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NAAC
NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

CURRENT WAVES

AN INITIATIVE BY EXTC DEPARTMENT

MAGAZINE

DESIGNED AND EDITED BY:

SILVIYA ALPHANSO

SEPTEMBER 2019

ELECTRONIX QUOTES

IT HAS BECOME APPALLINGLY OBVIOUS THAT OUR TECHNOLOGY HAS EXCEEDED OUR HUMANITY.

–ALBERT EINSTEIN

ONE MACHINE CAN DO THE WORK OF FIFTY ORDINARY MEN. NO MACHINE CAN DO THE WORK OF ONE EXTRAORDINARY MAN.

–ELBERT HUBBARD

TECHNOLOGY IS A WORD THAT DESCRIBES SOMETHING THAT DOESN'T WORK YET.

–DOUGLAS ADAMS

ALL THIS MODERN TECHNOLOGY JUST MAKES PEOPLE TRY TO DO EVERYTHING AT ONCE.

–BILL WATTERSON

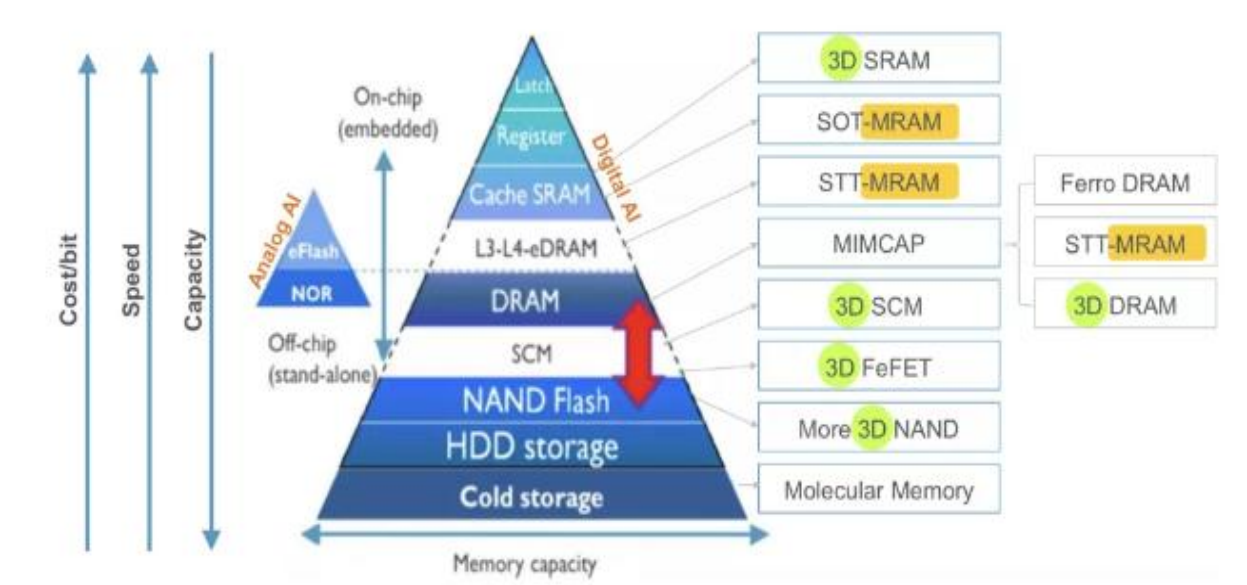
THE NEXT NEW MEMORIES

Several next-generation memory types are ramping up after years of R&D, but there are still more new memories in the research pipeline.

Today, several next-generation memories, such as MRAM, phase-change memory (PCM) and ReRAM, are shipping to one degree or another. Some of the next new memories are extensions of these technologies. Others are based on entirely new technologies or involve architectural changes, such as near- or in-memory computing, which bring the processing tasks near or inside of memory. Pushing any of them out of R&D involves overcoming several technical and business hurdles, and it's unlikely that all of them will succeed. But some are especially promising and potentially targeted to replace today's DRAM, NAND and SRAM.

Among the next new memory types are:

- ***FeFET*** *or* ***FeRAM***: A next-generation ferroelectric memory.
- ***Nanotube RAM***: In R&D for years, nanotube RAM is targeted to displace DRAM. Others are developing carbon nanotubes and next-generation memories on the same device.
- ***Phase-change memory***: After shipping the first PCM devices, Intel is readying a new version. Others may enter the PCM market.
- ***ReRAM***: Future versions are positioned for AI apps.
- ***Spin-orbit torque MRAM*** (SOT-MRAM): A next-generation MRAM targeted to replace SRAM.



