type of mathematics spread to the rest of Europe through his book, Liber Abaci (Book of Calculation), published in 1202

★ Fast forward in the late 19th and early 20th century, and here is Nikola Tesla, who laid the basis for the electronic and, ultimately, the digital age. His innovation opus includes wireless technology and other ideas that had not been deciphered until now. Like Al-Kwarizmi and Fibonacci, in the spirit of the best Mediterranean tradition, Tesla was a boundary spanner in many respects. His interest in spiritual life came from his childhood and the fact that his father was a Serbian Orthodox priest interested in the spiritual traditions of Asian cultures. Later on in his life, Tesla studied Buddhism. He wrote that many of his engineering inventions could be traced to spiritual insights.

This fascinating journey of number '0' from India across civilisations, religious, and cultural divides should serve as an inspiration for our time when the widening of divides between cultures and societies increases. The number '0' stands as a reminder that science and spirituality have the potential to change the world.

Reference: https://www.diplomacy.edu/blog/origins-of-zero-a-fascinating-story-of-science-and-spirituality-across-civilisations/#:~:text=The%20concept%20of%20zero%20is,inventing%20the%20number%20'0'.

★★★★★★★

Infinity Is Not Always Equal to Infinity

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There are infinite real and natural numbers—yet real numbers exceed natural numbers thanks to the mind-blowing logic of infinities.

What is the largest natural number possible?

By using the word natural, I have ruled out the possibility that you simply answer infinity (∞) to win the guessing game. But even if we allowed infinitely large values, this response would cause problems.

What about ∞+1, ∞^2 ? If people put forward these replies to the largest natural number question, who would be right?

The answer is no one because infinity is not an ordinary number that follows the usual rules of calculation. For example, the number line is infinite, regardless of whether you start it at –∞, 0 or 1. Therefore, a statement such as ∞+1 makes no sense. Furthermore, there are differences even with infinite values: infinity does not always equal infinity. Thus, infinity would not be a guaranteed winner in a largest number contest.

It took humankind several millennia to realize this idea and cast it into a neat theory. At the end of the 19th century, mathematician Georg Cantor laid a foundation for the mathematical concept of infinity by thinking about quantities and their size. For example, {1, 2, 3, 4} and {x, y, z, q} both consist of four elements each and therefore have a size of 4, which experts call a "cardinality of 4."

The natural numbers {0, 1, 2, 3,...}, on the other hand, contain infinitely many elements. We can add 1 to any natural number; the result is also a natural number. If we now look at the set of all even numbers {0, 2, 4,...}, we might assume that it is just half as large—after all, every second natural number is contained in it. But Cantor recognized that both sets (the natural and the even numbers) have the same cardinality.

Reference: https://www.scientificamerican.com.

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The Origin of Algebraic Number Theory: Kummer's Contribution

Lipismita Choudhury,
MSc. Mathematics,
4th semester.

Neither Euler nor Lagrange nor Gauss envisioned the rich possibilities which their work on complex integers opened up. The theory grew up out of the attempts of proving Fermat's assertion of the equation $x^n + y^n = z^n$. The theorem states that the above equation has no non-trivial integral solutions for $n \geq 3$, where $n \in N$.

Many people tried it for different values of n. It was taken up by Ernst Edward Kummer who turned from theology to Mathematics, became a student of Gauss and Richlet and later served as a professor in Berlin. Kummer took $x^p + y^p$ where p is a prime and factored it into $(x + y)(x + 2y)\dots(x + (2p - 1)y)$ where 2 is an imaginary p^{th} root of unity. This led him to extend Gauss theory of complex integers to algebraic numbers.

By 1843, Kummer made appropriate definitions of integers, prime integers, divisibility and then make a mistake of assuming that unique factorization holds in the class of algebraic numbers that he had introduced. He pointed out while transmitting his manuscript to Richlet that this assumption was necessary to prove Fermat's theorem. Richlet informed him that unique factorization holds only for certain primes. Incidentally Cauchy and Lame assumed the same for algebraic numbers. In 1844, Kummer recognized the correctness of Richlet's criticism. To restore unique factorization Kummer created a theory of Ideal numbers in a series of papers. However, Kummer's ideal numbers do not belong to the class of algebraic numbers he had introduced. Moreover, these ideal numbers were not defined in any general way (an Ideal number is an algebraic integer which represents an ideal in the ring of integers of a number field). As far as Fermat's theorem is concerned, with his ideal numbers, Kummer succeeded in showing that it was correct for a number of prime numbers. In the first hundred integers only $37, 59$ and 67 were not covered by Kummer's demonstration. Then in a paper in 1857 he extended his results to these exceptional primes.

Using this concept, he proved the insolubility of the Fermat relation for all but a small group of primes, and he thus laid the foundation for an eventual complete proof of Fermat's last theorem. For his great advance, the French Academy of Sciences awarded him its Grand Prize in 1857. The ideal numbers have made possible new developments in the arithmetic of algebraic numbers.

Inspired by the work of Sir William Rowan Hamilton on systems of optical rays, Kummer developed the surface (residing in four-dimensional space) now named in his honour. Kummer also extended the work of Carl Friedrich Gauss on the hypergeometric series, adding developments that are useful in the theory of differential equations.

Reference: https://www.britannica.com/biography/Ernst-Eduard

- https://en.m.wikipedia.org/wiki/Kummer
- The Annual Mathematics Magazine, Miranda House (2017-18)

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MATHEMATICAL MODELLING

CORDELIA D NONGRUM,
MSc Mathematics,
4th Semester

A mathematical model is an abstract description of a concrete system using mathematical concepts and language. The process of developing a mathematical model is termed as mathematical modelling. Mathematical Modelling is an essential tool for understanding the world. It essentially consists of translating real world problems into mathematical problems, solving the mathematical problems and interpreting these solutions in the language of the real world. In olden days, the Chinese, Egyptians, Indians, Babylonians and Greeks indulged in understanding and predicting the natural phenomena through their knowledge of

mathematics. The artisans, architects and craftsmen based many of their works of art on geometry principles.

Classifications of Mathematical Models.

Mathematical Models (M.M.) may be classified according to the subject matter of the models. Thus, we have M.M. in Physics (Mathematical Physics), M.M. in Chemistry (Theoretical Chemistry), M.M. in Biology (Mathematical Biology), M.M. in Medicine (Mathematical Medicine), M.M. in Economics (Mathematical Economics and Econometrics), M.M. in Psychology (Mathematical Psychology), M.M. in Sociology (Mathematical Sociology), M.M. in Engineering (Mathematical Engineering) and so on. We have similarly M.M. of transportation, of urban and regional planning, of pollution, of environment, of oceanography, of blood flows, of genetics, of water resources, of optimal utilization of exhaustible and renewable resources, of political systems, of land distribution, of linguistics and so on. In fact, every branch of knowledge has two aspects, one of which is theoretical, mathematical, statistical and computer-based and the other of which is empirical, experimental and observational. Mathematical Modelling is essential to the first of these two aspects.

We may also classify Mathematical Models according to the mathematical techniques used in solving them. Thus we have Mathematical Modelling (M.M.) through classical algebra, M.M. through linear algebra and matrices, M.M. through ordinary and partial differential equations, M.M. through ordinary and partial difference equation, M.M. through integral equations, M.M. through integro-differential equations, M.M. through differential-difference equations, M.M. through functional equations, M.M. through graphs, M.M. through mathematical programming, M.M. through calculus of variations, M.M. through maximum principle and so on.

Mathematical Models may also be classified according to their nature. Thus,

i. Mathematical Models may be Linear or Non-Linear according as the basic equations describing them are linear or non-linear.
ii. Mathematical Models may be Static or Dynamic according as the time variations in the system are not or are taken into account.
iii. Mathematical Models may be Deterministic or Stochastic according as the chance factors are not or are taken into account.
iv. Mathematical Models may be Discrete or Continuous according as the variables involved are discrete or continuous.

Advantages of Mathematical Modelling

Mathematical modelling offers the scientists, engineers, mathematicians and other professionals who use them many benefits including:

- It is extremely precise since it is math-based, which allows us to develop accurate ideas and assumptions.
- It is concise with clear and established rules.
- It gives us directions when trying to solve a problem.
- We can use computers to perform calculations and other functions.

- The results provide us with an in-depth understanding of how a system or object works.
- It can help us make decision quickly and accurately.
- Complex problems can be solved easily.

Disadvantages of Mathematical Modelling

There are thousands of mathematical models which have been successfully developed and applied to get insight into tens of thousands of situations. In fact, mathematical physics, mathematical economics, operations research, biomathematics etc. are almost synonymous with mathematical modelling. However, there are still an equally large or even a larger number of situations which have not yet been mathematically modelled either because the situations are sufficiently complex or because mathematical models formed are mathematically intractable. The development of powerful computers has enabled a much larger number of situations to be mathematically modelled. Moreover, it has been possible to make more realistic models and to obtain better agreement with observations. However, successful guidelines are not available for choosing the number of parameter and of estimating the values for these parameters. In fact, reasonably accurate models can be developed to fit any data by choosing number of parameters to be even five or six. We want a minimal number of parameters and we want to be able to estimate them accurately. Mathematical Modelling of large-scale systems presents its own special problems. These arise in study of world models and in global models of environment, oceanography, economic conditions, pollution control etc. However mathematical modellers from all disciplines-mathematics, statistics, computer science, physics, engineering, social sciences - meeting the challenges with courage. Six international conferences on Mathematical Modelling have been held and a large number of specialised conferences on mathematical modelling have been organised. Teaching of Mathematical Modelling has not been neglected and the first three international conference on the Teaching of Mathematical Modelling have already been held.

Uses of Mathematical Modelling

- Mathematical models are used in applied mathematics and in natural sciences (such as physics, biology, earth science, chemistry) like controlling the spread of diseases, developing forensic science technologies such as facial and fingerprint recognition.
- They are used in engineering disciplines (such as computer science, electrical engineering) for predicting earthquakes and other natural disasters, determining the stability of structures such as buildings and bridges, as well as in non-physical system such as the social sciences (such as economics, psychology, sociology, political science) for making strategic management or planning decisions, analyze economic data, analyzing risk analysis in finance.
- The use of mathematical models to solve problems in business or military operations is a large part of the field of operations research.
- Mathematical models are also used in music, linguistics and philosophy (for example, translating languages and intensively in analytic philosophy). A model may help to explain a system, how certain changes might affect a system and to

study the effects of different components and to make predictions about behavior.

- They can also be used in timing traffic lights, scheduling airplane traffics, interpreting images and speech recognition in artificial intelligence.
- They can also be taught as a subject in its own right.

References

- https://www.indeed.com
- https://en.m.wikipedia.org
- https://ncert.nic.in
- Mathematical Modelling by J.N Kapur

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APPLICATION TO SOME REAL LIFE PROBLEMS

Pallabi Das
MSC Mathematics,
4th Semester

Some applications of the eigenvalues and eigenvectors of a square matrix:

- **Communication system:** Eigenvalues were used by Claude Shannon to determine the theoretical limit to how much information can be transmitted through a communication medium like your telephone line or through the air. This is done by calculating the eigenvectors and eigenvalues of the communication channel(expressed a matrix) , and then waterfilling on the eigenvalues. The eigenvalues are then, in essence, the gains of the fundamental modes of the channel, which themselves are captured by the eigenvectors.

★ **Designing bridges:** The natural frequency of the bridge is the eigenvalue of smallest magnitude of a system that models the bridge. The engineers exploit this knowledge to ensure the stability of their constructions.

★ **Designing car stereo system:** Eigenvalue analysis is also used in the design of the car stereo systems, where it helps to reproduce the vibration of the car due to the music.

★ **Electrical Engineering:** In electrical engineering , the application of eigenvalues and eigenvectors is useful for decoupling three-phase system through symmetrical component transformation.

★ **Mechanical Engineering:** Eigenvalues and eigenvectors allow usto "reduce" a linear operation to separate ,simpler ,problems. For example, if stress is applied to 'plastic' solid, the deformation can be dissected into "principle direction", those directions in which deformation is greatest. Vectors in the principle directions are the eigenvectors and the percentage deformation in each principle direction is the corresponding eigenvalue.

Reference: 1) Numerical Methods by M.K. Jain, S.R.K. Iyengar and R.K. Jain.sa

2) https://en.m.wikipedia.org//eigenvaluesandeigenvectors

★★★★★★★

Aryabhata: The man who invented zero

Rimjhim Parashar
MSc Mathematics,
2nd semester.

Arya Bhatta was a well-known astronomer and mathematician. He was born in the Indian state of Bihar, in the town of Kusumapura (now Patna). Despite his enormous contributions to mathematics, science, and astronomy, he has received no credit in the history of science. He authored his famous "Aryabhatiya" at the age of 25. He understood the idea of zero and how to employ huge numbers up to 10<sup18. He was the first to compute the value of 'pi' to the fourth decimal point with precision. He was the one who came up with the formula for computing the areas of triangles and circles.

