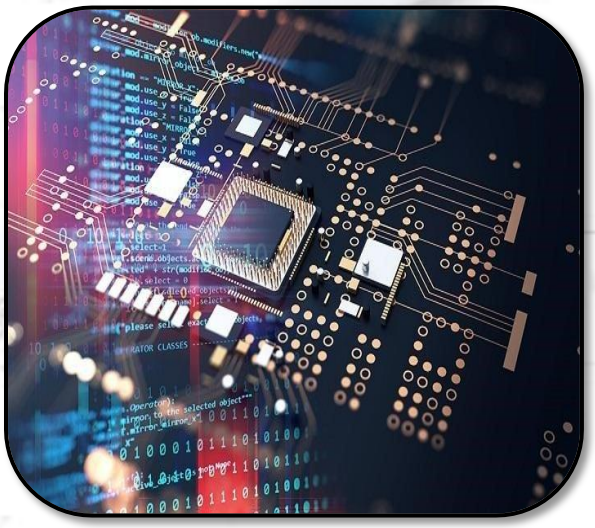
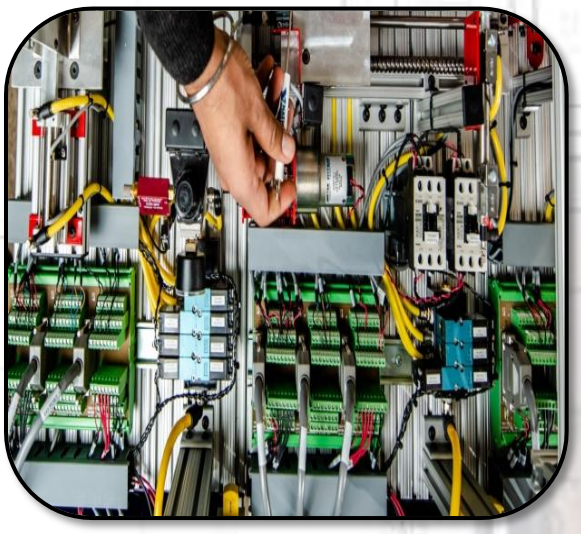
Electrical Engineering

Electrika – 2023-24





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HON'BLE CHAIRMAN MESSAGE

Bhai Gurdas Institute of Engineering and Technology (BGIET), shines as a symbol of educational excellence in North India, devoted to catalyzing societal, scientific, and economic progress globally. Committed to academic brilliance and holistic growth, BGIET earns acclaim from both students and society. The institution prioritizes individual excellence, offering diverse scholastic, cultural, and professional activities to mold students into versatile achievers ready for the global stage. Faculty members impart rigorous training in placement, personality development, and communication skills, guiding students towards prosperous careers and futures.

As part of the BGGI community, students thrive in an environment where aspirations are nurtured under exceptional leadership and inspiring faculty. The institution's steadfast commitment to international-quality education ensures students access top-notch opportunities for personal and professional development. With a notable placement record and emphasis on practical skill-building, BGGI remains dedicated to excellence, ensuring students not only excel academically but also flourish in their chosen fields, armed with the tools and knowledge to navigate today's dynamic world.

Dr. Guninderjit Singh Jawandha

Chairman

Bhai Gurdas Group of Institutions, Sangrur

DIRECTOR MESSAGE

Bhai Gurdas Organization of Designing and Innovation laid out in the year 2002, is a main designing foundation of Punjab and north India. We are happy that this organization has always upheld its tradition of excellence in the field of specialized education to this day. Our goal is to benefit humanity by providing understudies with high-quality, specialized training that would enable them to become employable directors, technocrats, civil officers, or more broadly, valuable citizens of Indian society.

After 14 years of administration, we are pleased that many of our students have exhibited their personalities in businesses, government associations, trans-public organizations, and universities across a range of boundaries, real-world locations, countries, and workplaces thanks to the specialized knowledge and experience they gained while residing at BGIET. Understudies and staff alike need to be taught research culture and propensities given the competitive global environment of today. Apart from academics, other activities such as games, social, extracurricular, and cultural ones are equally important to reinforce their confidence, advance communication/show expertise, foster unity, inculcate sportsmanship, administration quality, and critical thinking. In addition to our establishment's vision and mission, we have an obligation to develop people who are socially conscious and inventive leaders.

