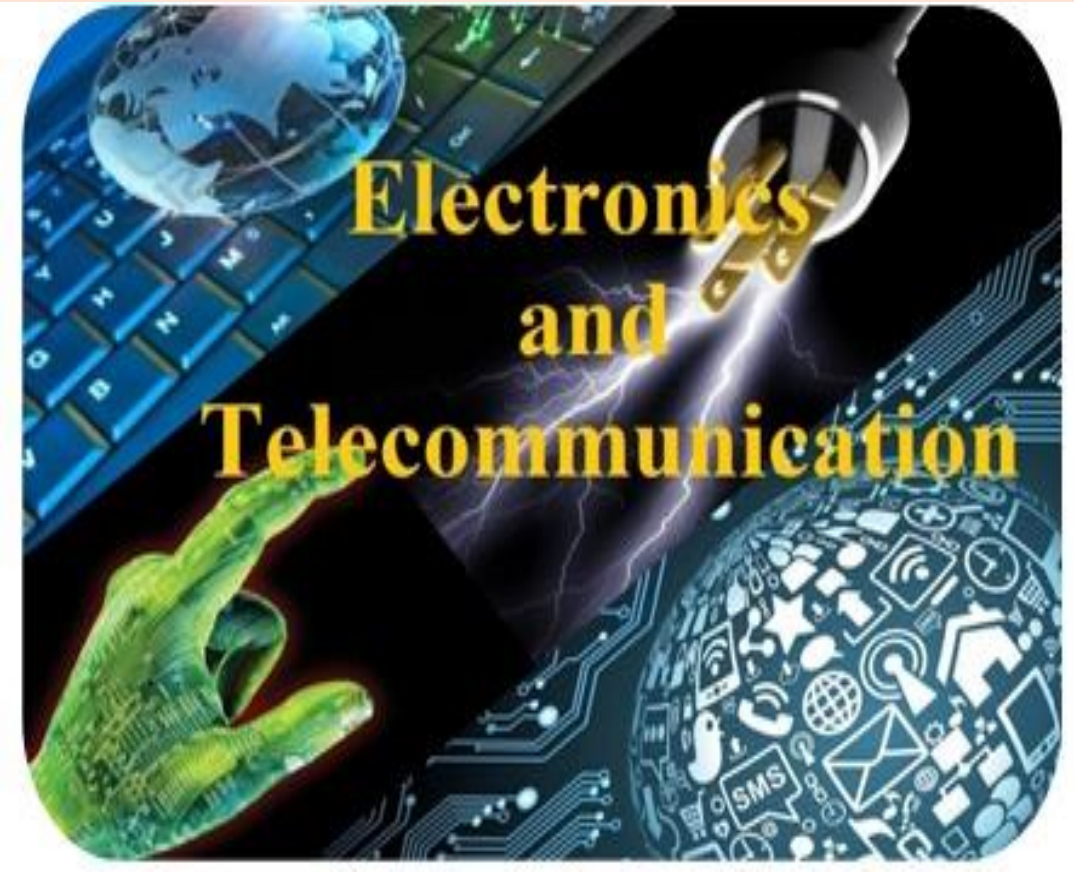
AKHIL BHARATIYA MARATHA SHIKSHAN PARISHAD'S
ANANTRAO PAWAR COLLEGE OF ENGINEERING & RESEARCH

## Department of Electronics & Telecommunication Engineering

# COMMUNICA – 2024-25



## Institute Vision

Committed to comprehensive development of students through quality technical education.

## Institute Mission

1. To  Provide state of art infrastructure that shall create ambience to encourage novel ideas, research activities and consultancy services
2. To inspire students in creation & entrepreneurship
3. To create future technocrats with intelligence, technical skills,& good ethical moral values so as to serve needs of society & industries
4. To provide healthy Teaching-Learning environment that will cultivate contemporary research activities, innovations & inventions
5. To develop Canter of excellence in technical education

## Goal of Institute

- Imparting quality engineering education
- Provide healthy environment for physical, intellectual, emotional and spiritual growth of students and staff.
- Create aesthetically sensitive, socially committed and technologically competent Engineers.

# OUR INSPIRATION

## Hon. Shri. Sharadchandra G. Pawar

President-Akhil Bharatiya Maratha Shikshan Parishad

# OUR OF VISIONARY LEADERS

**Hon. Shri. Ajit A. Pawar**
Vice President

**Hon. Shri. Shashikant S. Sutar**
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Treasurer

# Message from Principal's Desk

Dr. S. B. Thakare

Principal, APCOER

Dear Students, Faculty, and Alumni,

It is with great pride and joy that I extend my heartfelt greetings to all readers of this year's college magazine. Our institution continues to be a beacon of learning, creativity, and innovation, and this magazine is a testament to the hard work and dedication of our students and faculty.

This publication not only showcases the academic and extracurricular achievements of our students but also reflects the vibrant spirit of our college community. Each article, poem, and photograph contained within these pages represents the diverse talents and perspectives that thrive on our campus.

As we navigate an ever-changing world, I encourage each of you to continue pushing the boundaries of knowledge, to remain curious, and to embrace the challenges and opportunities that lie ahead. Our college has always been a place where ideas are born, nurtured, and brought to fruition, and I have no doubt that our students will continue to make us proud in all their future endeavors.

I would like to express my gratitude to the editorial team, the contributors, and everyone involved in the creation of this magazine. Your efforts have truly created something special that will be cherished by the entire college community.

Wishing you all success in your future endeavors and hoping that this magazine inspires you as much as it has inspired me.

AKHIL BHARATIYA MARATHA SHIKSHAN PARISHAD'S

# ANANTRAO PAWAR COLLEGE OF ENGINEERING & RESEARCH

## Department of Electronics & Telecommunication

## Department at a Glance

**S**ince the invention of transistor at Bell Laboratories in 1947, the field of electronics has grown exponentially and it continues to grow. From a simple Transistor IC, now this Digital World is witnessing million transistor ICs. Similarly, the communication engineering has progressed tremendously from the days of Alexander Graham Bell to the Internet of Things (IOT's). Together. These two areas touch upon every phase of human life.

The "ELECTRONICS AND TELECOMMUNICATION ENGINEERING" Course was started in 2012. The goal of the department is to provide the students with a techno-excellent education in the field of electronics and telecommunication. Innovation, orientation and an ever expanding base serve as a firm foundation for the edifice for the latest development in the Department of E&TC.The department employs faculty members with high academic & industrial experience. The Department is imparting the required technical and practical knowledge to the students. The Department has well equipped laboratories with the latest of kits and equipment available so as to give practical hands on experience to our students. Regular monitoring of conduct of the academic activities is carried out to ensure presence and learning outcomes of students. The equipment available in the labs is upgraded as an ongoing process so as to keep pace with the latest developments in the field of Electronics & Telecommunication Engineering. An effort is made to groom these students not only to become successful E& TC Engineers but also top notch professionals.

## VISION

To strive students for affirming quality through innovation in technical education.

## MISSION

1. To contribute in magnified education that enumerates and accomplishes brilliance in teaching learning process and innovation.

2. To create passion amongst students for contributing to research by providing industry exposure.

3. To inspire students and faculty by providing them various opportunities with industry oriented learning

4. To develop professional attitude, moral and ethical values among students for society

## PROGRAM SPECIFIC OUTCOMES (PSO)

1. Analyze and design electronic circuits and machines for a given specification and function.

2. Simulate and implement functional blocks of hardware and software designs for applications using signal processing, Communication, Computer network and Control systems.

3. Analyzing social awareness and professional ethics to have successful career and to sustain passion and zeal for real world applications as an entrepreneur.

## PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 1 - Core Knowledge - To design & develop solid foundation of E&TC engineering to solve technical problems.

PEO 2 – Placement and Higher Education - To design an ability to competent with strong technological Knowledge to solve industrial problems and make successful career in higher studies.

