



**GALGOTIAS COLLEGE
OF ENGINEERING & TECHNOLOGY**

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**Department of
Electronics & Communication**

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About ECE Department

The Department of ECE offers B.Tech courses in Electronics and Communication Engineering from Dr. A.P.J. Abdul Kalam Technical University, (formerly Uttar Pradesh Technical University/Gautam Buddh Technical University) Lucknow. Electronics & Communication Engineering deals with the electronic devices, circuits, communication equipments like transmitter, receiver, integrated circuits (IC). Microprocessors, satellite communication, microwave engineering, antenna and wave propagation. The department aims to impart high quality education in ECE and conduct top notch research in ECE related fields.

The department provides state-of-art infrastructure and computing facilities to students and faculty. The faculty members are actively involved in different domains of research with special focus in five thrust areas:

1. Wireless Communication and Networks
2. Microwave and Antennas,
3. VLSI Design
4. Communication Systems
5. Signal and Image Processing.

The department has regular hardware and software labs as well as state-of-the-art research labs in microwave and antennas, where faculty and students are working on funding projects and offering consultancy services. Some of the available software in the ECE department are Riverbed Academic edition, OrCAD PSPICE, eSim, SCILAB, OR-Tools, Expeyes, etc. The Department follows a well-proven pedagogy of sharing knowledge with the young and vibrant minds of the college. As we are affiliated with AKTU University, Lucknow, the curriculum and subjects are prescribed by AKTU University. In addition to instruction in core ECE subjects, we also teach elective subjects in advanced topics such as Voice over Internet Protocol, Filter Design, Digital Image Processing, Digital System Design using VHDL, Speech Processing, Advance Digital Design using Verilog, Microcontroller for Embedded Systems, etc. The department imparts world-class training and research besides promoting active industry-institute collaboration by identifying current trends and taking part in sponsored research projects and consultancy services. The department also has a worldwide reach with its vibrant alumni network. Working shoulder by shoulder with the institution, it is constantly aiming towards reaching greater heights to serve the needs of society and meet the aspirations of the student community.

Vision of Institute

To be a leading educational institution recognized for excellence in engineering education and research producing globally competent and socially responsible technocrats.

Mission of Institute

IM1: To provide state of the art infrastructural facilities that support achieving academic excellence.

IM2: To provide a work environment that is conducive for professional growth of faculty and staff.

IM3: To collaborate with industry for achieving excellence in research, consultancy and entrepreneurship development.

Vision of Department

To be recognized as a center of excellence in Electronics and Communication Engineering for the quality and global education, interdisciplinary research and innovation, to produce committed graduates who can apply knowledge and skills for the benefit of society.

Mission of Department

DM1: To provide quality education by providing state of the art facility and solutions for global challenges.

DM2: To provide a framework for promoting the industry-institution collaboration and empower the students in interdisciplinary research.

DM3: To transform students into socially responsible, ethical and technically proficient engineers with innovative skills and usage of modern tools.

DM4: To make the students corporate ready with spirit and necessary interpersonal skills.

Program Outcomes

- P01 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- P02 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.
- P03 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.
- P04 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.
- P05 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- P06 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.
- P07 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.
- P08 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- P09 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- P010 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.
- P011 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.
- P012 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.

Program Specific Outcomes

By the completion of Electronics & Communication Engineering program the student will be able to:

PSO1: Design and develop models for analog & digital electronic circuits and systems.

PSO2: Design, develop and test electronic and communication systems for applications with real Time constraints.

Program Educational Objectives

PEO 1	Graduates will excel in their career by acquiring knowledge in the field of Electronics and Communication Engineering with the usage of modern tools and emerging technologies.
PEO 2	Graduates will have the capability to analyze real life problems of the society and produce innovative solutions.
PEO 3	Graduates exhibit professionalism, ethical attitude, communication skills and team work in core engineering, academia and research organizations through professional development and lifelong learning.

