



Electrical Engineering

What it means to be an Electrical Engineer!

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

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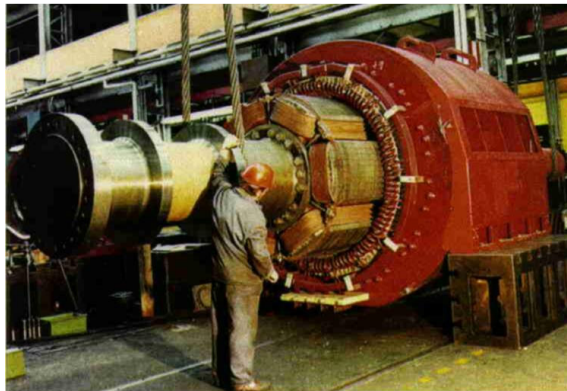
Introduction

Electricity has become the basic need for survival, globally. From household to industrial plants, communication and satellite navigation system, electronic equipment, computers etc., all require electricity. Electrical engineering thus deals with study and application of electrical systems for use in these different environments. It equips you with the knowledge of transmission and generation of electrical power, electrical circuit design, electronics, instrumentation, control system, understanding electrical and electronic networks etc. The course also covers the study of electronic devices and circuits involved in measurement, instrumentation, control and protection of electrical equipments and conversion systems. Concept of computer and recent applications of computer based systems in design, analysis and efficient operation of power system, maintaining quality and security, also included in the course. In India, generally, it does not include Electronics Engineering. However, "Power Electronics" is considered domain of Electrical Engineering as it deals with application of electronics to power distribution.

What You Learn in Electrical Engineering?

The main areas of study in Electrical Engineering are:

Power & Electrical Machine – deals with the generation, transmission, and distribution of electricity as well as the design of a range of related devices. These include transformers, electric generators, electric motors, high voltage engineering and power electronics.



Control – deals with use electrical circuits, digital signal processors, microcontrollers and PLCs (Programmable Logic Controllers) to control various machines for desired behavior. It has wide range of applications from the flight and propulsion systems of commercial airliners to the cruise control present in many modern automobiles. It also plays an important role in industrial automation.

Signal Processing – deals with processing of electrical signals (analog or digital). It is a very mathematically oriented and intensive area forming the core of digital signal processing and it is rapidly expanding with new applications in every field of electrical engineering such as communications, control, radar, TV/Audio/Video engineering, power electronics and bio-medical engineering as many already existing analog systems are replaced with their digital counterparts.

Power Electronics— deals with controlling power by means of electronics. “Inverters” in our daily life is an example of power electronics application.

Instrumentation – Instrumentation engineering deals with the design of devices to measure physical quantities such as pressure, flow and temperature. The design of such instrumentation requires a good understanding of physics that often extends beyond electromagnetic theory. For example, radar guns use the Doppler Effect to measure the speed of oncoming vehicles.

The following subjects are generally taught in India:

- Mathematics, Physics
- Basic Electrical
- Electronics
- Thermodynamics
- Electrical machines and design
- Digital Electronics
- Electrical Engg. Materials
- Linear Control Systems
- Instrumentation
- Electrical network and communication systems
- Power and control systems
- Computer Aided Power System Analysis
- Non-linear and Digital Control Systems
- Extra High Voltage Engg.
- Communication Engg.
- Electrical Machine Design
- Electric Drives & Utilization
- Power Electronics
- Numerical Analysis
- Microprocessors and Interfacing
- E.M. Field Theory
- Others



A Typical Electrical 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

Electrical Engineers are needed in all manufacturing units and all major companies of public and private sector. Electricity boards, large scale industries, manufacturing plants, power corporations, hydro-electricity sector are continuously in need of Electrical Engineers for their projects. Electrical Engineers also find job prospects in design industries, production plants, natural gas plants, petroleum as well as in steel and chemical plants. Many premier educational and research institutions regularly intake electrical engineers as graduate engineer trainees and management trainees to work on research projects.