Emerging Memories for Pervasive Data and Compute Source: Applied Materials

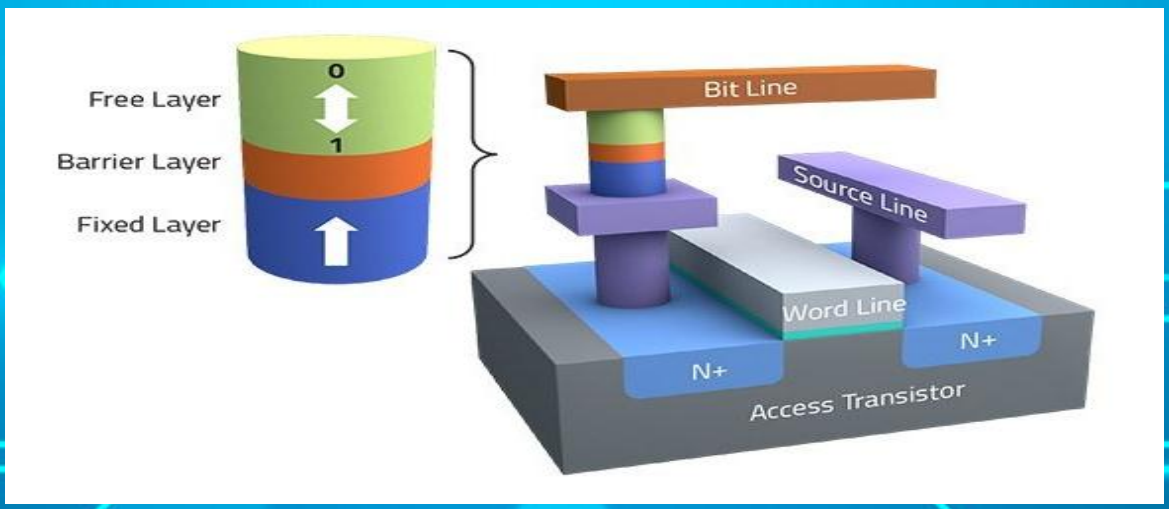
https://semiengineering.com/the-next-new-memories/

TEST, MEASUREMENT & ANALYTICS

Challenges In Making And Testing STT-MRAM

MRAM, which is still a tiny market, was a $36 million business in 2017, according to Coughlin Associates and Objective Analysis. In total, the MRAM market is expected to reach $325 million by 2020, according to MKW Ventures Consulting. STT-MRAM, phase-change memory (PCM) and resistive RAM (ReRAM) are among the new memory types in production today. Each technology is different and targeted for various applications.

Intel's 3D XPoint technology is one example of PCM. PCM stores information in the amorphous and crystalline phases. ReRAM is based on the electronic switching of a resistor element. STT-MRAM, which is different, is attractive for several reasons. "MRAM has a number of attractive attributes—it is fast (random reads and writes), non-volatile and low power, and offers low cost potential since the memory array can be embedded in the back-end interconnect layer of the chip with only three additional masks," said Gill Lee, managing director of memory technology at Applied Materials, in a recent blog.



STT-MRAM consists of one-transistor architecture with a magnetic tunnel junction (MTJ) memory cell, which serves as the storage element. "MRAM uses magnetic storage elements rather than conventional electric charges to store data. Each cell consists of two magnets: one that is stationary, and one that can flip. When the magnets are parallel to each other, resistance is low; when the second magnet flips and reverses direction, the resistance is high. Similar to PCM, the change in resistance correlates to a '0' or '1' data value," explained Alex Yoon, senior technical director at Lam Research, in a blog.

https://semiengineering.com/challenges-in-making-and-testing-mram/

MIT Builds Carbon Nanotube FET Based RISC-V Microprocessor

- Nitin Dahad, 09.09.19

Researchers at MIT have succeeded in building a 16-bit RISC-V microprocessor using carbon nanotube transistors using industry-standard design flows and processes and offering 10 times more energy efficiency than silicon microprocessor.

With silicon no longer following historical scaling trends, there's been considerable research in beyond-silicon nanotechnologies. Carbon nanotube field-effect transistor (CNFET)-based digital circuits offer one approach that promises substantial energy-efficiency benefits, but the inability to perfectly control intrinsic nanoscale defects and variability in carbon nanotubes has precluded the realization of very-large-scale integrated systems.