Dr. Tanuja Srivastava

Director

Bhai Gurdas Institute of Engineering & Technology

HOD MESSAGE

The Department of Electrical Engineering, BGIET, Sangrur is one of the most sought after branches by the young aspiring engineering students. The Electrical Engineering Discipline aims at providing quality education with stress on strong foundation and thorough understanding of the basic principle like sustainable growth in power, drives, control, automation and communication sectors which leads to wealth and welfare of human population. The department has well qualified and experienced faculty members along with excellent learning facilities. The Department is highly benefitted by the latest teaching aids. Developing the technology for a better and faster tomorrow is the moto that the discipline encourages. With an emphasis on green technology, the discipline pursues a holistic approach in ensuring that the students are sensitive to the environmental safety and economic context of their course work. The department is dedicated to encourage independent and critical thinking in students and culture their potential to pursue high quality of research.

Electrical Engineering broadly deals with electricity, electromagnetism and electronics in accordance with modern human life and industrial needs.

The placements of the department have remained promising since the years of its existence. The students are placed in the automotive sectors, power production units, communication industries and manufacturing industries to name a few.

For an aspiring engineer looking for a promising future, the department of Electrical Engineering is a great option.

I am extremely happy to be associated with this department, one of the core and oldest branch of Engineering. I thank our management, researchers, teachers, alumni and students for their continuous support and cooperation. We continue to play a leading role in our discipline which leads us towards creating innovative and effective professional graduate community which would vivacious and provide continuous learning. I extend my warm wishes to all budding Electrical Engineers.

I wish the very best for my faculties and students.

Dr. Sushil Kakkar

HOD – EE

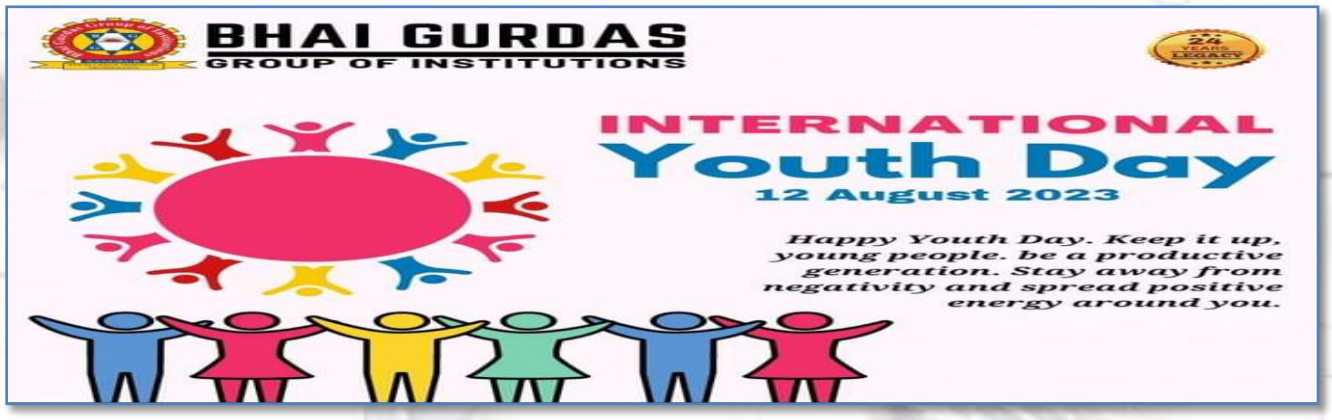
VISION AND MISSION OF THE DEPARTMENT

Vision of the Department	Vision of the Department It is aimed to provide the finest environment for teaching, learning, research, innovation and character building so as to mould youth of today into world-class technocrats of tomorrow who would Endeavour to increase the quality of life for mankind.	
Mission of the Department	**Mission No.**	**Mission Statements**
	M1	To evolve as an innovative & globally competent Electrical Engineering department that contributes to the socio – economic growth of region by utilizing the advancement in Electrical Engineering by providing conducive learning and interactive environment to students and faculty.
	M2	To impart the quality education and enhance skills for developing globally competent Electrical Engineers.
	M3	To provide state –of –the – art facilities and opportunities to create, interpret, apply and disseminate knowledge
	M4	To Develop students and faculty to cope up with modern technology with research attitude to meet the necessary industry standards.