PEO 3 - Professional capability - To empower graduates for good communication soft skills and ethics to Work in multidisciplinary fields.

## PROGRAM OUTCOMES (PO)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

## Message from HOD's Desk

Dr. Amar B. Deshmukh

HOD, E&TC Department

Dear Students, Faculty, and Friends,

It gives me immense pleasure to extend my warm greetings to all readers of this year's college magazine. The magazine is not just a collection of articles, artwork, and achievements it is a reflection of the vibrant academic culture, creativity, and talent that thrives in our institution. Each contribution represents the dedication, passion, and hard work of our students and faculty members.

In today's rapidly changing world, education goes beyond textbooks and classrooms. It is about developing the ability to think critically, work collaboratively, and adapt to new challenges. I am proud to see our students excelling not only in academics but also in innovation, cultural activities, and community engagement. These experiences will undoubtedly prepare them to be responsible professionals and conscientious citizens.

As we move forward, let us continue to inspire each other, embrace lifelong learning, and strive for excellence in all our endeavours. I congratulate the editorial team for their tireless efforts in bringing out this edition, and I wish all our students success, happiness, and fulfilment in the journey ahead.

## Message from Magazine coordinator's Desk

Prof. Ashwini Suryawanshi

Assistant Professor, E&TC Department

Dear Readers,

It gives me immense pleasure to present to you the latest edition of our "COMMUNICA 24-25". With each issue, we strive to bring articles, E&TC department highlights and achievements that reflect the dynamic and ever-evolving world of engineering and technology.

We are proud to feature contributions from students, faculty, and industry professionals, each offering a unique perspective and a wealth of knowledge.

Our sincere thanks to all contributors, reviewers, and editorial members for their dedication and hard work in curating this issue. I would also like to extend heartfelt gratitude to our readers for your continued support and encouragement your feedback drives us to raise the bar with every edition.

We hope you find this issue informative, inspiring, and intellectually enriching.

Happy Reading!

## Faculty List

| Sr. No. | Name of the Faculty | Specialization | Designation |
|---|---|---|---|
| 1 | Dr. Amar. B. Deshmukh | Image & Video Processing | Head of Department |
| 2 | Mr. Sudarshan V. Natu | Electronics and Telecommunication | Assistant Professor |
| 3 | Prof. Sharad S. Jagtap | VLSI and Embedded System | Assistant Professor |
| 4 | Prof. Vaishali V. Bhimte | VLSI Design | Assistant Professor |
| 5 | Prof. Ashwini A. Suryawanshi | Electronics and Communication | Assistant Professor |
| 6 | Prof. Prachi R. Upasani | VLSI Design | Assistant Professor |
| 7 | Prof. Kishor P. Jadhav | Electromagnetic, Wireless Communication | Assistant Professor |
| 8 | Prof. Nikita R. Bhagat | Digital Systems | Assistant Professor |
| 9 | Prof. Tushar Zombade | Wireless Communication | Assistant Professor |
| 10 | Prof. Anil M. Naikwade | Embedded System, Basic Electronics. | Assistant Professor |
| 11 | Prof. Prachi Admane | Digital Electronics, Communication | Assistant Professor |

## Supporting Staff

| Sr. No. | Name of the Faculty | Designation |
|---|---|---|
| 1. | Mrs. Ashwini R. Joshi | Lab Assistant |
| 2. | Mr. Kunal A. Gaikwad | Lab Assistant |
| 3. | Mr. Santosh G. Bhondve | Peon |

# Articles

| Sr.No | Name Of The Article | Article Author |
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| 2 | AI Co-Pilot | Prof. Vaishali Bhimte |
| 3 | Opportunities for Electronics Engineering Students | Prof. Sharad Jagatp |
| 4 | A Hybrid Deep Learning Approach for Fundus Image Segmentation | Prof. Ashwini Suryawanshi |
| 5 | System-in-Package (SiP) and 3D Integrated Circuit (3D IC) Technology: The Future of Chip Integration | Prof. Nikita Bhagat |
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| 11 | Smart Antennas Using Machine Learning Algorithms | Miss. Nikita Ghawad |
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# Upcoming Semiconductor Jobs in India

**Introduction:-**

India is witnessing a transformational phase in technology-driven industries, and at the center of this evolution lies the semiconductor sector. With growing demand for electronics, smart devices, electric vehicles, and AI-powered technologies, semiconductors have become the "brain" behind every modern system. The government's strong push to develop a domestic semiconductor ecosystem has created a promising landscape for emerging career opportunities, especially for engineering graduates.

National Initiatives Driving the Growth

The Indian government launched the **Semicon India Programme** with an investment of Rs. 76,000 crore to develop semiconductor fabrication, design, and display manufacturing units in the country. Key initiatives under this program include:

- **Setting up fabrication (fab) plants** through partnerships with global players.
- **Design Linked Incentive (DLI) Scheme** to promote local chip design startups.
- **Establishment of Centers of Excellence (CoEs)** in collaboration with leading academic institutions.

These efforts are expected to create 1 lakh+ new jobs in the coming years across various domains in the semiconductor industry.

Semiconductor Industry: Job Landscape

The semiconductor value chain includes multiple domains, and each offers unique employment opportunities. Some of the most in-demand job profiles include:

1. Chip Design Engineer:-
   - Focus: VLSI, ASIC, FPGA, and SoC design.
   - Tools: Cadence, Synopsys, Mentor Graphics.
2. Process and Fabrication Engineer:-
   - Involves: Wafer fabrication, lithography, cleanroom operations.
3. Packaging & Testing Engineer:-
   - Ensures chip reliability, performance testing, and yield optimization.
4. Embedded Systems Developer
   - Integrates hardware with software for chip-based systems.
5. EDA Tool Developer & Validation Engineer
   - Develops and validates Electronic Design Automation tools.
6. Software Engineers (for hardware-software co-design)
   - Write firmware and low-level drivers for chips.

Top Companies Hiring in India

Several national and international companies are expanding their operations in India:

- Tata Electronics
- Vedanta–Foxconn JV
- Micron Technology (Gujarat)
- Intel India
- Qualcomm
- Texas Instruments
- Lam Research
- MediaTek
- Synopsys
- Samsung Semiconductors

Preparing Students for Semiconductor Careers:-

For engineering students, especially from Electronics, Electrical, Instrumentation, and Computer branches, this is the right time to upskill and align with industry needs.

Recommended Preparation:

- **Certifications**: VLSI Design, Digital Electronics, Semiconductor Physics.
- **Tools**: Learn industry tools like Verilog, VHDL, Cadence, Xilinx.
- **Projects**: Take up mini-projects on FPGA, microcontrollers, IoT applications.
- **Online Learning**: Enroll in NPTEL, Coursera, or Udemy courses related to VLSI, RTL design, or embedded systems.
- **Internships**: Seek internships at design houses, R&D labs, or EDA tool companies.

Future Outlook

India is rapidly shifting from being a consumer of semiconductors to a producer and innovator. With geopolitical factors prompting global companies to diversify chip manufacturing beyond China, India is becoming a preferred destination for talent and investment.

For our students, this represents a once-in-a-generation opportunity to contribute to a strategic sector that will define the technological and economic progress of the country.

**Dr. Amar Deshmukh**
**HOD, E&TC**

## AI Co-Pilot

An AI Co-Pilot is an intelligent assistant embedded within software platforms that supports users by providing real-time suggestions, automating tasks, and enhancing productivity through contextual awareness. Unlike traditional automation, co-pilots are interactive, adaptive, and powered by large language models (LLMs), machine learning, and naturallanguage processing (NLP).Co-pilots can do Draft and edit documents, Generate code or debug software, Create visual designs and slide decks, Summarize meetings or customer interactions and Interpret data and suggest next steps. Key Players and Technologies are Microsoft 365 Copilot, GitHub Copilot, Google Duet AI, Adobe Firefly and Creative Co-Pilots. AI co-pilots rely on foundational AI models, often fine-tuned for specific tasks.
These models understand natural language inputs.

