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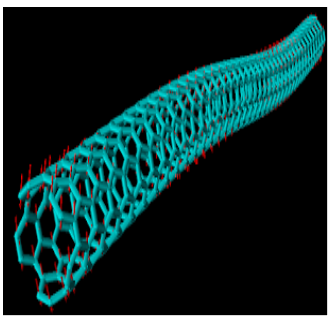
Society for Promotion of Excellence in Electronics Discipline

SPEED e- NEWSLETTER

Main Article

Marvels of Nanoscience and Nanotechnology in the Modern Era

INSIDE THIS ISSUE



The world today is known as the information age and has begun to make ever-lasting impact on mankind. It is bringing the world so closer that it is also termed as the 'global village'. To sustain the development of this new age as well as to improve the quality of life, the utmost important urge is to develop newer materials which will display 'greener, smaller, cheaper and faster' aspects, the mantra of today's era. Nanotechnology can fittingly perform this role of development of newer and advanced materials, which will help in fabricating superior device systems. Even though this technology has been developing in the 21st century, the seeds for its development were shown in the era of industrial revolution and nurtured during the 20th century itself. Scientists like Michael Faraday had already prepared colloidal nanoparticles of gold (showing pink colour) and attributed this change in colour to particle size (he used the term 'divided metals' to describe this effect). Visionaries like Richard Feynman had put forward a roadmap for the development of nanotechnology through his famous speech 'There is plenty of room at the bottom' at an American Physical Society meeting at Caltech on December 29, 1959. Rapid development of sophisticated and precise instruments made it possible to physically visualize these nanoparticles and study them in detail and establish the structure- property relationship. The major driving force for the development of this technology, though, was the distinctive changes in optical, electrical, magnetic, and mechanical properties of these nanomaterials as compared to their bulk counterparts. These changes in the properties at the nanoscale can be exploited for different applications to obtain novel materials and devices, which will be useful in almost all walks of life.

Thus, nanomaterials are the cornerstones of nanoscience and nanotechnology and are anticipated to play a profound role in future economy, technology, and human life in general.

Salient aspects of nanoscale phenomena

Officially, the United States National Science Foundation defines nanoscience / nanotechnology as studies that deal with materials and systems having the following key properties:
(1) Dimension: at least one dimension from 1 to 100 nanometers (nm).
(2) Process: designed with methodologies that shows fundamental control over the physical and chemical attributes of molecular-scale structures.

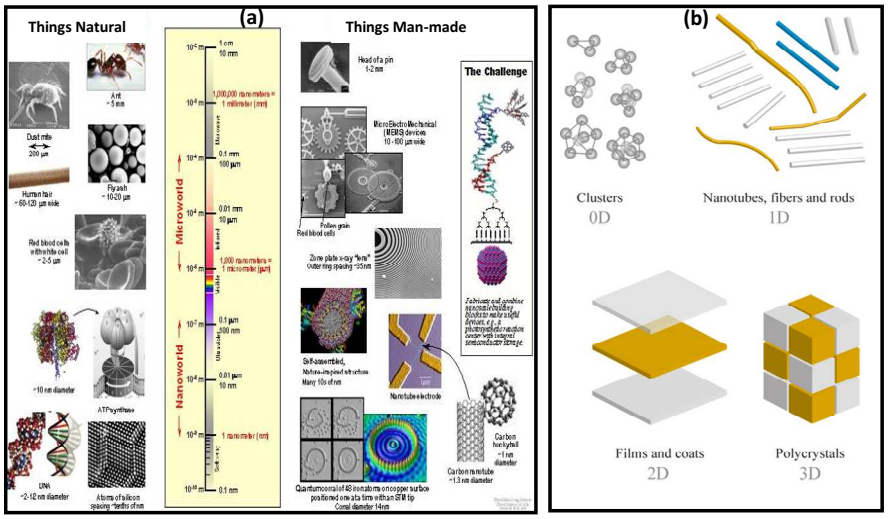


Figure 1: *(a) Scale of things – Nanometers and (b) basic types of nanostructures [3]*

(3) Building block property: they can be combined to form larger structures. Nanoscience, in a general sense, is quite natural in microbiological sciences considering that the sizes of many bioparticles dealt with (like enzymes, viruses, etc) fall within the nanometer range.

