Issue: 6

August 2021

Acuity Newsletter

Department of Basic Sciences & Humanities

Message from Executive Director

It gives me immense pleasure to pen a few words for our in-house Basic Sciences and Humanities departmental newsletter "ACUITY" exclusively meant for enriching the knowledge of the budding technologists in various fields and I believe such departmental newsletter will be beneficial for all.

I congratulate the efforts of the members of The Editorial Board that they have brought out this issue of the newsletter in such a beautiful form. It is because of their selfless and untiring efforts that we see the newsletter enriched with variety of articles.

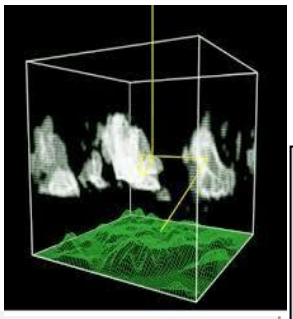
Once again, I extend my hearty congratulations to the entire team and wish the newsletter a great success.

Message from the Head of the Department

'A journey of thousand miles begins with a single step': With this conviction we decide to initiate this venture to progress in our pursuit of knowledge and excellence in academia. The task, we know, is not simple and requires united endevour for accomplishment. I hope that your enthusiastic cooperation will lead us to light.

তমসো মা জ্যোতির্গময়ঃ

Physics



BriePhys

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Laser-based camera improves view of the carotid artery: University of Michigan

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Smarter MRI diagnosis with nano MRI lamp :Institute of Basic Sciences

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Scientists build new ultrasound device using 3D printing technology: Anyang Technological University

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High-precision magnetic field sensing :ETH Zurich

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Engineers develop powerful millimeter-wave signal generator : University of California

Atmospheric Physics: An Important Field for Engineers

By Raja Ray

Atmospheric physics is the application of physics to the study of the atmosphere. Atmospheric physicists attempt to model Earth's atmosphere and the atmospheres of the other planets using fluid flow equations, chemical models, radiation budget, and energy transfer processes in the atmosphere (as well as how these tie into other systems such as the oceans). In order to model weather systems, atmospheric physicists employ elements of scattering theory, wave propagation models, cloud physics, statistical mechanics and spatial statistics which are highly mathematical and related to physics. It has close links to meteorology and climatology and also covers the design and construction of instruments for studying the atmosphere and the interpretation of the data they provide, including remote sensing instruments. At the dawn of the space age and the introduction of sounding rockets, agronomy became a sub discipline concerning the upper layers of the atmosphere, where dissociation and ionization are important.

Remote sensing is the small or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that is not in physical or intimate contact with the object (such as by way of aircraft, spacecraft, satellite, buoy, or ship). In practice, remote sensing is the stand-off collection through the use of a variety of devices for gathering information on a given object or area which gives more information than sensors at individual sites might convey. Thus, Earth observation or weather satellite collection platforms, ocean and atmospheric observing weather buoy platforms, monitoring of a pregnancy via ultrasound, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and space probes are all examples of remote sensing. In modern usage, the term generally refers to the use of imaging sensor technologies including but not limited to the use of instruments aboard aircraft and spacecraft, and is distinct from other imaging-related fields such as medical imaging.

Atmospheric physicists typically divide radiation into solar radiation (emitted by the sun) and terrestrial radiation (emitted by Earth's surface and atmosphere).

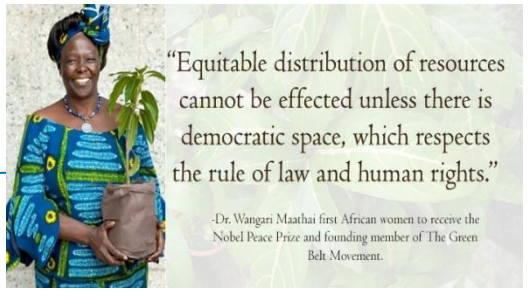
Solar radiation contains variety of wavelengths. Visible light has wavelengths between 0.4 and 0.7 micrometers. Shorter wavelengths are known as the ultraviolet (UV) part of the spectrum, while longer wavelengths are grouped into the infrared portion of the spectrum. Ozone is most effective in absorbing radiation around 0.25 micrometers,[6] where UV-c rays lie in the spectrum. This increases the temperature of the nearby stratosphere. Snow reflects 88% of UV rays, while sand reflects 12%, and water reflects only 4% of incoming UV radiation.[6] The more glancing the angle is between the atmosphere and the sun's rays, the more likely that energy will be reflected or absorbed by the atmosphere.

