



# Electronics Engineering

What it means to be an Electronics Engineer!

**Gajendra Circle Initiative (GCI) from IIT Madras Alumni Association and The Hindu Group**

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## Introduction

In the field of electronic engineering, engineers design and test circuits that use the electromagnetic properties of electrical components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality. The tuner circuit, which allows the user of a radio to filter out all but a single station, is just one example of such a circuit.

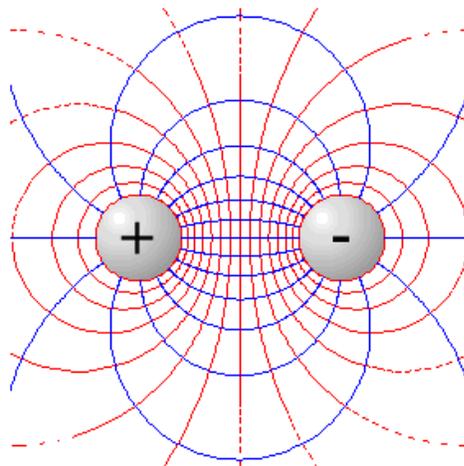
In designing an integrated circuit, electronics engineers first construct circuit schematics that specify the electrical components and describe the interconnections between them. When completed, VLSI engineers convert the schematics into actual layouts, which map the layers of various conductor and semiconductor materials needed to construct the circuit. The conversion from schematics to layouts can be done by software, but very often requires human fine-tuning to decrease space and power consumption. Once the layout is complete, it can be sent to a fabrication plant for manufacturing.

Integrated circuits and other electrical components can then be assembled on printed circuit boards to form more complicated circuits. Today, printed circuit boards are found in most electronic devices including televisions, computers and audio players.

## What You Learn in Electronics Engineering?

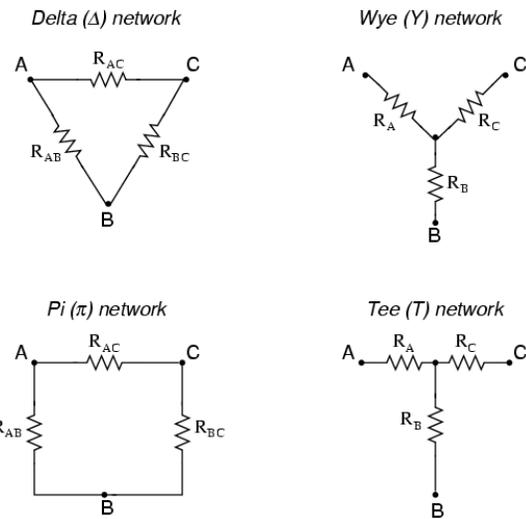
The main areas of study in Electronics Engineering are:

**Electromagnetics**- deals with about electromagnetics: ranging from electromagnetic fields and how they operate to the specifics of direct current and alternating current circuitry is intended to help you navigate those troubled currents of electrons.

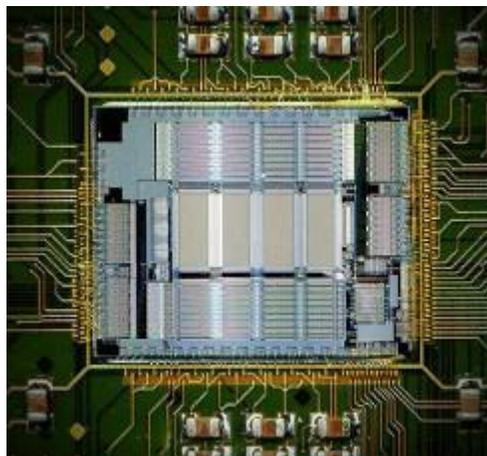


**Network Analysis**—deals with Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state

sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.