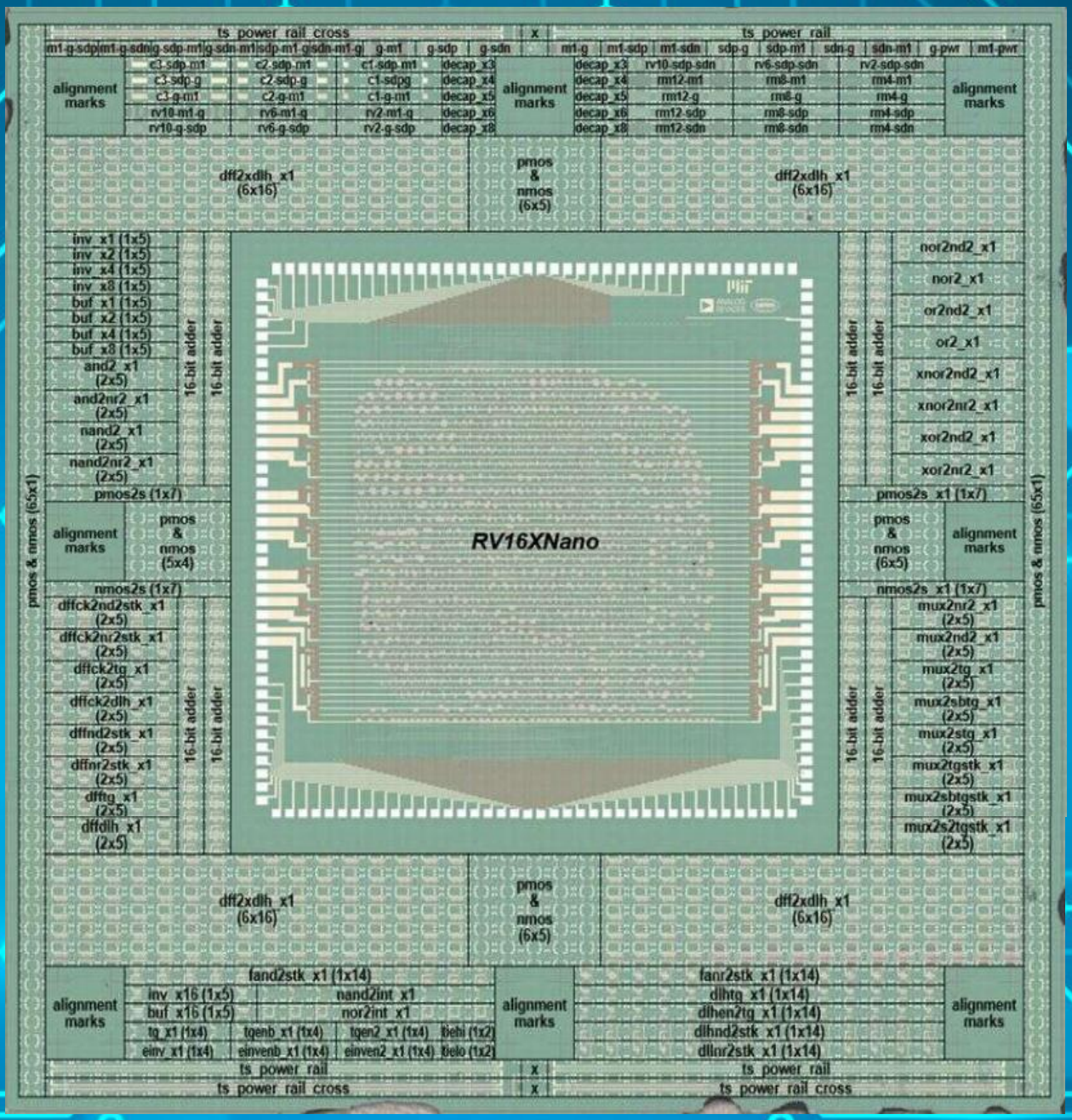
The 16-bit microprocessor is based on the RISC-V instruction set, runs standard 32-bit instructions on 16-bit data and addresses, comprises more than 14,000 complementary metal–oxide–semiconductor CNFETs and is designed and fabricated using industry-standard design flows and processes. In the paper, they propose a manufacturing methodology for carbon nanotubes, a set of combined processing and design techniques for overcoming nanoscale imperfections at macroscopic scales across full wafer substrates.

Beyond silicon, beyond Moore's Law

The industry has to date been following Moore's Law, shrinking and cramming more transistors onto chips every couple of years to carry out increasingly complex computations. But there will come a time when silicon transistors will stop shrinking and become increasingly inefficient. Research indicates CNFETs have properties that promise around 10 times the energy efficiency and far greater speeds compared to silicon. But when fabricated at scale, the transistors often come with many defects that affect performance, so they remain impractical.

The MIT researchers invented new techniques to dramatically limit defects and enable full functional control in fabricating CNFETs, using processes in traditional silicon chip foundries. Their CNFET based microprocessor based on the RISC-V open-source chip architecture was able to execute the full set of instructions accurately. It also executed a modified version of the classic "Hello, World!" program, printing out, "Hello, World! I am RV16XNano, made from CNTs."

"This is by far the most advanced chip made from any emerging nanotechnology that is promising for high-performance and energy-efficient computing," said co-author Max M. Shulaker, the Emanuel E Landsman Career Development Assistant Professor of Electrical Engineering and Computer Science (EECS) and a member of the Microsystems Technology Laboratories.



Microscopy image of a full fabricated RV16X-NANO die. The processor core is in the middle of the die, with test circuitry surrounding the perimeter (Image: Nature)

"There are limits to silicon. If we want to continue to have gains in computing, carbon nanotubes represent one of the most promising ways to overcome those limits. The paper completely re-invents how we build chips with carbon nanotubes.

https://www.eetimes.com/document.asp?doc_id=1335098

Qualcomm Sees 6 GHz Primed for 5G Industrial IoT

Commercial 5G networks and smartphones have already launched in the U.S. and around the world, but as we wait for consumer applications to surface, much industry attention is also focused on the potential of 5G for private networks and Industrial IoT.

"For industrial IoT, the increase in capacity and improvement in latency are just as, if not more, important [than speed]," Kevin Hasley, executive director of performance benchmarking for RootMetrics by IHS Markit told Wireless Week. "Lower latency will help propel the growth of smarter factories that have the ability to process more information, react quicker, and create products at a potentially cheaper cost."

Qualcomm has taken a particular interest in industrial applications using a portion of the 6 GHz band, which the FCC last year proposed opening up 1,200 megahertz of for unlicensed use, and the chip giant has been developing techniques that utilize synchronization to share spectrum more efficiently among users in the same location.