The term "nanotechnology" was defined by Tokyo Science University Professor Norio Taniguchi in 1974 as follows: 'Nano-technology' mainly consists of the processing, separation, consolidation, and deformation of materials by one atom or by one molecule". Figure 1a shows the scale of things (both naturally occurring and man-made) at different sizes from centimeter scale down to nanometer and sub-nanometer scale for the sake of comparison of materials in nanometer scale with their corresponding bulk and molecular level counterparts to put the things into the proper perspective [2]. From the Figure 1a, it becomes clear that while the word nanotechnology is relatively new, the existence of functional devices and structures of nanometer dimensions is not new, at least to the nature and in fact such structures have existed on Earth as long as life itself. Figure 1b shows the basic types of nanomaterials, namely zero (0), one (1), two (2) and three (3) – dimensional nanostructures.

The small sizes of nanoparticles/ nanostructured materials which are responsible for the different properties (electronic, optical, electrical, magnetic, chemical and mechanical) with respect to their bulk materials make them suitable for new applications. Having a size between the molecular and bulk solid-state structures, nanoparticles have hybrid properties, which are still not completely understood till today, thus, creating a challenge for theoreticians as well. Some of the important materials properties which change at nanometer scale are shown in Table 1.

Applications of nanomaterials

Figure 1.2 presents the summary of the applications of the prepared nanostructures in different fields. As evident from the figure, nanomaterials have huge potential for application in every field.

At this point, Centre for Materials for Electronics Technology (C-MET) has undertaken the efforts to venture into this exciting field. C-MET has developed state of the art facilities for the synthesis of nanostructures using various advanced techniques such as thermal plasma, microwave assisted solvothermal, sonochemical, spray pyrolysis etc. C-MET has also undertaken different projects of national interest on topics like hydrogen generation, non-conventional solar cells (like hybrid, DSSC), rechargeable batteries, advanced photo-sensors photo-catalysis etc. C-MET has also developed state of the art facility to analyze the nanomaterials.

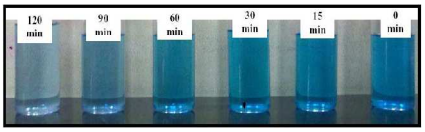


Figure 1.3: *Photocatalytic MB dye degradation using CdS nanostructures (at CMET, Pune)*

Properties	Examples
Catalytic	Better catalytic efficiency through higher surface-to-volume ratio
Electrical	Increased electrical conductivity in ceramics and magnetic nanocomposites, increased electric resistance in metals
Magnetic	Increased magnetic coercivity up to a critical grain size, superparamagnetic behaviour
Mechanical	Improved hardness and toughness of metals and alloys, ductility and superplasticity of ceramic
Optical	Spectral shift of optical absorbtion and fluorescence properties, increased quantum efficiency of semiconductor crystals
Sterical	Increased selectivity, hollow spheres for specific drug transportation and controlled release
Biological	Increased permeability through biological barriers (membranes, blood-brain barrier, etc.), improved biocom-patibility

Table 1: Changes in the properties of materials shown at nanoscale

As an example, photo-catalytic dye degradation using CdS nanostructures against methylene blue dye is shown in Figure 1.3.