Program Outcome (PO)

PO Number	PO Statement
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.

INTERNATIONAL YOUTH DAY

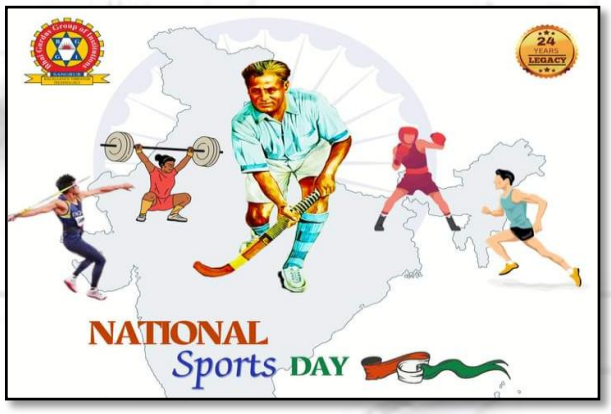


International Youth Day is commemorated every year on 12 August, bringing youth issues to the attention of the international community and celebrating the potential of youth as partners in today's global society. The purpose of the day is to draw attention to a given set of cultural and legal issues surrounding youth.When it comes to productivity; Youth is the at the forefront. We on the behalf of entire BGIET family wishes a very prosperous International youth day to our young energetic minds who withhold with them the spirits of upliftment of this nation. Choose BGIET to celebrate each day with zeal and zest towards your dreams.

MEGA EVENT

New Beginnings (23 Aug.2023) are always wonderful specially when blessings of Goddess Saraswati are seeked. This is the auspicious beginning of academic journey of the young minds. The Induction ceremony concluded towards cultural activities and vote of thanks.

NATIONAL SPORTS DAY



Sports are extremely crucial if the holistic development of a person is concerned. The National Sports Day in India is celebrated on 29 August every year. It is celebrated to commemorate the birth anniversary of hockey legend Major Dhyan Chand Singh. We at BGIET lay great emphasis on each and every aspect of a person's development. It is our prime concern to keep our students and faculties physically and mentally fit so we celebrate National Sports day with loads of zeal and enthusiasm. There is ample space in our premises for all types of games. We have badminton court and other spaces for all types of athletic events to take place.

CELEBRATE ENGINEER'S DAY

Bhai Gurdas Group of Institutions celebrated on 21 September 2023Engineers' Day with great zeal, honoring the legacy of Sir Mokshagundam Visvesvaraya. The highlight of this day was a motivational program by the Brahma Kumaris on "Moral Values and Positive Thinking." Engineers were reminded that besides technical prowess, ethical values and positive mindset are vital. This event underscored our commitment to nurturing engineers who not only innovate but also uphold moral standards, ensuring a brighter future for society. It was a day of inspiration and reflection, emphasizing that engineers are not just builders but also guardians of ethics.

A prosperous, excited and a fresh gesture is evident in all of us as we welcome on 21 Aug.2023 our new batches. We named this megaevent ' Prarambh' which literally means a fresh beginning. So it is the beginning of the students academic life and gives us yet another year and chance to serve them with extreme diligence. The event started off with Saraswati Vandana, witnessed many cultural performances and terminated with national Anthem. A talent hunt was also organized, we also gave the faculties and students an opportunity to interact and gel up with each other, there was round for volunteer performance where students could exhibit their talent and it boosts their confidence.