Dean Brenner SVP of Spectrum Strategy & Technology Policy at Qualcomm Brenner wrote a blog on the topic last month, and Qualcomm demoed the technology at this year's MWC in Barcelona.

It's not only the U.S., other parts of the world are also looking at the 6 GHz band, including Europe and China, considering licensed, unlicensed, or a mix of both.

In December, 3GPP approved a work item for Release 16 to define 5G for unlicensed spectrum, called 5G NR-U. In addition to support for operations in the existing unlicensed 5 GHz band, with a 5G version similar to License Assisted Access (LAA) for LTE, there will also be a standalone option using only unlicensed or shared spectrum, including the 6 GHz band.

Work on 3GPP Release 16 is expected to be finalized some time in 2020.

New 6 GHz spectrum, when combined with new technology, can solve connectivity issues in places like warehouses, factories and ports that require faster and more reliable and robust connections than current WiFi technology can provide, or mobility not offered by wired connections, Brenner told Wireless Week in an interview.

Qualcomm filed comments with the FCC in February, detailing its vision for the 6 GHz band and urging adoption of technology-neutral rules giving precedence to synchronized systems to enable 5G NR-U and next-gen WiFi 802.11be technologies.

Time-synchronized Spectrum Sharing

The technology Qualcomm is working involves a new way of sharing spectrum that is based on beam direction rather than splitting time between users. This technique is called time-synchronized sharing and enables users in the same geographic area to utilize spectrum

simultaneously, driving what Brenner described as “gigantic” efficiency gains of three or four times more throughput.

This is in contrast to how unlicensed spectrum is shared today, an asynchronous sharing method where nodes (even those on the same network) must listen first to see if a channel is in use. While the node “listens” it remains silent and is unable to use the spectrum until its turn so as not to interfere, as must other nodes sharing the channel. This method can fall short as networks become more burdened, like in industrial settings that potentially require thousands of sensors or modules.

Enter 5G, which brings fast new radios and many base station and device antennas capable of transmitting very narrow beams that are steered and highly directional, Brenner explained.

With Qualcomm’s technique, operations are time-synchronized and users know which spatial direction others are going, so everyone in a system that’s employing a synchronized approach can utilize spectrum at the same time without blocking each other.

In terms of IIoT, Brenner envisions high-performance use cases, in a factory for example, with robots and machinery that require mobility and lower, more predictable latency.

For unlicensed spectrum, time-synchronized operation would enable ultra-reliable low latency communication using Coordinated Multi-Point (CoMP), more consistent quality-of-service when sharing spectrum compared to current WiFi and LAA, and increased spectral efficiency, according to Qualcomm.

Still, there will be users who aren’t synchronized and continue asynchronous operation. In a port setting for example, or a piece of equipment in a factory that’s not part of the synchronized network, Brenner explained.

To incentivize time-synchronized sharing where possible, Qualcomm proposed partitioning a 350 megahertz portion of the 6 GHz band that would give time-synchronized nodes precedent. While still refining the rules, Brenner clarified it wouldn’t necessarily be prioritization for synchronized users, as asynchronous operations could still use the band but would first check if any synchronized nodes were already operating.

Yongbin Wei, senior director of Engineering with Wireless R&D at Qualcomm said the company envisions the small portion that gives precedence to time-synchronized systems would only be used in locations where operations really require it, in settings where certain applications can’t be handled in the traditional way.

Wei, who with colleagues is developing the new technology, said the 6 GHz band also presents a great opportunity for the WiFi ecosystem, in terms of how next-generation WiFi will take advantage of this “critical” part of the band.

Global Interest

With interest in 6 GHz spanning the globe, and varying frameworks of use being considered in different countries, Brenner explained the synchronized techniques can be employed regardless of whether 6 GHz spectrum is licensed, unlicensed, or a mix of both.

“Every major region in the world is focusing on this industrial IoT, private network, vertical use case,” Brenner said. “The interest is incredible.”

A key consideration for Qualcomm when it comes to developing 6 GHz technology is maintaining a level of commonality or harmonization of at least part of the band, no matter what region machinery is produced or operations take place in, according to Wei.

Brenner said that Qualcomm has been working and speaking with players around the world, noting particular interest from major industrial companies like Bosch, Siemens, and GE, that want better connectivity in factories and warehouses in order to drive productivity and efficiency gains, and eventually, monetary payoff.

While Qualcomm is best known for its smartphone chip business, the company also creates chips for small cells or access points, which Brenner said is the part of the business that would tie in with the 6 GHz work, alongside tech for industrial machine modules.

Another company focusing efforts on 6 GHz is Federated Wireless, an industry player that helped spearhead efforts to commercialize the shared CBRS 3.5 GHz band.

In an earlier interview last month Federated CEO Iyad Tarazi told Wireless Week that the company is putting significant work into 6 GHz and in May had a prototype device built. Tarazi said at the time that Federated was starting to put a commercial team in place and had four or five commercial partners that are “fairly significant” in this space.

A recent May filing detailed a meeting between Federated and the FCC, in which Federated said a simplified version of spectrum sharing technology used in the CBRS 3.5 GHZ band would provide an “ideal solution” for the 6 GHz band, protecting incumbents while allowing new unlicensed users to maximize access to the band quickly and efficiently.