Electrical Engineers can also get a job in major players in public sector such as Indian Railways, Armed forces (Technical Branch) and also in Thermal and Nuclear power Corporation Limited.

They may also enter the fields of communications, computers, electronics, robotics, biomedical electronics and signal processing, transportation, industrial process control, energy operation and distribution, and electro-mechanical energy conversion. Representative list of fields for electrical engineers from career perspective is:

- 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

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

- Communication Engineering
- Control & Computing
- Power Electronics & Power Systems
- Micro Electronics
- Electronic Systems

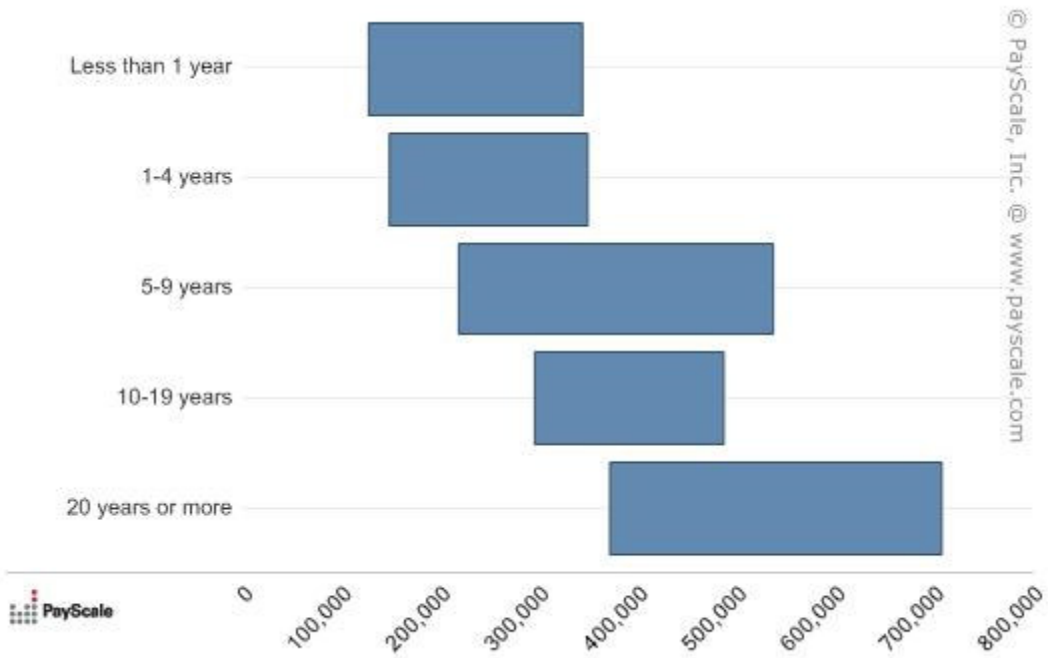
Professional bodies of note for electrical engineers include the Institute of Electrical and Electronics Engineers (IEEE).