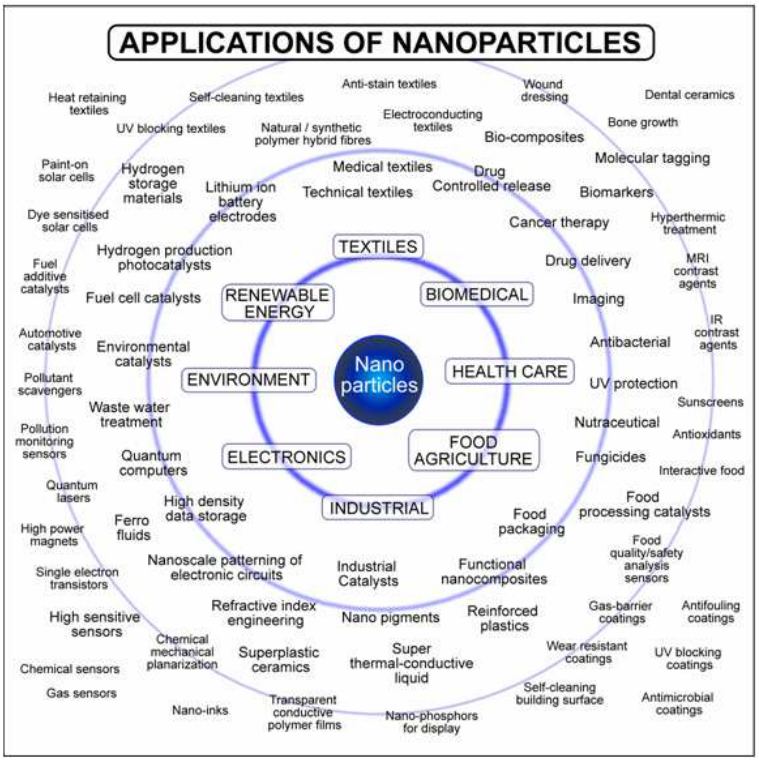


Figure 1.2 Applications of nanomaterials in different fields

In nutshell, nanotechnology and nanomaterials are the marvels of this century and may be the wonder tools for advanced progress of mankind in future. C-MET is trying its best to share the knowledge in this field for various applications.

References:

[1] C. P. Poole Jr., F. J. Owens: John Wiley and Sons, einheim, Introduction to Nanotechnology
[2] J. S. Murday: AMPTIAC Newsletter, 6/1 (2002) 5.
[3] Office of Basic Energy Sciences, U.S. DOE, http://www.science.doe.gov/bes/scale_of_things.html.
[4] I. Freestone, N. Meeks, M. Sax and C. Higgitt: Gold Bulletin, 40/4 (2007) 271.
[5] Takuya Tsuzuki, International Journal of Nanotechnology (IJNT), 6 (2009) 567.

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NET NEUTRALITY

By: Prof.R.K.Nerakar,Nowrosjee Wadia College,Pune-1

What is Net Neutrality?

Very recently this word is used to express the freedom of net users to access data, text, video etc. from internet with uniform charges. The importance of net neutrality can be understood best only if there is no neutrality. This is similar to the freedom of independence. Once the internet plan is selected for a month then one should be able to use internet at any place at no extra cost as long as the data plan limit is not crossed. This is Net Neutrality. This ensures ***the use of internet for any purpose*** that is suitable for the user e.g. sending mail, receiving it, WhatsApp application, Facebook, Google search, YouTube, Twitter etc.

Non Net Neutrality or Differential Net:

Let's have a counterword for net neutrality as differential net. So if net neutrality is abolished or if differential net comes in existence then the operational charges will be different for different applications on net even if the data accessed is same in length. Hence the name is differential net.

Market pricing:

Most of the commodities in the market are neutral as far as their pricing is concerned i.e. the price is independent of place, user or purpose. The best example that can be given is that of milk. The price of milk per liter is independent (neutral) of its use. Once the milk is bought the customer is free to use it for any end product that he wants to use it e.g. for a child to drink it, for making tea, for making ice-cream or for any other purpose.

If Gawali (milkwala) puts different prices for his milk, nobody will purchase it. So his strategy will not work, because there are so many vendors from where consumer can buy milk. On the contrary consumer would not like to be asked the question about its use before purchasing. This means cost of the milk per liter is same for drinking or for any other use. Thus milk is neutral or one can say that there is milk neutrality. Why not same should be applicable to internet usage? This is the crux of net neutrality.

Potato is another example. One can make veg, finger chips, wafers etc. Cost of the end product is different but the cost of raw potato is same. Potato is neutral.