Cloud physics is the study of the physical processes that lead to the formation, growth and precipitation of clouds. Clouds are composed of microscopic droplets of water (warm clouds), tiny crystals of ice, or both (mixed phase clouds). Under suitable conditions, the droplets combine to form precipitation, where they may fall to the earth. The precise mechanics of how a cloud forms and grows is not completely understood, but scientists have developed theories explaining the structure of clouds by studying the microphysics of individual droplets. Advances in radar and satellite technology have also allowed the precise study of clouds on a large scale.

Atmospheric electricity is the term given to the electrostatics and electrodynamics of the atmosphere (or, more broadly, the atmosphere of any planet). The Earth's surface, the ionosphere, and the atmosphere is known as the global atmospheric electrical circuit. Lightning discharges 30,000 amperes, at up to 100 million volts, and emits light, radio waves, x-rays and even gamma rays.[10] Plasma temperatures in lightning can approach 28,000 kelvins and electron densities may exceed $1024/m^3$.

The largest-amplitude atmospheric tides are mostly generated in the troposphere and stratosphere when the atmosphere is periodically heated as water vapour and ozone absorb solar radiation during the day.

Aeronomy is the science of the upper region of the atmosphere, where dissociation and ionization are important. The term aeronomy was introduced by Sydney Chapman in 1960



Urine Is Sugary and Swimming Pools Are Sweet

By Debdeep Ray

Calorie-free, artificial sweeteners aren't metabolized in the body—they go in, and they come out unscathed.With that in mind, take a moment to metabolize the title of a new study: "Sweetened Swimming Pools and Hot Tubs."In a study published in Environmental Science & Technology Letters, researchers describe a new test that measures levels of acesulfame-K, a widely consumed artificial sweetener, floating in dubious pool water. Of course, researchers put their method to the test in pools and hot tubs in Canada, and the results may be disconcerting for some. It's yet another addition to the corpus of research focusing on the cocktail of chemicals we swim in for fun. **How Sweet Are Pools?**In the study, researchers tested for acesulfame-K in 250 samples from 31 pools and hot tubs in two Canadian cities. They cross-analyzed those results with Canadian urine samples and found that concentrations of acesulfame-K in pools and hot tubs ranged between 30 to 7,110 nanograms per liter, which, on the high end of that range, is 570 times higher than what's found in tap water. They followed that up by monitoring the levels of acesulfame-K in two pools over a three-week timeframe. Based on their results, a 222,000 gallon pool may contain up to 20 gallons of urine. Put another way, that's about 0.1 percent. Not much. However, pool water contained consistently higher levels of dissolved organic carbon, which can react with disinfecting compounds in pool water to produce several environmental pollutants and carcinogens. **CHEMICAL SNAPSHOT** Urine contamination is usually played for laughs. For a moment back in 2014, however, when a study on urine contamination in pools fleetingly inspired headlines like "Why peeing in the pool is chemical warfare," pee in the pool almost seemed less like punch line material. When the uric acid in pee and the chlorine in pool water react, they create cyanogen chloride. In high concentrations it can cause a host of nasty symptoms and even death—it was once used as a chemical weapon. But, as ArsTechnica calculated, for urine in pools to produce toxic agents, one would "need a pool that is two parts water to one part chlorine and would probably burn the eyeballs out of your sockets and make your skin peel away from your bones." Further research is needed to understand urine's role as an organic catalyst for certain chemical reactions, and researchers new method provides a means to target it. However, there's one surprising part of this study that demands more research immediately: The researchers report "19 percent of adults have admitted (emphasis own) to having urinated in a swimming pool at least once."What's the real percentage?