**Electronic Devices and Circuits** – An electronic component is any physical entity in an electronic system used to affect the electrons or their associated fields in a desired manner consistent with the intended function of the electronic system. Components are generally intended to be connected together, usually by being soldered to a printed circuit board (PCB), to create an electronic circuit with a particular function (for example an amplifier, radio receiver, or oscillator). Components may be packaged singly or in more complex groups as integrated circuits. Some common electronic components are capacitors, resistors, diodes, transistors, etc. Components are often categorized as active (e.g. transistors and thyristors) or passive (e.g. resistors and capacitors).



**Signals and Systems** – A signal represents a set of one or more variables and is used to convey the characteristic information (or the attributes) of a physical phenomenon.

The world around us is full of signals. Indeed our connection with the world is through the various signals that our senses can interpret for their corresponding physical phenomena: the human voice, the sounds of nature, the light we see, the heat we feel, are all signals.

The classification of a signal is based on: (1) how is it represented in time and (2) how is its amplitude allowed to vary.

**Communications** – The “electronic communication” means any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photooptical system that affects interstate or foreign commerce, but does not include (A) any wire or oral communication; (B) any communication made through a tone-only paging device; (C) any communication from a tracking device; or (D) electronic funds transfer information stored by a financial institution in a communications system used for the electronic storage and transfer of funds.

The following subjects are generally taught in India:

- Mathematics, Physics
- Basics of Electronics Engineering
- Electronics Devices & Circuits
- Digital Techniques & Applications
- Electronics Measuring Instruments
- Electronics Materials & Components
- Communication System
- Microprocessor & Microcontroller
- Microprocessor 8085 Lab
- Power Electronics
- Computerized Distributed Process Control
- Data Communication & Networking
- VLSI-Design Techniques
- Embedded Systems
- Mechatronics
- Industrial Electronics
- Robotics & Automation
- Optical Fiber Communication
- Industrial Automation
- Linear Integrated Circuits
- Mobile Communication
- Radio Frequency Identification Techniques
- Nanotechnology
- Medical Imaging (Biomedical Electronics)
- Introduction to Instrumentation Electronics
- Biomedical
- Noise Screening & Calibration (Biomedical)
- Physiological Measurements (Biomedical)
- Manufacture, Management & Safety of
- Medical Equipments (Biomedical)



A Typical Electronics Lab

In some institutes, Electrical Engineering and Electronics & Communication Engineering are taught as a unified course such as IIT Bombay, Delhi & Kanpur. IIT Kharagpur & Madras & IT-BHU at Varanasi, on the other hand, offer separate course for the two board discipline.

## Opportunities

Most colleges have courses in electronics, as well as electromagnetics, which someone going into electronics will need. Good knowledge of mathematics, especially wave functions is necessary. Depending on the school, you may be considered an Engineering student instead of a physics student, but there will be a fair amount of overlap. This is one of the more practical fields of physics, so you will likely focus more on applications than theory.

- Telecommunications Systems
- Electric Power Stations & Plants
- Wiring and lighting of houses
- Designing household appliances
- Electrically-controlled industrial machinery
- Communications
- Computers
- Electronics
- Robotics
- Biomedical electronics
- Signal processing
- Transportation
- Industrial process control
- Energy operation and distribution
- Electro-mechanical energy conversion

Electronic Engineers can also go for higher studies such as PG. Some of the PG specializations offered are:

- Embedded systems design
- VLSI electronics
- Communication Engineering
- Control & Computing
- Power Electronics & Power Systems
- Micro Electronics
- Electronic Systems