ARTICLE: 1 Quantum Communication: The Future of Secure Data Transmission

Quantum communication leverages the principles of quantum mechanics to enable ultra-secure data transmission and encryption. Utilizing quantum key distribution (QKD), this technology allows two parties to exchange encryption keys with theoretically perfect security, as any attempt to intercept or eavesdrop on the transmission would disturb the quantum state and be detected. This capability addresses the growing need for secure communication channels in an era of increasing cyber threats and data breaches.

In electronics and communication engineering, quantum communication represents a significant leap forward in secure data transfer. Research is focusing on developing quantum networks that use quantum entanglement and teleportation to transmit information over long distances with enhanced security. These advancements could revolutionize sectors such as financial transactions, government communications, and confidential data sharing, providing a new level of protection against cyber espionage and hacking.

In addition to enhancing security, quantum communication also promises to improve the efficiency and reliability of data networks. Quantum networks can potentially enable new forms of communication that leverage quantum entanglement to achieve instantaneous information transfer between distant nodes, overcoming the limitations of classical communication channels. This can lead to faster and more reliable network infrastructure, with applications extending beyond secure communications to areas like distributed quantum computing and advanced sensor networks. As quantum communication technology progresses, it is expected to not only bolster data security but also drive innovations in how information is transmitted and processed across global networks, marking a new era in the field of electronics and communication engineering.

Ms. Gaurav Mehra
Asst.Prof./ECE/GCET

ARTICLE: 2 Satellite Communication: Bridging the Connectivity Gap Worldwide

Satellite communication plays a critical role in connecting remote and underserved areas where traditional terrestrial networks are impractical. Using geostationary, medium, and low earth orbit satellites, this technology provides broadband internet, television broadcasting, and global positioning services across the globe. Recent advancements, such as the development of mega-constellations like SpaceX's Starlink, aim to deliver high-speed, low-latency internet services to even the most remote locations, bridging the digital divide.

In electronics and communication engineering, satellite communication systems incorporate complex signal processing, modulation techniques, and error correction methods to ensure reliable data transmission over vast distances. These systems are crucial in disaster management, military operations, and aviation, where uninterrupted communication is essential. The evolution of satellite technology, combined with advancements in antenna design and miniaturization, continues to expand the capabilities of global communication networks, making them more accessible, robust, and efficient.

As satellite communication technology continues to advance, the integration of innovations such as high-throughput satellites (HTS) and advanced beamforming techniques is enhancing the performance and efficiency of satellite networks. HTS increases data throughput and bandwidth by using multiple frequency bands and spot beams to concentrate coverage on specific areas, allowing for higher data rates and improved service quality. Additionally, developments in software-defined satellites (SDS) offer greater flexibility and adaptability by allowing real-time reconfiguration of satellite functions and services. These advancements are not only improving the quality of satellite-based internet and communications but also driving new applications in global connectivity, including IoT networks and emergency response systems. As technology evolves, satellite communication will play an increasingly pivotal role in supporting global infrastructure, enabling connectivity in previously unreachable areas, and fostering innovation in various sectors.