Chem-Call

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Dissolvable Easy to use milk capsules are available by Martin Luther University

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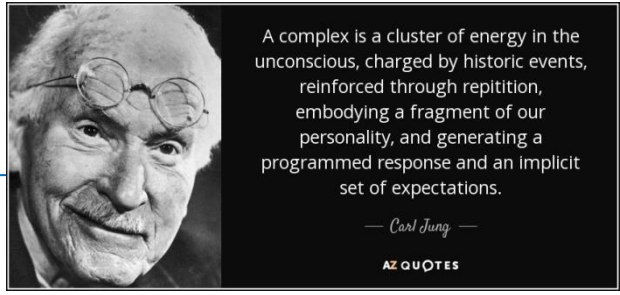
An innovation with water allows electro chromic conjugated polymer films to be applied more safely : by Georgia Institute of Technology

❖

Nanoparticles pollution rises 30 percent when flex-fuel cars switch from bio to fossil



Mathematics

Math Magica

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Robin Hood Effect on motivation in math

❖

Using Mathematical Model to understand biological network by Luxembourg University

❖

New Mathematical tool provides roadmap for cell development by university of Coloumbia

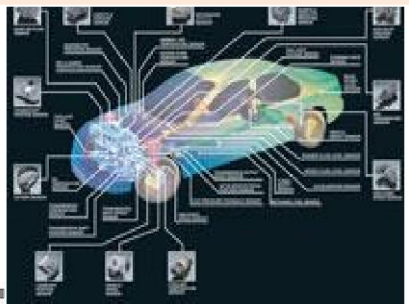
❖

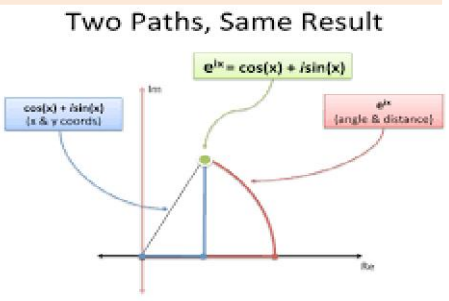
How to color a Lizard : from biology to mathematic..By University of Geneva