The concept of zero is believed to have originated in the Hindu cultural and spiritual space around the 5th century CE. In Sanskrit, the word for zero is sunya which refers to nothingness. In scientific history, astronomer and mathematician Aryabhata is often associated with inventing the number '0'.

Aryabhata's principal work, Aryabhatiya, presented astronomical and mathematical theories in 118 verses, covering topics such as algebra, trigonometry, and arithmetic. Even though he

did not explicitly use a zero in his work, his understanding of the place-value system inherently required the concept of zero.

It Is worth noting that Aryabhata used the word 'kha' for positional purposes, hinting towards a placeholder concept similar to zero. He used 'kha' to signify absence or void in the place-value system, serving a role very similar to zero in positional notation.

Reference:

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Mathematical Web

Rinismita Sarma,
M.Sc. Mathematics,
4th Semester

What is Mathematical Web :

Mathematical web refers to the integration of mathematical concepts, tools, and resources into the World Wide Web. This could involve the development of mathematical software, online platforms for mathematical collaboration, interactive math resources, and the dissemination of mathematical knowledge through websites, blogs, and forums. It encompasses various aspects such as online calculators, mathematical visualization tools, educational materials, and research databases accessible through the internet.

Some uses of Mathematical Web :

1) Education: Providing access to online courses, tutorials, and interactive tools for learning various mathematical concepts at different levels of difficulty.

2) Research: Facilitating collaboration among mathematicians and researchers through online platforms, forums, and repositories for sharing ideas, papers, and data.

3) Problem-solving: Offering online resources, such as problem-solving communities and databases, to help users tackle mathematical problems and find solutions.

4) Visualization: Providing interactive visualizations and simulations to help users understand complex mathematical concepts and phenomena.

5) Communication: Enabling communication and discussion among mathematicians, students, and enthusiasts through blogs, forums, and social media platforms dedicated to mathematics.

6) Software development: Supporting the development and distribution of mathematical software tools and libraries accessible online for various mathematical tasks, such as computation, modeling, and analysis.

7) Open access: Promoting open access to mathematical knowledge and resources, including journals, textbooks, and lecture notes, through online repositories and archives.

8) Problem dissemination: Disseminating mathematical problems, conjectures, and challenges to a wider audience through online platforms, encouraging collaborative efforts towards their solutions.

Conclusion:

Overall, the mathematical web enhances accessibility, collaboration, and innovation in mathematics by leveraging the power of the internet and digital technologies.

Reference: https://www.cantorsparadise.com/the-web-of-mathematics-a-data-visualisation-baa5d478d908

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Important points about Pi(π)

Shankupar Kharkongor,
MSc. Mathematics,
4th Semester

- **Definition**: π is a mathematical constant representing the ratio of a circle's circumference to its diameter.

- **Approximate Value**: It is an irrational number, approximately equal to 3.14159.
- **Symbol**: The symbol for pi (π) is derived from the Greek word "periphery" or "circumference."
- **Irrationality**: π cannot be expressed as a fraction and has an infinite, non-repeating decimal expansion.
- **Transcendental**: π is also a transcendental number, meaning it is not the root of any non-zero polynomial equation with rational coefficients.
- **Archimedes' Contribution**: Archimedes of Syracuse was one of the earliest mathematicians to calculate an accurate approximation of π.
- **Decimal Digits**: The decimal representation of π goes on forever and has been calculated to trillions of digits.
- **Geometry**: π is fundamental to geometry and appears in various formulas, such as those for the area and circumference of a circle.
- **Pi Day**: March 14th (3/14) is celebrated as Pi Day because the date corresponds to the first three digits of π.
- **Infinite Series**: Several mathematical series converge to π, such as the Gregory-Leibniz series and the Nilakantha Somayaji series

- **Buffon's Needle**: A statistical experiment involving dropping a needle on a lined surface can be used to estimate the value of π.

- **Famous Formulas:** Euler's formula e^(iπ) +1=0 connects π with other fundamental mathematical constants.
- **Applications**: π is used in numerous scientific and engineering calculations, including physics, statistics, and signal processing.
  Reference: https://chat.openai.com/c/703d4b61-24a9-4682-af0d-defb2e1a6dd6

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Vedic Mathematics

Shilpi Shikha Bordoloi,
MSc. Mathematics,
2nd semester

Vedic Mathematics is an ancient system of calculation which comprises a collection of techniques and sutras to solve mathematical problems in an easy and faster way.

Vedic Mathematics was discovered by Shri Bharathi Krishna Tirthaji between AD 1911 and 1918. Regarded as the Father of Vedic Maths, Tirthaji published his findings in a book titled Vedic Mathematics in 1957 wherein he wrote about the 16 Sutras.

Vedic Mathematics aids an individual in solving maths problems faster compared to the modern Maths.Vedic Mathematics has also found to reduce the level of memorization and increase the concentration of students to learn and develop his/her skills.

Vedic Mathematics Sutras and it's meaning :

1)Ekadhikina Purvena : It means By one more than the previous one.

2)Nikhilam Navatashcaramam Dashatah: All from 9 and the last from 10

3)Urdhva-Tiryagbyham:Vertically and crosswise

4)Paraavartya Yojayet:

Transpose and adjust

5)Shunyam Saamyasamuccaye:

When the sum is the same, that sum is zero

6)(Anurupye) Shunyamanyat:

If one is in ratio, the other is zero

7)Sankalana-vyavakalanabhyam:

By addition and by subtraction

8)Puranapuranabyham:

By the completion or non-completion

9)Chalana-Kalanabyham:

Differences and Similarities

10)Yaavadunam:

Whatever the extent of its deficiency

11)Vyashtisamanstih:

Part and Whole

12)Shesanyankena Charamena:

The remainders by the last digit

13)Sopaantyadvayamantyam: The ultimate and twice the penultimate

14)Ekanyunena Purvena:

By one less than the previous one

15)Gunitasamuchyah:

The product of the sum is equal to the sum of the product

16)Gunakasamuchyah:

The factors of the sum is equal to the sum of the factors.

The Sulva Sutras are part of the larger corpus of texts called the Shrauta Sutras, considered to be appendices to the Vedas. They are the only sources of knowledge of Indian mathematics from the Vedic period.

Reference: An article about Vedic mathematics written by Roopashree Sharma.

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Taxicab number

Shahanaj Rahman
MSc Mathematics,
2nd semester

1729 is the smallest nontrivial taxicab number and is known as the Hardy–Ramanujan number, after an anecdote of the British mathematician G. H. Hardy when he visited Indian mathematician Srinivasa Ramanujan in hospital. He related their conversation:

"I remember once going to see him when he was ill at Putney. I had ridden in taxi cab No. 1729 and remarked that the number seemed to me rather a dull one, and that I hoped it was not an unfavourable omen. "No," he replied, "it is a very interesting number; it is the smallest number expressible as the sum of two cubes in two different ways."

The two different ways are:

1729 = 1^3 + 12^3 = 9^3 + 10^3
The quotation is sometimes expressed using the term "positive cubes", since allowing negative perfect cubes (the cube of a negative integer) gives the smallest solution as 91 (which is a divisor of 1729; 19 × 91 = 1729).

91 = 6^3 + (−5)^3 = 4^3 + 3^3

The same expression defines 1729 as the first in the sequence of "Fermat near misses" defined, in reference to Fermat's Last Theorem, as numbers of the form 1 + z^3 which are also expressible as the sum of two other cubes .
Other properties:

1729 is a sphenic number. It is the third Carmichael number, and more specifically the first Chernick–Carmichael number . Furthermore, it is the first in the family of absolute Euler pseudoprimes, which are a subset of Carmichael numbers.

1729 is the third Zeisel number.It is a centered cube number, as well as a dodecagonal number, a 24-gonal and 84-gonal number.

Investigating pairs of distinct integer-valued quadratic forms that represent every integer the same number of times, Schiemann found that such quadratic forms must be in four or more variables, and the least possible discriminant of a four-variable pair is 1729.

1729 is the lowest number which can be represented by a Loeschian quadratic form $a^2 + ab + b^2$ in four different ways with a and b positive integers. The integer pairs (a,b) are (25,23), (32,15), (37,8) and (40,3).

1729 is also the smallest integer side
'd' of an equilateral triangle for which there are three sets of non-equivalent points at integer distances from their vertices: {211, 1541, 1560}, {195, 1544, 1591}, and {824, 915, 1591}

1729 is the dimension of the Fourier transform on which the fastest known algorithm for multiplying two numbers is based.

Reference: Wikipedia.

★★★★★★★

Unveiling Navashesh: A modern approach to Mathematical Optimization

In the field of Mathematics verifying our answers is an important factor. Such techniques are known as result verification techniques. Here comes the role of Vedic mathematics as it offers a very simple method which can be used with great ease.

Navashesh Method: Navashesh means eliminating nine and retaining other digits. Every number has got its unique single digit value. This single digit value is called Navashesh. The Navashesh of any number is the sum of all digits, continued until there is one digit left.

Navashesh method for verifying addition operations:

$$\mathbf{67 + 34 = 101}$$

Step1: Navashesh of left hand side

$$67 = 6 + 7 = 13 = 1 + 3 = 4$$

$$34 = 3 + 4 = 7$$

$$7 + 4 = 11 = 1 + 1 = 2$$

Step2: Navashesh of Right hand side

$$101 = 1 + 0 + 1 = 2$$

As Navashesh of left hand side =Navashesh of right hand side

Therefore the answer is correct.

Navashesh method for verifying subtraction:

$$88 - 31 = 57$$

Step1: Navashesh of left side

$$88 = 8 + 8 = 16 = 1 + 6 = 7$$

$$31 = 3 + 1 = 4$$

$$7 - 4 = 3$$

Step2: Navashesh of right side

$$57 = 5 + 7 = 12 = 1 + 2 = 3$$

As Navashesh of left hand side =Navashesh of right hand side

Therefore the answer is correct.

Navashesh method for multiplication:

$$\mathbf{73 \times 51 = 3723}$$

Step1:

$$\mathbf{73} = \mathbf{7} + 3 = 10 = 1 + 0 = 1$$

$$\mathbf{51} = \mathbf{5} + 1 = 6$$

$$\mathbf{6} \times \mathbf{1} = 6$$

Step2: Navashesh of right side

$$\mathbf{3723} = \mathbf{3} + 3 = 6$$

(eliminating 2 and 7 as its addition gives 9)

As Navashesh of left hand side =Navashesh of right hand side

Therefore, the answer is correct.

Navashesh method for division:

Divide 37637 by 7 and check the answer with Navashesh method

Step1: With the help of long division method, we get

Quotient = 5376

Remainder= 5

Step2: Navashesh of divisor 7 = 7

Step3: Navashesh of quotient 5376 = 5 + 7 = 12 = 1 + 2 = 3

Step4: Navashesh of remainder 5 = 5

Step5: applying the Navashesh formula for division. Which is given by

Divisor × Quotient+ Remainder= Dividend

Therefore, Navashesh of left hand side

$$\mathbf{7} \times \mathbf{3} + 5 = 26 = 2 + 6 = 8$$

Navashesh of right hand side.

Navashesh of dividend.

Cross out 9

$$37637 = 17 = 1 + 7 = 8$$

As Navashesh of left hand side = Navashesh of right hand side. Therefore the answer is correct.

Reference: Vedic Math 2 by H.K. Gupta.

Smitakhee Handique

MSc. Mathematics,

2nd semester.

THE ASSAM ROYAL GLOBAL UNIVERSITY
GUWAHATI

22 Dec 2023

National Mathematics Day Celebration 2023

Organised by Department of Mathematics, The Assam Royal Global University in collaboration with Assam Academy of Mathematics (AAM).

Felicitation of two eminent Mathematicians

Prof. (Dr.) Ranjana Choudhury
HoD ,Department of Mathematics, Handique Girls' College, Guwahati.

Prof. (Dr.) Tarini Kumar Dutta
Professor, Department of Mathematics, Assam Don Bosco University.

Invited talk by Keynote speaker

Prof. (Dr.) Tarini Kumar Dutta
Professor, Department of Mathematics, Assam University, Guwahati.

Ramanujan portrait sketch competition

Poster presentation competition

Poster Topic
Mathematics for Science.

Poster Size
The poster must be of size 1m×1m (preferably flex print) and should be easily readable at a distance of 1m.
(1st and 2nd prize for each event)

Advisory Committee:

1. Prof. (Dr.) Anuradha Devi, Professor, Department of Mathematics & Dean, RSAPS.
2. Prof. (Dr.) Dilip Chandra Nath, Professor Emeritus, Department of Mathematics, RGU.
3. Prof. (Dr.) Rita Choudhury Professor, Department of Mathematics, RGU.