Certain things are differential in India e.g. electricity. Electricity tariffs are different for consumer uses and for commercial users. Corporation taxes are different for dwelling units and for commercial units. So electricity and taxes are examples of non neutrality.

Role of TRI (Telecom Authority of India):

Earlier the spectrum was allotted on first come first serve basis and it was done at a nominal price. But now 2G and 3G spectrums are allotted by auction. Telecom companies are purchasing them by paying heavy fees. These companies would like to recover the license fee amount. So they have thought of abolishing net neutrality with the consent of TRI.

Issue of net neutrality came to discussion only after TRI issued a circular whereby net neutrality is difficult (particularly after 2G and 3G auctions).

Differential pricing was thought for extracting maximum benefits from net users. So TRI is going to play a very important role in fixing the charges for the internet usage.

Birth of Internet:

In the beginning some professors and research scholars have started using internet for sending their research papers and thesis in the form of texts. The verbal discussion was carried on telephone. So internet was a medium or facility used for information exchange at a very fast rate and at a very low cost (almost free, only landline charges). But the scope of internet increased beyond the imagination of those early users for data communication. Software giants could not anticipate that it will go to such an extent. Fortunately nobody owns internet. Therefore net neutrality must be maintained.

Future:

Earlier internet was available only on desktop computers. Because of Wi- Fi, now it is available on laptops and because of 2G and 3G networks, it is available on mobile phones and I phones. Now people are addicted to it. Even if net neutrality is not maintained and differential pricing is done by service providers, the people will use it. Whether they like it or not, they will be forced to use these facilities at higher rates. But if people put pressure on government and these companies providing net connections, probably for some period net neutrality can be maintained.

Science is the systematic way of acquiring knowledge through observation and experimentation, whereas **technology** is the practical application of science. Technology is used to design products that improve the quality of human life.

Every year**, `National Technology Day' is celebrated across India on May 11**; being commemorated to memorize the anniversary of **Shakti**, the Pokhran nuclear test held on 11 May 1998. The day glorifies the importance of science in day to day life. First indigenous air craft "**Hansa_3"** was test flown at Banglore and India performed test firing of the "**Trishul**" Missile on the same day.

NEWS and EVENTS at COLLEGES

❖ MAEER's Arts, Commerce and Science College of MIT Group of Institutions, Pune

MAEER's Arts, Commerce and Science College, Kothrud , Pune had organized First National Conference on **'Digital Image and Signal Processing'** on 12th and 13th February 2015, under Quality Improvement Program of Savitribai Phule Pune University. The Conference was inaugurated by chief guest, **Padma Bhushan Dr. Vijay Bhatkar,** Eminent Scientist and President, IIMV, Pune and Prof Dr. U. Pal, Computer Vision and Pattern Recognition Unit, Indian Statistical Institute, Kolkata. Dr. Vijay Bhatkar highlighted various applications of digital Image and Signal Processing like Image fusion, Face recognition, speech recognition, etc. He also explained about the technique in which any language could be converted into our mother tongue language by using image processing. Prof Dr. U. Pal, spoke on **Document Image Analysis: Recent Advantages**. He explained the concept of Graphology - the technique to detect human nature by recognizing his/her handwriting. He discussed various areas of research such as Video Document Processing, Automatic cheque Processing, Automatic Mail sorting, face recognition etc.

The details of the technical sessions are as follow:

Session I: "Imaging Radar : Signal and Image Processing" was given by **Dr. C. Bhattacharya,** Sc, 'G', DRDO, Defense Institute of Advanced Technology (DIAT), Pune.

Session II: "Pattern Classification: A study on diabetic Retinology" by Dr. G. G. Rajput

Session III: "Current research issues in Image Processing and its application areas" by Dr. Merchant from Department of Electrical Engineering,IIT Bombay, Powai, Mumbai**.**

Session IV: "Object Detection and Tracking in Image and Video" was given by **Prof. Dr. Nilesh J. Uke,** Professor and Head, Department of Information Technology, Sinhgad College of Engineering, Pune

Session V: "Speech Recognition" was given by **Prof. Dr. A. D. Shaligram,** Head, Department of Electronic Science , Savitribai Phule University, Pune.