- Access contextual data (files, emails, calendar).
- Provide intelligent responses or actions in real-time.
- Learn from user behavior to personalize interactions.

**Prof. Vaishali Bhimte**

**Assistant Professor, E&TC Department**

## Opportunities for Electronics Engineering Students

Electronics engineering is a foundational and ever-evolving field that offers an extensive range of opportunities for students, both in traditional industries and in cutting-edge technological domains. As the world becomes increasingly digitized and interconnected, the role of electronics engineers is expanding beyond conventional boundaries. Students specializing in this discipline can pursue careers in core sectors such as consumer electronics, telecommunications, automotive, aerospace, and manufacturing, where they are involved in the design, development, testing, and maintenance of electronic hardware and systems. Job roles in these areas include hardware design engineer, embedded systems developer, VLSI design engineer, and circuit design specialist, all of which provide a strong technical base and opportunities for long-term career growth.

Beyond the core sectors, electronics engineering has a significant presence in emerging technologies that are shaping the future. The integration of electronics with the Internet of Things (IoT), artificial intelligence (AI), machine learning (ML), and automation is creating new job profiles that demand a blend of hardware and software expertise. Electronics engineers are now designing smart systems for healthcare, agriculture, home automation, and industrial applications, contributing to innovations such as wearable health monitors, autonomous robots, and AI-driven consumer devices. Similarly, the push towards sustainable development has opened up roles in

renewable energy systems, where engineers work on solar inverters, battery management systems, and energy-efficient devices. The advent of 5G technology and advancements in wireless communication also provide new challenges and opportunities in areas like antenna design, signal processing, and high-speed networking.

Electronics engineering also serves as a gateway to interdisciplinary careers. With the increasing overlap between electronics and computer science, many students transition into roles involving software development, data science, Cybersecurity, and IT infrastructure. In the biomedical sector, electronics engineers contribute to the development of diagnostic devices, patient monitoring systems, and medical imaging equipment. The field of robotics combines mechanical, electrical, and electronic systems, and electronics engineers play a key role in building intelligent machines for industries ranging from manufacturing to defence.

Entrepreneurship is an exciting and growing opportunity for electronics engineering students. With the availability of low-cost microcontrollers, sensors, development boards, and prototyping platforms such as Arduino and Raspberry Pi, students can create innovative products and launch their own start-ups. Government initiatives, innovation hubs, and technology incubators are increasingly supporting such entrepreneurial ventures, providing funding, mentorship, and infrastructure to transform ideas into viable businesses.

In the public sector, electronics engineers have access to numerous career opportunities through competitive exams and recruitment drives. Organizations like ISRO, DRDO, BHEL, BEL, and other public sector undertakings (PSUs) offer roles in research, development, and infrastructure projects that contribute to national security and technological self-reliance. Additionally, services such as the Indian Engineering Services (IES) offer prestigious roles in central government departments, telecommunications, and energy sectors, ensuring job security and societal impact.

In summary, electronics engineering is a dynamic and multidisciplinary field that empowers students with the skills to contribute to a rapidly transforming world. Whether one's interest lies in industrial application, research innovation, cross-disciplinary exploration, or entrepreneurship, the opportunities are both vast and diverse. As technology continues to evolve, electronics engineers will remain at the forefront of progress, driving innovation and solving some of the world’s most pressing challenges.

**Prof. Sharad Jagtap**

**Assistant Professor, E&TC Department**

# A Hybrid Deep Learning Approach for Fundus Image Segmentation

Early and accurate detection of retinal diseases such as diabetic retinopathy, glaucoma, and age-related macular degeneration is critical for preventing vision loss. One of the key steps in this process is fundus image segmentation—the automatic identification of anatomical structures like blood vessels, the optic disc, and lesions in retinal images. Traditional segmentation methods often struggle with low-contrast images, irregular vessel structures, and pathological variations. That's where hybrid deep learning approaches come in—combining the strengths of multiple models to improve segmentation accuracy and robustness.

Fundus Image Segmentation

Fundus imaging captures the back of the eye, including the retina, optic disc, and blood vessels. Segmenting these structures allows for Vessel analysis (important for diabetic retinopathy),Optic disc and cup segmentation (used for glaucoma screening),Lesion detection (such as microaneurysms and hemorrhages).

A hybrid approach typically merges different deep learning techniques to take advantage of their unique capabilities such as

1. Convolutional Neural Networks (CNNs)

2. Recurrent Neural Networks (RNNs)

3. Attention Mechanisms

4. Generative Adversarial Networks (GANs).

Hybrid deep learning models are being integrated into clinical decision support systems for ophthalmology. Tools like Google’s DeepMind, IDx-DR, and open-source projects are pushing the boundaries of AI-assisted eye care.

The future lies in real-time fundus analysis on portable devices, explainable AI for clinical trust, and large-scale screening programs using AI-driven segmentation. By combining multiple deep learning techniques, hybrid models are paving the way for smarter, faster, and more accurate eye disease diagnosis.

**Prof. Ashwini Suryawanshi**

**Assistant Professor, E&TC Department**

## System-in-Package (SiP) and 3D Integrated Circuit (3D IC) Technology: The Future of Chip Integration

As digital devices become smaller, faster, and more energy-efficient, traditional methods of integrating electronic components have reached their physical and performance limits. To overcome these challenges, System-in-Package (SiP) and 3D Integrated Circuit (3D IC) technologies have emerged as powerful solutions. These technologies allow multiple components to be packed tightly together, improving performance, reducing size, and enabling new applications in fields like AI, IoT, mobile computing, and high-performance computing. System-in-Package (SiP) is an advanced packaging technology that integrates multiple electronic components—such as processors, memory, sensors, and passive devices—into a single compact module. 3D Integrated Circuits (3D ICs) involve stacking multiple silicon dies vertically and interconnecting them using Through-Silicon Vias (TSVs). Unlike SiP, which connects dies side-by-side, 3D ICs create a single, monolithic system with high integration density. System-in-Package and 3D IC technologies represent a major leap in electronics integration, enabling powerful, compact, and energy-efficient systems. As the demand for high-speed, low-latency computing grows—especially in AI, 5G, and edge computing—these technologies are set to become standard in next-generation electronic devices.

**Prof. Nikita R. Bhagat**

**Assistant Professor, E&TC Department**

## The Essence of VLSI Design

In today's digital era, almost every electronic device we use from smartphones to satellites relies on microchips designed using Very-Large-Scale Integration (VLSI) technology. VLSI design enables engineers to pack billions of transistors onto a single chip, dramatically improving performance, reducing size, and lowering cost. This integration revolution has been at the heart of the semiconductor industry for decades, and its influence continues to grow with the rise of Artificial Intelligence (AI), 5G communications, and the Internet of Things (IoT). India has long been a supplier of top semiconductor talent globally, with research-focused infrastructure. The India Semiconductor Mission (ISM) aims to establish a commercial semiconductor manufacturing ecosystem, necessitating workforce development at multiple levels, operators, technicians, engineers, and researchers. VLSI design is not just about packing more transistors into a chip it's about unlocking possibilities. From enabling AI breakthroughs to making medical devices smarter, it is shaping the way we live, work, and connect. For students, researchers, and engineers, this is a

field where innovation meets impact, and where the next great leap in technology is just a design away.

**Prof. Anil M. Naikwade**
**Assistant Professor, E&TC Department**

## Semiconductor Trends Shaping: An Emerging Application Areas Driving and Modern Circuit Design Trends

The semiconductor industry stands at the forefront of innovation and change. From the smartphones in our pockets to the autonomous vehicles of the future, semiconductors are the critical building blocks that drive progress across various sectors. Understanding the trends shaping this industry is essential for grasping the future of technology

The semiconductor landscape is influenced by several key drivers, including the explosive growth of artificial intelligence and cloud infrastructure. Additionally, emerging applications in consumer electronics and automotive technology are accelerating demand for more advanced chip solutions. These shifts also come with unique challenges in supply chain dynamics, necessitating a closer look at geopolitical influences, weather-related disruptions, and cyclical demand management.