Organizing Committee Members:

1. Dr. Kamal Debnath, HoD, & Associate Professor, Department of Mathematics, RGU
2. Dr. Bimalendu Kalita, Associate Professor, Department of Mathematics, RGU
3. Dr. Shibu Basak, Vice Principal, Kokrajhar Govt. College and Vice President, Assam Academy of Mathematics.
4. Dr. Bapan Kalita, Associate Professor, Department of Mathematics, RGU)
5. Dr. Anuja Sinha, Assistant Professor, Department of Mathematics, RGU)
6. Mr. H. Imo Mani Singha, Assistant Professor, Department of Mathematics, RGU.
7. Dr. Dhiman Dutta, Assistant Professor, Department of Mathematics, RGU
8. Dr. Dipankar Saha, Assistant Professor, Department of Mathematics, RGU.

For further details Contact: 9707850886

Details of Registration

Last date of registration: 20 December, 2023

Link for registration:
https://forms.gle/wvZ7WUMf9tQgm1haA

REPORT

NATIONAL MATHEMATICS DAY, 2023, ORGANISED BY DEPARTMENT OF MATHEMATICS, THE ASSAM ROYAL GLOBAL UNIVERSITY, GUWAHATI IN ASSOCIATION WITH ASSAM ACADEMY OF MATHEMATICS (AAM)

Venue: Seminar Hall D-Block 1st floor.

22nd December 2023.

Department of Mathematics, Royal School of Applied & Pure Sciences celebrated National Mathematics Day, 2023 on 22nd December 2023 in association with Assam Academy of Mathematics (AAM) at the premises of Royal Global University to commemorate the birth anniversary of Srinivasa Ramanujan Aiyengar. Prof. (Dr.) Anuradha Devi, Professor, Department of Mathematics & Dean, RSAPS gave her welcome address and mentioned the importance of the event.

Department of Mathematics felicitated Prof. (Dr.) *Ranjana Choudhury,* Founder HoD (Retd.), Department of Mathematics, Handique Girls' College, Guwahati, and Prof. (Dr.) Tarini Kumar Dutta, Professor, Department of Mathematics, Assam Don Bosco University as eminent Mathematician of the state for their lifelong achievement in Mathematics Education and its popularisation in Assam.

Dr. Shibu Basak, Vice Principal, Kokrajhar Govt. College and Vice President, Assam Academy of Mathematics delivered a talk on "Srinivasa Ramanujan: Contribution to the world of Mathematics".

Prof. (Dr.) Tarini Kumar Dutta gave his keynote speech on Cancer Modelling. In his lecture, he discussed mathematical modelling of cancer disease, difference between cancer cell and normal cell, advantage and disadvantage of chemotherapy, application of eigenvalues and eigenvectors, optimal control theory and its characterization, existence of control theory, Numerical simulations etc.

Various events like Ramanujan's portrait sketch competition, Poster presentation competition were the major parts of the celebration. The celebration ends with a great success in presence of Invited Guests, Teachers and Students of Royal School of Applied and Pure Sciences.


GPS Map Camera
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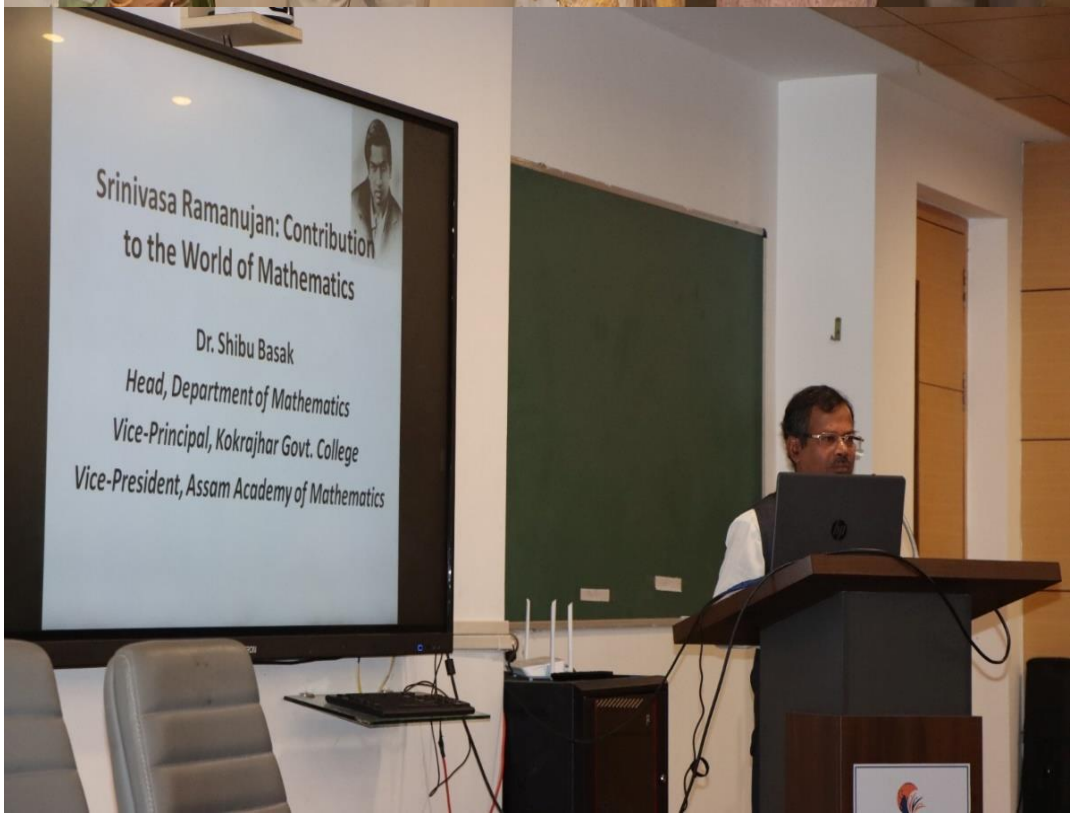
NATIONAL MATHEMATICS DAY


EMINENT
MATHEMATICIAN
Prof. (Dr.) Tanna Kumar Dutta
Professor, Department of
Mathematics, Assam Don
Bosco University, Guwahati


Srinivasa Ramanujan: Contribution
to the World of Mathematics
Dr. Shibu Basak
Head, Department of Mathematics
Vice-Principal, Kokrajhar Govt. College
Vice-President, Assam Academy of Mathematics


EMINENT
MATHEMATICIAN
Prof. (Dr.) Ranjana Choudhury
Founder HoD (Retd.), Department of Mathematics, Handique Girls College, Guwahati
ROYAL GLOBAL UNIVERSITY


NATIONAL MATHEMATICS DAY
REMEMBERING
THE GREAT MATHEMATICIAN
SRINIVASA RAMANUJAN
ON HIS BIRTH ANNIVERSARY
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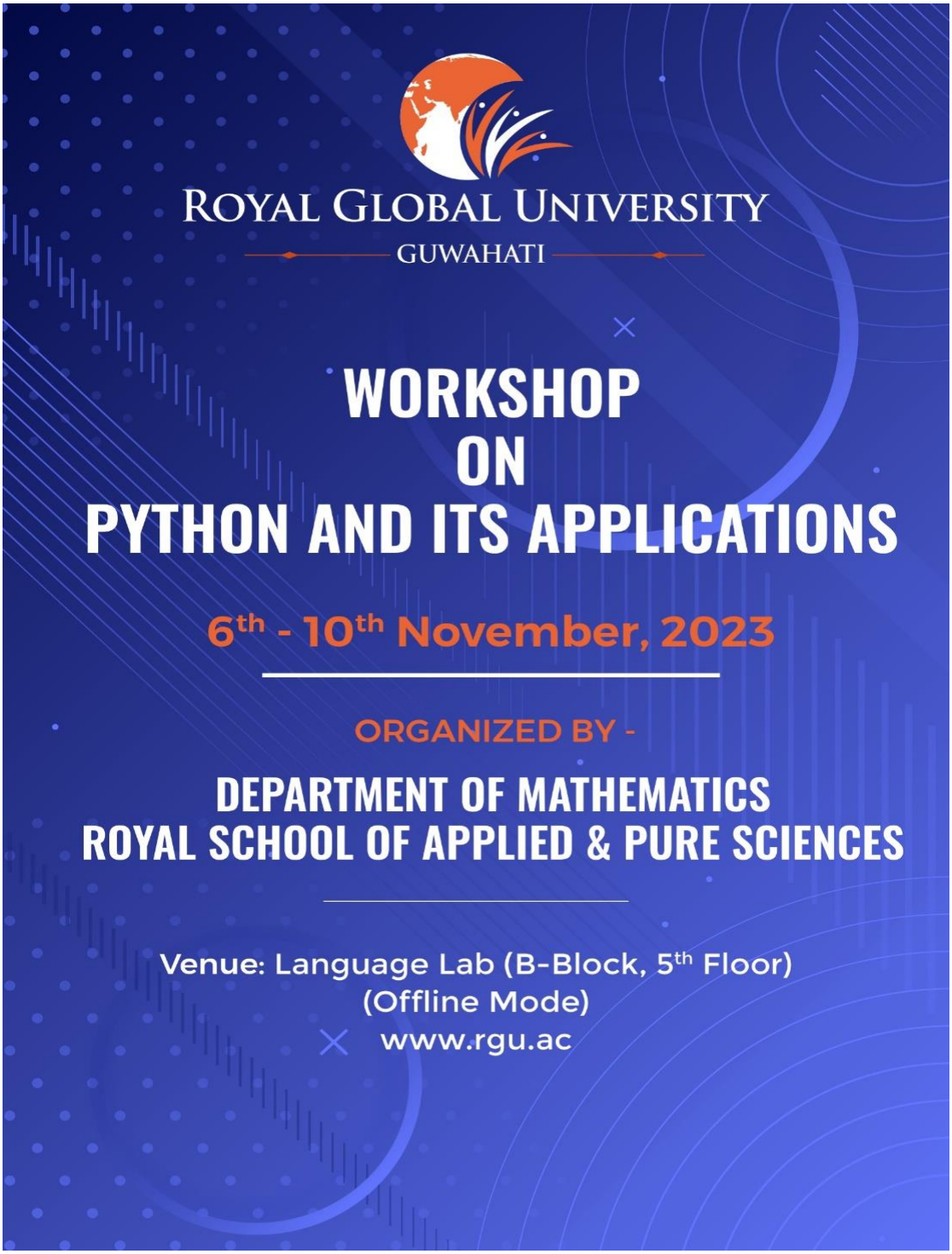
ROYAL GLOBAL UNIVERSITY
GUWAHATI
WORKSHOP
ON
PYTHON AND ITS APPLICATIONS
6th - 10th November, 2023
ORGANIZED BY -
DEPARTMENT OF MATHEMATICS
ROYAL SCHOOL OF APPLIED & PURE SCIENCES
Venue: Language Lab (B-Block, 5th Floor)
(Offline Mode)
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Prof. (Dr.) S.P. Singh, Vice Chancellor, RGU

Patrons:

Prof. (Dr.) Rohit Singh, Pro-Vice Chancellor, RGU
Prof. (Dr.) Alak Kumar Buragohain, Chairperson, Academic, RGU
Prof. (Dr.) Ankur Ganguly, Dean Academics & Dean RSET, RGU

Advisory Committee:

1. Prof. (Dr.) Anuradha Devi
   Professor, Department of Mathematics & Dean, RSAPS
2. Prof. (Dr.) Dilip Chandra Nath
   Professor Emeritus, Department of Mathematics, RGU
3. Prof. (Dr.) Rita Choudhury
   Professor, Department of Mathematics, RGU

Convenors:

1. Dr. Bapan Kalita, Associate Professor (Department of Mathematics, RGU)
2. Dr. Dipankar Saha, Assistant Professor (Department of Mathematics, RGU)

Organising Committee Members:

1. Dr. Kamal Debnath, Associate Professor & HOD (Department of Mathematics, RGU)
2. Dr. Bimalendu Kalita, Associate Professor (Department of Mathematics, RGU)
3. Mr. H. Imo Mani Singha, Assistant Professor (Department of Mathematics, RGU)
4. Dr. Dhiman Dutta, Assistant Professor (Department of Mathematics, RGU)
5. Dr. Anuja Sinha, Assistant Professor, (Department of Mathematics, RGU

ABOUT THE UNIVERSITY

Royal Global University is one of the premium universities in India. Ever since its establishment, it has acted as a leadership platform that aligns the interest of industries, entrepreneurs and the youth. Royal Global University aims at creating and sustaining an environment whereby employment and entrepreneurship can flourish. With the help of collaborative efforts from its extensive network of influential corporates, individual members, and academic institutes, Royal Global University has been able to provide the necessary resources, knowledge, and support to create effective employment and entrepreneurship opportunities. Located on National Highway 37, Royal Global University stands high with its virtues of excellence and a humble contribution to the society at large. The Campus is more than 27 acres of land and about 12 lakh square feet with centrally air-conditioned areas available for running various courses of Royal Global University (RGU). With experienced faculty and world class infrastructure & facilities, Royal Global University is one of the finest universities in the country. RGU offers a unique educational experience that prepares the next generation of global citizens to lead and make a difference in the world. With its talented and motivated student body and accomplished faculty, RGU is a leading educational hub in the North Eastern region that maintains a commitment to exceptional undergraduate and postgraduate programs. Undergraduates, graduates and postgraduates will have a variety of options available to them. The faculty members work very closely with students to solve major scientific, technological and societal challenges. RGU ensures that its students are transformed into well-rounded, industry- ready individuals, who are equipped to take on leadership responsibilities. RGU stands to be recognized for its world-class infrastructure, cultural events, campus recruitment programmes, expert faculties, updated facilities and other such activities.

