



2025 Vol. 13 Issue 1

# TECH-ZINE

*A Technical Magazine of ECE Dept.*

DEPARTMENT OF  
ELECTRONICS AND COMMUNICATION ENGINEERING



**VARDHAMAN**  
COLLEGE OF ENGINEERING



[www.vardhaman.org](http://www.vardhaman.org)

# *Message from the* **PRINCIPAL**



*Dear Faculty, Staff, and Students,*

*It gives me great pleasure to announce the release of **Tech-Zine 2025 – Issue 1 (January–June)**, the technical magazine of the Department of Electronics and Communication Engineering at Vardhaman College of Engineering.*

*Tech-Zine continues to serve as a dynamic platform for students and faculty to showcase their talents across diverse technical, creative, and interdisciplinary domains. This edition reflects the department's sustained commitment to academic excellence, innovation, and holistic development.*

*I extend my sincere appreciation to the editorial team, contributors, and all those involved in the successful publication of this issue. Their dedication, teamwork, and enthusiasm are truly commendable and have contributed significantly to the quality of this magazine.*

*I encourage all members of the college community to explore this issue of Tech-Zine and engage with the insightful and inspiring content it presents.*

*I congratulate the Department of Electronics and Communication Engineering on the successful release of **Tech-Zine 2025 – Issue 1** and wish them continued success in their academic and creative endeavours.*

**Dr. J V R Ravindra**  
Principal & Professor of ECE  
Vardhaman College of Engineering



# *Message from the* **HEAD OF THE DEPARTMENT**

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*It gives me great pleasure to announce the release of **Tech-Zine 2025 – Issue 1 (January–June)**, the Department Magazine of **Electronics and Communication Engineering**. This publication reflects the dedication, creativity, and sustained efforts of our students and faculty.*

*The Department of ECE continuously strives for excellence in academics, research, and industry collaboration. This issue of Tech-Zine highlights the achievements, innovative projects, and research initiatives undertaken by our talented students and faculty members, showcasing their commitment to learning and technological advancement.*

*I extend my sincere congratulations to the editorial team, contributors, and all those who have worked diligently to bring this magazine to fruition. Their collective efforts have ensured the quality and relevance of this publication.*

*I hope this magazine serves as a valuable source of knowledge, inspiration, and motivation for all its readers.*

*Let us continue to explore new horizons and push the boundaries of knowledge and innovation in the field of Electronics and Communication Engineering.*

**Dr. S. Rajendar**  
*Professor & Head of Department of ECE*

# EDITORIAL

## FACULTY IN CHARGE

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*Tech-Zine 2025 – Issue 1 (January–June) proudly presents a dynamic confluence of innovation, creativity, and technical excellence in the field of **Electronics and Communication Engineering**. This bi-annual e-magazine stands as a reflection of the vibrant voices within our academic community—students and faculty alike—who seamlessly blend technical expertise with literary expression and artistic creativity.*

*Within its pages, Tech-Zine showcases a rich mosaic of ideas and talents, each contributing to a tapestry of knowledge, insight, and inspiration. More than a publication, it serves as a platform where innovation finds expression and the future of technology is shaped through thoughtful discourse, research, and imaginative exploration.*

*We invite readers to explore **Tech-Zine 2025 – Issue 1** and engage with the latest advancements in electronics, insightful technical articles, compelling creative writing, and inspiring visual artistry. This edition captures the essence of our community's dedication, curiosity, and creative spirit, curated to ignite young minds and inspire new perspectives.*

*We extend our heartfelt gratitude to all contributors, reviewers, and members of the editorial team whose commitment and hard work made this issue possible. Join us as we celebrate the spirit of innovation and excellence in Electronics and Communication Engineering through the pages of Tech-Zine 2025—a true showcase of brilliance and boundless potential.*

**Dr. Sunkaraboina Sreenu**  
Assistant Professor



# EDITORIAL

## STUDENT EDITOR

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***“Success is not final; failure is not fatal: it is the courage to continue that counts.”***  
**— Winston Churchill**