Competition is heating up between major semiconductor companies. Giants like Samsung Semiconductor, Micron Technology, and Texas Instruments are leading the pack. They're focusing on increasing production of high-bandwidth memory and chips for electric vehicles. This sector is poised for double-digit growth. Consumers and industries like automotive and consumer electronics are boosting center demand for these technologies.

As we explore Semiconductor Trends, we'll delve into innovations in chip technology, sustainability initiatives, and the changing competitive landscape. By examining these elements, we can gain a clearer understanding of the trajectory the semiconductor industry is on, and the implications for businesses and consumers.

**Prof. Prachi S. Admane**
**Assistant Professor, E & TC Department**

# Green Electronics: Powering a Sustainable Future in the Digital Age

In a world where technology evolves at lightning speed, our dependence on electronic devices has become a double-edged sword. While gadgets like smartphones, laptops, and smart appliances have transformed the way we live and work, they also come with an often-overlooked environmental price tag.

Despite their shiny design and smart capabilities, today's electronics can be incredibly harmful to the environment. Over 50 million metric tons of e-waste are produced globally each year, most of it improperly discarded. Green electronics is a growing movement that's reshaping how technology is designed, built, and disposed of to protect our planet. Green electronics refer to electronic products developed with environmental sustainability in mind. This means minimizing their carbon footprint, using safer materials, improving energy efficiency, and ensuring responsible end-of-life recycling.

Some key features of green electronics include use of Eco-friendly materials (biodegradable plastics, recycled metals), Energy-efficient components that reduce power consumption Repairable and upgradeable designs to extend product lifespan and Sustainable packaging and reduced e-waste during manufacturing

The future of technology doesn't have to come at the planet's expense. Green electronics offer a vision where innovation and sustainability go hand in hand. As more consumers, companies, and policymakers embrace eco-conscious practices, we can build a digital world that's as smart as it is sustainable. Because the best technology is the kind that powers progress—without costing the Earth.

**Prof. Shridevi Kumbhare**

**E & TC Department**

# VLSI and Chip Design Trends in India

The global semiconductor industry is witnessing a surge in demand, driven by technologies like 5G, AI, IoT, and electric vehicles. At the heart of these innovations is VLSI (Very Large Scale Integration) the process of integrating millions of transistors onto a single chip. India, traditionally a consumer of chips, is now emerging as a growing player in chip design and semiconductor innovation.

VLSI involves designing integrated circuits (ICs) by combining thousands of transistors on a microchip. These chips power everything from smartphones and laptops to satellites and pacemakers. VLSI design is typically divided into Front-end design and Back-end design. Front-end design include RTL design, verification, and synthesis. Back-end design includes Physical design, layout, and testing

India houses R&D centers for global semiconductor giants like Intel, Qualcomm, AMD, Texas Instruments, and MediaTek. These centers handle cutting-edge chip design for global products. Meanwhile, Indian companies like Tata Elxsi, Sankalp Semiconductor, and Saankhya Labs are innovating in custom ASIC, SoC, and RF designs.

The Indian government has launched multiple initiatives to position India as a global semiconductor hub: Semicon India Programme (₹76,000 crore) – Incentives for setting up fabs and design units. Design Linked Incentive (DLI) Scheme – Supports domestic design startups with funding and mentorship. India Semiconductor Mission (ISM) – Aims to build a sustainable chip ecosystem in India.These schemes are attracting global investments, like Micron’s semiconductor plant in Gujarat and Tata's chip packaging units.AI & Edge Computing ,Low Power Design ,Chiplets & Heterogeneous Integration, Open-Source Hardware ,EDA & Simulation Tools

Top Indian institutes like IITs, IIITs, and NITs are focusing on VLSI research and offering specialized M.Tech programs. The Chips to Startup (C2S) initiative is also nurturing thousands of design engineers across India. With strong government support, a skilled talent pool, and rising global demand, India is poised to become a major global hub for chip design. The next decade could see India not just designing chips for the world—but manufacturing them too. VLSI is not just technology—it’s a strategic enabler for digital sovereignty. India is ready to rise.

**Miss. Komal Mane**

**BE E&TC**

## Low-Power Design Techniques for Embedded Systems

In today's connected world, embedded systems are everywhere from smart watches and medical devices to autonomous drones and IoT sensors. A key challenge in these systems is power consumption. Devices often run on batteries and are expected to operate efficiently for days, months, or even years without replacement. This makes low-power design not just desirable but essential.

Most embedded systems work under strict power constraints. For example IoT sensors in remote locations need to last for years on a single battery. Wearable tech demands compact form factors and high energy efficiency. Medical implants require ultra-low power to avoid frequent surgeries. Reducing power consumption improves battery life, reduces heat generation, and enables smaller, lighter devices.

Low-Power Design Techniques

1. Dynamic Power Management (DPM)

Turn off or reduce power to unused components. Microcontrollers often have sleep modes, deep sleep, or shutdown modes to save energy during idle times.

2. Dynamic Voltage and Frequency Scaling (DVFS)

Adjust the processor's voltage and clock frequency based on workload. Lower voltage = lower dynamic power ($P \propto V^2f$).

With the rise of battery-less devices, energy harvesting, and always-on sensors, low-power design is no longer just an optimization it's a design requirement. Future innovations will combine AI, ultra-low-power silicon, and smart firmware to push energy efficiency even further.

In embedded systems, power isn't just performance its survival. Designing for low power means designing for the future.

**Mr. Harshal More**

**BE E&TC**

## Smart Antennas Using Machine Learning Algorithms

In an era dominated by wireless communication, the demand for high-speed, interference-free, and efficient data transmission has never been greater. Smart antennas, also known as adaptive or intelligent antennas, are rapidly transforming traditional communication systems by dynamically optimizing signal transmission and reception. With the integration of Machine Learning (ML), these systems are becoming even smarter—capable of learning from their environment and adapting in real-time.

What Are Smart Antennas?
Smart antennas use multiple antenna elements and advanced signal processing techniques to steer beams, suppress interference, and enhance signal quality. Unlike traditional fixed antennas, smart antennas can dynamically adapt their radiation patterns, focusing energy toward the intended user and away from noise or interference sources.

Role of Machine Learning
Machine Learning algorithms bring intelligence to these systems by learning patterns from data, enabling real-time decision-making and self-optimization. Common ML applications in smart antennas include: beamforming Optimization,Interference Mitigation,User Localization and Spectrum Sensing in Cognitive Radio
Techniques such as K-Nearest Neighbors (KNN), Support Vector Machines (SVM), and Neural Networks are widely used to enhance the performance of smart antennas in complex, dynamic environments.

Applications
5G and beyond for massive MIMO systems
Autonomous vehicles for precise vehicle-to-vehicle communication
IoT networks to manage dense device environments
Defense and satellite systems for secure, directional communication

Future Scope
The convergence of AI, ML, and antenna engineering is opening new frontiers in wireless communication. As algorithms become more efficient and hardware continues to evolve, smart antennas will play a crucial role in 6G, terahertz communication, and space-based networks.