ABOUT THE DEPARTMENT

Department of Mathematics is a constituent part of Royal School of Applied & Pure Sciences was formed in July 2017 under Royal Global University, Guwahati. At present the department is offering courses like B.Sc. Mathematics, B.Sc. Mathematics & Computing, M.Sc. Mathematics. The department has also started the Ph.D. programme from July 2018 under The Assam Royal Global University. All the faculty members of the department are actively involved in research and published their research findings in reputed International Journals. The department is blessed with four senior experienced faculty members along with 8 young, energetic and dedicated faculty members who leave no stone unturned to present the aspiring students, the principles and concepts of mathematics.

ABOUT THE WORKSHOP

Python is a powerful, open-source language used for a range of activities including scientific computing, online applications and gaming. This is the typical programming language used to build the web in Python. The most prominent of its many uses is web development. It is used to create the home page, images, other essential website building blocks, construct programs and to handle, organize and analyse data. Python is an interpretive, dynamic, object-oriented, multi-paradigm and scripting language. Thus, there are numerous approaches to construct software using Python code. At the end of this program, the participants are expected to apply Python skilfully as per their requirements.

RESOURCE PERSONS:

- **Prof. (Dr.) Debabrata Datta**
  Retired Professor, Bhabha Atomic Research Centre (BARC), Mumbai
- **Dr. Satyajit Sarmah**
  Assistant Professor, Department of Information Technology, Gauhati University, Guwahati.
- **Dr. Debanga Raj Neog**
  Assistant Professor, Mehta Family School of Data Science and Artificial Intelligence, IIT, Guwahati.
- **Dr. Anupam Das**
  Associate Professor & HOD, RSIT, The Assam Royal Global University, Guwahati.
- **Dr. Samarjit Das**
  Associate Professor, RSIT, The Assam Royal Global University, Guwahati.
- **Dr. Bapan Kalita**
  Associate Professor, Department of Mathematics, The Assam Royal Global University, Assam

Registration Fee:

For Student / Research Scholar: ₹300
(Use QR Code given below for payment of registration fee)

Last Date Of Registration: 03-11-2023


QR CODE
Scan QR Code
REGISTRATION LINK:
https://forms.gle/6Cf2Cz7tVLuqFWxD6
CONTACT DETAILS
Dr. Bapan Kalita: +919854152518
Dr. Dipankar Saha: +916000913621

A Report on one week workshop on Python and its Applications

6th November to 10th November, 2023

The department of mathematics organized one week workshop on **Python and its applications** from 6th November to 10th November, 2023. The convenors of this workshop were Dr. Bapan Kalita and Dr. Anuja Sinha. The anchor was Dr. Anuja Sinha.

On 6th Nov. which is the day 1 of the workshop, the anchor gave the welcome address. The audience was also addressed by HoD, Department of Mathematics, Prof.(Dr.) Anuradha Devi, Dean, RSAPS, Prof.(Dr.) Rita Choudhary, Senior Professor, Department of Mathematics, Prof. (Dr.) Dilip Chandra Nath, Professor Emeritus, RSAPS and Prof.(Dr.) Debabrata Dutta. The invited speaker of the session was Dr. Satyajit Sarmah, Assistant Professor, Department of Information Technology, Gauhati University, Guwahati. His topic was Understanding Python Data Types, Logical and Arithmetic Operators, Working with User inputs.

The 2nd day of the workshop was 7th Nov.. The invited speaker was Dr.Debanga Raj Neog, Assistant Professor, Mehta Family School of Data Science and Artificial Intelligence, IIT Guwahati, Associate Faculty, Department of Design.

On 8th Nov., which is the 3rd day , the invited speaker was Prof. (Dr.) Debabrata Datta, Retired Professor, Bhabha Atomic Research Centre (BARC), Mumbai. His topic was Numerical Techniques with Python.

On the 4th day i.e. on 9th Nov., there were two speakers. In the 1st session Dr. Anupam Das, Associate Professor, The Assam Royal Global University was the invited speaker and Dr. Samarjit Das, Associate Professor, The Assam Royal Global University was the speaker in the 2nd session. Dr. Anupam Das topic was on Web building with Python and the topic of Dr. Samarjit Das was also on Web building with Python.

Dr. Bapan Kalita , Associate Professor, department of Mathematics, The Assam Royal Global University was the speaker on the 10th Nov., which was the 5th day of workshop.

The workshop was ended with vote of thanks given by Dr. Bapan Kalita.


ROYAL GLOBAL UNIVERSITY
GUWAHATI
WORKSHOP ON
PYTHON AND ITS APPLICATIONS
6th - 10th November, 2023
ORGANIZED BY
DEPARTMENT OF MATHEMATICS
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Royal Group of Institutions Gate, 4P7F+2V3, Bhabanand Boro Path, Ahom Gaon,
AHOM GAON, Guwahati, Assam 781035, India
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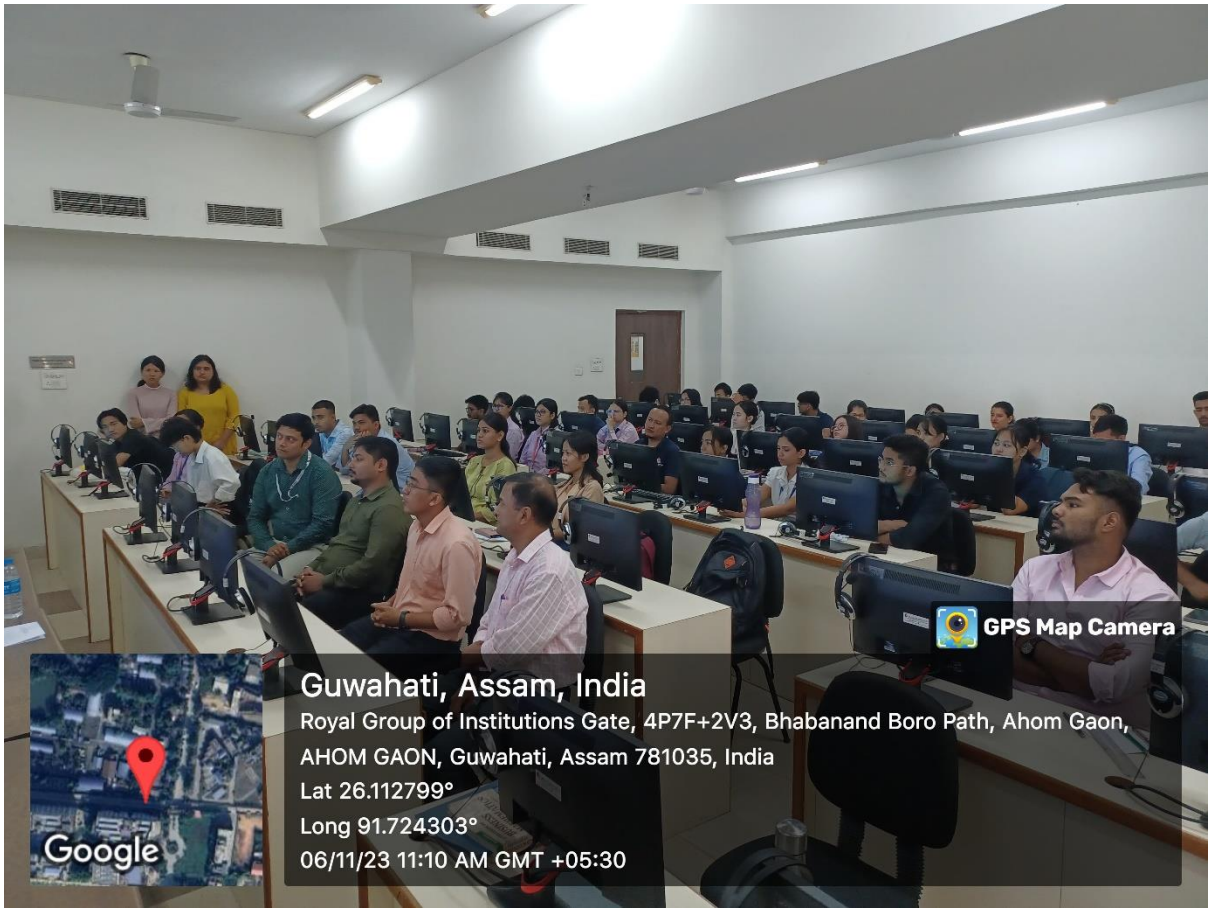
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ROYAL GLOBAL UNIVERSITY
GUWAHATI
WORKSHOP ON
PYTHON AND ITS APPLICATIONS
6th - 10th November, 2023
ORGANIZED BY -
DEPARTMENT OF MATHEMATICS
ROYAL SCHOOL OF APPLIED & PURE SCIENCES
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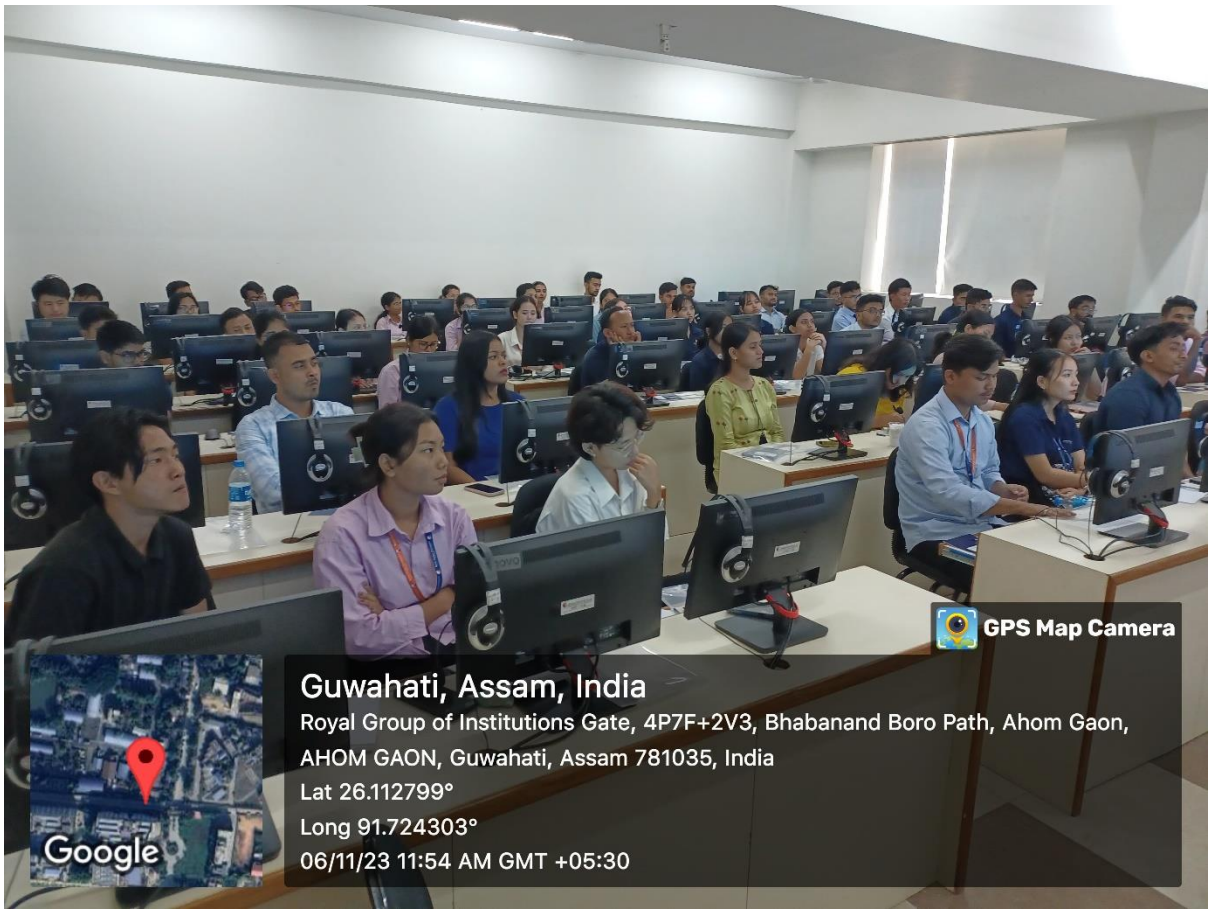
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ROYAL GLOBAL UNIVERSITY
GUWAHATI