*These inspiring words beautifully capture the resilient spirit behind the creation of this edition of Tech-Zine. While achieving goals marks progress, it is the perseverance, learning, and determination experienced along the journey that truly shape us. The process of bringing this magazine to life has been deeply rewarding, filled with continuous learning, collaborative brainstorming, and the refinement of both technical and creative skills.*

*We are delighted to present the latest edition of Tech-Zine, a platform that celebrates innovation, creativity, and intellectual curiosity within our technical community. This magazine serves as a window into the ingenuity and diverse perspectives of our talented students and faculty, reflecting a shared passion for exploration and excellence.*

*Within these pages, readers will discover a rich and diverse collection of content—ranging from futuristic technology articles and analytical discussions to expressive illustrations, captivating photography, thoughtful poetry, and various creative endeavors. Together, these contributions form a vibrant tapestry that highlights human curiosity and technological advancement through a multitude of voices and ideas.*

*I extend my sincere gratitude to Dr. S. Sreenu for his invaluable guidance and constant encouragement throughout the journey of this publication. My heartfelt appreciation goes to K S L Dedeepya and the entire team whose creativity, commitment, and collaborative efforts made Tech-Zine possible.*

*As we continue to explore new technological horizons, let us cherish the process of creation itself—for true fulfillment lies in shared discovery, teamwork, and the courage to keep moving forward.*

**— Kona Keerthana**  
**(23881A0494)**

# EDITORIAL

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EXCELLENCE IN  
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# **SECTION-I**

## **PART - A**

### **FACULTY TECHNICAL ARTICLES**

#### **Edge Computing: Powering Real-Time IoT Intelligence**



*Edge computing is redefining the architecture of the Internet of Things (IoT) by shifting data processing from centralized cloud servers to the network's periphery. By analyzing data closer to the source—such as sensors, cameras, and industrial gateways—edge computing significantly reduces latency and minimizes the bandwidth required for constant cloud communication. Unlike traditional cloud-centric models, edge environments allow for instantaneous decision-making, which is vital for time-sensitive applications where even a millisecond of delay can impact safety or performance. This decentralized approach not only enhances system responsiveness but also provides a layer of data privacy and security by keeping sensitive information localized.*

*The impact of edge intelligence is profound in high-stakes industries like autonomous transportation, where vehicles must process massive streams of lidar and radar data locally to navigate safely. In healthcare, wearable edge devices monitor patient vitals in real-time, alerting medical staff to emergencies without relying on a stable internet connection. Furthermore, smart manufacturing utilizes edge-driven computer vision to detect assembly line defects instantly, preventing costly downtime and resource waste. While integrating edge nodes introduces complexities in hardware management and software synchronization, the synergy between edge computing and 5G is rapidly overcoming these hurdles. As IoT ecosystems become more complex, the ability to process data at the edge will be essential for creating truly autonomous, resilient, and high-performance digital infrastructures.*

*- Dr. Ch. Sreenivasa Rao  
(Professor)*

## 3D IC Integration: Redefining the Future of VLSI Architecture



*3D IC Integration represents a groundbreaking advancement in the intersection of semiconductor manufacturing and system-on-chip design. As traditional two-dimensional integrated circuits face interconnect bottlenecks and latency challenges with increasing transistor density, 3D integration leverages vertical stacking to enhance communication speed and bandwidth, making it a promising approach for high-performance computing. 3D ICs are inspired by classical monolithic chips but operate using multiple active layers, which allow them to reduce signal travel distances exponentially in complex architectures.*

*The vertical connectivity and through-silicon via (TSV) properties enable 3D ICs to perform high-speed data transfer and memory access more efficiently than their traditional planar counterparts. One of the key advantages of 3D ICs is their ability to reduce the average wire length compared to standard two-dimensional layouts, thus improving the overall energy efficiency and signal integrity of the system.*

*A significant application of 3D ICs is in High Bandwidth Memory (HBM), where they can efficiently bridge the gap between processing units and storage, a task that is computationally constrained by the limited pin counts of classical packaging. Moreover, 3D ICs show promise in enhancing tasks such as heterogeneous integration, sensor fusion, and neural network hardware, making them a valuable tool in modern microelectronics. 3D ICs are expected to become more practical for mass-market applications. As manufacturing yields improve, the transition from 2D to 3D VLSI design could lead to revolutionary breakthroughs, transforming industries ranging from data centers to mobile telecommunications and beyond.*