Best Research paper- Oral presentation and Best research paper- poster presentation awards were given at the hands of respected chief guest **to Ms. B M Reshmi, Gulbarga and Ms. Guari Mhatre K.J. Sumaiya College, Mumbai respectively.**

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NEWS and EVENTS at COLLEGES

- **L.A.D. & Smt. R. P. College for Women's Nagpur, organized following workshops** :

  - **One Day Hands-on Training cum Syllabus Workshop on LabVIEW Software**
    'One Day Hands-on Training cum Syllabus Workshop on LabVIEW Software' for teachers of Electronics under RTMNU was organized on 19th April, 2014. 25 teachers of Electronics participated and benefitted from the same. Mr. Ashish Uttarwar, CEO of Arav Technologies, Nagpur guided the participants. The morning session was an introduction to Labview programming environment and data acquisition fundamentals. The post lunch session was a complete hands-on training session. One month free software given to participants helped in prescribed practical experiments of third semester of B.Sc. II. The valedictory session was chaired by Dr. B. Malewar, Vice-Principal of the college. The workshop received excellent feedback from the participants.

  - **E- Communication :** A workshop on e- communication was conducted for students of B. Sc. I (PEM), in the month of August 2014.

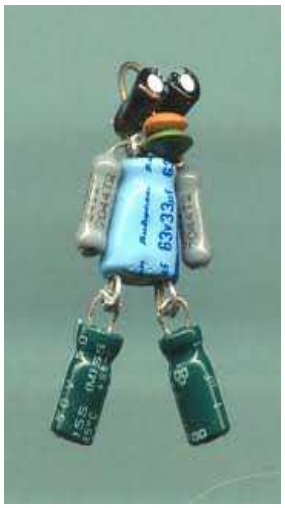
  - **Bridge Course and Workshop on Laboratory Measurements and Techniques :** Bridge Course and Workshop on Laboratory Measurements and Techniques was conducted for students of F.Y. B.Sc. in the month of March 2014 and in August 2014. The students were guided on laboratory practices, graph plotting, common measuring instruments and electronic components – identification and testing. A manual cum workbook was prepared and supplied to the class.

  - **Robotics Workshop :** The Depts. of Electronics and Applied Electronics jointly organized a one day workshop on Robotics for the students of T.Y. B.Sc. (Electronics) and Bachelor of Applied Electronics and Software Technology on 5th January 2015. There were 20 participants. The resource person of the program was Ms. Sumana Pallampati, student of final year B. E from BITS, Pilani, Dubai Campus. She motivated the participants with video and PPT presentations of the thrill and excitements of robots in various fields. She guided the participants on programming a robot for line follower, wall follower, obstacle detector etc.

  - **Digital Electronics Workshop :** The Depts. of Electronics and Applied Electronics jointly organized a one day workshop on Digital Electronics for the students of final B.Sc. (Electronics) and Bachelor of Applied Electronics and Software Technology on 6th January 2015. There were 20 participants. The resource person was Mr. Tushar Nighot, Ice Computers and Systems, Nagpur. He guided the participants in preparing experimental units for practical digital electronics like multiplexers, counters, shift registers etc.

Come on ..

Don't be afraid of electronic components. Play with them and be their friends. They can make interesting and useful gadgets.

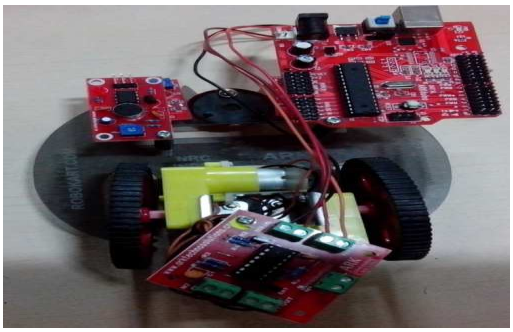


NEWS and EVENTS at COLLEGES

❖ **KTHM College Nasik has organized, Two days workshop on ROBOTICS:**

Two days workshop on ROBOTICS was jointly organized by Department of Electronic Science, K.R.T. Arts, B.H. Commerce & A.M. Science College, Nashik and ARK Techno solutions, Helios IIT, Mumbai on 25th & 26th February, 2015. Dr. V. S. Kale and Dr. M. B. Matsagar worked as a coordinator of workshop. Workshop was divided into four sessions.

