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K.S.R COLLEGE OF ENGINEERING

# ELECTRONICS AND COMMUNICATION ENGINEERING

MAGAZINE

# TRONIX

# K S R COLLEGE OF ENGINEERING

**An Autonomous Institution**

**(Approved by AICTE, Affiliated to Anna University, Accredited by NAAC (A+))**

**K.S.R. Kalvi Nagar, Tiruchengode – 637 215, Namakkal District, Tamil Nadu**

## DEPARTMENT ELETRONICS AND COMMUNICATION ENGINEERING

# TRONIX

## TECHNICAL MAGAZINE

**ACADEMIC YEAR 2024-2025**

# Vision and Mission of Institution

## Vision

To become a globally renowned institution in Engineering and Management, committed to providing holistic education that fosters research, innovation and sustainable development.

## Mission

**IM1** Deliver value-based quality education through modern pedagogy and experiential learning.

**IM2** Enrich Engineering and Managerial Skills through cutting-edge laboratories to meet evolving global demands.

**IM3** Empower research and innovation by integrating collaboration, social responsibility, and commitment to sustainable development.

# Vision and Mission of Department

## Vision

We envision as a center of excellence in the field of Electronics and Communication Engineering to produce technically competent graduates with diverse teaching and research environments.

## Mission

**DM1** To educate the students with the state of art technologies to meet the growing challenges of the industries.

**DM2** To develop an innovate, competent and ethical Electronics and Communication Engineer with strong foundations to enable them for continuing education.

**DM3** Nurture Innovation and Research towards sustainable solutions and societal well-being.

# PEOs and PSOs

## Program Educational Objectives (PEOs)

| | | |
|---|---|---|
| **PEO1 -** | **Employability and Higher Education** | Excel in Professional career and higher education by acquiring knowledge in mathematical, social, scientific & engineering principles. |
| **PEO2 -** | **Core Competence** | Analyze, design and develop/implement core engineering problems in communication systems that are technically sound, economically feasible and socially acceptable. |
| **PEO3 -** | **Interpersonal Skills and Team Work** | Graduates will explore competency in the higher education and research and to become the State-of-the-art technocrat. |

## Program Specific Outcomes (PSOs)

| | | |
|---|---|---|
| **PSO1 -** | **Professional Skill** | Specify design and test modern electronic systems that perform analog and digital processing functions. |
| **PSO2 -** | **Problem – Solving Skills:** | Design essential elements (circuits and antennas) of modern RF/Wireless communication systems. |

# K S R COLLEGE OF ENGINEERING

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## Chairman Message

**Shri. R. Srinivasan, BBM., MISTE.,**
Chairman, KSR Educational Institutions

*"Education is the foundation of a brighter tomorrow, and this magazine reflects the vibrant spirit of our learners."*

It brings me immense joy to witness the publication of this edition of the **Electronics and Communication Engineering Department Technical Magazine – TRONIX**. As we stand at the forefront of rapid technological advancement, it is essential that our students are not only informed but inspired to think critically, innovate responsibly, and act ethically.

At **KSR College of Engineering**, we have always emphasized the **importance of holistic learning**—where academic excellence is complemented by research, practical experience, and ethical grounding. This magazine is a testament to that vision. It represents the convergence of classroom knowledge and **real-world application**, aligning perfectly with our mission to create globally competitive and socially responsible engineers.

I extend my heartfelt congratulations to the editorial board, contributors, and faculty coordinators for their efforts in bringing this edition to life. I am confident that **TRONIX** will inspire many young minds and serve as a milestone in our journey towards academic and professional excellence.

With best wishes,
**Shri. R. Srinivasan**
Chairman, KSR Educational Institutions

# K S R COLLEGE OF ENGINEERING

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## Dean Message

**Dr. M. Venkatesan, M.E., Ph.D.,**
**Dean, KSRCE**

**"Knowledge shared is knowledge multiplied."**

I am delighted to extend my warm wishes to the Department of Electronics and Communication Engineering for the successful launch of the **TRONIX** magazine. This remarkable initiative stands as a reflection of the department's unwavering commitment to fostering knowledge sharing, innovation, and awareness in the dynamic and ever-evolving field of electronics and communication.