- Dr. I. Babu  
(Associate Professor)

## Reconfigurable Intelligent Surfaces: Shaping the Wireless Propagation Environment



*Generally, Reconfigurable Intelligent Surface (RIS) techniques are classified into three functional categories: reflective, transmissive, and refractive metasurfaces. RIS is a method to programmatically control the electromagnetic properties of an environment, effectively turning walls and buildings into active participants in signal propagation. This "smart skin" technology can overcome the challenges of signal blockage, dead zones, and non-line-of-sight (NLOS) limitations common in high-frequency bands. Several theoretical models have demonstrated that RIS-aided communication, by intelligently reflecting signals toward the receiver, is the way forward for enabling the upcoming beyond 5G and 6G networks.*

*A massive array of low-cost passive elements can be designed to manipulate the phase and amplitude of incident waves. Such surfaces are known as software-defined metasurfaces. RIS has become a highly attractive area of research within the field of wireless communications for applications in not just urban 6G networks but also in indoor localization, secure physical layer communications, and smart factories.*

*RIS is a key enabler for ultra-dense terrestrial networks; with the introduction of 6G standards in the coming years, commercialization of these surfaces will enable the telecommunication industry to establish a highly energy-efficient network infrastructure. Also, the above-mentioned functional categories have their own set of merits and demerits in terms of hardware overhead, energy efficiency, path loss compensation, tuning speed, and deployment scalability.*

- Dr. Sulakshana Chilukuri  
(Associate Professor)

## TinyML: Bringing Intelligence to Resource-Constrained Embedded Systems



*Generally, Tiny Machine Learning (TinyML) techniques are classified into three functional stages: model compression, hardware-aware optimization, and on-device inference. TinyML is a method to programmatically implement deep learning algorithms on ultra-low-power microcontrollers, effectively turning simple sensors into intelligent participants in data analysis. This "on-device AI" technology can overcome the challenges of high cloud latency, excessive bandwidth consumption, and data privacy risks common in traditional centralized IoT architectures.*

*Several empirical studies have demonstrated that TinyML-enabled devices, by intelligently processing raw sensor data at the source, are the way forward for enabling the upcoming smart infrastructure and personalized healthcare networks. A compact array of optimized neural network kernels can be designed to manipulate complex patterns using only milliwatts of power. Such systems are known as edge intelligence nodes. TinyML has become a highly attractive area of research within the field of embedded systems for applications in not just keyword spotting but also in predictive maintenance, anomaly detection, and real-time gesture recognition.*

*TinyML is a key enabler for autonomous terrestrial sensors; with the introduction of specialized AI-accelerated microcontrollers in the coming years, commercialization of these models will enable the electronics industry to establish a highly decentralized digital infrastructure*

- Mrs. J. Swetha Priyanka  
(Assistant Professor)

## Integrated Sensing and Communication: Merging Radar and Data for 6G Networks



*Integrated Sensing and Communication (ISAC) represents a groundbreaking advancement in the intersection of signal processing and wireless network design. As traditional telecommunication systems face spectrum scarcity and hardware redundancy challenges with increasing connectivity demands, ISAC leverages a unified waveform to enhance both data throughput and environmental awareness, making it a promising approach for high-performance 6G networks. ISAC systems are inspired by classical radio frequency (RF) designs but operate using shared hardware and spectral resources, which allow them to reduce infrastructure costs exponentially in complex urban environments.*

*The dual-functional waveform and joint signal processing properties enable ISAC networks to perform high-resolution object detection and multi-gigabit data transfer more efficiently than their traditional separate counterparts. One of the key advantages of ISAC is its ability to reduce the overall power consumption compared to standard independent radar and communication deployments, thus improving the overall spectral efficiency and resource utilization of the system. A significant application of ISAC is in autonomous vehicular networks (V2X), where they can efficiently bridge the gap between safety-critical collision avoidance and high-speed infotainment, a task that is computationally constrained by the limited coordination of classical disjoint architectures.*