- Introduction to ROBOTICS (include classification of robot, application, sensors necessary and assembled the robot: wheels, motors, sensors, controller module, battery etc.)
- Software installation and Robot assembly and testing with simple programs (ATMega8 controller, Arduino kit, and software Arduino 1.0.5)
- Students developed programs for various applications.
- Competition topic: Design & develop a robotic assembly.

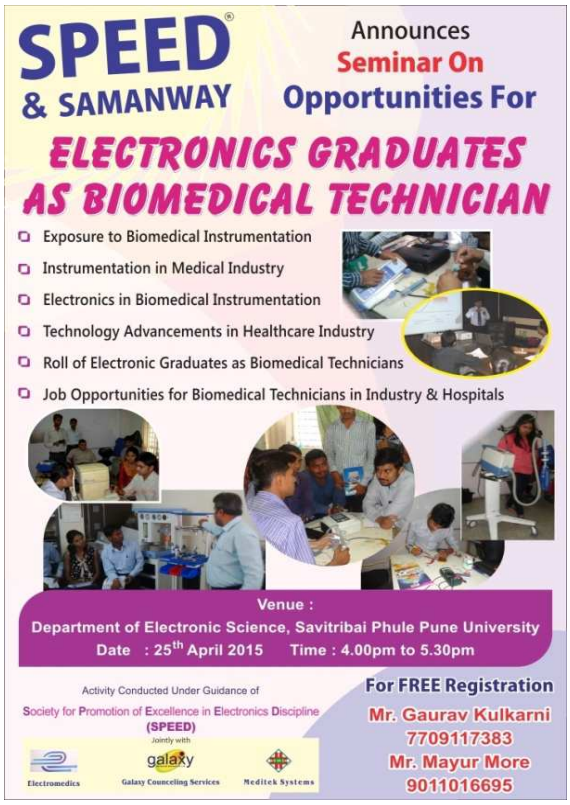


❖ **Workshops at Sinhgad College of Science, Ambegaon, Pune**
Dr. Deepa Ramane, Associate Prof. has organized Laptop Repairing and Mobile repairing workshops.

❖ A four day workshop on **LAPTOP REPAIRING** was organized by Sinhgad College of Science (SCOS) in association with Board of Student Welfare (BSW), Savitribai Phule Pune on 16-21 Feb 2015 especially for PG students. The workshop was conducted by Prof. Arun More, director of Success Institute of Technology, Nigadi, Pune. He explained in detail hardware of latest Laptops. He guided the students about maintenance and repairing of laptops. Hands on training about repairing and installation of software built the confidence amongst the students about fault finding and troubleshooting.

❖ Considering overwhelming response of students the college has also organized three day workshop on "MOBILE REPAIRING" on 9-11 March 2015 for UG students. Since mobile is an essential gadget of every individual, students from B.Com and BCA along with B.Sc., B.Sc.(C.S.) also participated in the workshop willingly. Workshop was conducted by Prof. Arun More, director of Success Institute of Technology, Nigadi, Pune and his team. He practiced the students about disassembling and reassembling of various models of mobiles including smart phones. Students find practical sessions of the workshops very useful and interesting. They gain knowledge about repairing of mobiles when fell in water, battery problems, software or application installation problems etc.

SPEED ACTIVITIES DURING MARCH – MAY 2015



To achieve goals and objectives of SPEED, the organization had organized a seminar for B. Sc. Electronic Science students to guide the students about making career in Bio-Medical Instrumentation : operation and maintenance field.