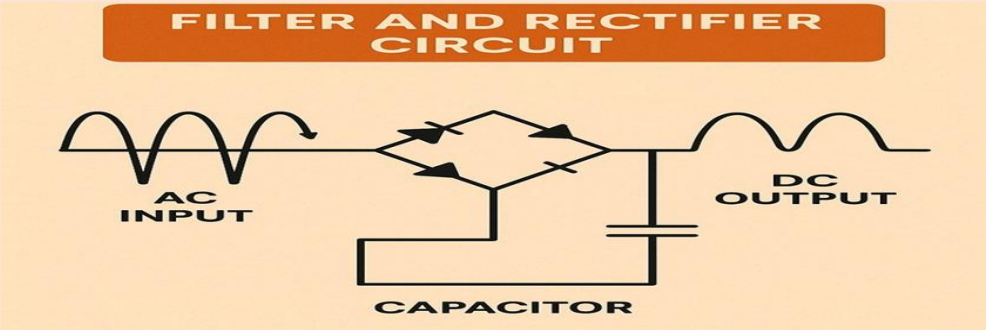
**Miss. Nikita Ghawad**

**BE E&TC**

## Demystifying Filter and Rectifier Circuits in Modern Electronics

Filter and rectifier circuits are indispensable building blocks in electronic systems. Rectifiers convert alternating current (AC) into unidirectional direct current (DC), laying the groundwork for powering sensitive electronic components. Filters, typically employing capacitors or inductors, then smooth out voltage ripples to ensure a stable and noise-free DC output.

This duo plays a pivotal role in everything from mobile chargers to industrial control units-quietly powering our digital world with precision.




**Mr. Kasushal Londhe**

**TE E&TC**

## Multiplexer- The Smart Selector in Electronics

A multiplexer, or MUX, is an electronic circuit that takes several input signals and sends only one of them to the output at a time. The choice of which signal passes is made by control signals, called select lines. Inside, logic gates like AND, OR, and NOT work together so that only the selected input reaches the output.

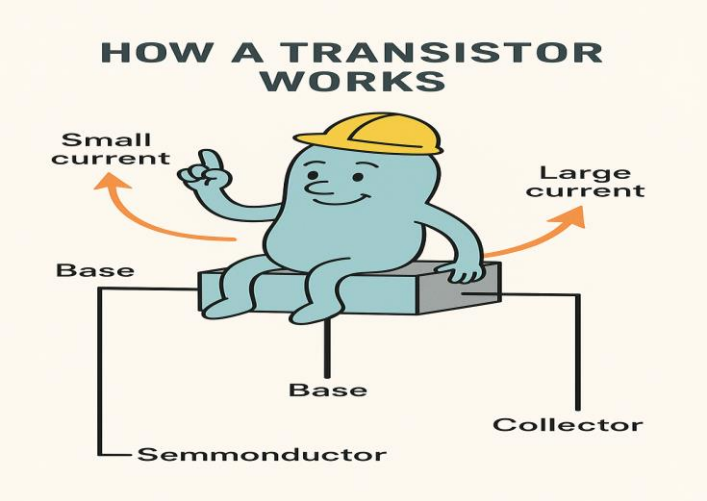
We need multiplexers because they reduce the number of data paths, save hardware, cut costs, and make circuits simpler. Instead of having separate lines for every signal, a MUX allows multiple signals to share the same line—just at different times.

In telecommunications, multiplexers are crucial. They allow many conversations, video streams, or data signals to travel over the same cable or frequency without mixing up. From mobile networks and satellite links to computer processors and digital systems, multiplexers quietly manage the smooth flow of information, making our devices faster, smaller, and more efficient.

**Mr. Harshwardhan Nalgude**

**TE E&TC**

# Transistor–The Tiny Switch That Changed the World




A transistor is a small semiconductor device that can amplify signals or act as an electronic switch. Made mostly from materials like silicon, it has three parts—Emitter, Base, and Collector. By controlling a small current at the base, a transistor can control a much larger current between the collector and emitter. This ability makes it the backbone of modern electronics.

We need transistors because they make circuits smaller, faster, and more reliable than the old vacuum tubes they replaced. In telecommunications, transistors amplify weak signals so they can travel long distances without loss. They also work as switches in digital devices, allowing computers, smartphones, and networking equipment to process billions of operations per second.

From radios and TVs to satellites and microprocessors, transistors are everywhere. They're the reason we can fit the power of a room-sized computer into our pocket today—proving that sometimes, the smallest components make the biggest difference.

**Miss. Akshata Manwadkar**

**TE E&TC**

# Mind-Reading Robots: Bridging Brain and Machine with BCI and AI

## Introduction

Controlling machines with nothing but your thoughts—once a concept rooted in science fiction—is now a remarkable reality, thanks to advances in Brain-Computer Interface (BCI) technology. BCIs establish a direct line of communication between the human brain and external devices, enabling users to control robots, prosthetics, and digital systems without any physical movement. This extraordinary breakthrough has emerged from the convergence of neuroscience, artificial intelligence (AI), and robotics. At the forefront of this evolution are "mind-reading robots"—intelligent systems that decode brain activity and translate it into purposeful action.

What is a BCI?

A Brain-Computer Interface (BCI) is a system that interprets neural signals from the brain and converts them into commands that can control external devices. Unlike traditional communication pathways, BCIs bypass the body's muscular system entirely, creating new opportunities for individuals with mobility impairments or neurological conditions. BCIs come in various forms depending on how the brain signals are collected: invasive systems use electrodes implanted directly into the brain for high precision; semi-invasive approaches involve placing electrodes on the brain's surface; and non-invasive methods, such as EEG (electroencephalography), use scalp electrodes to detect electrical activity with minimal risk and discomfort. Each type offers different trade-offs between safety, signal clarity, and resolution.

## Neurons: The Building Blocks of Thought

To understand how BCIs work, it's essential to understand the role of neurons—the specialized cells responsible for transmitting information in the brain. Each neuron communicates through a combination of electrical impulses and chemical signals. When a neuron is activated, it generates an action potential, an electrical signal that travels down its axon. At the junction between neurons, called the synapse, neurotransmitters carry the message across to the next neuron, either exciting or inhibiting its activity. These interconnected networks of neurons produce complex patterns of activity that reflect our thoughts, emotions, intentions, and sensory experiences. BCIs aim to detect and interpret these patterns in real time.

## From Brainwaves to Robotic Action

When large groups of neurons fire together, they generate electrical fields that can be measured using various technologies. EEG, one of the most widely used non-invasive methods, places electrodes on the scalp to detect these electrical patterns. Other methods include electrocorticography (ECoG), which places sensors directly on the brain's surface, and intracortical implants that penetrate brain tissue for even higher-resolution signals. Regardless of the method, the process begins with capturing raw neural data. These signals are then amplified, digitized, and passed through complex algorithms that search for meaningful patterns corresponding to specific thoughts or intentions—like imagining hand movement or focusing attention on a visual target.

## AI: The Mind's Translator

The true magic of mind-reading robots lies in artificial intelligence. The brain's electrical signals are highly complex, noisy, and unique to each individual. Traditional software cannot keep up with this variability. This is where machine learning, especially deep learning, plays a vital role. AI systems are trained on labelled neural data, learning to associate particular brain patterns with specific commands or actions. For instance, a neural pattern linked to imagining a left-hand movement might be mapped to a "move left" command in a robotic arm. Over time, the AI refines its accuracy through feedback and additional data, allowing for real-time, personalized control. In essence, AI acts as the brain's translator, bridging biology and digital logic.

The electrical activity detected by EEG appears as rhythmic waves, commonly known as brainwaves. These are categorized by their frequency and are linked to different mental states. Delta waves (0.5–4 Hz) dominate during deep, dreamless sleep, while theta waves (4–8 Hz) are present in light sleep or deep meditation. Alpha waves (8–13 Hz) appear during calm, relaxed states and are often used in motor-related BCI applications. Beta waves (12–30 Hz) indicate focused mental activity and alertness, while gamma waves (30–100 Hz) are associated with higher-level cognitive processes such as learning and memory. BCIs often rely on detecting changes in alpha and beta waves to interpret motor intentions and attention shifts.

## The Future of BCI and Mind-Controlled Technology

Powered by AI, BCIs hold the potential to revolutionize healthcare by enabling paralyzed individuals to control wheelchairs, robotic limbs, and communication devices purely through neural signals. For patients with Locked-in Syndrome, BCIs provide essential communication pathways. Advances in prosthetics are making limbs more responsive and lifelike, while thought-controlled exoskeletons offer hope for restoring mobility in spinal injury patients. Beyond clinical applications, BCIs are set to redefine human-computer interaction, facilitating intuitive control of virtual environments, robotics, and complex machinery.