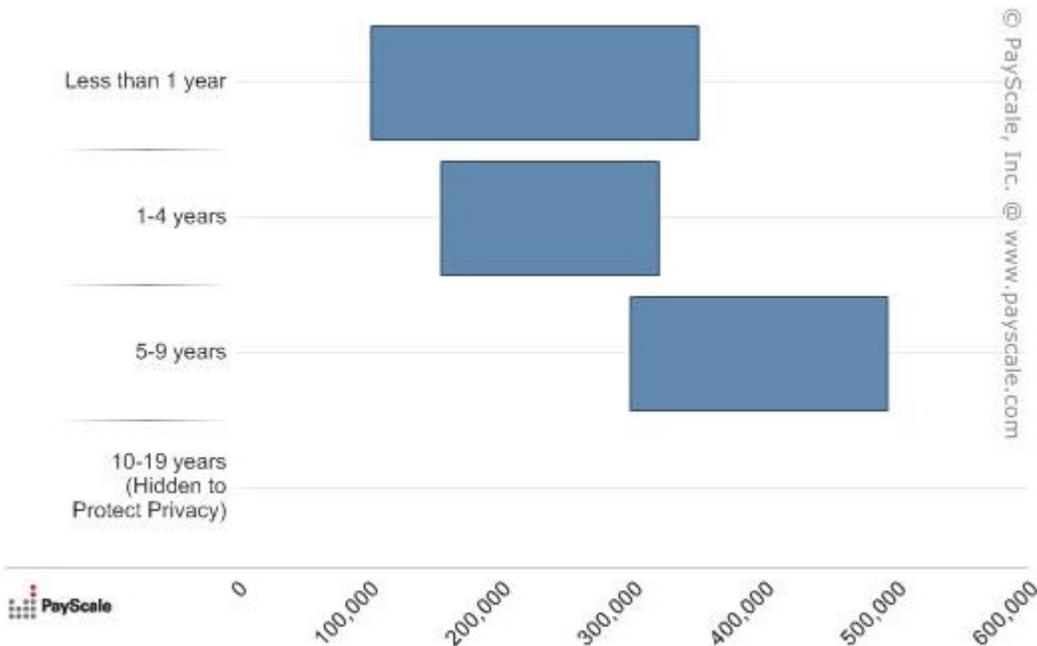
Professional bodies of note for electrical engineers include the Institute of Electrical and Electronics Engineers (IEEE).

Some leading companies in this field are: GE, Siemens, Larsen & Toubro (L&T), BHEL.