The seminar was jointly organized by SPEED, Electromedics Meditek Pvt. Ltd, Galaxy counseling services and Meditek Systems at Department of Electronic Science, Savitribai Phule Pune University, on Saturday 25th April 2015. Mr. Shripad Thakurdesai, Mr. Mandar Lonkar and Professor Arvind Shaligram guided the audience on the modernization of the hospitals, the advanced equipments and needs and opportunities in the operation and maintenance in Bio-Medical instrumentation in the hospital and industrial domains.

SAMANWAY is conducting certificate course for Graduates as Biomedical Technicians. It gives an opportunity to handle High-Tech Products with Demonstrations and Functional use. For Details contact :

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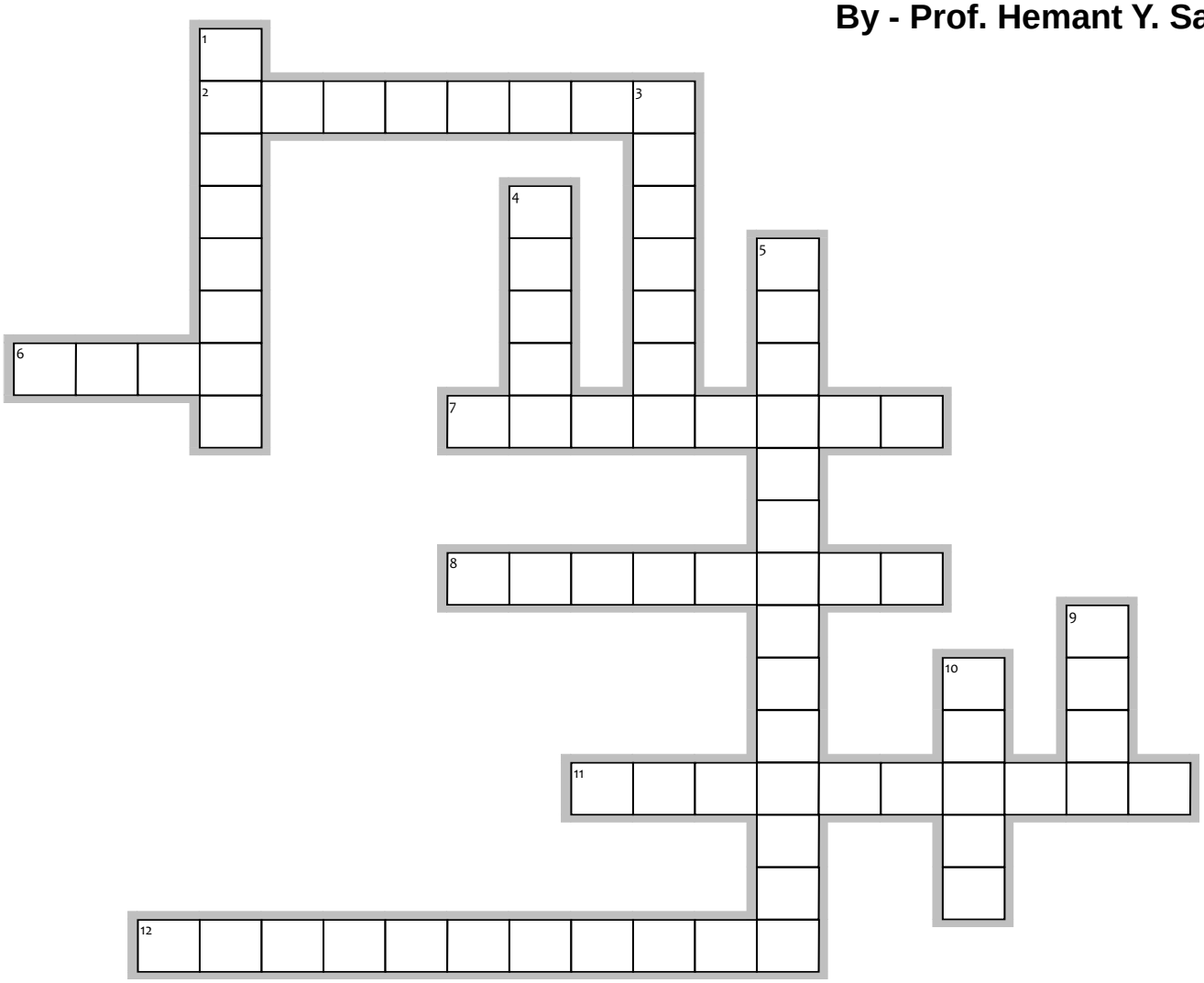