This rapid development also enhances real-time brain monitoring, deepening neuroscience insights. However, the expansion of BCIs raises critical ethical issues such as safeguarding mental privacy, ensuring data security, and preserving cognitive autonomy that demand robust frameworks to govern their safe and ethical use.

**Mr. Mohit V. Nagarkar**

**SE, E&TC**

# Events

## Department at a Glance

Events Conducted and Participated by the Department Students and Faculty Members:



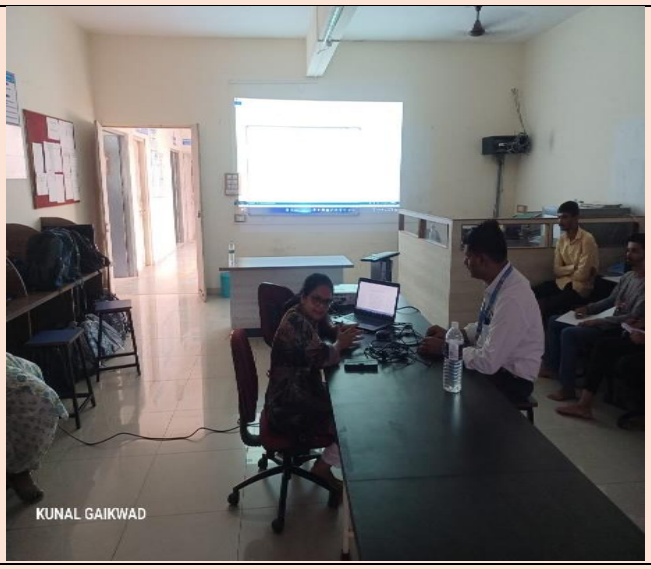
E&TC Department DAB Meeting conducted on 27/07/2024


IEEE Session conducted on 27/08/2024


Dr. Meenakshi Patil, SKNCOE Vadgaon, Budruk, Pune Visits E&TC Department on 05/09/2024



Carrier Guidance & Industry Need Seminar conducted on 23/09/2024

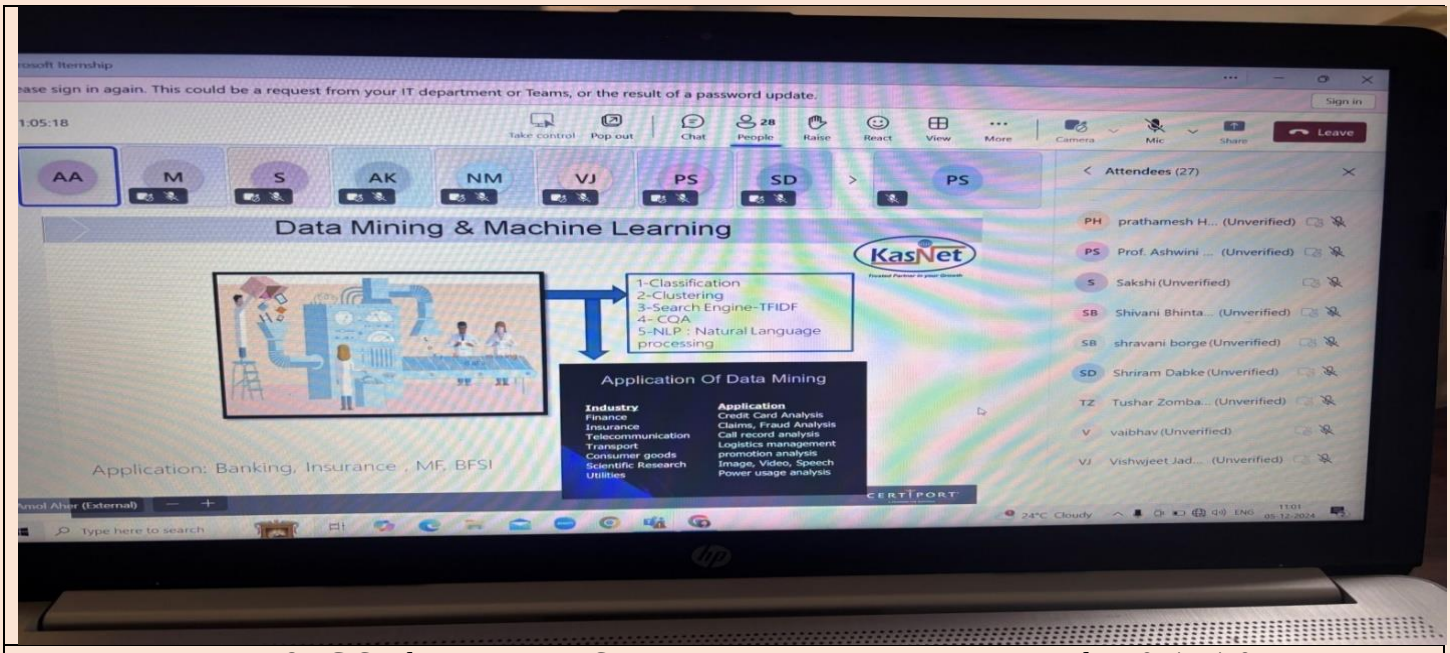

Guest Session conducted for Cloud Computing subject for BE E&TC on 07/10/2024



Real Word Interfacing with 18FXXXX of the subject Microcontroller TE E&TC conducted on 16/10/2024

Industrial Visit of our E&TC Department Students was planned to CDAC, Hinjewadi, Pune on 24/10/2024


To bridge the gap between Parents and Teachers, Parent Teacher Meeting(SEM-I) was conducted on 29/10/2024




For TE E&TC Students INTERNSHIP awareness session was organised on 05/12/2024



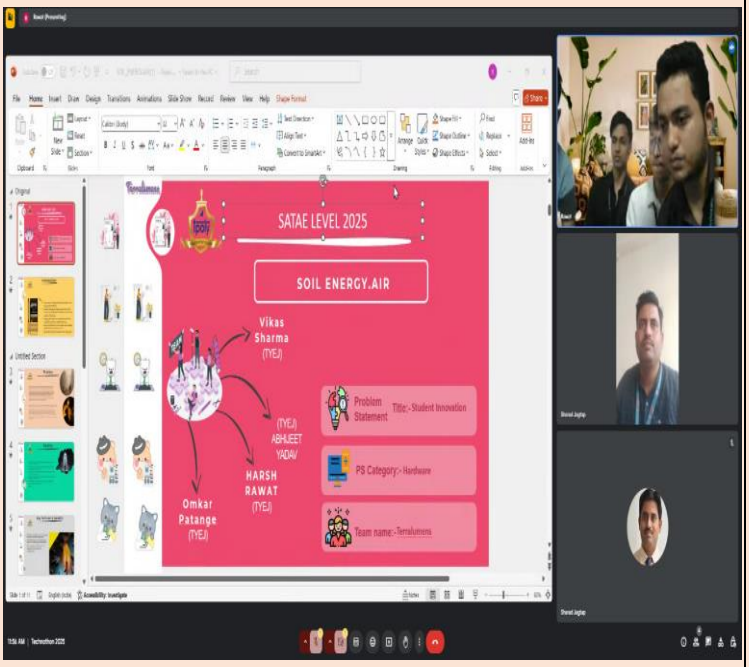
SPARKTECH 2K25 Annual Event conducted from 28/01/2025 to 01/02/2025. Under SPARKTECH-2K25 Mock-Interview, Techno-Walk, Cultural, Dance, Fashion Show were organized.