Dr. P.C. Joshi
Asst. Prof./ECE/GCET

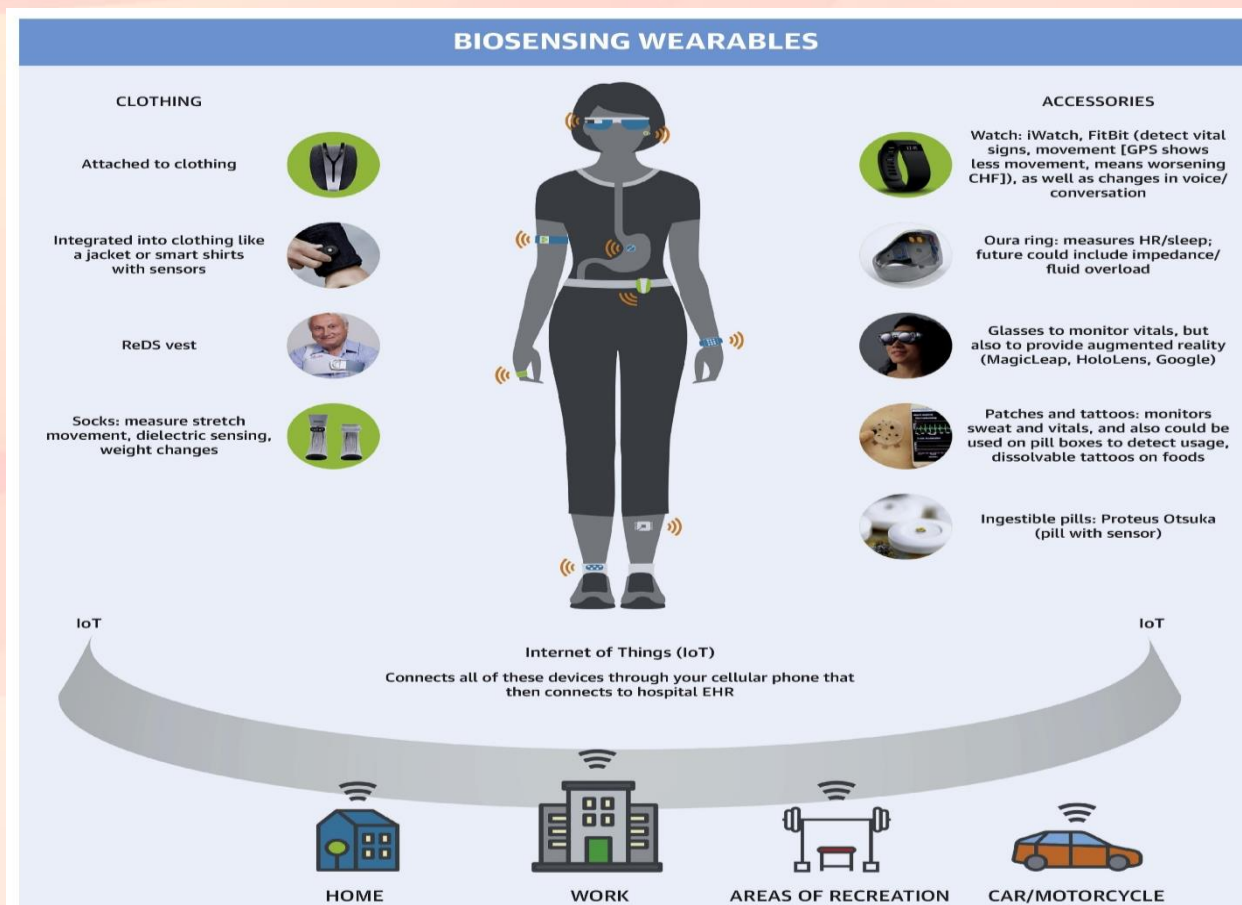
ARTICLE: 3 Wearable Technology: Enhancing Health and Fitness Through Electronics

Wearable technology, encompassing smartwatches, fitness trackers, and health monitoring devices, has firmly established itself as a vital component of modern electronics. These devices have revolutionized the way we monitor and manage our health by leveraging advanced sensors and communication technologies to track a wide range of health metrics, including heart rate, sleep patterns, and physical activity levels. By seamlessly integrating with mobile applications and cloud services, wearables provide users with real-time insights and feedback on their health and fitness, encouraging healthier lifestyles and enabling proactive health management.

The development of wearable technology in the field of electronics and communication engineering involves several key challenges and innovations. One of the primary focuses is the miniaturization of components, which allows for the creation of compact, lightweight, and comfortable devices that can be worn throughout the day. Power efficiency is another critical area, as wearables need to operate for extended periods on small batteries without frequent recharging. This has led to innovations in low-power electronics and energy-efficient designs. Advanced sensor integration is also crucial, as it enables wearables to accurately monitor various physiological parameters. Innovations in materials science and the development of flexible electronics are further enhancing the comfort and versatility of wearables, making them suitable for a wide range of applications, from fitness tracking to medical monitoring.

