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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 a regular hardware and software labs as well as the state-of-art research labs in microwave and antennas, where faculty and students are working on funding projects and offering consultancy services. Some of the available softwares in ECE department areRiverbed 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 to 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 with shoulder with the institution, it is constantly aiming towards reaching greater heights to serve the needs of the 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

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 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.

PO3 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.

PO4 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.

PO5 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.

PO6 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.

PO7 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.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 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.

PO11 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.

PO12 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 DATA - THE NEW GOLD

Yes you read it right, ”DATA IS THE NEW GOLD”, this piece of writing talks about a thing, which has become the most precious thing in the world so much so that it is as exquisite as some of the most valuable resources in our world. Over the years, gold, oil etc. have been regarded as the most valuable assets of this world but now it has all been replaced by a new entity called DATA. The arrival of computers, machines and subsequent rise and advancement of the internet has fabricated a human dependence on technology. The top titans of the Silicon Valley like Microsoft, Google etc. know more about our day-to-day interaction with devices than we ever will. This industry is collecting gigantic amounts of data from millions of users every day.

Data is a very general term, it can be anything related to information about something, like for example the name of a person or his or her address can be regarded as data. So basically data is a set of characters that has been rendered into a form that is efficient for movement, processing and communication. Data can be as small as one bit or as large as millions of terabytes. In the computing world, data has massive importance and usage. So much so that a new derivative has branched out from data known as BIG DATA due to its massive utilization by the companies all over the world. Big DATA is data in the form of petabytes range or even larger than that. It has got a lot of prominence over the time and is used by huge multinationals for giving out good products. People all over the world are using products made by the Silicon Valley, for example use of Google maps. People use Google maps for navigation and knowingly or unknowingly share their current location data with the company. Then a combination of data from other users is used to create specific traffic patterns which suggest which route is faster and which one is slower. This inter-combination of data enables Google Maps to function so efficiently. Along with this, Youtube is another example of the versatile use of data, where the user’s video preferences are based upon the search history, trending videos, location etc. This also helps in boosting advertising which is a major source of income for these companies, as data helps anticipate user behaviour and targets customers involved with the respective product. The data availability and accessibility have massively transformed mankind’s interaction with technology. Smartwatches would not have existed without the availability of data related to a user’s behaviour, location parameters etc. We wouldn’t be able to make weather predictions, stock-market performance analysis etc without the use of data. Data conceptualisation, processing and visualisation are the most proficient ways to convey an anecdote and give out facts in a way that encapsulates the mankind’s curiosity.

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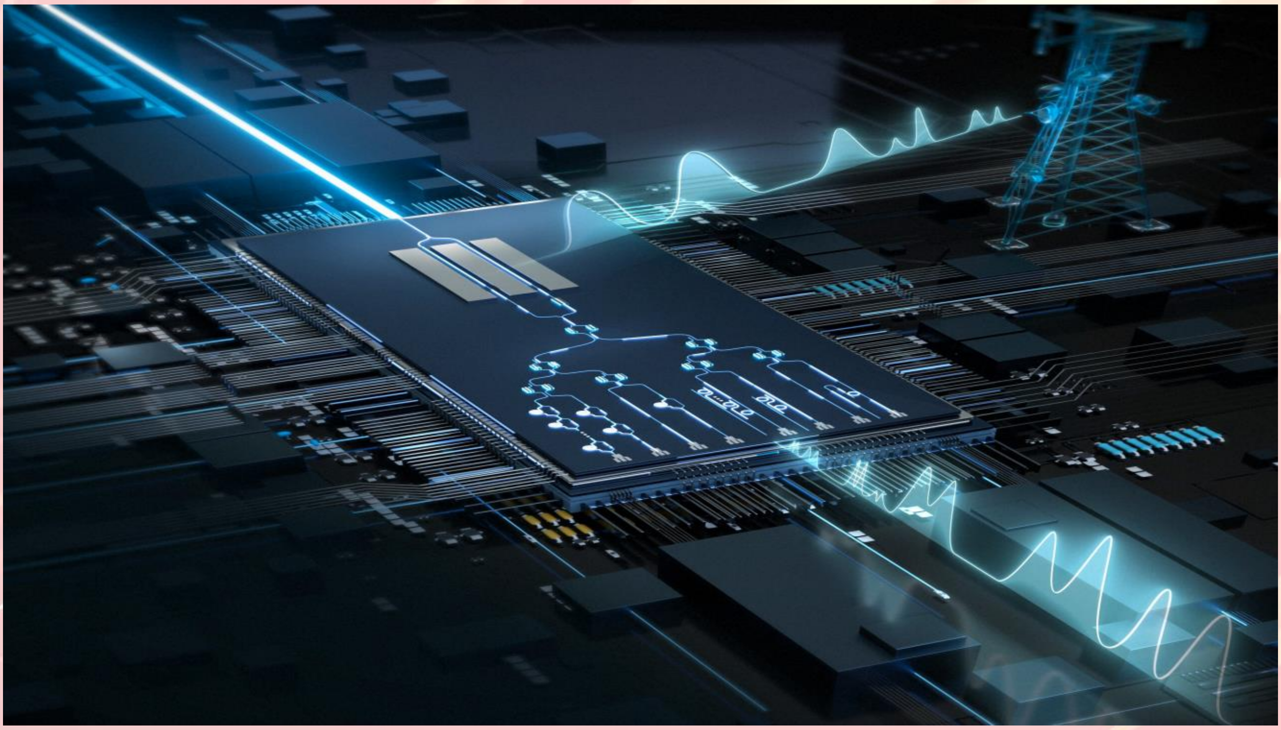
ARTICLE :2 Microwave Photonics