Federated indicated it would demo the fully functional automated frequency coordination (AFC) prototype “in the very near term.”

https://www.ecnmag.com/news/2019/06/qualcomm-sees-6-ghz-primed-5g-industrial-iot

DEPARTMENT ACTIVITIES

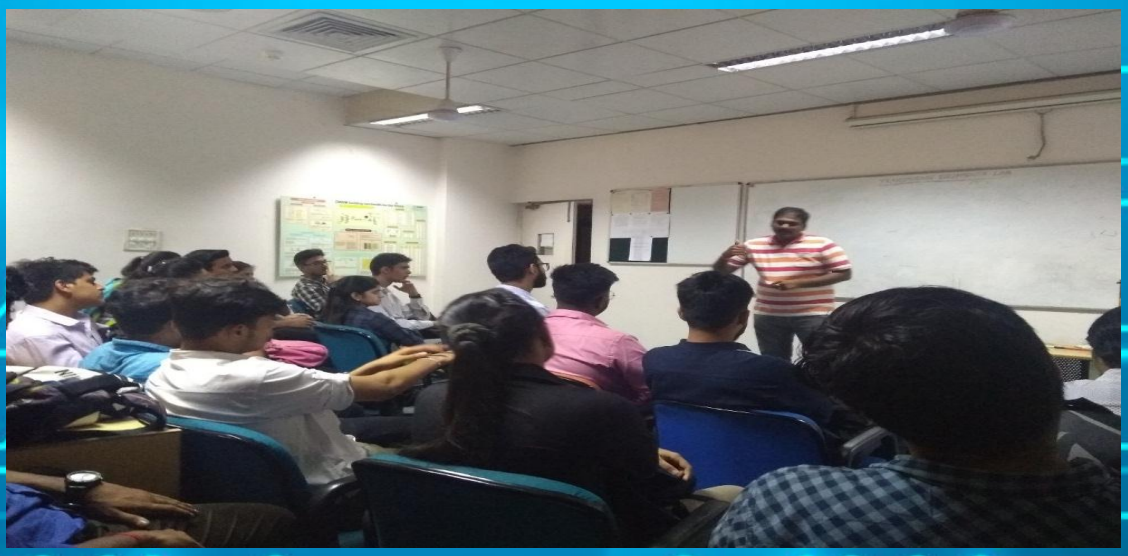
2 August' 2019

Industrial visit to MTNL, POWAI

Faculty Coordinate: 1) Sushant Gawade, 2) Sandeep Dubey

In the GSM cabin, MTNL faculty addressing to the students on different topics such as RF bands, UHF communication, 5G, WRC, TDM, FDM, UMTS 3G, LTE 4G, restrictions on Maximum power transmitted, different types of antenna.

In the transmission room, MTNL faculty addressing to the students on different topics such as Medium of transmission, Optical, Wi-Fi, Bluetooth, Radio, Satellite, Microwave, quality wired, MUX, DeMUX, MIXER.



In the Switching room, Switching to MTNL is likely to save you money! It will also allow you to reduce or eliminate roaming charges if you switch to another mobile phone operator. As mobile phone technology improves and becomes cheaper, and with increased competition among the mobile phone operators, the result is cheaper mobile phone tariffs. If you want to move from your

current mobile phone network to MTNL you will be able to keep your mobile phone number using MNP - mobile number portability.

Take advantage of the new MTNL mobile phone tariffs that are now available since the implementation of MNP. With the introduction of MNP - mobile number portability - take advantage of the fact that you will now be able to keep your existing mobile phone number

Switching Room

Broadcast Room

7 August' 2019

Industrial visit to WINAIR compressor limited

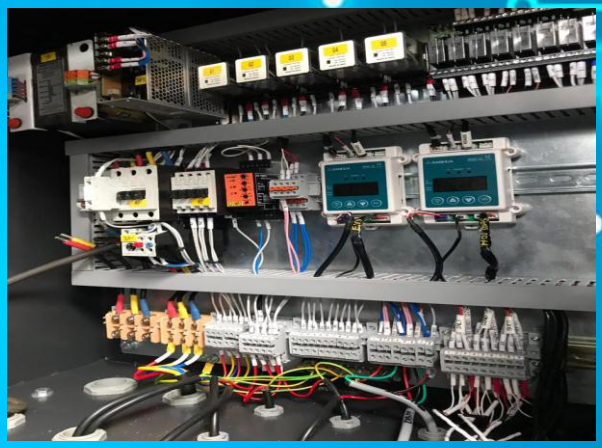
Faculty Coordinate: 1) Kaveri Sawant, 2) Harsha Rewatkar, 3) Sushil Dubey

The aim of the visit was to understand the logic and the mechanism behind the different types of air compressors. speaker explained that how does an compressor work, how does it generates pressure(of air and fluid), how it is stored in the storage tanks, at how much pressure the air or fluid in stored in the storage tanks, the crucial temperature which has to be maintained to have an desired pressure at the output.

Screw compressor.

Piston type air compressor.

Storage tanks.