*Moreover, ISAC shows promise in enhancing tasks such as indoor localization, drone navigation, and smart gesture recognition, making them a valuable tool in modern digital infrastructure. ISAC protocols are expected to become more practical for mass-market applications. As standardization progresses, the transition from communication-only to sensing-centric network design could lead to revolutionary breakthroughs, transforming industries ranging from smart cities to industrial automation and beyond.*

-Dr.V. Harini  
(Assistant Professor)

## GAAFET Architecture: Redefining Transistor Scaling for Next-Generation Nodes



*Gate-All-Around (GAA) transistor techniques are classified into three functional geometries: nanowires, nanosheets, and multi-bridge channel FETs. GAAFET is a method to programmatically enhance the electrostatic control of a channel, effectively turning traditional 3D fins into horizontally stacked sheets completely surrounded by the gate. This "wrap-around" technology can overcome the challenges of short-channel effects, high leakage current, and threshold voltage variability common in sub-5nm FinFET architectures. Several fabrication studies*

*have demonstrated that GAA-based designs, by intelligently increasing the effective gate width within a smaller footprint, are the way forward for enabling the upcoming high-performance computing and mobile AI networks.*

*A vertical stack of ultra-thin silicon layers can be designed to manipulate current flow with unprecedented precision at extremely low operating voltages. Such structures are known as nanosheet transistors. GAAFET has become a highly attractive area of research within the field of VLSI design for applications in not just flagship microprocessors but also in energy-efficient data centers, autonomous driving chips, and 6G infrastructure.*

*GAA architecture is a key enabler for the 2nm logic node; with the introduction of mass-market production in the coming years, commercialization of these devices will enable the electronics industry to establish a highly dense and power-efficient digital infrastructure. Also, the above-mentioned functional geometries have their own set of merits and demerits in terms of drive current, manufacturing complexity, parasitic capacitance, thermal management, and design-technology co-optimization.*

Dr. S. Rajendar  
(Professor)

# PART - B

## STUDENT TECHNICAL ARTICLES

### Artificial Intelligence in Communication Systems

*Artificial Intelligence (AI) is revolutionizing modern communication systems by enabling intelligent decision-making, adaptive control, and efficient resource utilization. Unlike traditional rule-based systems, AI-driven communication networks can learn from data, predict network behavior, and optimize performance in real time. Machine learning algorithms are increasingly used to enhance signal detection, modulation recognition, and error correction techniques.*

*In wireless communication, AI plays a significant role in channel estimation, spectrum management, and interference mitigation. Cognitive radio systems use AI to dynamically sense and adapt to the radio environment, ensuring efficient spectrum usage. This is particularly important as the number of connected devices continues to grow exponentially.*

*AI also supports the development of self-organizing networks, where communication infrastructure can automatically configure, optimize, and heal itself without human intervention. These networks improve reliability, reduce operational costs, and enhance user experience. AI-based network analytics help operators detect anomalies and predict failures before they occur.*

*As communication technologies evolve toward 6G and beyond, AI is expected to become an integral component of intelligent networks. The fusion of AI with communication systems will enable ultra-reliable, low-latency, and high-capacity networks that support futuristic applications such as autonomous systems, smart cities, and immersive digital experiences.*



Peddaboodhi Vaishnavi  
23881A04H9

## Internet of Things (IoT) and Smart Connected Devices

*The Internet of Things (IoT) connects physical objects embedded with sensors, actuators, and communication modules, enabling them to collect and exchange data over the internet. IoT has transformed everyday devices into smart, connected systems capable of monitoring, automation, and intelligent control. From smart homes to industrial automation, IoT applications are rapidly expanding across multiple domains.*



Punna Pranitha  
23881A04J3

*In the field of Electronics and Communication Engineering, IoT integrates embedded systems, wireless communication, and cloud computing. Smart sensors gather real-time data, which is transmitted through communication protocols such as Wi-Fi, Bluetooth, LoRa, and cellular networks. This data is then processed to enable informed decision-making and automated responses.*

*IoT plays a crucial role in applications such as healthcare monitoring, smart agriculture, environmental sensing, and industrial IoT. Wearable devices track vital signs, smart irrigation systems optimize water usage, and industrial sensors improve productivity through predictive maintenance. These applications enhance efficiency, safety, and sustainability.*