Circuit Building & PCB Making Workshop arranged by E&TC Department with association with Dolphin Labs, Pune form 20/02/2025 to 24/02/2025


Poster Presentation Competition of Innovations in collaboration with IIC, APCOER 25/02/2025

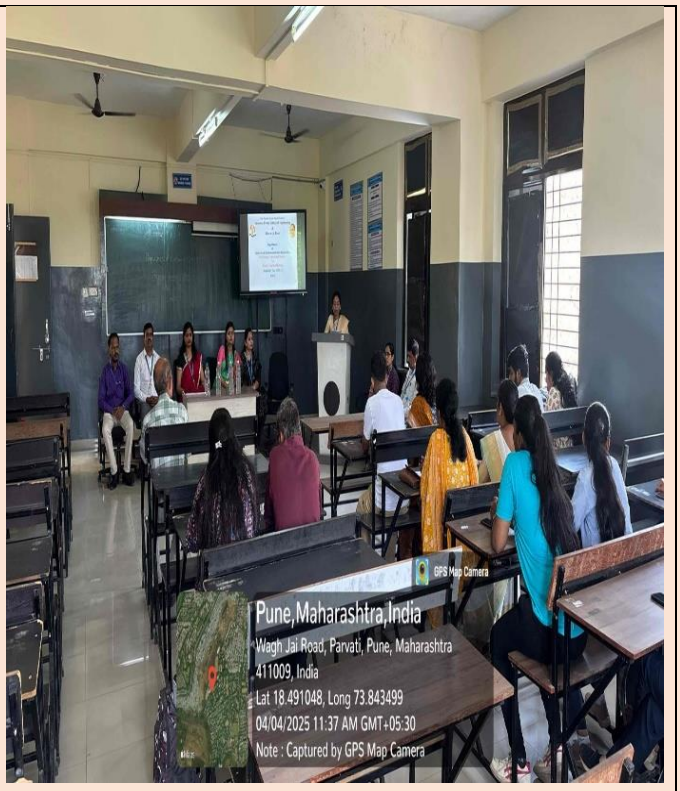




Technical Competition Technothon 2025 was organized by APCOER College on 25/03/2025 & 26/03/2025



Guest Lecture was organised for SE E&TC Students for subject of Signals & Systems on 27/03/2025



Parent Teacher Meeting for Sem-II was conducted on 04/04/2025

# Academics

# Toppers from Batch 24-25

**BE Class Toppers**

| Rank | Name Of The Student | CGPA |
|---|---|---|
| 1st | SHIRKE ANAGHA NARENDRA | 8.8 |
| 2nd | GHAWAD NIKITA PRAKASH | 8.75 |
| | KANNADIAR TILAK MURUGAN | |
| 3rd | WAVARE PRATIKSHA SUNIL | 8.72 |

**TE Class Toppers**

| Rank | Name Of The Student | CGPA |
|---|---|---|
| 1st | JADHAV VISHWAJEET SAMPAT | 9.33 |
| 2nd | BORGE SHRAVANI KAILAS | 9.26 |
| 3rd | PATIL MRUNALI UDAYKUMAR | 8.71 |

**SE Class Toppers**

| Rank | Name Of The Student | CGPA |
|---|---|---|
| 1st | PATIL PRATIK MAHADEV | 9.77 |
| 2nd | SOLAPURE NAMRATA ANAND | 9.73 |
| 3rd | NALE OMKAR SUKUMAR | 9.5 |

## Book/Paper/Patent Published by Faculty/Students

| Sr. No | Name of the Particular | Book/Paper /Patent | Name of the Faculty/Student |
|---|---|---|---|
| 1 | "Embedded Systems and IOT", GCS- Publishers ISBN No: 978-81- 978186-7-7, e-ISBN: 978-81-978186-4-6.September 2024 | Book | Dr. Amar Deshmukh |
| 2 | "Electromagnetic Fields", Deccan International Academic Publishers ISBN No: 978-81- 979284-1-3, e-ISBN: 978-81- 979284-9-9 | | Dr. Amar Deshmukh |
| 3 | "AI Cyber Security: Threats, Challenges & Solutions", Vaagai International Publishing House ISBN No: 978-81- 986561-1-7 | | Dr. Amar Deshmukh |
| 4 | Title "Skin Cancer Detection Using Multi-Model Neural Network". Application No.202441061986A, The Patent Office Journal No. 34/2024, Dated 23/08/2024, Page No:74709 | Patent | Dr. Amar Deshmukh |
| 5 | Title "5G Enable Smart Irrigation System". Application Page 5 of 20 No.202431079861A, The Patent Office Journal No. 44/2024, Dated 01/11/2024, Page No:102261. | | Dr. Amar Deshmukh |
| 6 | Title of the invention : Voice Assistance using ESP32 and Conversational AI. The Patent Office Journal No. 45/2024 Dated 08/11/2024 | | Prof. Sharad Jagtap<br>Prof. Ashwini Suryawanshi<br>Prof. Prachi Upasani<br>Mr. Prabhanjan Bongarde<br>Mr. Krunal Kosumbkar |
| 7 | Title "Augmenting Robotic Navigation: An Page 7 of 20 Analytical Examination of X-Y with Yaw Tolerance Modulations within ROS2 and the Dynamic Window Paradigm using fusion of Nav2 Stack with DWA Algorithm" in Proc. Of Journal of Information Systems Engineering and Management. E-ISSN: 2468-4376, Vol 2025,10(23s), pp.183-195. May-2025. SCOPUS Index | Paper | Dr. Amar Deshmukh |
| 8 | "Memory Efficient Summarization of Real-Time CCTV Surveillance System" in Proc. Of Journal of Information Systems Engineering and Management. E-ISSN: 2468- 4376, Vol 2025, 10(23s), pp.196-206. May-2025. SCOPUS Index | | Dr. Amar Deshmukh |
| 9 | "Optimizing Precision and Operational Efficiency in Object Manipulation: A Novel Algorithmic Paradigm for the UR-3 Robotic Arm Integrated with ROS Framework" in Proc. Of Journal of Information Systems Engineering and Management. E-ISSN: 2468-4376, Vol 2025, 10(23s), pp.207-225. April-2025. SCOPUS Index | | Dr. Amar Deshmukh |