Control panel for compressor

INNOVATION CELL

Session: Innovation Cell inauguration

Session Date: 9'August 2019

Session timing: 11-1

Faculty Coordinator: Sonal Borse

Innovation cell: this is joint initiative of Department of Electronics and Department of Electronics and Telecommunication Engineering.

Aim behind this is to have a tie up with the companies. Students get awareness of new/upcoming technologies and hands on experience, so they are ready for industry, also inculcating team work and leadership.

The event was commenced by our Campus director sir and the HODs by lightening the Bluetooth controlled lamp made by the innovation cell. The termination of the event was followed by an expert lecture conducted by **Mr. Rishu Jha.**

Faculties present at the event

ROBOTICS WORKSHOP IN RAVAL COLLEGE

Session: Robotics Workshop

Session Date: 10'August 2019

Faculty Coordinator: Sushant Gawade, Gaurav Shetty

The faculty coordinator Sushant Gawade and Gaurav Shetty faculty of EXTC DEPT conducted Robotics workshop session in the Raval College for 11th and 12th standard Bifocal students.

Sushant sir has given breef idea to the students about wired and wireless robo and practical session for wired nd wireless robo was conducted by Gaurav Shetty, where sir had covered about Zigbee , Bluetooth. In this session, students performed the practicals for wired as well as wireless Robo. Practicals conducted on Robo such like Zigbee, Bluetooth were performed using arduino uno programming software.

The main moto of arranging the Robotics Workshop was to create an awarness about the Robotic environment and the trending technologies in today's era.

FIRST YEAR STUDENTS VIST ELECTRONICS AND TELECOMMUNICATION DEPARTMRNT DURING INDUCTION PROGRAM

Session: Virtual Lab

Session Date: 28'August 2019

Session timing: 2-5

Faculty Coordinator: Swarali Narvekar

The first year students visit to EXTC DEPT during Induction Program. Virtual Lab Coordinator Swarali Narvekar conducted session on virtual lab even she conducted experiments session of virtual lab for BEE subject.

The session covered the different types of virtual labs available. One of the benefits of Virtual lab is instead of using different hardware and software to perform the practical, we can perform that practical with the help of Virtual lab by accessing different parameters for the input and it will be easier to obtain the output for various input combination. Even for developing Virtual labs IIT Bombay organize bootcamps which is of 8-12 days session, where students develop the specific practical or Lab for that particular subject.

In the Hands-on training students can perform the different experiments and giving feedback about the experiments performed using Virtual Labs. The Program was concluded by feedback from the students. The necessity of feedback session, if particular college wants to stay as Nodal Coordinator for Virtual Lab than that particular college has to perform at least 8000 experiments per year and for that respective practicals feedback should be generated, through those feedback only IIT Bombay will come to know that particular college has conducted how many experiments.

Movies an Engineer should watch

The movies listed below have no explicit content or usage of strong language –

Silviya Alphanso
Assistant Professor, EXTC Dept.

1. INTERSTELLAR

2 out of the 10 films listed here have been directed by Christopher Nolan. It takes more than a director to a make a movie like this. With our time on Earth coming to an end, a team of explorers undertakes the most important mission in human history; traveling beyond this galaxy to discover whether mankind has a future among the stars. There is no better sci-fi movie than this nor will ever be.

2. INCEPTION

A masterpiece, The Movie took 4 years of shooting and was worth every bit of it.
Inception is a feast for the mind and the senses, the kind of movie experience we dream of. No matter how you look at it - as a new take on the heist film, as a narrative mind game, or as a metaphor for filmmaking itself - Inception will thrill you into thinking about weird new ideas.

Christopher Nolan

3. THE MATRIX

What if virtual reality wasn't just for fun, but was being used to imprison you? That's the dilemma that faces mild-mannered computer jockey Thomas Anderson in The Matrix. Where other films are done in by the freedom offered by computer effects, The Matrix integrates them beautifully.

4. MINORITY REPORT

Tom Cruise stars as John Anderson, a Washington, D.C. detective in the year 2054. Anderson works for "Precrime" a special unit of the police department that arrests murderers before they have committed the actual crime. Precrime bases its work on the visions of three psychics or "precogs" whose prophecies of future events are never in error. For its stunning visuals and standout performances, Minority Report or at least the first three-fourths of it might just be the best movie so far.

5. I ROBOT

In the future presented in the film, humans have become exceedingly dependent on robots in their everyday lives. Robots have become more and more advanced, but each one is preprogrammed to always obey humans and to, under no circumstances, ever harm a human. So, when a scientist turns up dead and a humanoid robot is the main suspect. The movie does an excellent job in portraying how Artificial Intelligence is going to make a huge impact over the society.

6. SOURCE CODE

This is a film that feels 'smart' without desperately trying to be so. The characters are few and the settings limited, such that complex ideas can peacefully exist inside the film, without tying the narrative in knots. It won't seem like a sci-fi, as the movie proceeds towards the climax...BOOM!! The best sci-fi ever watched.

7. PREDESTINATION

Predestination chronicles the life of a Temporal Agent (Ethan Hawke) sent on an intricate series of time-travel journeys designed to prevent future killers from committing their crimes. I DARE YOU TO UNDERSTAND THE MOVIE ON THE FIRST WATCH.