The insightful contributions from both students and faculty members, as showcased in this magazine, are a true testament to their dedication, creativity, and technical excellence. It is encouraging to see such a platform being established to spotlight emerging technologies, thought-provoking perspectives, and real-world applications in the ECE domain.

I whole heartedly encourage everyone to actively engage with **TRONIX**, leveraging it as a valuable medium to share insights, explore new ideas, and collaboratively strengthen the electronics and communication engineering ecosystem.

My heartfelt congratulations to the entire team behind **TRONIX** for their exceptional efforts and vision.

With best wishes,
**Dr. M. Venkatesan**
Dean, KSR College of Engineering

# K S R COLLEGE OF ENGINEERING

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## Principal Message

**Dr. P. Meenakshi Devi, M.E., Ph.D.,**
**Principal, KSRCE**

*"It is with immense pride that I present the Electronics and Communication Engineering Department magazine."*

This edition of **TRONIX** is not just a compilation of technical articles—it is a mirror reflecting the intellectual energy, dedication, and innovation of our students and faculty. In an era where technology is rapidly transforming every aspect of our lives, it is crucial that educational institutions take the lead in nurturing professionals who can think critically, innovate effectively, and uphold ethical standards in the face of evolving engineering challenges.

At **KSR College of Engineering**, we take immense pride in offering an environment that fosters innovation, interdisciplinary collaboration, and hands-on experience. Our state-of-the-art laboratories, industry-relevant curriculum, and dedicated faculty ensure that students are not only **job-ready but also future-ready**. This magazine is living proof of that vision—where students are encouraged to question, explore, and solve real-world problems through the lens of electronics and communication engineering.

I offer my heartfelt congratulations to the editorial team, student authors, and department staff who have contributed to the successful release of this magazine. Your efforts have created a platform for **thought leadership, creativity, and technical** insight.

Let this magazine serve as a source of **motivation, knowledge, and academic excellence**, and may it inspire all readers to contribute meaningfully to the ever - evolving world of electronics and communication.

With best wishes,
**Dr. P. Meenakshi Devi**
Principal, KSR College of Engineering

# K S R COLLEGE OF ENGINEERING

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## HoD Message

**Dr. C. Gowri Shankar, M.E., Ph.D.,**
**Professor & Head, KSRCE**

*"It is with great pleasure that I present the Electronics and Communication Engineering Department magazine."*

This edition of ***TRONIX*** goes beyond a simple collection of articles—it embodies the **enthusiasm, creativity, and hard work** of our students and faculty. In today's fast-paced technological world, it is vital for academic institutions to cultivate individuals who are not only technically sound but also ethically grounded and forward-thinking.

At **KSR College of Engineering**, we remain committed to providing a learning environment that **champions innovation, practical exposure, and interdisciplinary growth**. With cutting-edge labs, an industry-aligned curriculum, and passionate educators, we ensure that our students are equipped to face the future with confidence. ***TRONIX*** stands as a testimony to that mission—encouraging students to imagine, innovate, and implement.

I extend my warmest congratulations to the editorial board, contributing writers, and faculty coordinators who have worked diligently to bring this edition to life. Your dedication has given rise to a platform that **inspires knowledge-sharing, originality, and technical excellence.**

With best wishes,
**Dr. C . Gowri Shankar**
HoD, KSR College of Engineering

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## TRONIX

# FLEXIBLE AND WEARABLE ELECTRONICS

## Introduction:

Flexible and Wearable Electronics are revolutionizing how technology interacts with the human body and environment, making devices more personal, portable, and powerful. In 2024, advancements in material science, nanotechnology, and miniaturization are driving this exciting transformation.