विकसित भारत अभियान
1947 TO 2047

INSTITUTION'S INNOVATION COUNCIL
(Ministry of Education Initiative)

On the occasion of

NATIONAL

SCIENCE DAY, 2024

"Indigenous Technologies for Viksit Bharat"

INVITED TALK BY

Guest Speaker

DR. BULA CHOUDHURY
Senior Scientist
Guwahati Biotech Park

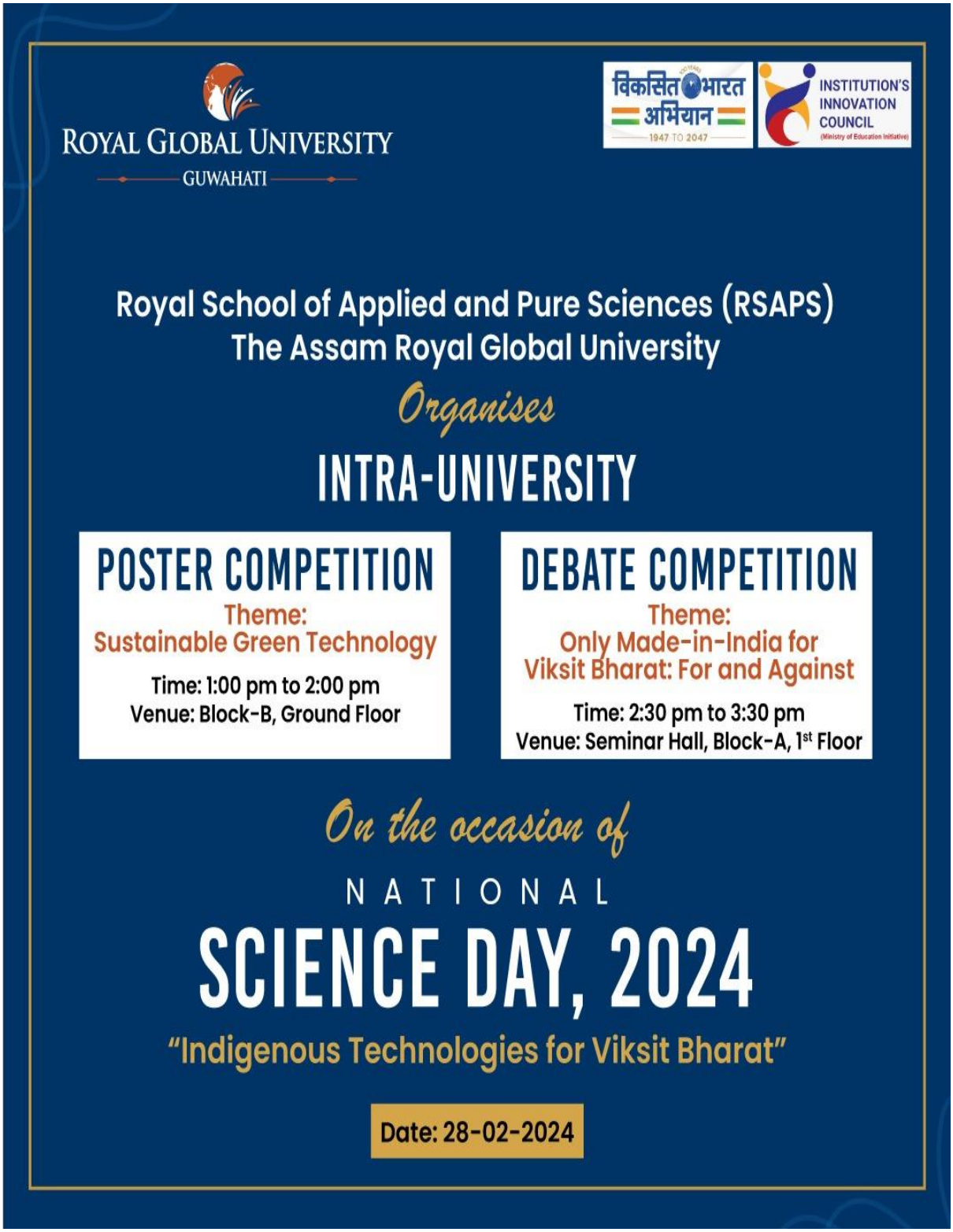
Guest Speaker

DR. RAJIB CH DEV GOSWAMI
Research Associate
Guwahati Biotech Park

Organised By:
Royal School of Applied and Pure Sciences (RSAPS)
The Assam Royal Global University

Date: 28-02-2024 **Time: 10.00 AM Onwards**

Venue: Seminar Hall, Block-A, 1st Floor


ROYAL GLOBAL UNIVERSITY
GUWAHATI
विकसित भारत अभियान
1947 TO 2047
INSTITUTION'S INNOVATION COUNCIL
(Ministry of Education Initiative)
Royal School of Applied and Pure Sciences (RSAPS)
The Assam Royal Global University
Organises
INTRA-UNIVERSITY
POSTER COMPETITION
Theme:
Sustainable Green Technology
Time: 1:00 pm to 2:00 pm
Venue: Block-B, Ground Floor
DEBATE COMPETITION
Theme:
Only Made-in-India for
Viksit Bharat: For and Against
Time: 2:30 pm to 3:30 pm
Venue: Seminar Hall, Block-A, 1st Floor
On the occasion of
NATIONAL
SCIENCE DAY, 2024
"Indigenous Technologies for Viksit Bharat"
Date: 28-02-2024

National Science Day, 2024

"Indigeneous Technologies for Viksit Bharat"

Royal School of Applied and Pure Sciences (RSAPS)

The Assam Royal Global University

On 28th November, 2024 The Royal School of Applied and Pure Sciences (RSAPS) celebrated the National Science Day. The programme started at 10 am. Our Honorable Vice Chancellor, Prof. SP Singh addressed the gathering followed by Chairperson Academics Prof. (Dr.) Alak Kr. Buragohain, HOD of Mathematics Department, Dr. Kamal Debnath. The invited speakers were Dr. Bula Choudhury, Senior Scientist, Guwahati Biotech Park and Dr. Rajiv Ch Dev Goswami, Research Associate, Guwahati Biotech Park. Dr. Bula Choudhury talked about Entrepreneurship and Innovation for Viksit Bharat and Dr. Rajiv Ch Dev Goswami spoke about the structure of Guwahati Biotech park.

Keeping in view of theme of event, there were two intra university competitions. One was the poster competition and the other was debate competition. The judges for the poster competition were Dr. Sujata Deb, Dr. Bimalendu Kalita and Dr. Biswajit Sharma. The judges for the debate competition were Dr. Ayushman Dev Raj and Dr. Dhiraj Borkotoky. The best debator was Mujahidul Islam and the 1st runner up was Uma Tamang for the debate competition. For the poster competition the 1st prize was bagged by Ruplekha Barman, Satabdajit S Baruah and Hirok Jyoti Deka, 2nd prize winner were Pujashree Barman, Pranjan Ghosh and 3rd prize winner were Asif Mondal and Sibam Karmakar.

The Dean of Academics Prof (Dr.) Ankur Ganguly addressed the event in the afternoon session. Finally the event ended with the vote of thanks.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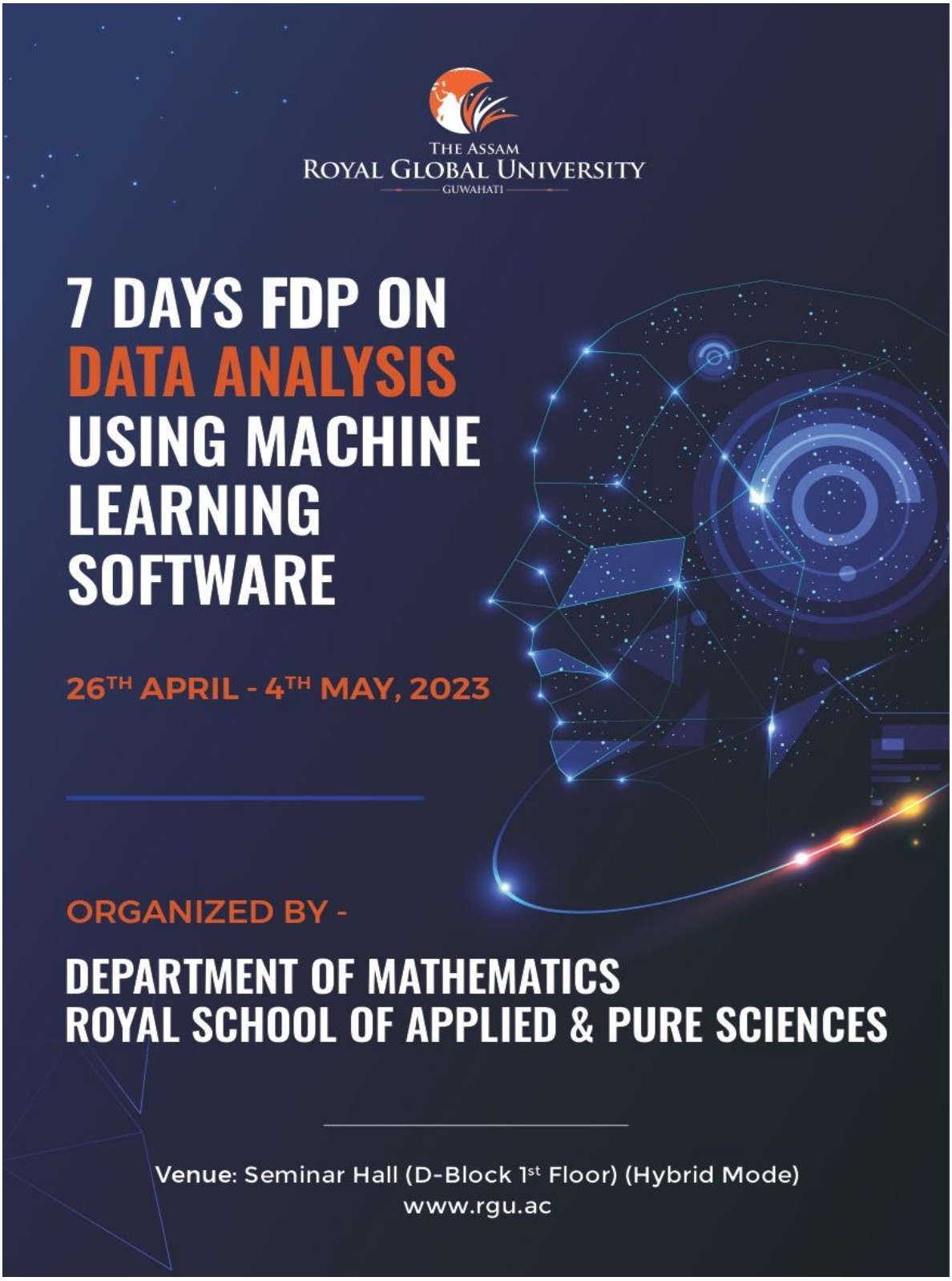
ROYAL GLOBAL UNIVERSITY
GUWAHATI


GUWAHATI


Sustainable
Green Technology


THE ASSAM
ROYAL GLOBAL UNIVERSITY
GUWAHATI
7 DAYS FDP ON
DATA ANALYSIS
USING MACHINE
LEARNING
SOFTWARE
26TH APRIL - 4TH MAY, 2023
ORGANIZED BY -
DEPARTMENT OF MATHEMATICS
ROYAL SCHOOL OF APPLIED & PURE SCIENCES
Venue: Seminar Hall (D-Block 1st Floor) (Hybrid Mode)
www.rgu.ac

Chief Patron:

Prof. (Dr.) S.P. Singh, Vice Chancellor, RGU

Patrons:

Prof. (Dr.) Rohit Singh, Pro-Vice Chancellor, RGU
Prof. (Dr.) Ankur Ganguly, Dean Academics & Dean RSET

Advisory Committee:

1. Prof. (Dr.) Anuradha Devi
   Professor, Department of Mathematics & Dean, RSAPS
2. Prof. (Dr.) Dilip Chandra Nath
   Professor Emeritus, Department of Mathematics, RGU
3. Prof. (Dr.) Rita Choudhury
   Professor, Department of Mathematics, RGU
4. Dr. Kamal Debnath, Associate Professor & HOD
   Department of Mathematics, RGU

Convenors:

1. Dr. Bimalendu Kalita, Associate Professor
   Department of Mathematics, RGU
2. Dr. Bapan Kalita, Assistant Professor
   Department of Mathematics, RGU

Organising Committee Members:

1. H. Imo Mani Singha,
   Assistant Professor (Department of Mathematics, RGU)
2. Dr. Dhiman Dutta
   Assistant Professor (Department of Mathematics, RGU)
3. Dr. Chayanika Boruah
   Assistant Professor (Department of Mathematics, RGU)
4. Dr. Ankur Jyoti Kashyap
   Assistant Professor, (Department of Mathematics, RGU)

ABOUT THE UNIVERSITY

The Assam Royal Global University (RGU), Guwahati, Assam is a leading University in North-East India committed to provide unparalleled education to render holistic development of the students. It caters to 27 Schools, offering 130+ courses. Nestled in the prime location of Guwahati, the campus is well accessible. RGU is spread over a picturesque 27 acres of land with about 12 lakh square feet built-up area. The campus is secured, well-maintained, and facilitated with state-of-the-art amenities, including conducive classrooms, conference rooms, auditoriums, studios, moot court, 85+ high-tech laboratories, and libraries. One of the strongest pillars of RGU is its highly qualified and well-experienced intellectual capital (300+ faculty), who also serve as the motivation catalyst for 7000+ students. Learning at RGU goes beyond the classrooms and textbooks. RGU strives for academic excellence through research-intensive and industry-oriented education instilled with a strong sense of becoming a global citizen.