ARTICLES

Energy Harvesting

Energy harvesting (EH) also known as power harvesting, energy scavenging, or ambient power – is the process by which energy is derived from external sources (e.g., solar power, thermal energy, wind energy, salinity gradients, and kinetic energy, also known as ambient energy), then stored for use by small, wireless autonomous devices, like those used in wearable electronics, condition monitoring and wireless sensor networks. Energy harvesters usually provide a very small amount of power for low-energy electronics. While the input fuel to some large-scale energy generation costs resources (oil, coal, etc.), the energy source for energy harvesters is present as ambient background. For example, temperature gradients exist from the operation of a combustion engine and in urban areas, there is a large amount of electromagnetic energy in the environment due to radio and television broadcasting.

One of the main driving forces behind the search for new energy harvesting devices is the desire to power sensor networks and mobile devices without batteries that need external charging or service. Batteries have several limitations, such as limited lifespan, environmental impact, size, weight, and cost. Energy harvesting devices can provide an alternative or complementary source of power for applications that require low power consumption, such as remote sensing, wearable electronics, condition monitoring, and wireless sensor networks. Energy harvesting devices can also extend the battery life or enable batteryless operation of some applications.

Another motivation for energy harvesting is the potential to address the issue of climate change by reducing greenhouse gas emissions and fossil fuel consumption. Energy harvesting devices can utilize renewable and clean sources of energy that are abundant and ubiquitous in the environment, such as solar, thermal, wind, and kinetic energy. Energy harvesting devices can also reduce the need for power transmission and distribution systems that cause energy losses and environmental impacts. Energy harvesting devices can therefore contribute to the development of a more sustainable and resilient energy system. Energy can also be harvested to power small autonomous sensors such as those developed using MEMS technology. These systems are often very small and require little power, but their applications are limited by the reliance on battery power. Scavenging energy from ambient vibrations, wind, heat, or light could enable smart sensors to function indefinitely.

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Semester 4th

Industrial Automation

Automated machines can be subdivided into two large categories—open-loop and closed-loop machines, which can then be subdivided into even smaller categories. Open-loop machines are devices that, once started, gothrough a cycle and then stop. A common example is the automaticdishwashing machine. Once dishes are loaded into the machine and a button pushed, the machine goes through a predetermined cycle of operations: pre-rinse, wash, rinse, and dry, for example. A human operator may havechoices as to which sequence the machine should follow—heavy wash, light wash, warm and cold, and so on—but each of these operations is alike in that the machine simply does the task and then stops. Today's manufacturers in numerous industries are gaining rapid increases in productivity by taking advantage of automation technologies. One of these automation technologies, robotics, is a key factor leading the way in the twenty-first century. As manufacturing assembly has grown increasingly complex, the need for new and expanded capabilities, particularly in automated assembly systems, has become evident. As components get smaller, as in micro-manufacturing, it is required that greater precision, more flexibility and higher throughput are achieved. Manual assembly no longer suffices for a great many of manufacturing's current requirements. Functions formerly performed by humans, especially difficult, dangerous, monotonous, or tedious tasks, are now often assumed by robots or other mechanical devices that can be operated by humans or computers. Robots can take the place of humans in extreme settings or life threatening situations involving nuclear contaminants or poisonous fumes.

While the automotive industry is the largest market for robot manufacturers, other industries are increasing their use of robotics. According to reports from the Robotics Industries Association, industries such as semiconductors and electronics, metals, plastics and rubber, food and consumer goods, life sciences and pharmaceuticals, and aerospace are all finding ways that their services can be enhanced and improved through robotics.

Some of these manufacturers are also improving the quality of their products by using robots with powerful machine-vision inspection equipment or by linking their robots to statistical process control systems. Robot fixtures can move quickly and fluidly without sacrificing accuracy. Servo-driven positioners can be programmed to handle more than one model on the same line, something especially important to lean organizations.

Name: Satyam Kumar Sahani
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Semester: 4th

Programmable Logic Controller

In the 1960s and 1970s, industry was beginning to see the need for automation. Industry saw the need to improve quality and increase productivity. Flexibility had also become a major concern. Industry needed to be able to change processes quickly to meet the needs of the consumer.

PLC is a programmable logic controller, also called a PLC or programmable Controller, is a computer-type device used to control equipment in an industrial facility. The kinds of equipment that PLCs can control are as varied as industrial facilities themselves. Conveyor systems, food-processing machinery, auto assembly lines.