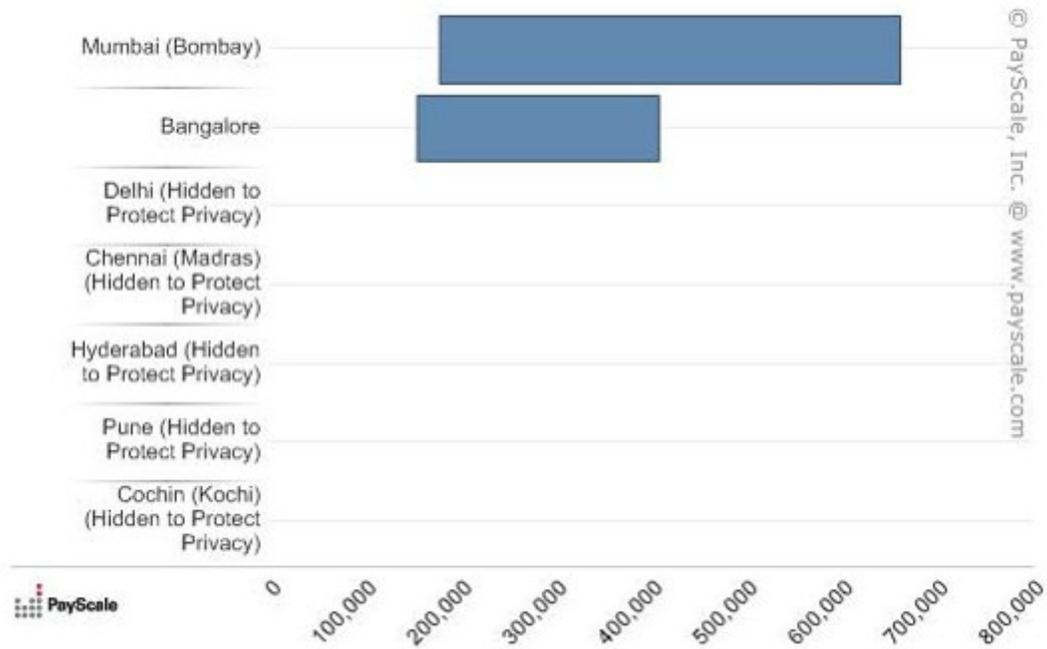
## Salary Profile

This section provides salary profile of Electronics engineers in India based on years of experience, city of employment, type of employer.

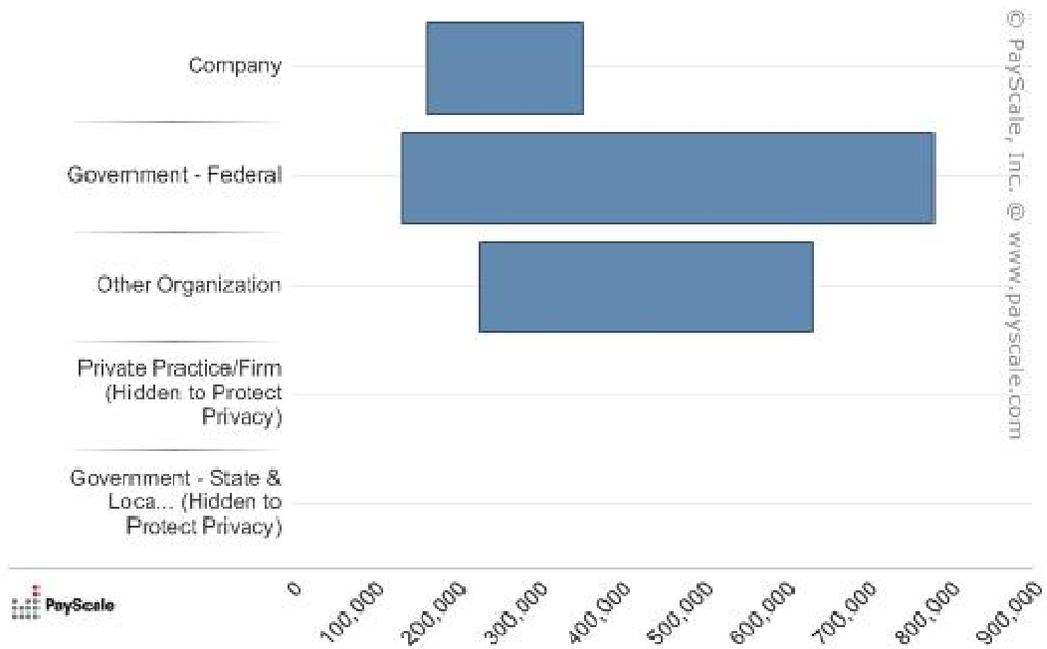
### Salary Range for Electronics Engineers (by years of experience)



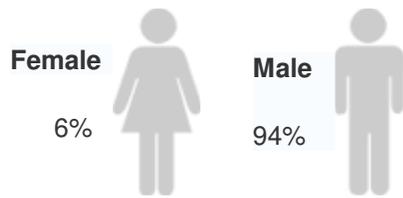
### Salary Range for Electronics Engineers (by City)



### Salary Range by Type of Employer for Electronics Engineers



## Gender Profile



## Areas of Research in Electronics Engineering

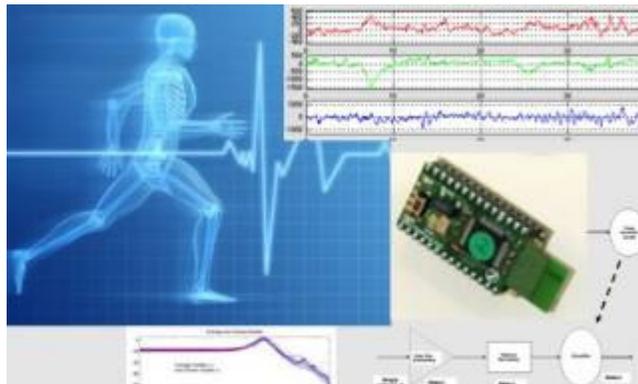
In conjunction with our field-based Advanced Engineering Group you can gain access to our regional System Design Centers.