After the invention of laser, some visionaries thought about future high speed communication in 1960s, and saw photonics as a possible alternative to microwaves. For terrestrial telecommunication, it was not clear to the researcher as to which one of these two technologies would prevail. However, it was very much clear at the time; that the two technologies were complementary to one another in many aspects.

So, it was not surprising that these two technologies would overlap and combine to form an interdisciplinary subject called "microwave photonics". Over the years microwave photonics gained technical maturity and evolved significantly. Microwave photonics basically combines technologies that are developed for both optical parts of spectrum and microwave. From a historical point of view, it is seen that ample number of examples of simple optical communications are present since ancient times. These depended on the vision of humans to notice signals, such as the semaphore visual telegraph codes generated by Chappe's optical telegraph created during the French Revolution. Optical communication was suppressed by the subsequent appearance of electrical telegraph almost a century later. Transatlantic telegraph cable was first commercially and successfully installed in 1866. Before the publication by Kao and Hockham, it would take another century to use optical communication techniques.

In the 19th century, in addition to telegraph, research on wireless communication had also begun, despite the invention of the photophone (a telecommunications device that allows transmission of speech on a beam of light) by Alexander Graham Bell and Charles Sumner Tainter in 1880. It was the first demonstration of open space communication linkage, in which the light beam's intensity modulation was done at the transmitter, and the modulated light was converted in RF domain at the receiver end. This technique was employed for telephone transmission.



But eventually, radio techn iques for wireless transmission prevailed over the optical techniques, and this domination continued ever since. Chandra Bose in the 1890s recognized the advantage of higher frequencies, and invented the mm-wave transmission. During the 2nd World War, researchers started working in microwave domain, and invented the radar. In satellite communications and radar system, vacuum tubes were an important component of microwave electronics. Now, CMOS technology dominates over microwave circuits. Complex and compact circuits required for satellite navigation receiver and mobile communications are possible because of microwave monolithic integrated circuits development.

In the beginning, researchers working in microwave photonics field were only focused on defense applications. But recently this field has been expanded beyond defense applications, including medical imaging, wireless communication, satellite communication, cellular, optical signal processing, cable television and distributed antenna systems. All these applications require large bandwidth, high speed and increasing value of dynamic range. Simultaneously, low-power and lightweight devices are also required.

Mr. Hitesh Gupta
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ARTICLE :3 Internet of Things

The term IoT might have been coined not more Technological advancements are trying to fast catch up with what viewers have been promised by sci-fi movies for a while. A potential concept that has gained massive traction and can assist in bringing about enhancements in varied aspects of life using programmed machine intelligence and adaptive learning capability is Internet of Things (IoT) than a couple decades ago, but interest in endeavoring fields with similar goals have been around for a while.

IoT is about interconnecting devices of physical world within the prevailing internet infrastructure using assorted sensors to manipulate existing robust functioning and extrapolating ways to improve throughput while shortening response time, without human-to-machine or machine to machine interactions. Many leading entrepreneurs believe that with IoT, physical world is becoming one big information system and it can fundamentally change the way business function.