## What are flexible and wearable electronics?

Flexible electronics are devices that can bend, stretch, and twist without losing functionality, using flexible substrates like plastics, paper, or textiles. Wearable electronics are designed to be worn on the body, often blending into clothing or accessories while offering continuous connectivity, health monitoring, or entertainment.

## Key Innovations And Applications

- **Stretchable Batteries and Circuits:**

Researchers have created batteries and electronic circuits that can stretch by up to 50% without breaking. This innovation is critical for wearables that must conform to the movement of human skin or clothing.

- **Smart Clothing:**

Athletes are now wearing shirts embedded with sensors that monitor heart rate, hydration levels, and muscle fatigue in real time. Military uniforms are being developed with built-in communication systems and environmental sensors, enhancing soldier safety and efficiency.

- **Health Care Revolution:**

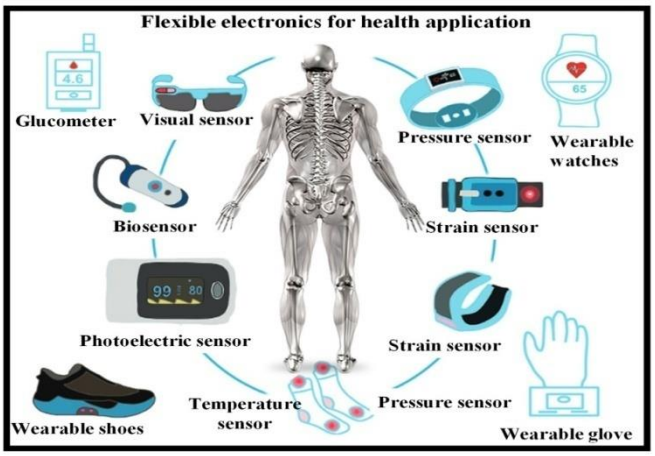
Flexible medical patches can monitor vital signs like ECG (electrocardiogram) readings continuously, offering a non-invasive alternative to traditional bulky medical equipment. These devices can even detect early signs of diseases such as arrhythmia or dehydration and send alerts to doctors remotely.

- **Consumer Gadgets:**

From bendable smartphones to fitness bands that adapt perfectly to your wrist shape, flexible electronics are redefining what personal devices can be. Companies are also exploring foldable and rollable displays that can be expanded or collapsed based on user needs.

## Advantages of Flexible and Wearable Technology

- Enhanced Comfort: Adapts naturally to body movement.
- Portability: Lightweight and unobtrusive for daily use.
- Durability: Resistant to impact and mechanical stress.
- Customization: Personalized healthcare and fitness tracking become more accessible.




## Challenges and the Road Ahead

- Power Management: Developing long-lasting flexible batteries.
- Data Privacy: Protecting sensitive personal data.
- Durability Over Time: Addressing performance loss due to moisture, friction, and heat.

## Future scope for Electronics and Communication Engineers

The flexible and wearable electronics market is projected to grow significantly, offering career opportunities in:

- Biomedical Device Design

- Wearable Computing
- Flexible Sensor Development
- Energy Harvesting Systems
- Advanced Communication Interfaces

Engineers at the intersection of electronics, healthcare, and AI have the opportunity to shape a future where technology becomes an invisible yet essential part of life.

## Conclusion

Flexible and wearable electronics are no longer futuristic dreams; they are becoming a vital part of modern living. These technologies promise a healthier, safer, and more connected world. For future engineers, mastering this field will be key to creating a smarter, human-centric future.

**UGESHRAJA S**

**CLASS: II-ECE**

# Art Meets Electronics: Where Creativity Dances with Circuits

Today, artists and engineers are joining hands to create stunning masterpieces that glow, move, and even respond to sound. From glowing dresses that dance to your heartbeat to giant light installations that mesmerize crowds, electronics is bringing art to life in ways which we never. This magical blend of creativity and technology proves that beauty can be coded, wired, and powered — one microcontroller at a time.