ABOUT THE DEPARTMENT

Department of Mathematics, a constituent part of Royal School of Applied & Pure Sciences was formed in July, 2017 under The Assam Royal Global University, Guwahati. At present, the department is offering courses like B.Sc. Mathematics, B.Sc. Mathematics & Computing, M.Sc. Mathematics, M.Sc. Mathematics & Computing. The department has also started the Ph.D. programme from July 2018 under The Assam Royal Global University. All the faculty members of the department are actively involved in research and published their research findings in reputed International Journals. The department is blessed with four senior experienced faculty members along with 8 young, energetic and dedicated faculty members who leave no stone unturned to present the aspiring students, the principles and concepts of mathematics.

ABOUT THE FDP

Data Analysis has taken the premier platform in almost all research activities.Accordingly,-Faculty members look for new techniques and software of data analysis. Several software are available in this regard. This faculty development program will enable the faculty members to perform scientifically the task of data analysis using machine learning software. After completion of this program, the participants are expected to handle, organise and analyse their data successfully.

RESOURCE PERSONS:

- **Prof. (Dr.) Debabrata Datta**
  Retired Professor, Bhabha Atomic Research Centre (BARC), Mumbai
- **Prof.(Dr.) Amit Choudhury**
  Professor, Department of Statistics, Gauhati University
- **Dr. Vivek Verma**
  Assistant Professor, Department of Statistics, Assam University
- **Dr. Hemanta Saikia**
  Assistant Professor, Assam Agricultural University, Assam
- **Dr. Bapan Kalita**
  Assistant Professor, The Assam Royal Global University, Assam

Registration Fee:

For Faculty/Industry Personnel/Academician: ₹500

Last Date Of Registration: 23-04-2023


BANK DETAILS
Account no: 4651002100004685
IFSC No: PUNB0465100
Account Name: Royal Global University
Bank: PUNJAB NATIONAL BANK
Branch: BHANGAGARH
REGISTRATION LINK:
https://forms.gle/fW1xTRfXmqNcoZNk8
QR CODE
CONTACT DETAILS
Dr. Bimalendu Kalita: +919707850886
Dr. Bapan Kalita: +919854152518

7-DAYS FDP ON

DATA ANALYSIS USING MACHINE LEARNING SOFTWARE

26 APRIL-4 MAY, 2023

ORGANIZED BY
DEPARTMENT OF MATHEMATICS
ROYAL SCHOOL OF APPLIED & PURE SCIENCES
REPORT

DAY 1 (26.04.2023): Invited Speaker Prof. (Dr.) Debabrata Datta, Retired Professor, Bhabha Atomic Research Centre (BARC), Mumbai. **Topic: Machine Learning Applications in Biomedical Sciences using PYTHON. In this lecture, Python code and application of python code to predict covid in India with an accuracy of 75% was discussed.**

DAY 2 (27.04.2023): Dr. Bapan Kalita, Assistant Professor, RGU **Topic: Introduction to SPSS. In this session he discussed different columns of variable view of SPSS alongwith the dataview. He also discussed the basic part of frequencies, missing frequencies and drawing of charts.**

DAY 3 (28.04.2023): Invited Speaker Prof.(Dr.) Amit Choudhury, Professor, Department of Statistics, Gauhati University**, Topic: Testing of Hypothesis using SPSS. He discussed the theory of testing of hypothesis and showed to perform t-test for single sample, independent samples and ANOVA in SPSS.**

DAY 4 (01.05.2023): Session by Invited Speaker Dr. Vivek Verma, Assistant Professor, Department of Statistics, Assam University. **Topic: Introduction to R and basic statistics. The lecture elaborates idea of basic data handling with R.**

DAY 5 (02.05.2023): Session by Invited Speaker Dr. Vivek Verma, Assistant Professor, Department of Statistics, Assam University. **Topic: Testing of Hypothesis using R. He also discussed different processes of test of significance in R platform.**

DAY 6 (03.05.2023): Session by Invited Speaker Dr. Hemanta Saikia, Assistant Professor, Assam Agricultural University. **Topic: Correlation and Regression using R. The topic focused on the relationship between variables in terms of correlation and cause effect relation.**

DAY 7(04.05.2023): Session by Dr. Bapan Kalita, Assistant Professor, RGU
Topic: Dimension reduction in SPSS and SEM in R. **The topic of presentation highlights the process of principle component analysis in SPSS for dimension reduction and structural relation of different factors of factor analysis.**

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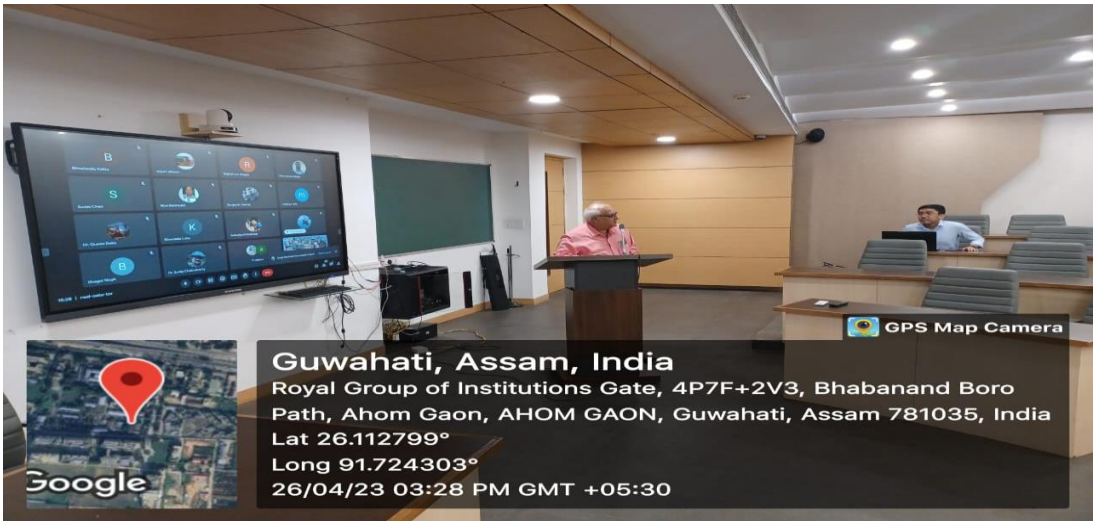
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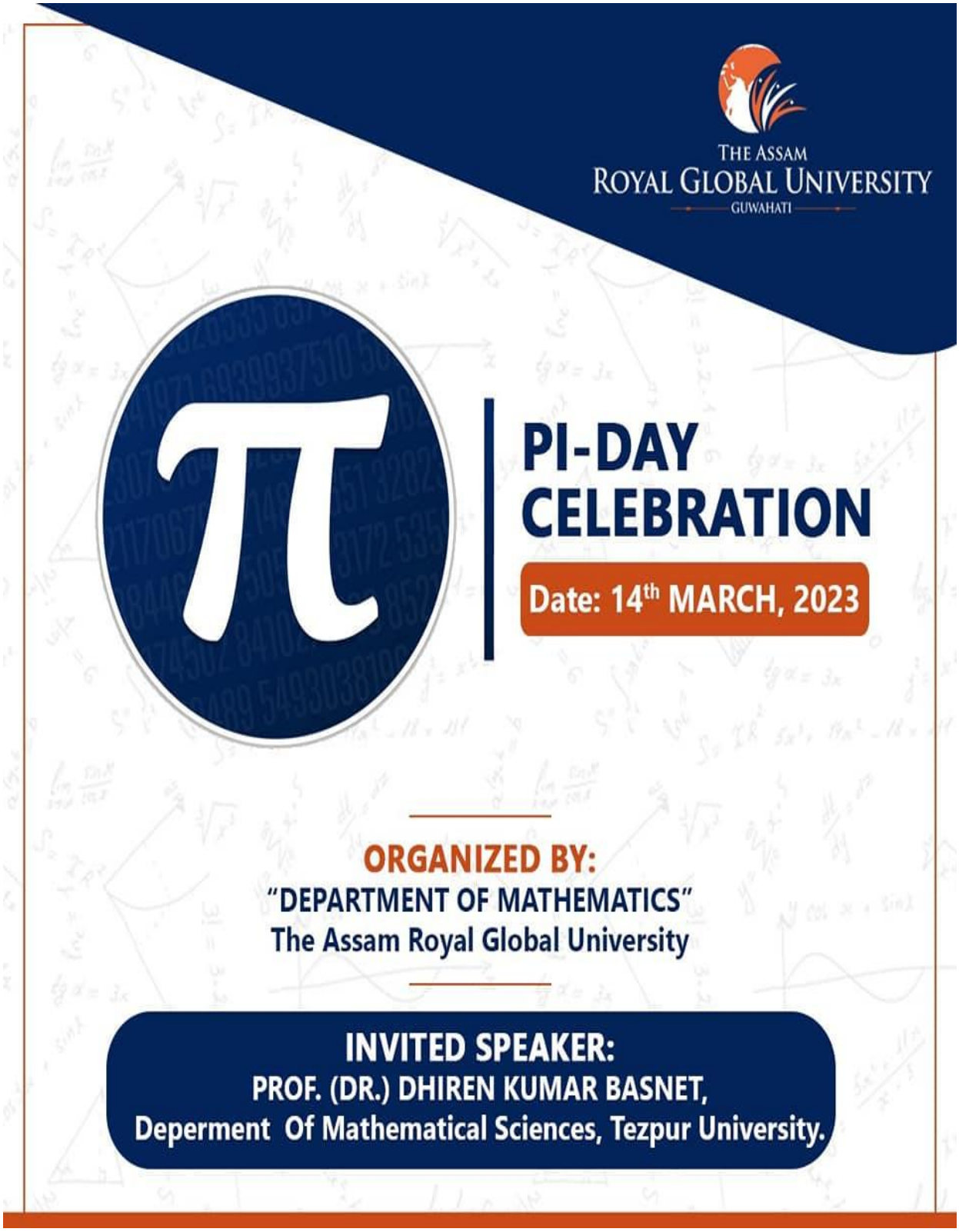
FIELD TRIP: "THE KAZIRANGA NATIONAL PARK" ON 1ST AND 2ND MARCH, 2024.

AN INTERACTIVE SESSION WITH MR. BISHAL PHUKAN (8TH RANK HOLDER, APSC- CCE 2022)

Mr. Bishal Phukan (8th Rank holder, APSC- CCE 2022) was invited for an interactive session by the Royal School of Applied and Pure Sciences. Mr. Phukan, an alumni of Royal Global University shared his awe-inspiring story of resilience, hard work, and exceptional achievement, having secured a coveted rank in the Assam Public Service Commission Combined Competitive Examination (APSC CCE) and subsequently selected for the prestigious Assam Urban Administrative Service. Highlighting the importance of self-confidence for constant motivation, he urged the students to believe in themselves. Mr. Phukan thanked his alma-matar for honing his competence to build a successful career along with inculcating discipline, consistency and punctuality.


THE ASSAM
ROYAL GLOBAL UNIVERSITY
GUWAHATI
PI-DAY
CELEBRATION
Date: 14th MARCH, 2023
ORGANIZED BY:
"DEPARTMENT OF MATHEMATICS"
The Assam Royal Global University
INVITED SPEAKER:
PROF. (DR.) DHIREN KUMAR BASNET,
Deperment Of Mathematical Sciences, Tezpur University.