Old ways There was always a huge wiring panel to control the system. Inside the panel there were masses of electromechanical relays. These relays were all hardwired together to make the system work. Hardwiring means that an electrician had to install wires between the connections of the relays. An engineer would design the logic of the system and electricians would be given a blueprint of the logic and would have to wire the components together.

Earlier ways The only way to see everything was correct was to run the system. Troubleshooting was done by running the actual system. This was a very time-consuming process. No product could be manufactured while the wiring was being changed and system had to be disabled for wiring changes. This means that all the production personnel associated with that production line were without work until the system was repaired.

Need for PLC Due to the disadvantages of the hardwired control panels industry saw the need to replace them and introduce PLCs.Increased competition to manufacturers to improve both quality and Productivity.Flexibility, rapid changeover and reduced downtime became important.Industry realized that a computer could be used for logic instead of hardwired relays. Computer could take the place of huge, costly, inflexible, hardwired control panels. If changes in the system logic or sequence of operations were needed, the program of the computer could be changed instead of rewiring. Imagine eliminating all the downtime associated with wiring changes. Imagine being able to completely change how a system operated by simply changing the software in the computer.

Advantages of PLC

1. High reliability
2. Small space requirements
3. Computing capabilities
4. Reduced costs
5. Ability to withstand harsh environments
6. Expandability.

How PLC helps in removing complexity

In a traditional industrial control system, all control devices are wired directly to each other according to how the system is supposed to operate. In a PLC system, however, the PLC replaces the wiring between the devices. Thus, instead of being wired directly to each other, all equipment is wired to the PLC. Then, the control program inside the PLC provides the "wiring" connection between the devices.

The control program is the computer program stored in the PLC's memory that tells the PLC what's supposed to be going on in the system. The use of a PLC to provide the wiring connections between system devices is called soft wiring.

The soft wiring advantage provided by programmable controllers is tremendous. In fact, it is one of the most important features of PLCs. Soft wiring makes changes in the control system easy and cheap. If you want a device in a PLC system to behave differently or to control a different process element, all you have to do is change the control program. In a traditional system, making this type of change would involve physically changing the wiring between the devices, a costly and time-consuming process.

Lets say that two push buttons, PB1 and PB2, are connected to a PLC. Two pilot lights, PL1 and PL2, are also connected to the PLC. The way these devices are connected now pressing push button PB1 turns on pilot light PL1 and pressing push button PB2 turns on pilot light PL2. Lets say that you want to change this around so that PB1 controls PL2 and PB2 controls PL1. In a traditional system, you would have to rewire the circuit so that the wiring from the first push button goes to the second pilot light and vice versa. However, because these devices are connected to a PLC, making this change is as simple as making a small change in the control program.

Name: Jied kupar jarain
Roll No: 2101231
Semester: 8th

"You have brains in your head. You have feet in your shoes. You can steer yourself any direction you choose. You're on your own. And you know what you know. And you are the guy who'll decide where to go."

— Dr. Seuss

Wireless Commuincation Systems

In the current scenario development sin wireless communication industries continue to derive requirement of small, compatible and affordable micro strip patch antennas. A patch antenna is a narrowband antenna with large beamwidth. It is fabricated by etching the antenna element pattern in metal trace which is bonded to an insulating dielectric substrate such as a printed circuit board with a continuous metal layer bonded to the opposite side of the substrate known as a ground plane. There are different shapes of micro strip antenna which are square, rectangular, circular and elliptical, but antenna can have any continuous shape. Instead of using a dielectric substrate, some antennas can be made of ametal patch mounted above a ground plane using dielectric spacers. They are often mounted on the exterior of air craft and space craft or are incorporated into mobile radio communications devices. Micro stripantennasare best choice for wireless devices because of characteristics like low profile, low weight, ease of fabrication and low cost. Since it is common practice to combines ever all radios into one wireless and use single antenna. Micro stripantenna suffers from disadvantages like they have less bandwidth and gain. For obtaining multi band and wide band characteristics, different techniques have been used like cutting slot in patch, fractal geometry and DGS. In order to increase bandwidth DGS has been used. DGS may be realized by cutting shape from ground plane. Shape can be simple or complex. It is to be noted that with in particular area of ground different DGS can produce different reason ant frequencies and different bandwidth. In this dissertation two radiating Usloting round plane have been cut out. Hence new resonances along with effective current paths are generated in ground plane, as result wide band characteristics have been obtained.