7. ARRIVAL

When mysterious spacecraft touch down across the globe, an elite team--lead by expert linguist Louise Banks (Amy Adams) are brought together to investigate. As mankind teeters on the verge of global war, Banks and the team race against time for answers and to find them, she will take a chance that could threaten her life, and quite possibly humanity. More Heart melting than Science fiction.

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https://newengineer.com/insight/10-movies-engineers-will-love-1091692

Researchers Find that Mona Lisa's Smile was Non-Genuine Because of its Asymmetry

Mona Lisa's smile has intrigued humanity since famed artist Leonardo da Vinci painted the portrait in the early 16th century. A research team that includes a University of Cincinnati (UC) neurologist now says that her smile was non-genuine because of its asymmetry.

"Our results indicate that happiness is expressed only on the left side. According to some influential theories of emotion neuropsychology, we here interpreted the Mona Lisa asymmetric smile as a none genuine smile, also thought to occur when the subject lies," the authors write in their study published recently in the April 2019 issue of the journal *Cortex*. Luca Marsili, MD, PhD, an instructor in neurology and rehabilitation medicine at the UC College of Medicine, was the lead author of the paper.

Marsili and his colleagues Lucia Ricciardi, MD, PhD, with St. George's University of London, and Matteo Bologna, PhD, of the Sapienza University of Rome, asked 42 people to judge which of six basic emotions were expressed by two chimeric images of the left and right sides of Mona Lisa's smile. A chimeric image is a mirror image of, in this case, just one side of the smile. Thirty-nine, or 92.8%, of the raters indicated that the left half of the smile displayed happiness while none indicated the right side showed happiness. In assessing the right side smile, 35 said the expression was neutral, five said it was disgust and two indicated sadness.

The authors also point out that there also is no upper face muscle activation in the Mona Lisa painting. A genuine smile causes the checks to raise and muscles around the eyes to contract, and is called a Duchenne smile, after 19th century French neurologist Guillaume Duchenne. The asymmetric smile, also known as a non-Duchenne smile, "reflects a non-genuine emotion and is thought to occur when the subject lies," the authors note.

"Considering it is unlikely that a person who sits motionless for hours to be painted is able to constantly smile in genuine happiness, the simplest explanation is that the Mona Lisa asymmetric smile is the manifestation of an 'untrue enjoyment' in spite of all the efforts that Leonardo's jesters used to make in order to keep his models merry," the researchers write. "An alternative intriguing possibility, however, is that Leonardo already knew the true meaning of asymmetric smile more than three centuries before Duchenne's reports and deliberately illustrated a smile expressing a 'non-felt' emotion."

If da Vinci was aware of the meaning of an asymmetric smile, the authors speculate that Mona Lisa's smile might hide cryptic messages, for example, that this was in reality a self-portrait or that the portrait referred to a man or a dead woman.

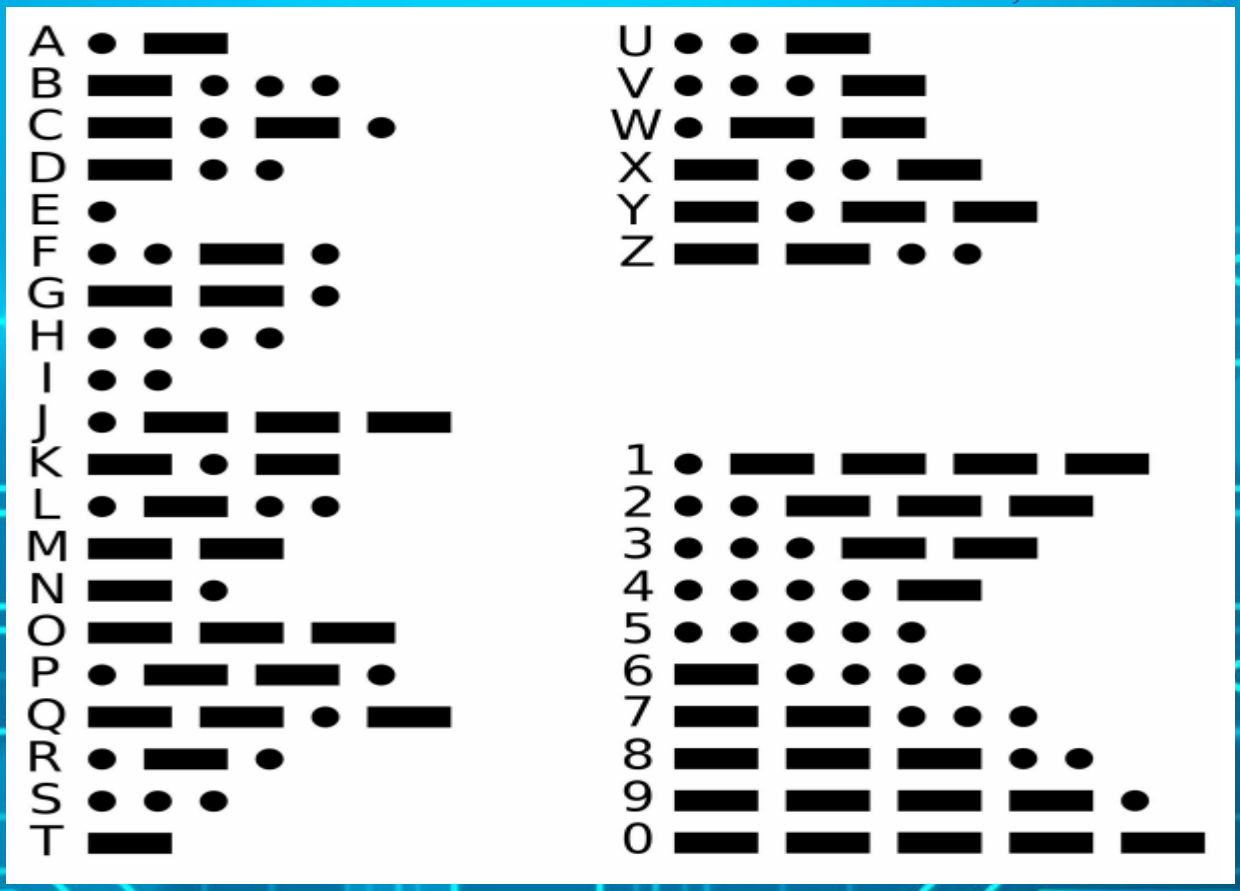
"While the Mona Lisa smile continues to attract attention of its observers, the true message it conveys remains elusive and many unsolved mysteries remain to be elucidated, perhaps via the knowledge of emotion neuropsychology," the researchers conclude.