PI-DAY CELEBRATION

14TH MARCH, 2023

ORGANIZED BY

DEPARTMENT OF MATHEMATICS

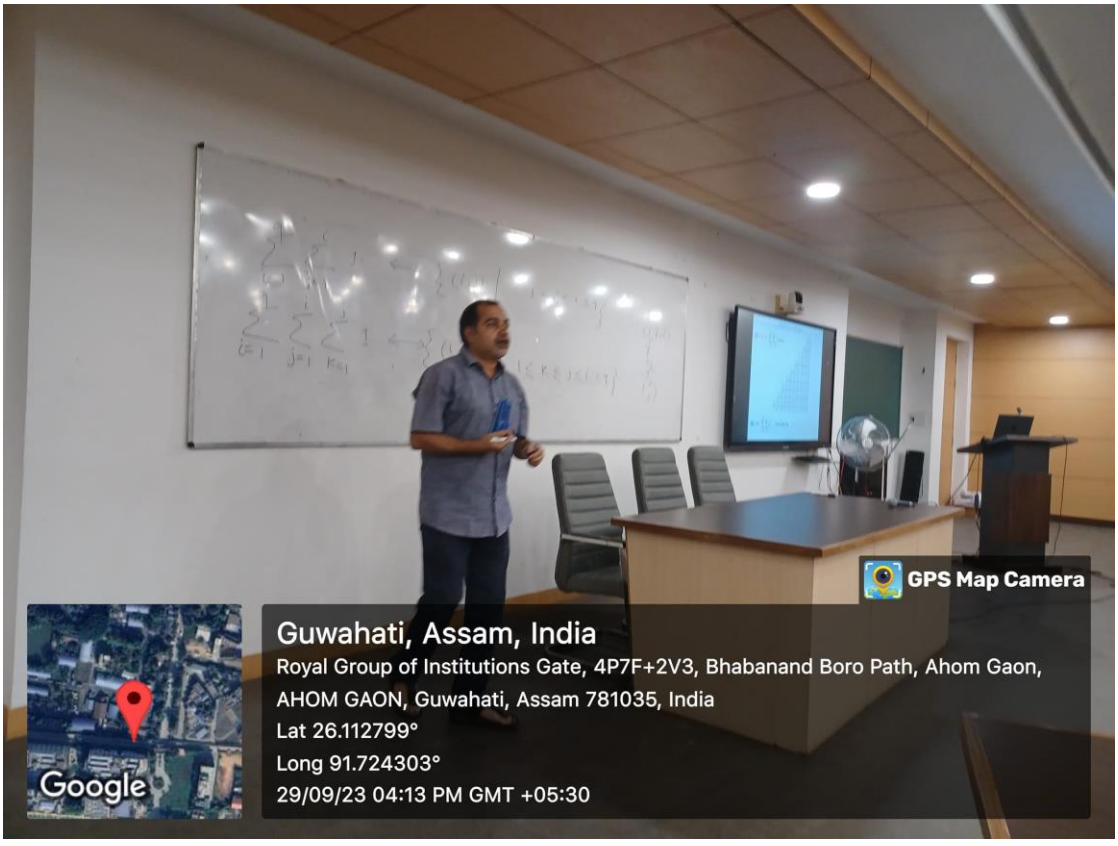
Department of Mathematics, Royal School of Applied & Pure Sciences celebrated Pi-Day on 14th March, 2023. Prof. (Dr.) Anuradha Devi, Dean Royal gave her opening remark. Prof. (Dr.) Rohit Singh, Pro-Vice Chancellor, RGU addressed the session and highlighted the importance of numbers. Prof. (Dr.) Dhiren Kumar Basnet, Professor, Department of Mathematical Sciences, Tezpur University was the Keynote speaker of the session. Sir delivered his talk on the theme of Pi-Day ***"Mathematics for Everyone*!**". The wall magazine "Sparshok" and the first edition of e-Magazine **entitled "Pi"** of Department of Mathematics were inaugurated in this session. Pi-value recitation competition was the major part of the celebration.


Dept of Mathematics
Editorial

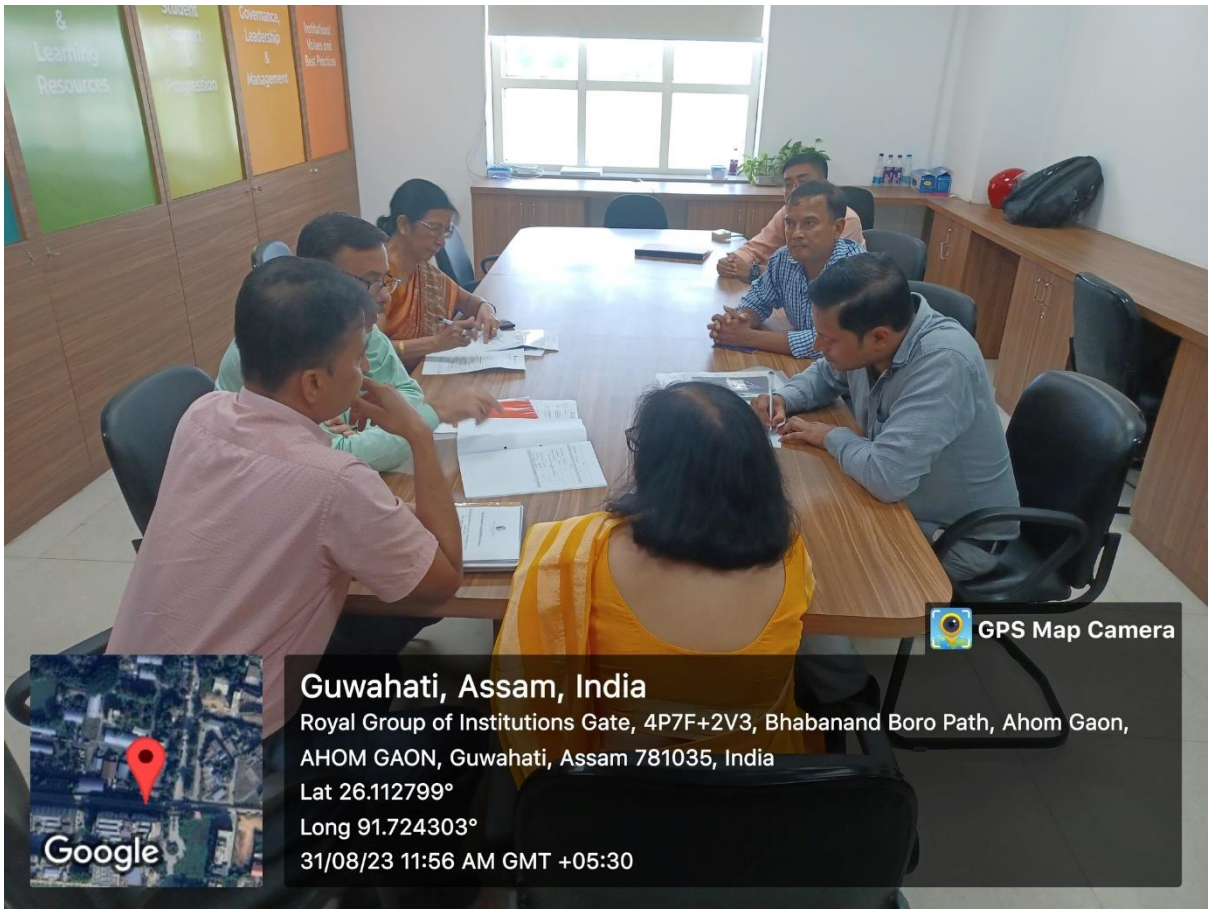
GLIMPSES OF DEPARTMENTAL ALUMNI MEET ON 30TH OCTOBER, 2023.

SOME GLIMPSES FROM TODAY'S TEACHERS' DAY CELEBRATION ORGANIZED BY THE STUDENTS OF THE DEPARTMENT OF MATHEMATICS, ROYAL GLOBAL UNIVERSITY.

An invited talk on "Repeated Sums" by Prof.(Dr.) Sukanta Pati, Department of Mathematics, IIT Guwahati was organized by the Department of Mathematics, Royal Global University.



9TH BOARD OF STUDIES MEETING OF DEPARTMENT OF MATHEMATICS, THE ASSAM ROYAL GLOBAL UNIVERSITY.

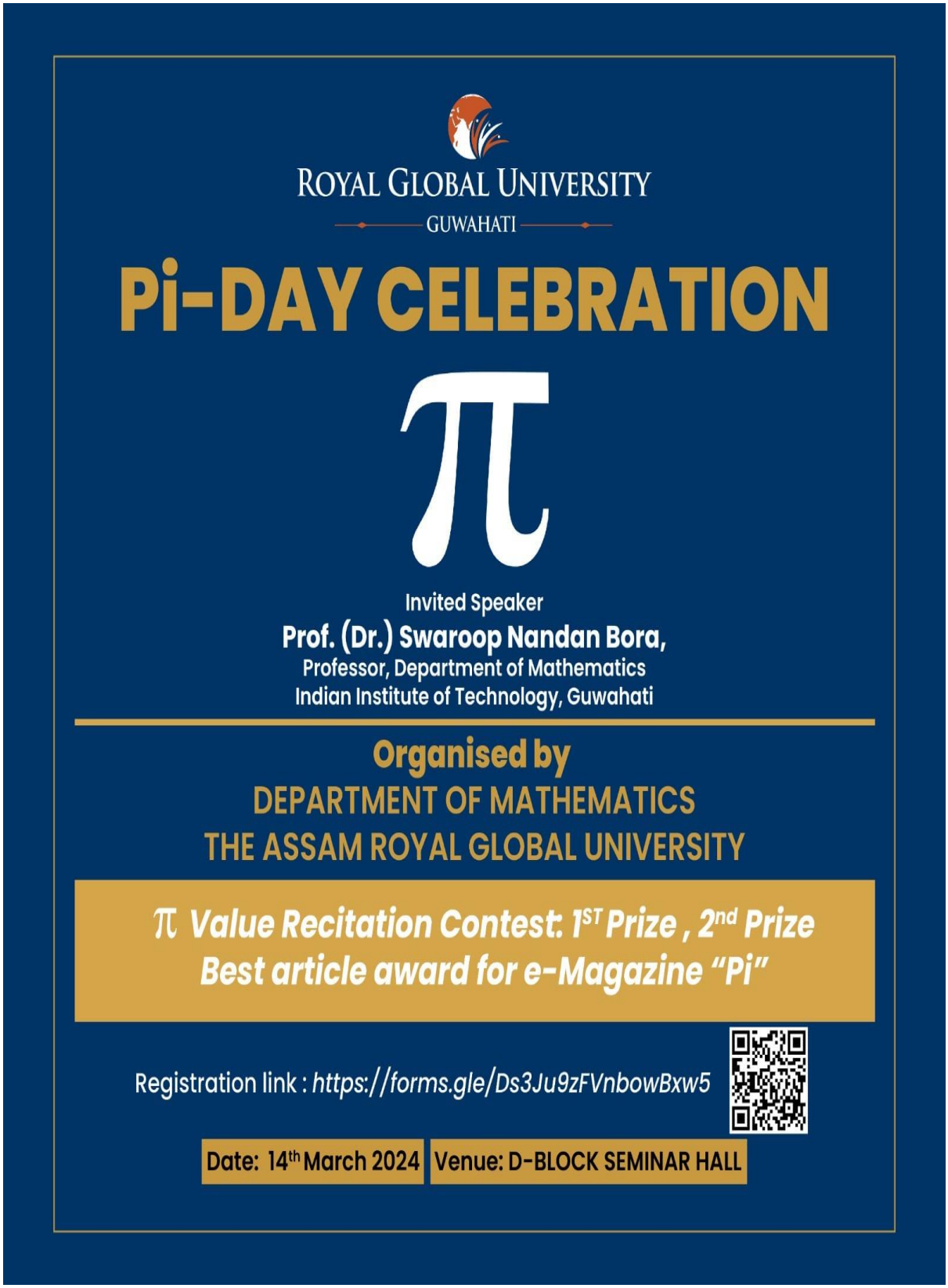


GLIMPSES OF DAY-1(AUGUST 7, 2023) REORIENTATION PROGRAMME OF BSC 3RD, 5TH AND MSC 3RD SEM STUDENTS OF MATHEMATICS DEPARTMENT.

An invited talk was organized by Department of Mathematics, The Assam Royal Global University in association with Assam Academy of Mathematics (AAM), Guwahati. Dr. Pinkimani Goswami, Assistant Professor, Department of Mathematics, University of Science and Technology gave her speech as a member of AAM on the topic "Introduction to Braid Group".