As wearable technology continues to evolve, its role in personalized healthcare is becoming increasingly significant. Wearables are now being used for remote patient monitoring, allowing healthcare providers to track patients' health in real-time, even when they are not in a clinical setting. This capability is particularly valuable for managing chronic conditions, where continuous monitoring can help detect early signs of deterioration and enable timely interventions. Proactive health management is another area where wearables are making a substantial impact, empowering users to take control of their health by providing them with the information they need to make informed decisions about their lifestyle and well-being.

The integration of artificial intelligence (AI) and machine learning with wearable technology is driving even more advanced capabilities. AI algorithms can analyze the vast amounts of data collected by wearables to detect patterns, predict potential health issues, and provide personalized recommendations. For instance, AI can help identify irregular heart rhythms, predict the likelihood of sleep disorders, or suggest personalized exercise routines based on an individual's health profile. This advanced data processing allows wearables to move beyond basic tracking and deliver actionable insights and early warnings that can significantly improve health outcomes.



In addition to individual benefits, wearable technology is contributing to broader healthcare initiatives. By supporting preventive care and the management of chronic diseases, wearables are playing a role in reducing healthcare costs and improving the quality of life for many individuals. As these devices become more sophisticated, they are likely to become an integral part of the healthcare ecosystem, facilitating a shift from reactive to proactive healthcare and enabling more personalized, data-driven treatment plans.

ARTICLE: 4 5G Technology: Transforming Communication Networks and Beyond

5G technology represents the next generation of mobile communication, offering significantly faster data speeds, ultra-low latency, and the capacity to connect a vast number of devices simultaneously. Unlike previous generations, 5G is designed not just for faster mobile internet but also to enable the Internet of Things (IoT), smart cities, autonomous vehicles, and advanced healthcare applications. By leveraging new spectrum bands, including millimeter waves, and technologies like Massive MIMO (Multiple Input Multiple Output) and beamforming, 5G enhances data throughput and network efficiency, making real-time communication a reality for various industries.

The impact of 5G extends far beyond personal mobile devices, as it plays a critical role in modernizing infrastructure and industry. For instance, 5G enables remote surgery with real-time control, precision manufacturing in smart factories, and autonomous vehicle communication for safer transportation systems. Its ability to handle high data volumes and support massive device connectivity paves the way for innovations and services, marking a significant leap in the evolution of global communication networks.

As 5G networks continue to deploy globally, their integration with edge computing and artificial intelligence (AI) is set to further enhance their capabilities. Edge computing reduces latency by processing data closer to the source rather than relying solely on distant data centers, which is crucial for applications requiring real-time responses, such as augmented reality (AR) and virtual reality (VR). AI algorithms can optimize network management, predict maintenance needs, and dynamically adjust resource allocation, ensuring more efficient and reliable service. This synergy of 5G with edge computing and AI not only improves performance but also enables the creation of new applications and services across various sectors, including smart grids, healthcare, and entertainment. As a result, 5G technology is not only advancing communication networks but also driving broader technological and societal transformations.

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ARTICLE: 5 IoT and Smart Sensors: Revolutionizing Data Collection and Automation

The Internet of Things (IoT) has transformed how devices communicate, collect, and share data, driving a wave of automation across industries. IoT relies on smart sensors that gather data on environmental conditions, machinery performance, and human activities, transmitting this information to cloud-based systems for analysis and decision-making. These sensors can monitor everything from temperature and humidity to pressure and motion, providing real-time data that enhances operational efficiency, predictive maintenance, and remote monitoring capabilities.



In electronics and communication engineering, IoT plays a crucial role in smart home devices, industrial automation, healthcare monitoring, and environmental management. For example, smart cities use IoT sensors for traffic management, energy consumption optimization, and pollution monitoring. The integration of IoT with advanced communication protocols such as LoRaWAN, NB-IoT, and 5G is expanding the capabilities of connected devices, enabling new levels of automation and data-driven insights that improve the quality of life and operational efficiency across various sectors.

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