It works by assigning an IPv6 address to all the components of real world(primarily electronic real world(primarily electronic components). In an attempt to broaden the horizons of the concept of IoT, capacity of IP addresses have been increased enormously. The functioning are then monitored using ubiquitous sensing elements present all over the unit. Sensors sends feedback at regular intervals over a secured network to provide real time functioning of that object while also registering anomalies. These data collected over a period of time can then be processed to triangulate methods of enhancing performance. An added benefit of this system is that manufactures can recognize a malfunction in a unit present with a consumer in any part of the city. The particular malfunctioning part can also be meticulously found, and manufacturer can then fabricate that part beforehand and effectively eliminate delays in maintenance.

IoT has the potential to bring about advancements in healthcare sector, construction management and transportation systems and energy efficiency in a manner never seen before. It can also be greatly employed in farming practices to evolve it to the level of precision farming. Data collected over a period can help in determining precise weather conditions for a particular crop to flourish and process this along with meteorological department's predictions to remotely provide all relevant information. A drone can then be employed to perform the task. Determining quantity of water supply, manure and other relevant stuffs will become more sophisticated, timely and precise.

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ARTICLE:4 WHY QUANTUM COMPUTING ?

"Quantum Mechanics: Real black magic calculus."
-Sir Albert Einstein

Quantum computing stands at the forefront of technological innovation, promising to overcome limitations that classical computers face. Unlike their classical counterparts, which rely on binary bits, quantum computers use quantum bits or qubits, capable of existing in multiple states simultaneously due to superposition and entanglement. This fundamental difference enables quantum computers to solve complex problems more efficiently than classical systems. For instance, tasks such as factoring large numbers, a cornerstone of modern encryption, become tractable with quantum algorithms like Shor's, potentially transforming data security. Moreover, quantum computers are expected to revolutionize simulations of quantum systems, which could lead to breakthroughs in chemistry, materials science, and drug discovery by providing unprecedented accuracy in modeling molecular interactions.

The potential applications of quantum computing extend far beyond solving specific problems. In optimization, quantum algorithms offer new ways to tackle complex challenges in logistics, finance, and artificial intelligence, providing faster and more accurate solutions. As quantum technology advances, it will likely drive significant economic growth by creating new industries and opportunities. However, this progress also necessitates the development of quantum-resistant encryption methods to safeguard digital information against future quantum threats. In essence, quantum computing not only represents a leap forward in computational power but also heralds a transformative shift across numerous fields, promising to unlock new possibilities and address some of the most pressing challenges of our time.

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ARTICLE: 5 MIMO Communication Systems Design and Challenges

Wireless standards are continuously evolving to meet the growing demand for higher data rates and to enhance the multimedia experience for mobile users. As mobile data consumption and the need for seamless connectivity rise, achieving higher data rates becomes a fundamental requirement. According to the fundamental channel capacity formula, these higher data rates can be achieved by either increasing the transmitted power to improve the signal-to-noise ratio (SNR) or by expanding the available bandwidth. However, both methods present significant challenges: increasing power levels is restricted by regulatory bodies to avoid interference with other devices and maintain network stability, while acquiring additional bandwidth is increasingly costly and challenging due to spectrum congestion and the limited availability of usable frequencies.

To address these challenges effectively, the implementation of multiple antenna systems at both the mobile terminal and the base station has emerged as a key solution. Multiple-input-multiple-output (MIMO) technology has become a critical component in modern wireless communication systems, offering a substantial increase in data throughput, spectral efficiency, and reliability. MIMO technology leverages multiple antenna elements at both ends transmitter and receiver to exploit spatial diversity and multipath propagation, significantly enhancing signal quality and network capacity.

Designing compact printed MIMO antenna systems is particularly challenging, especially for small mobile devices where space is highly constrained. Engineers must carefully consider factors such as antenna placement, isolation, and coupling to minimize interference and optimize performance. The advent of MIMO technology has introduced various new performance metrics and measurement methods that are essential for evaluating the effectiveness of these antenna systems in real-world environments. These advancements enable designers to fine-tune antenna performance, ensure robust and reliable communication links, and meet the increasing demands of high-speed data and multimedia services, even within the limitations imposed by physical size, power regulations, and spectrum availability.

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