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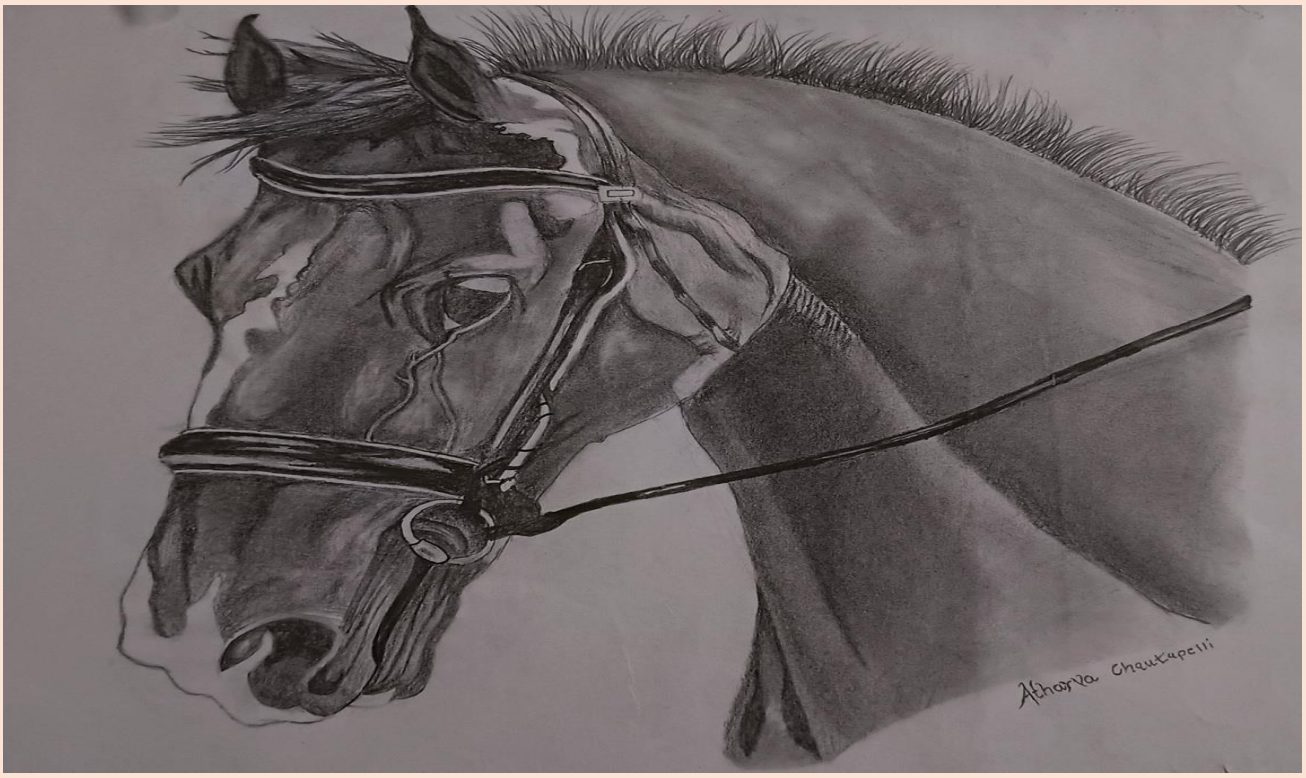
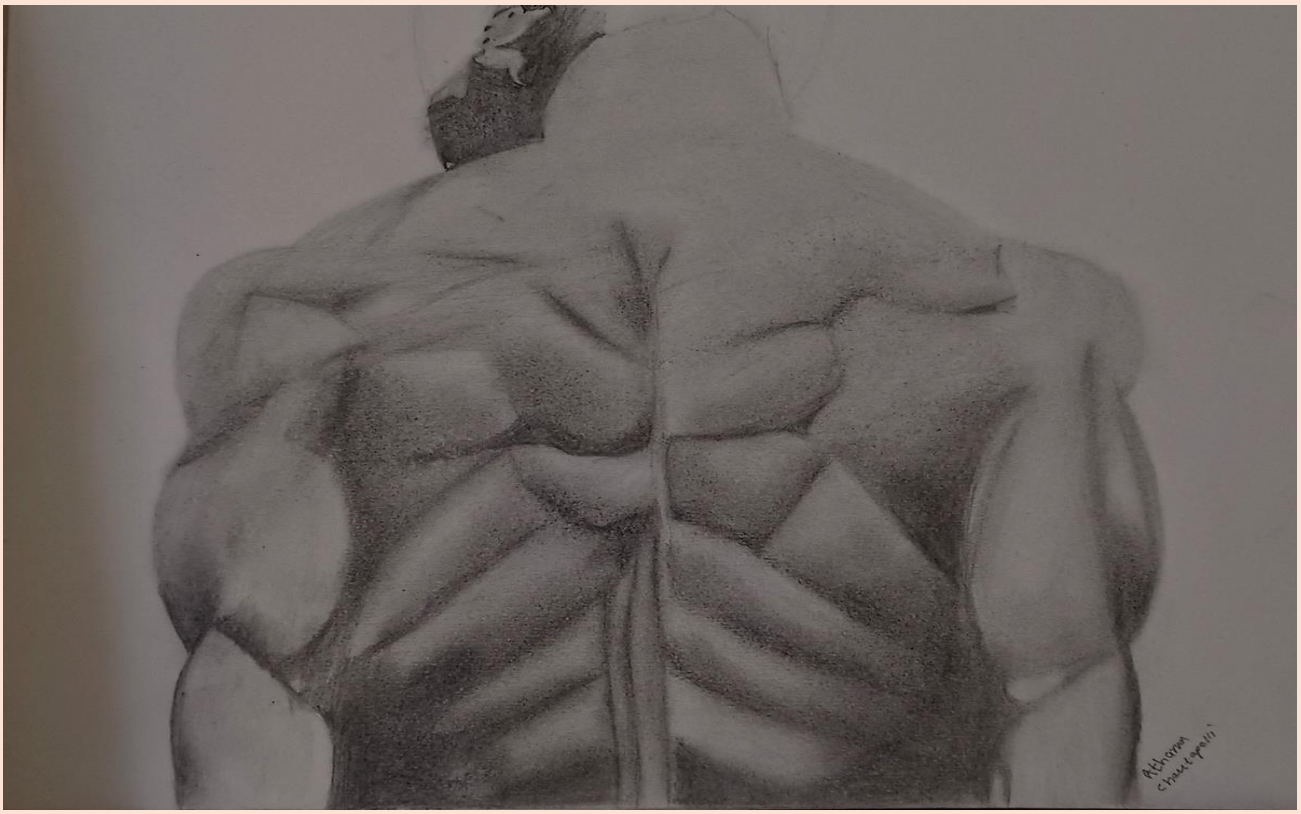
|---|---|---|---|
| 10 | "SolarGrowNet: Autonomous Greenhouse Monitoring and Control System for Gerbera" in Proc. Of Journal of Information Systems Engineering and Management. E-ISSN: 2468-4376, Vol 2025, 10(23s), pp.238-254. April-2025. SCOPUS Index | Paper | Dr. Amar Deshmukh |
| 11 | Dr. Amar B. Deshmukh, et all, "Deep Reinforcement Learning for Traffic Optimization in Urban Planning" in Proc. Of Communications on Applied Nonlinear Analysis. ISSN: 1074-133X, Vol 32 No. 5s (2025), pp.455-468. January-2025. SCOPUS Index | | Dr. Amar Deshmukh |
| 12 | "Effect of Transformer Rating on the Power Quality Problems in 11kv/440v Distribution System" in Proc. Of WSEAS Transactions on Circuits and Systems. EISSN: 2224-266X, Vol 23December-2024. SCOPUS Index | | Dr. Amar Deshmukh |
| 13 | "IoT Based Air, Water, and Soil Monitoring System for Pomegranate Farming" in Proc. Of Annals of Agri-Bio Research. ISSN: 0971-9660, Vol. 29(2)(2024), pp.71-86. Page 8 December-2024. SCOPUS Index | | Dr. Amar Deshmukh |
| 14 | Water Resource Optimization by using a Hyper Parameter Tuned LSTM of a Smart Agriculture Publisher:IEEE,10.1109/ESCI59607.2024.10497403 | | Prof. Sharad Jagtap |
| 15 | Integration of Remote Sensing and IoT for Real-Time Monitoring of Irrigation in Smart Farming. PublisherIEEE,10.1109/ISTEMS60181.2024.10560275 | | Prof. Sharad Jagtap |
| 16 | Hybrid ABC-WOA based Machine Learning Approach for Smart Irrigation System. Publisher:IEEE, 10.1109/ICNWC60771.2024.10537592 | | Prof. Sharad Jagtap |
| 17 | Smart Polyhouse Robotic System With IOT | | Prof. Vaishali Bhimate<br>Mr. Siddharath Patil<br>Miss. Prerana Lole<br>Miss. Tejashri Waghmode |
| 18 | Smart Safety Band for Women Safety | | Prof. Ashwini Suryawanshi<br>Miss.Nikita Ghawad<br>Miss.Aarti Gaikwad<br>Miss. Rohini Lendave |
| 19 | IOT Based Robotic Arm | | Prof. Nikita Bhagat<br>Miss. Megha Kasavkar<br>Miss. Trupti More<br>Mr. Aniket Bhagat |
| 20 | Enemy Tank Detection using Image Processing | | Dr. Amar Deshmukh<br>Prof. Anil Naikwade<br>Mr. Atharva Date<br>Mr. Harshal More<br>Mr. Yashraj gaikwad |

# Students Corner


Atharva Chautapelli


Atharva
Chautapelli



**Mr. Atharva Vinod Chautapelli**

**SE E&TC**

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