Wireless and Microwave Communication Applications

Wireless communication is fastest growing segment of the communication industry. It has captured the attention of the media and the imagination of public. Cellular systems have experienced exponential growth over the last few decades and there are currently around two billion users worldwide. Cellular phones have become an important business tool and play a good role in day to day life in most developed countries. They are rapidly supplanting antiquated wire line systems in many developing countries. The table below shows the different wireless and microwave communication their ranges, applications and there bandwidth. Standard band designations for microwave frequencies listed as per Institute of Electrical and Electronics Engineering (IEEE) is the industry standards.

Name: Doman Deep

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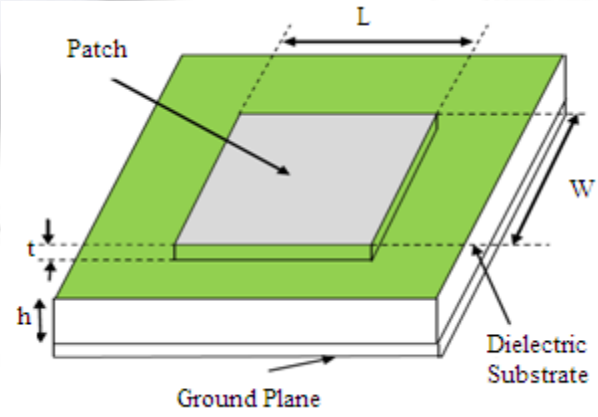
Semester: fourth

Microstrip Antenna

The idea of the microstrip antenna was introduced in 1950's but it became popular and took place in various applications 1970's. A microstrip patch antenna consists of a radiating conducting strip placed on a grounded dielectric layer. Design of the radiating patch (length, width, feed type etc.) and characteristic of the dielectric substrate (dielectric constant, height of the substrate etc,) determines the behavior of antenna. The center conductor of a coaxial cable serves as feed probe to couple electromagnetic energy in and out of the patch. The electric field distribution of a rectangular patch antenna can be excited in its fundamental mode. Microstrip patch can be of different such as a rectangular, square or disk patches. They can provide linear, dual or circular polarization by appropriate feeding. Patch antennas are low cost; have a low profile and compact are easily fabricated. Microstrip antenna is shown in Figure 1.2 The patch is having a length L, width W, and thickness h with permittivity ε_r. The thickness of the ground plane or of the microstrip patch is not much important. The height h is much smaller than the wavelength of operation but not much smaller than 0.05 of a wavelength. The frequency of operation of patch antenna is determined by the length L and width W. The center frequency is given as by following equation.

$$Fc = C / 2 \times L \times \sqrt{\mathcal{E}r} = 1 / 2 \times L \times \sqrt{\varepsilon_0 \varepsilon_r \mu_0}$$

The electric field is zero at the center of the patch, maximum (positive) at one side, and minimum (negative) on the opposite side. The minimum and maximum electric fields continuously change side according to the instantaneous phase of the applied signal the field extends the outer periphery to some degree. These fields extension are known as fringing fields and cause the patch to radiate.



The dielectric substrate act as an electrical insulator is a substance that is highly resistant to the flow of electric current. Ideally, the dielectric constant $\in_r$ of the substrate should be low ($\in_r < 2.5$) to enhance the fringing field that account for radiation. However in some cases, other performance requirements may dictate the use of dielectric material whose dielectric constants can be greater for $\in_r > 4$ [17]. Microstrip patch antenna

is widely considered to be suitable for many wireless applications, even though it usually has a narrow bandwidth. To meet the above requirements, two individually challenging modification may have to be combined to design a microstrip antenna with dual-frequency characteristics and wideband operation. Several broad banding techniques for microstrip patch antenna are widely known, prominent among them are the use of parasitic patch configuration. The stacked microstrip patch antennas have multilayer structure consisting of several parasitic radiating elements placed one above the other and above driven element. However this approach has the inherent disadvantage of increased overall thickness and issue related to aligning various layers precisely.