## Lights That Paint

Imagine a blank wall that bursts into color the moment you walk by. Or a giant sculpture that changes hues with every beat of your favorite song.Thanks to tiny LEDs, clever circuits, and a dash of code, artists today are turning ordinary spaces into glowing wonderlands. Whether it's dazzling street installations or cozy café walls that ripple with light, electronics is helping art quite literally shine — painting the world in vibrant, living colors.

## Music in Wires

Close your eyes at a concert, and you'll feel it — pulsing beats, shimmering lights, and melodies that seem to flow through the air itself. Behind the scenes, it's clever circuits, oscillators, and synthesizers weaving this magic.From EDM drops that make crowds jump to soft electronic harmonies in movie scores, electronics shapes the music we love. In these tiny wires and chips, art finds a new voice — one that hums, beeps, and dances through every speaker.

### Fun fact

Your favorite pop songs often use **synths** that are nothing but clever arrangements of electronic signals.

# Beyond the Gallery: More Ways Electronics Inspires Art

## Sound That Shimmers

Not all art is seen — some is heard and felt. Artists and engineers are building immersive spaces where sound waves drive light patterns, creating rooms that seem to breathe with your voice. Using microphones, frequency analyzers, and smart LEDs, even a simple laugh can ripple across a wall in a burst of color.

## Art You Can Control

Interactive installations are taking over museums and festivals. Step into a space, wave your hand, and watch patterns twist and swirl. Thanks to motion sensors, pressure pads, and clever programming, spectators become co-creators, turning passive viewers into active participants.

"Art powered by electrons shows us that circuits can do more than compute — they can captivate."

**VIJAYASREE K**

**III-ECE-B**

# MACHINE LEARNING IN SIGNAL PROCESSING

## Introduction:

Signal processing is the science of analyzing, modifying, and synthesizing signals—such as sound, images, and sensor data. Traditionally, this field relied on mathematical models and linear systems. However, with the explosive growth of data and computational power, Machine Learning (ML) has become a game-changer, empowering signal processing with intelligence and adaptability.

## What is machine learning in signal processing?

- Machine learning brings algorithms that can **learn** from data patterns instead of relying on fixed rules. When applied to signal processing, ML enables systems to recognize trends, make predictions, classify signals, and adapt to complex environments.
- This combination is especially powerful in environments where traditional signal processing techniques struggle due to noise, variability, or the need for real-time decisions.

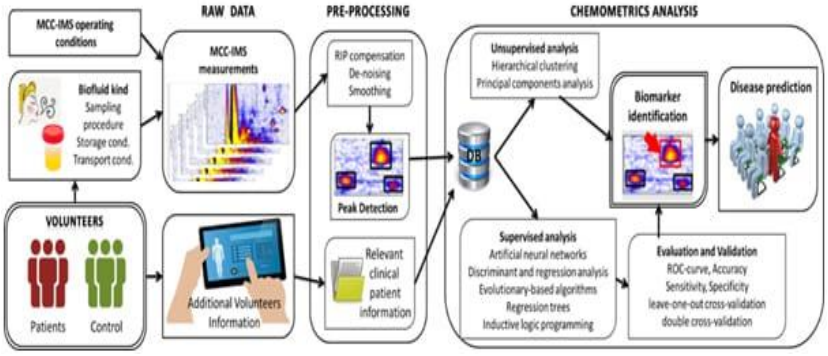
## Key Applications:

- **Speech Recognition and Enhancement**
  ML algorithms like Recurrent Neural Networks (RNNs) and Transformers help process voice signals for virtual assistants like Alexa or Siri. They filter noise, detect speech, and convert it into text.
- **Biomedical Signal Analysis**
  Electrocardiogram (ECG), EEG, and other bio-signals are analyzed using ML to detect anomalies like arrhythmia or seizures.
- **Wireless Communications**
  ML optimizes modulation, beamforming, and spectrum sensing in 5G and upcoming 6G systems.
- **Image and Video Processing**
  Convolutional Neural Networks (CNNs) help in denoising, image compression, facial recognition, and real-time video enhancement.
- **Radar and Sonar Signal Interpretation**
  Autonomous vehicles and defense systems use ML to process radar/sonar data for object detection and tracking.