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

https://www.ecnmag.com/news/2019/06/researchers-find-mona-lisas-smile-was-non-genuine-because-its-asymmetry

Let's Learn Morse Code

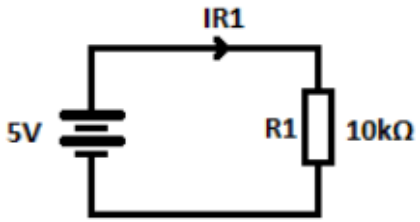
-Silviya Alphanso,
Assistant Professor, EXTC



Quiz

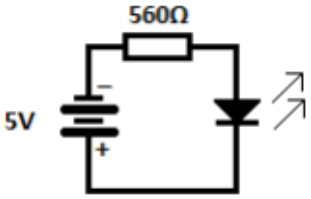
-Silviya Alphanso ,
Assistant Professor, EXTC

What is the value of IR1 (current through R1)?



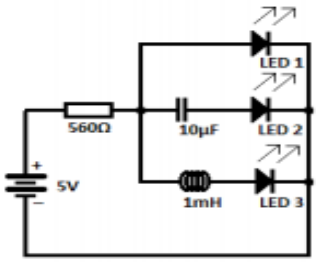
1) IR1 = 0.1mA
2) IR1 = 5mA
3) IR1 = 0.5mA
4) IR1 = 1mA

Will the LED turn on?



1) YES
2) NO

Which LED will turn ON?



1) only LED 1
2) only LED 2
3) LED 1 and LED 3
4) LED 1 and LED 2

What type of transistor is this one ?

1) Triac
2) Thyristor
3) NPN
4) PNP

A bipolar transistor usually has:

1) 2 Terminals
2) 3 Terminals
3) 4 Terminals
4) 5 Terminals

Quiz

-Silviya Alphanso,
Assistant Professor, EXTC

1. **Assertion (A):** A demultiplexer can be used as a decoder.
   Reason (R): A demultiplexer can be built by using AND gates only.

A. Both A and R are correct and R is correct explanation of A

B. Both A and R are correct but R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: Option **C**
Explanation: Demultiplexer requires NOT gates also in addition to AND gates

2. What will be output for decimal input 82?

A. 0.82 V

B. 8 V

C. 0.1 V

D. 10 mV

Answer: Option **A**
Explanation: Output for decimal input 82/(10000010) = 0.01 x 82 = 0.82 V

3. **Assertion (A):** Tristate logic is used for bus oriented systems
   Reason (R) : The outputs of a tristate logic are 0, 1 and indeterminant.

A. Both A and R are correct and R is correct explanation of A

B. Both A and R are correct but R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: Option **C**
Explanation: Outputs of tristate logic are 0, 1 and high impedance state.

4. The number of bits in ASCII is

A. 12

B. 10

C. 9

D. 7

Answer: Option **D**
Explanation: ASCII is a 7 bit code.

5. A logical expression Y = A + AB is equal to

A. Y = AB

B. Y = AB

C. Y = A + B

D. Y = A + B

Answer: Option **D**
Explanation: Y = A + A B = (A + A) (A + B) = (A + B).

6. If memory chip size is 256 x 1 bits, the number of chips required to make 1 k byte memory is

A. 8

B. 12

C. 24

D. 32

Answer: Option **D**
Explanation: (1024 x 8)/(256 x 1) = 32

7 The maximum counting range of a four stage counter using IC 74193 is

A. 0 to 1023

B. 0 to 4093

C. 0 to 65535

D. 0 to 131071

Answer: Option **C**
Explanation: IC 74193 is a divide by 16 counters.
Since 4 stages are used, counting range = 16^4 = 65536

WeLcOmE DirecT SeconD YeAr STuDEnTS to tHe OXyGEn PArloR