*Despite its advantages, IoT faces challenges related to security, scalability, and energy efficiency. Ongoing research focuses on secure communication protocols, low-power devices, and edge computing solutions. As these challenges are addressed, IoT will continue to shape the future of smart and connected environments.*

## 5G and Future Wireless Communication Technologies

*5G wireless technology represents a major advancement in communication systems, offering high data rates, ultra-low latency, and massive device connectivity. These features enable advanced applications such as autonomous vehicles, remote surgery, smart factories, and augmented reality. 5G marks a significant shift from traditional mobile communication to a platform that supports diverse and mission-critical services.*

*Key technologies behind 5G include massive MIMO, beamforming, millimeter-wave communication, and network slicing. These innovations improve spectral efficiency and allow customized network performance for different applications. For example, ultra-reliable low-latency communication supports real-time control systems, while enhanced mobile broadband enables high-quality multimedia services. In Electronics and Communication Engineering, 5G has opened new research opportunities in antenna design, signal processing, and network optimization. It plays a vital role in smart transportation, smart grids, and industrial automation, where reliable and fast communication is essential.*

*Looking ahead, research into 6G aims to integrate artificial intelligence, terahertz communication, and intelligent network management. Future wireless systems are expected to support immersive experiences, global connectivity, and intelligent services, redefining the boundaries of communication technology.*



N Akshara  
(22881A04G8)

## Embedded Systems: The Intelligence Behind Everyday Technology

*Embedded systems are specialized computing systems designed to perform dedicated functions within larger electronic products. Unlike general-purpose computers, embedded systems operate with specific hardware and software configurations optimized for efficiency, reliability, and real-time performance. They are built using microcontrollers or microprocessors integrated with sensors, actuators, memory, and communication interfaces to control and monitor devices.*

*Embedded systems play a vital role in numerous applications, including consumer electronics, automotive systems, medical equipment, and industrial automation. Devices such as washing machines, microwave ovens, smart thermostats, and wearable health monitors rely on embedded systems for precise control and intelligent operation. In automobiles, embedded controllers manage engine control units, anti-lock braking systems, airbag deployment, and infotainment systems.*

*Real-time operating systems (RTOS) are often used in embedded applications where timely response is critical. An RTOS ensures predictable task execution, efficient resource management, and reliable system behavior. Communication protocols such as UART, SPI, I<sup>2</sup>C, CAN, and Ethernet enable embedded systems to interact with other devices and networks, making them integral to connected and intelligent environments.*

*With the rise of the Internet of Things (IoT), artificial intelligence, and smart infrastructure, embedded systems are evolving rapidly. Low-power design, security, and edge intelligence are key focus areas in modern embedded development. As technology advances, embedded systems will continue to form the foundation of smart, autonomous, and interconnected devices that shape the future of electronics and communication engineering.*



Ganja Datta Sai Naga  
Venkata Vinay  
(23881A0488)

## VLSI Design: Powering the Next Generation of Smart Electronics

*Very Large-Scale Integration (VLSI) is the backbone of modern electronic systems, enabling millions to billions of transistors to be integrated onto a single silicon chip. From smartphones and laptops to automotive electronics and medical devices, VLSI technology plays a critical role in delivering compact, high-performance, and energy-efficient solutions. Continuous advancements in semiconductor fabrication have driven the miniaturization of devices, making complex functionalities possible within limited chip area.*

*VLSI design involves multiple stages, including system specification, logic design, circuit design, physical layout, and verification. Each stage requires careful optimization to meet performance, power, and area constraints. With the rise of System-on-Chip (SoC) architectures, designers integrate processors, memory, analog blocks, and communication interfaces onto a single chip, increasing design complexity and efficiency simultaneously.*

*Low-power VLSI design has become a major focus due to the growing demand for portable and battery-powered devices. Techniques such as clock gating, power gating, dynamic voltage scaling, and multi-threshold CMOS are widely used to reduce power consumption. These innovations are especially important in applications like wearable electronics, Internet of Things (IoT) devices, and mobile communication systems.*