Across

2. Binary..... is the repeated process of subtraction. (8)
6. Binary multiplication (1) (0) results into (.....) (4)
7. Binary Division is the ..... process of subtraction. (8)
8. "Binary Multiplication is like Decimal Multiplication except you deal only with 1s and 0s" - This statement is..... (8)
11. The ..... digits are always 0 or 1. (10)
12. Binary division is the repeated process of..... (11)

Down

1. Multiplication is nothing but repetitive..... (8)
3. "Boolean Multiplication is symbolized by A + B " - This statement is..... (7)
4. "The solution to the binary problem (1011) x (0110) is (01100110)" - This statement is..... (5)
5. Binary..... (1) * (0) results into binary (0) (14)
9. "Binary division and Decimal division use the same procedure" - This statement is..... (4)
10. 0 / 1 = 0 & 1 / 1 = 1 These are ..... for Binary Division. (5)

ANSWER FOR LAST ISSUE PUZZLE

Across

2. **WITH**—Half adders can be combined to form a Full adders ..... additional gates.
5. **FIRST**—In a parallel Full Adder, the ..... stage may be a Half Adder.
6. **FULL**—A logic circuit which has two inputs & previous carry input and Two outputs (Sum & Carry) is ..... adder.
8. **CARRY**—Full adders have a ..... input capability.
10. **GATES**—Half adders can be combined to form a Full adder with additional .....
11. **SUM**—The logic gate normally used to get the ..... bit in a Half adder is an EXOR gate.
12. **AND**—An EXOR and an ,,,,,,,,, gates are required to build a Half adder.
14. **FULLADDER**—A ..... circuit would normally be used each time a carry input is required in an adder circuit.
16. **TWO**—A Full adder circuit will have ..... outputs.
19. **FALSE**—"It is not necessary to have the same number of bits when adding or subtrating signed binary numbers in the 2's complement system" - This statement is .....
20. **THREE**—A Full adder logic circuit will have ..... inputs.
22. **TRUE**—"A Half adder is faster than Full Adder" - This is a ..... statement.
23. **ZERO**—The binary subtraction (0 - 0) will produce Difference = Borrow = ...
24. **SAME**—It is necessary to have the ..... number of bits when adding or subtrating signed binary numbers in the 2's complement system.
26. **FASTER**—A Half adder is ..... than Full adder.

DOWN

1. **SUBTRACTOR**—A logic circuit with two inputs and two outputs (Difference & Borrow) is Half .....
3. **INPUTS**—The ..... of a full adder are labeled as A1, B1 and Cin.
4. **HALF**—A logic circuit which has two inputs & two outputs (Sum and Carry) is ..... adder.
5. **FULLSUBTRACTOR**—A logic circuit with two inputs and previous borrow input and two outputs (Difference & Borrow) is .....
7. **PARALLEL**—In a ..... Full adder, the first stage may be a half adder.
9. **CARRYBIT**—The logic gate normally used to get the ..... in a Half adder is an AND gate.
13. **CARRYIN**—A full adder has a .....
14. **FOUR**—There are ..... possible combinations for subtracting two binary numbers.
15. **DIFFERENCE**—The binary subtraction (1 - 0) will produce ..... = 1 and Borrow = 0.
17. **BASIC**—Half and Full Adder circuits are two types of ..... adder circuits.
18. **REGISTERS**—Full adder results are typically stored in .....
21. **SLOWER**—Full adder is ..... than the Half adder.
25. **EXOR**—One ..... and one AND gate forms a Half adder circuit.