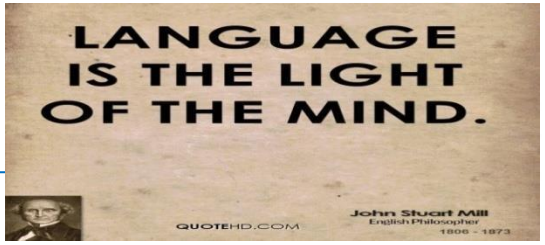
Complex Analysis for Engineers

By Prof. Tirtha Roy Chowdhury

Now a days, a common trends found in student's mind is resist to solve any sort of mathematics beyond simple arithmetic. Obviously, complex numbers are not required for calculating for SGPA or CGPA or balancing the checkbook. For most human tasks, real numbers offer an adequate description of data. Fractions such as 3/7 or 5/13 are meaningless to a person counting mangos, but essential to a person who selling mangos in market by weight. Negative numbers such as -3 and -5 are meaningless when measuring the mass of an object, but essential when keeping track of monetary debits and credits. Similarly, imaginary numbers have essential concrete applications in a variety of sciences and related areas such as control theory, signal processing, cartography, quantum mechanics, electromagnetism, vibration analysis, and many others. The concept of complex geometry and Argand plane is very much useful in constructing buildings and cars. This concept is used in 2-D designing of buildings and cars. Bridges are designed using complex number to analysis stresses in its structures. Complex number is needed to analysis the fluid or air flows around an objects and this understanding is necessary in the design of cars or aero plane wings for examples. Another possibility to use complex numbers in simple mechanics might be to use them to represent rotations. Complex numbers are used in signal analysis and other fields for a convenient description for periodically varying signals. For given real functions representing actual physical quantities, often in terms of sines and cosines, corresponding complex functions are considered of which the real parts are the original quantities. Complex numbers are used in AC Circuits because Resistor(R), Capacitor (C), Inductors (L) all react differently to AC Current. The effective resistance of each element called reactance(X). AC voltage through each element either lags or leads the current e.g. voltage across resistor in phase with the current (I) whereas voltage across Inductors lags I by 90° and voltage across Capacitor leads I by 90°. For calculating Impedance of AC circuit having Resistor, Capacitor and Inductor in series with AC Voltage, if we put numeric values of Resistor in positive real axis, capacitive reactance is along negative Y axis and Inductive reactance is positive Y axis, then impedance can be calculated comparing with complex number. Complex number are also used to generate so called Fractals. Fractals are geometric objects with high degree of self resembles at all scales. The idea of fractals comes from the nature. A fern consists of leafs which is made from many similar but smaller leafs. Closer look gives more detail structure of it. Romanesco broccoli which is striking example of fractal type self-similarity occurring in nature. Complex number can be used to create beautiful calculated fractals. After a point, most people end up seeing real numbers as just a 'special case' of complex numbers where the imaginary part happens to be zero. So if one intends to study engineering, he should be happy to play with complex numbers. After all, Engineers needs tools, Mathematics is one of the important tool box in which complex number has a special compartment.