The Advantages & Disadvantages of Microstrip Antenna

Microstrip antenna has several advantages compared to the conventional microwave antennas, and many applications cover the broad frequency range from ~100 MHz to ~100 GHz. Below are some advantages of them compared to the conventional antennas.

- Light weight, low volume, thin profile configurations
- Low fabrication cost, readily amenable to mass production
- Both linear and circular polarization are possible with simple feed
- Dual polarization and dual frequency antennas can be easily made
- No cavity backing is required
- Easily can be integrated with microwave integrated circuits.
- Feed lines as well as matching networks can be fabricated at the same time with the antenna structure, on the other side, there are also some limitations compared to the conventional antennas as follow.
- These antenna have narrow bandwidth
- Lower gain (~6dB)
- Feed structure of arrays have large ohmic loss
- Most microstrip antennas radiate in to half-space
- Complex feed structures needed for high performance arrays
- Polarization purity is difficult to achieve for these antennas
- Poor end –fire radiator, except tapered slot antenna
- Extraneous radiation from feed and junctions

Applications

Microstrip antennas are spreading widely in all the fields and areas are now they are playing an important role in the commercial aspects due to their low cost of the substrate material and the fabrication.

Microstrip patch antennas can be used for different applications. Some of applications of microstrip antenna are discussed as below:

- **Mobile and Satellite Communication Application:** Circularly polarized radiation patterns are required for satellite communication which can be realized using either square or circular patch with one or two feed points. Microstrip antennas have been designed for different mobile communication systems. Small, low-cost, low profile antennas are required for mobile communication applications.
- **Global Positioning System Applications:** Microstrip patch antennas with substrate having high permittivity are used for mainly GPS applications, there are millions of GPS receivers that are used by the general population for aircraft, land vehicles and maritime vessels to find their position accurately.
- **Radio Frequency Identification:** This application is find its use in different areas like mobile communication, logistics, transportation, manufacturing and health care. RFID system uses frequencies between ranges of 30 Hz to 5.8 GHz depending on its applications. RFID system is a tag or transponder and a transceiver or reader.
- **Worldwide Interoperability for Microwave Access:** The IEEE 802.16 standard is known as WiMAX. It can reach up to 30 mile radius theoretically and data rate 70Mbps. MPA generates three resonant modes at 2.7, 3.3 and 5.3 GHz and can hence can be used in WiMAX compliant communication equipment.
- **Radar Application:** The microstrip antennas are an ideal choice as compared to that of conventional antennas. Radar finds its application for detecting moving targets like people and vehicles. Since this application demands a low profile, light weight antenna subsystem.
- **Telemedicine Application:** Microstrip antenna is most suitable for Wireless Body Area Network (WBAN). For telemedicine application antenna can be operate at 2.45GHz. The proposed antenna achieved a higher gain. An antenna having gain of 6.7 dB and a front to back ratio of 11.7 dB and resonates at 2.45 GHz is suitable for these applications.

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Roll no: 2101232
Semester: 8th

QUIZ

Questions

1. Who was the first President of India?
2. Who is known as Father of Indian Constitution?
3. Which is the most sensitive organ in our body?
4. Which is the heavier metal of these two? Gold or Silver?
5. Who invented Computer?
6. 1024 Kilobytes is equal to?
7. Brain of computer is?
8. India lies in which continent?
9. Which country are the Giza Pyramids in?
10. What city is the statue of liberty in?

Answers

1. Dr. Rajendra Prasad
2. Dr. B. R. Ambedkar
3. Skin
4. Gold
5. Charles Babbage
6. 1 Megabyte (MB)
7. CPU
8. Asia
9. The Giza Pyramids are in Egypt.
10. The statue of liberty is in New York City

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