To explore the beauty of Mathematics in Physics, the Department of Mathematics, The Assam Royal Global University visited "Centre of Plasma Physics-Institute for Plasma Research (CPP-IPR)", Sonapur, Assam on 26 May, 2023 along with all the BSc (Mathematics) and MSc (Mathematics) students accompanied by faculty members of the department.
The students had a great interactive session and also got an opportunity to explore the labs of the institute.

GLIMPSES FROM THE DEPARTMENTAL PICNIC TODAY I.E. 3RD FEBRUARY, 2024 WITH THE FACULTY MEMBERS AND STUDENTS TO "UKIAM".


ROYAL GLOBAL UNIVERSITY
GUWAHATI
Pi-DAY CELEBRATION
π
Invited Speaker
Prof. (Dr.) Swaroop Nandan Bora,
Professor, Department of Mathematics
Indian Institute of Technology, Guwahati
Organised by
DEPARTMENT OF MATHEMATICS
THE ASSAM ROYAL GLOBAL UNIVERSITY
π Value Recitation Contest: 1ST Prize , 2nd Prize
Best article award for e-Magazine "Pi"
Registration link : https://forms.gle/Ds3Ju9zFVnbowBxw5
Date: 14th March 2024
Venue: D-BLOCK SEMINAR HALL

Pi Day Celebration (14th March, 2024)
Organized by
Department of Mathematics, RSAPS
The Assam Royal Global University

The Department of Mathematics at the Department of Mathematics, RSAPS, The Assam Royal Global University celebrated Pi Day on March 14, 2024, with enthusiasm and zeal. Pi Day is an annual celebration commemorating the mathematical constant π (pi), which is the ratio of a circle's circumference to its diameter. It's a day celebrated globally by math enthusiasts, educators, and students alike. The aim of our celebration was to promote mathematical awareness and foster a sense of community within the department and university.

Event Activities:

1. Guest/Invited Speaker Lecture:

We invited Prof. (Dr.) Swaroop Nandan Bora, Professor, Department of Mathematics, IIT Guwahati as our guest speaker to deliver a lecture on the significance of Pi in mathematics and its applications in various fields. The lecture aimed to inspire and educate attendees about the beauty and importance of Pi beyond its numerical value.

2. Pi Memorization Contest:

We organized a Pi memorization contest where participants were challenged to recite as many digits of Pi as they could from memory. The contest was open to students of our university. Prizes were awarded to the top two contestants who could recall the most digits accurately. 25 students participated in this event and Mr. Aktar Hussain, a student of MSc Mathematics 4th semester recited highest number, 287 digits of Pi.

3. Launch of E-Magazine 'Pi':

The second volume of the departmental magazine named 'Pi' was also launched today.

4. Inauguration of Departmental Wall magazine:

Following the yearly tradition of our department, this year also the departmental wall magazine was inaugurated by the invited/guest speaker Prof. (Dr.) Swaroop Nandan Bora.

The Pi Day celebration organized by the Department of Mathematics was a resounding success, bringing together students, faculty, and staff in a festive atmosphere of mathematical appreciation. The event not only celebrated the significance of Pi but also highlighted the broader importance of mathematics in our daily lives.


GPS Map Camera
Guwahati, Assam, India
Royal Group of Institutions Gate, 4P7F+2V3, Bhabanand Boro Path, Ahom Gaon, AHOM GAON, Guwahati, Assam 781035, India
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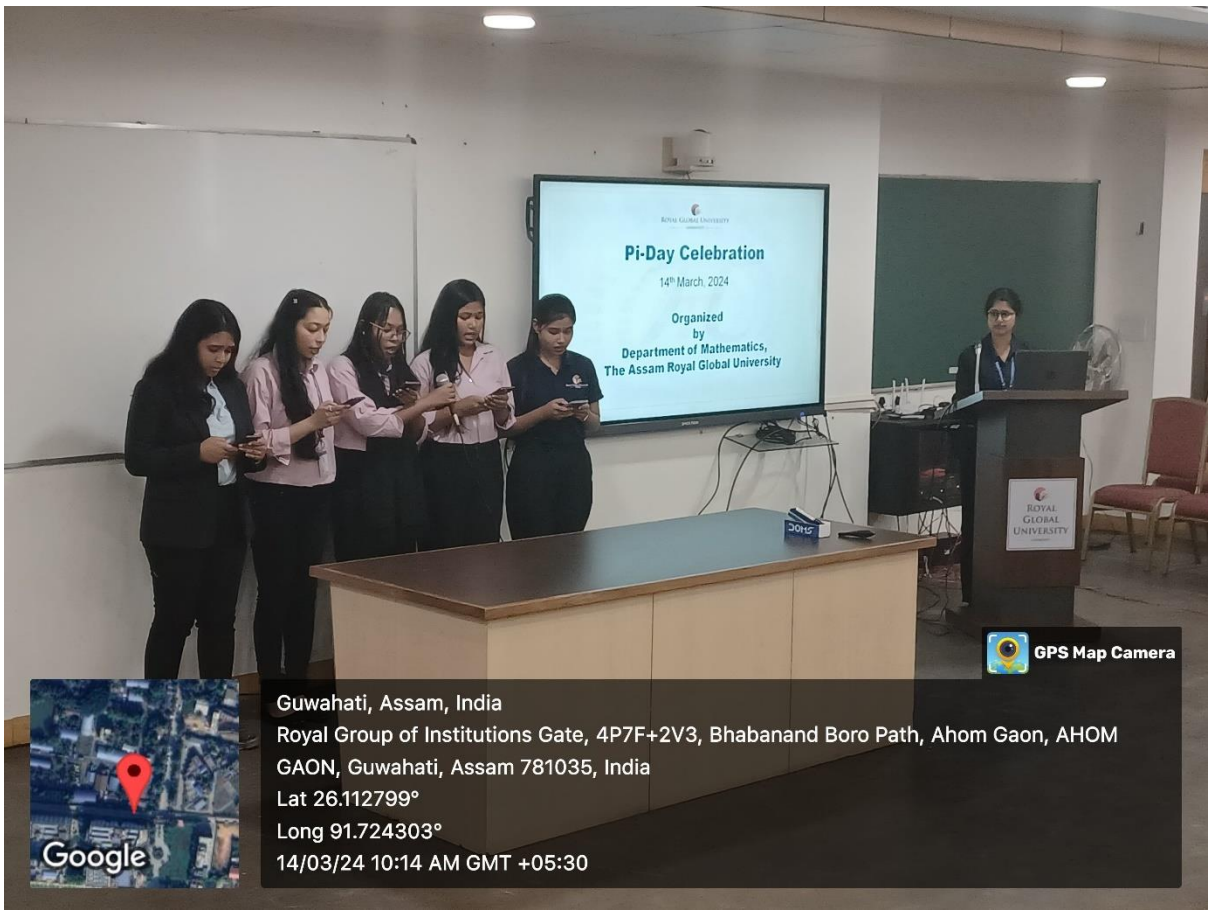
14/03/24 10:22 AM GMT +05:30
Google


Pi-Day Celebration
14th March, 2024
Organized
by
Department of Mathematics,
The Assam Royal Global University
GPS Map Camera
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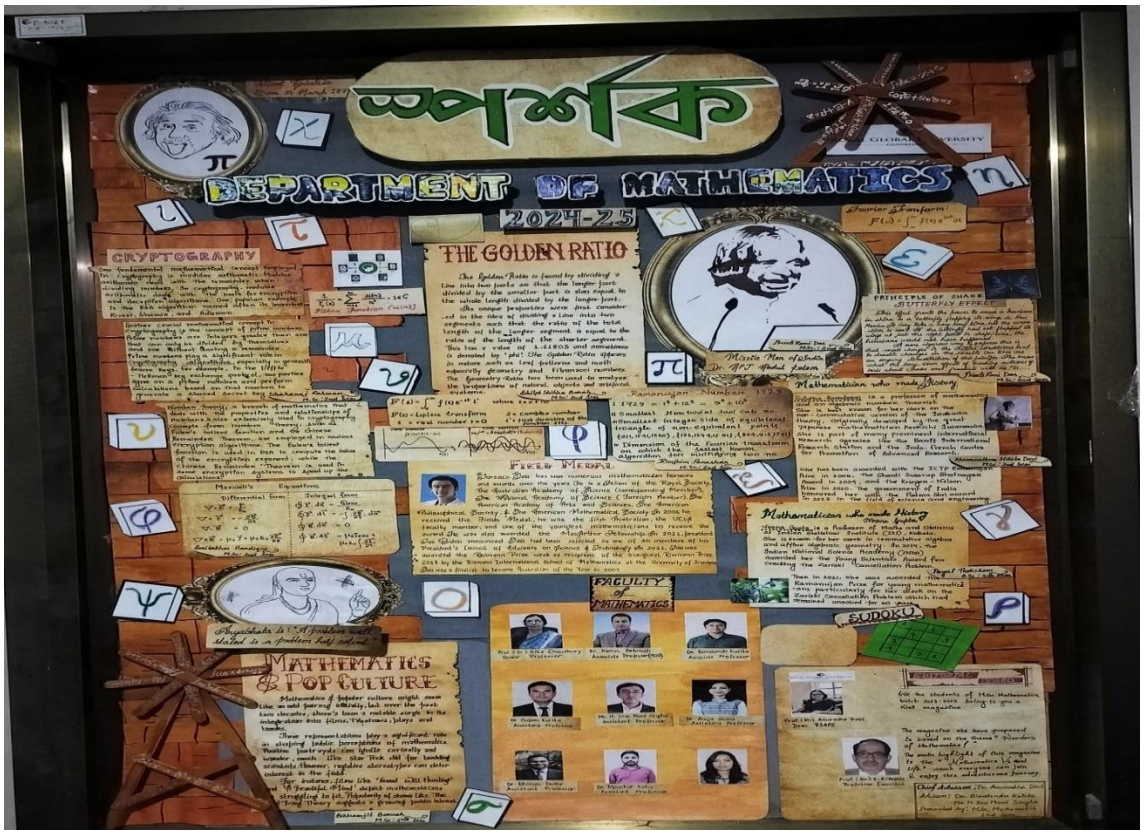
WALL MAGAZINE, 2024 CRAFTED BY THE ESTEEMED STUDENTS OF MSC MATHEMATICS, BATCH 2023-2025:




MATHEMATICS
Dr. Kamal Debnath
Dr. Bimalendu Kalita
Dr. Bapan Kalita

FACULTY PUBLICATIONS:

1. Bapan Kalita, "Multi-Level Marketing in the Context of Dynamical System", International Journal of Advanced Multidisciplinary Research and Studies, 2023; 3(3);1071-1076.
2. Kamal Debnath , "Reactive Solute Diffusion in Elastico- Viscous Fluid Past a Flat Permeable Plate, High Technology Letters", Volume 29, Issue 7, 2023.
3. Dipankar Saha, Nimai Sarkar, Mausumi Sen, Bipan Hazarika, "A qualitative study on fractional logistic integrodifferential equations in an arbitrary time scale", Kragujevac Journal of Mathematics, February, 2024.
4. Barman, S. and Kalita, B., Effectiveness Of Surface Texturing And Optical Width In Minimizing The Optical Loss Of A Solar Cell: A Simulated Study. Journal of Applied and Fundamental Sciences, 8(1), pp.39-50.
5. Barman, S. and Kalita, B, Energy, Environment And Cost Benefit Analysis Of Semi-Transparent Pv Window-A Review. Journal of Applied and Fundamental Sciences, 8(2), pp.103-108.
6. Kalita, B., Decision Making With Simplex Model: A Case Study. Journal of Applied and Fundamental Sciences, 8(2), pp.81-88.
7. Kalita, B., Public Revolution: A Mathematical Modelling. Journal of Applied and Fundamental Sciences, 8(1), pp.6-12.
8. Ankur jyoti Kashyap, Arnab jyoti Bordoloi, Fanitsha Mohan and Anuradha Devi, "Dynamical analysis of and anthrax disease model in animals with nonlinear transmission rate", Mathematical Modelling and Control, Vol.3 No 4, Dec 2023, pp 370-386.
9. Md Nazir Hussain, Navalakhi Hazarika and Anuradha Devi," Intuitionistic fuzzy aspects of multiplication N-groups", South East Asian J. of Mathematics and Mathematical Sciences, Vol. 19 No. 2, 2023. Pp 273-284.
10. Balajied Me Syrti, Anuradha Devi, Ankur Jyoti Kashyap," Analysis of stability, sensitity Index and Hopf Bifurcation of Eco-Epidemiological SIR Model under Perticide Application, Vol 6. No 2. 2023. Pp 136-144.
11. Md Nazir Hussain , Navalakhi Hazarika, Anuradha Devi," Distributive Character of Multiplication N-groups", International Journal of Mathematics Trends and Technology, Vol. 69. No. 6 June-2023, pp 59-66.

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