Future Electronics' System Design Centers provide a complete offering of solutions from new product development, product design evaluation, reference designs validation, proof of concepts and other various design consulting services.

One of the most valued services of our System Design Center is our Tool Loaner Program. Future Electronics offers, on loan, free development tools from many of our major manufacturer partners. This allows our customers to evaluate both hardware platforms as well as tool offerings without significant up front expenditures.

Future Electronics also develops reference and evaluation platforms that we offer to our customers. These designs will often incorporate a variety of technologies that act as enablers to product development. These tested and documented designs include the hardware, software and documentation needed to replicate example designs or applications.

This section provides guidance to some of the technological advancements - giving glimpse of what an Electronics Engineer may work on in future.



Some of the promising areas based on advancement and research are as below. There are research as well as employment opportunities in these areas:

- Nanoelectronics and Nanomaterials
- Signal and Image Processing
- Systems and Control
- Telecommunications

## Reference

This report has been compiled based on the following publications.

- [http://en.wikipedia.org/wiki/Electronic\\_engineering](http://en.wikipedia.org/wiki/Electronic_engineering)
- [www.winentrance.com](http://www.winentrance.com)
- <http://www.naukrihub.com/job-openings/electrical-engineer-india/>
- <http://afterbtech.com/electrical-engineering-scope-and-career-prospects.html>
- <http://career-advice.monster.com/job-search/company-industry-research/engineering-hiring-salary-2009/article.aspx>
- [http://www.officialwire.com/main.php?action=posted\\_news&rid=121558&catid=1255](http://www.officialwire.com/main.php?action=posted_news&rid=121558&catid=1255)
- <http://www.ulinks.com>
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- <http://www.google.co.in/images?q=Electronics+Engineering&btnG=Search&um=1&hl=en&client=firefox-a&rls=org.mozilla%3Aen-US%3Aofficial&tbs=isch%3A1&sa=2>
- <http://www.dcu.ie/electronics/research.shtml>
- <http://uk.futureelectronics.com/en/company-information/about-future-electronics/Pages/AdvancedEngineeringGroup.aspx>

## About Gajendra Circle

Gajendra Circle (GC) Initiative is a subset of IITM alumni association, and is aimed at building the IIT Madras brand and strengthening the Institute resources. It has been structured as a collection of city specific cells. GC Hyderabad was constituted in April 2010 with the aim to take up activities which strengthen IIT Madras and have a good resonance with the core team.

## About Adayana

Adayana is a leading Human Capital Development organization with its headquarters in Indianapolis, IN, USA and offices across Americas, EMEA, Asia. Adayana provides comprehensive learning services that leverage best-of-class and proprietary technologies and processes.

For four subsequent years, from 2006 to 2009, TrainingOutsourcing.com recognized us as one of the "Top 20 Companies in the Training Outsourcing Industry" for its unique and diverse capabilities. In 2007, 2008 and 2009 Adayana has been named to the Inc. 500 list of America's 500 fastest growing companies. Adayana offers e-Learning, instructor-led training, mobile learning, gameware and performance support tools to its customers for improving human capital performance.

Adayana India (based in Hyderabad) focuses on India and Asia markets - serving large multinationals in the Automotive, IT/ITES, Healthcare, Agriculture & Food and other verticals. Adayana is a leading player in skill development and capacity building and has partnered with leading universities and colleges to provide finishing school content to improve employability of students.

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