English is ruling the world as always

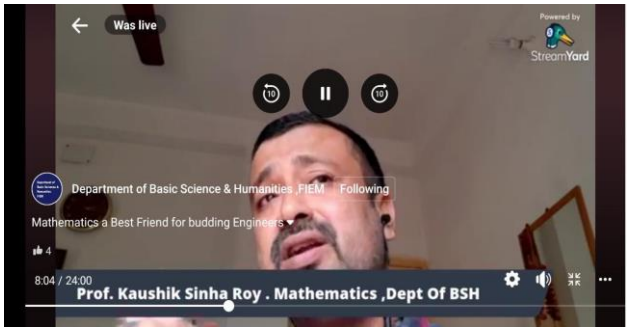
~ By Debarati Biswas

Why is English considered as an International Language? We all know that English is the international language, and that the same is the basis of all organizational and professional communication. But why is it so? There are innumerable languages in the world, but only English is regarded as international or global language. Why is it so? There are various factors responsible for this, and we will look into the matter in this article. Five hundred years ago, between five and seven million people spoke English, almost all of them living in the British Isles. Now, anywhere up to 1.8 billion people around the world speak English. The growth of English has nothing to do with the structure of the language, or any inherent qualities, and everything to do with politics. After developing for almost a millennium on the British Isles, English was taken around the world by the sailors, soldiers, pilgrims, traders and missionaries of the British Empire. By the time anything resembling a language policy was introduced, English had already reached all corners of the globe. For example, English-speaking puritans were not the only Europeans to arrive in North America: Spanish, French, Dutch and German were also widely spoken. All of the languages were reinforced by waves of immigration from Europe in the following centuries. But in the process of designing a "United" States, the USA's founders knew the importance of language for national identity. English was the majority language and had to be encouraged. As recently as the start of the 20th Century, several states banned the teaching of foreign languages in private schools and homes. The U.S. Supreme Court only struck down restrictions on private language education in 1923.Even today, English is not the official language of the USA, but there is no question that it is the dominant language in practice. And it wasn't just America that said "hello" to English. At one point in the early twentieth century, the British Empire expanded across almost a quarter of the world's surface, not including the USA. According to a popular saying, "the sun never set on the British Empire".Nowadays, the sun has set on the empire, but English remains an important language in every single former colony.To this day, English has a key administrative role in the former colonies. For a long time, access to English meant access to education, whether in the mission schools in Africa or the first universities in India. This created an English-speaking elite in some of the world's most populous countries, and elites are good at self-preservation. Post-independence, many countries became officially multilingual for the first time, but the various groups needed a language for communication with each other and with other nations. Again, that was English. English is now the dominant or official language in 75 territories: a direct legacy of the British Empire. The influence of American business, combined with the tradition of English left around the world by the British Empire, have made English the number one language of international trade in the 21st Century. All of the world's top business schools now teach in English. English is now the most widely spoken foreign language in 19 of the 25 EU Member States where it is not an official language. The 6 states where English is not number one also show the importance of politics in language policy: Russian is the most widely spoken foreign language in Lithuania, Latvia and Estonia; Croatian the most commonly spoken in Slovenia; and Czech the most widely spoken in Slovakia. But the cultural legacy of the post-war decades is also very important to the growth of English as a world language. As well as sending money across the Atlantic, the USA provided the soundtrack through rock and roll, jazz and, later, disco and hip hop. Hollywood movies became global sensations and American television series became cultural reference points. American culture was everywhere, radiating confidence and success; just the things for a world that had been ravaged by war.It wasn't just American music that brought English into the world's discotheques and homes. British bands including the Beatles, the Rolling Stones, Queen, Pink Floyd, the Police or Led Zeppelin ensured that Britannia ruled the airwaves, if not the waves. The hippy movement came from San Francisco and London. Music festivals including the Isle of Wight and Woodstock became iconic for a whole generation, whether English speakers or not. This "soft power" continues today…Bands release their work in English to reach the largest possible audience. Film-makers too. This invisible pressure to produce creative works in English adds to the cultural momentum the language developed in the second half of the Twentieth Century..The global power of the USA coincided with the birth of popular computing, and English is the language of the technological revolution and the internet. Consider a keyboard for example; they are designed for Latin characters, so speakers of Asian languages (particularly) use complicated techniques to enter words. What happens *inside* the devices is also dominated by English. The USA remains the most innovative technological nation and, because of the language policy of the nation's founders, English is the dominant language. Apart from the efforts of some early colonisers, hundreds of years ago, the success of English has more to do with "pull" than "push". People in British colonies who wanted an education would receive that education in English. Artists who want to reach the largest audience for their work can do that in English. If you want to trade internationally, you will need to speak English. And you don't have to speak English to have a successful career, but it certainly helps. Languages and borders change over time, but English is likely to remain the world's number one language during our lifetimes.

Online Talks

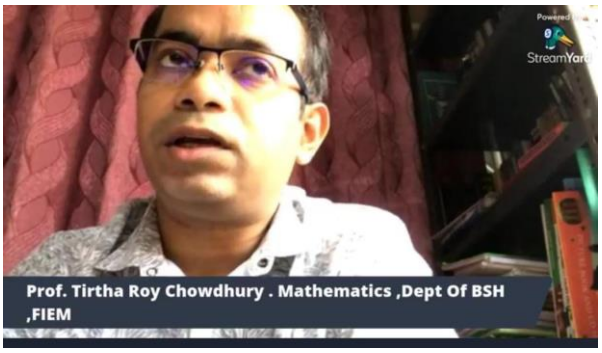
The department organized a series of online talks on:

- English for Engineers by Dr. Jhumur Ghosh on 20/7/21.
- Mathematics: The best friend for the budding Engineer by Prof. Kaushik Sinha Ray on 21/7/21.
- Mathematics: It is possible: Learning probability in a new Way by Prof. Tirtha Roy Chowdhury on 22/21.
- Physics for Engineers by Prof. Sanjiban Mukhopadhyay on 23/7/21.



Paper Presentation

M. Bhattacharyya and S.S. Sana, published a paper on An Integral Inequality With Two Parameters, Far East Journal Of Applied Mathematics ,111(2)(2021),97-114



Introduction of Internet Facility in Interaction Centre

The Smart Television is being introduced in the Interaction Centre convenient teaching and learningprocedures.