## Popular Tools And Techniques:

- **Deep Learning Frameworks**: TensorFlow, PyTorch, and Keras are used for training neural networks on large signal datasets.

- **Feature Extraction Methods**: Short-Time Fourier Transform (STFT), Wavelet Transform, and MFCCs (Mel Frequency Cepstral Coefficients) help convert raw signals into meaningful features for ML models.
- **Autoencoders & GANs**: Used for denoising signals or generating synthetic data for training.




## Challenges:

- **Data Quality**: Signals are often noisy and unstructured, requiring preprocessing before ML can be applied effectively.
- **Real-Time Processing**: High-speed applications like autonomous driving or industrial control require fast and efficient ML models.
- **Interpretability**: Deep learning models can be black boxes, making it difficult to understand how decisions are made.

## Conclusion

Machine learning is not replacing traditional signal processing—it's enhancing it. This fusion allows systems to perceive, adapt, and act intelligently in real-world scenarios. Whether you're an electronics engineer or a data science enthusiast, mastering this intersection can unlock a wide range of futuristic applications.

**CHRISWIN J**

**CLASS: II-ECE**

# ARTIFICIAL INTELLIGENCE IN ELECTRONICS

## Introduction:

Artificial Intelligence (AI) is transforming the field of Electronics by making devices smarter,faster,andmoreefficient.By combining AI algorithms with electronic systems, machines are now able to think, learn, and make decisions — tasks that were once possible only with human intervention.

## What Is Artificial Intelligence In Electronics?

AI in Electronics refers to the integration of machine learning models, neural networks, and intelligent algorithms into electronic devices and systems. These devices can process huge amounts of data, recognize patterns, make decisions, and even improve their own performance over time without explicit programming.

### APPLICATIONS OF AI IN ELECTRONICS

➢ **Smartphones And Wearables:**

AI powers features like facial recognition, voice assistants, health monitoring, and personalized user experiences.

➢ **Consumer Electronics:**

Smart TVs, smart speakers, and home automation systems use AI to optimize performance and user preferences.

➢ **Industrial Automation:**

Robots and automated machines with AI capabilities improve manufacturing efficiency, quality control, and predictive maintenance.

➢ **Healthcare Devices:**

AI-driven electronics are used for diagnostics, real-time monitoring, and robotic surgeries.

➢ **Autonomous Vehicles:**

Self-driving cars use AI-powered electronic systems for navigation, obstacle detection, and decision-making.

### RECENT DEVELOPMENTS

➢**Edge AI:**

AI algorithms are now being run directly on devices (like sensors and microcontrollers) without needing constant internet access, improving speed and privacy.

➢**AI Chips:**

Specialized processors, like Google's TPU and NVIDIA's AI chips, are being developed to accelerate AI computations in electronic devices.

➢**Brain-Machine Interfaces (BMI):**

Advanced electronics powered by AI are allowing direct communication between the human brain and computers.


## Opportunities For Electronics And Communication Engineers

➢ Designing AI hardware like neural network accelerators.

➢ Developing embedded systems with built-in AI capabilities.

➢ Innovating in robotics, healthcare electronics, and smart city solutions.

**Conclusion**

Artificial Intelligence is no longer limited to software; it has deeply entered the world of electronics, making devices intelligent and revolutionizing every industry. Future engineers who master AI technologies in electronics will lead the next wave of innovation, making our lives smarter, easier, and more connected.

**PRABHU M**

**II-ECE**


ART by C. Kiruthika

**C.KIRUTHIKA**

**I-ECE**