*The future of VLSI lies in emerging technologies such as FinFETs, 3D ICs, and hardware accelerators for artificial intelligence and machine learning. As semiconductor scaling approaches physical limits, innovative design methodologies and materials are shaping the next era of chip design. VLSI will continue to be a driving force behind technological progress, enabling faster, smarter, and more efficient electronic systems.*



Suraj Kuila  
(23881A04C0)



# SECTION -II

## PHOTOGRAPHY

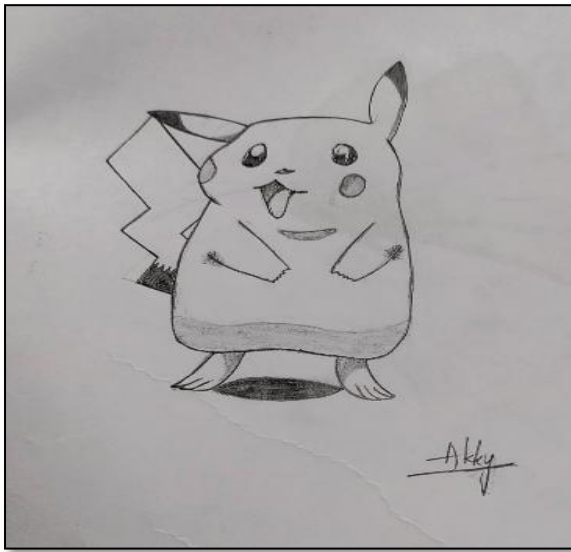


Chenneram Kiran  
24881A0478

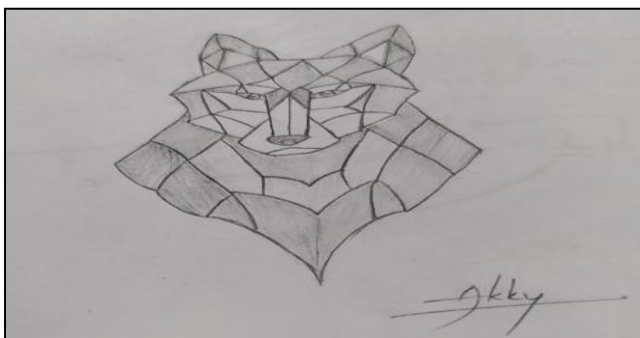


# SECTION -III

## ARTWORKS



Gollapelly Akshaya  
23881A0489



### Program Educational Objectives (PEOs):

**PEO1:** Graduates will be able to foster continuing education with their existing knowledge in the field of Electronics and Communication Engineering.

**PEO2:** Graduates will be able to evolve with the ever-changing global technological advancements and cater to the needs of the society.

**PEO3:** Graduates will be able to demonstrate leadership skills to address issues in a responsive, ethical and innovative manner.

**PEO4:** Graduates will be able to excel in a career while contributing to the growth of their organization

### Program Outcomes (POs):

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

### Program Specific Outcomes (PSOs):

**PSO1:** Apply the knowledge of domain-specific skill set for the design and analysis of components in VLSI and Embedded systems.

**PSO2:** Demonstrate the technical competency and use appropriate techniques in the realization of advanced communication systems.

# VISION AND MISSION

## Vision of the College

To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

## Mission of the College

- To adopt innovative student centric learning methods.
- To enhance professional and entrepreneurial skills through industry institute interaction.
- To train the students to meet dynamic needs of the society.
- To promote research and continuing education.

## Quality Policy

- We at Vardhaman College of Engineering, endeavor to uphold excellence in all spheres by adopting best practices in effort and effect.

## Vision and Mission of the Department:

### Vision:

To produce competent engineers with social responsibility to address the global challenges in the field of Electronics and Communication Engineering.

### Mission

- Promote active learning strategies to facilitate student centric learning.
- Provide self-learning capabilities to enhance employability and entrepreneurial skills.
- Inculcate human values and ethics to make learners sensitive towards societal issues.
- Strengthen core competencies among the learners through experiential curriculum.

## VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to JNTUH, Approved by AICTE, Accredited by NAAC with A++ Grade, ISO 9001:2015 Certified  
Kacharam, Shamshabad, Hyderabad - 501218, Telangana, India