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

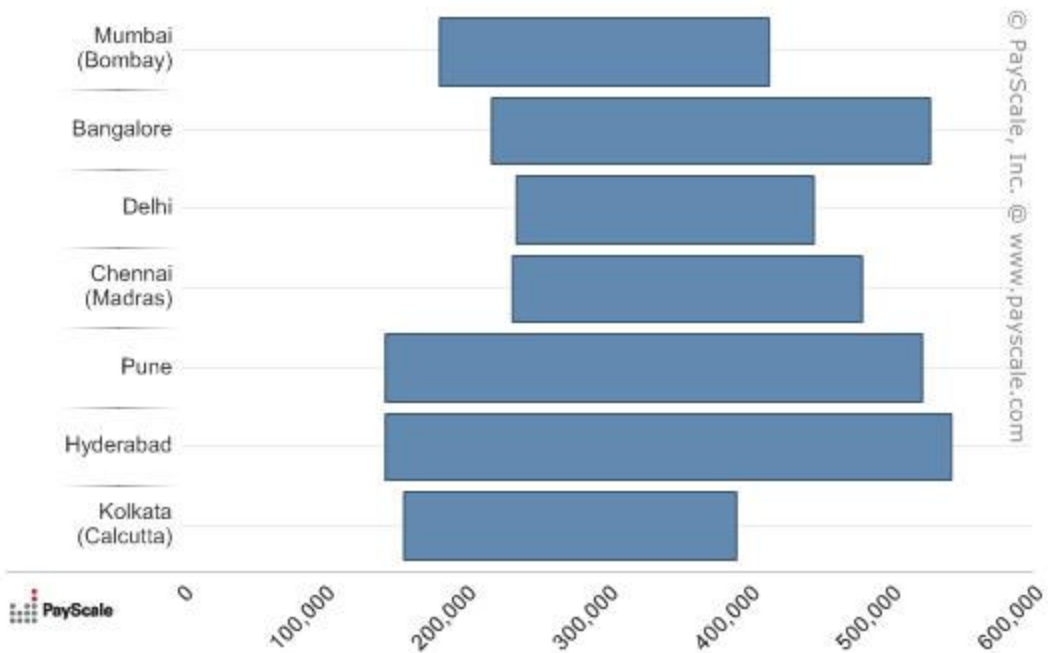
Salary Profile

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

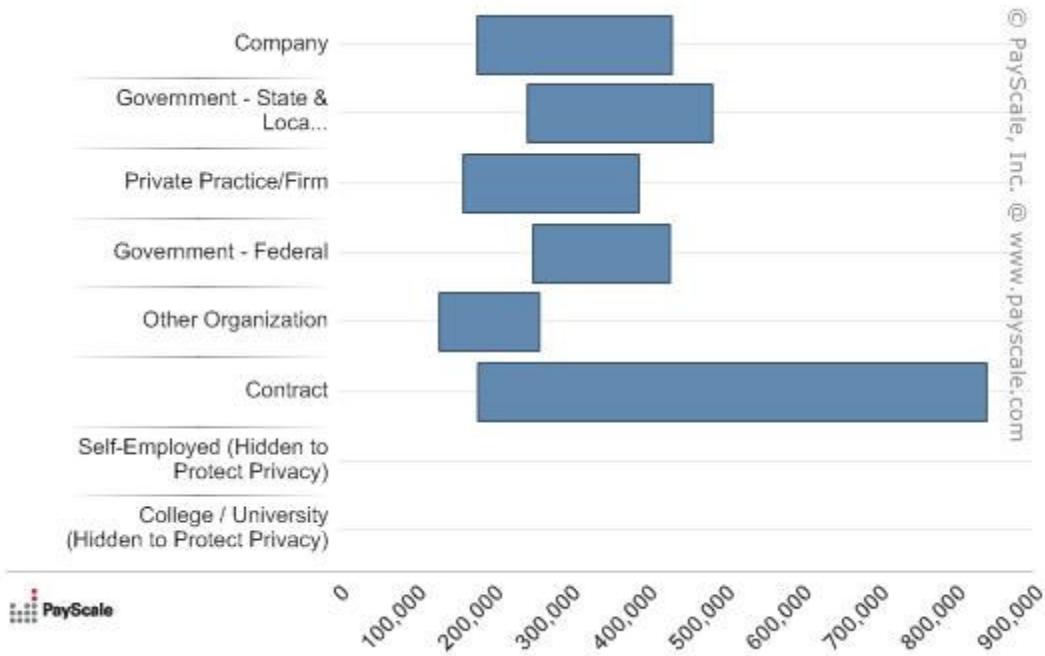
Typical Salary Data for Electrical Engineers (by years of experience)



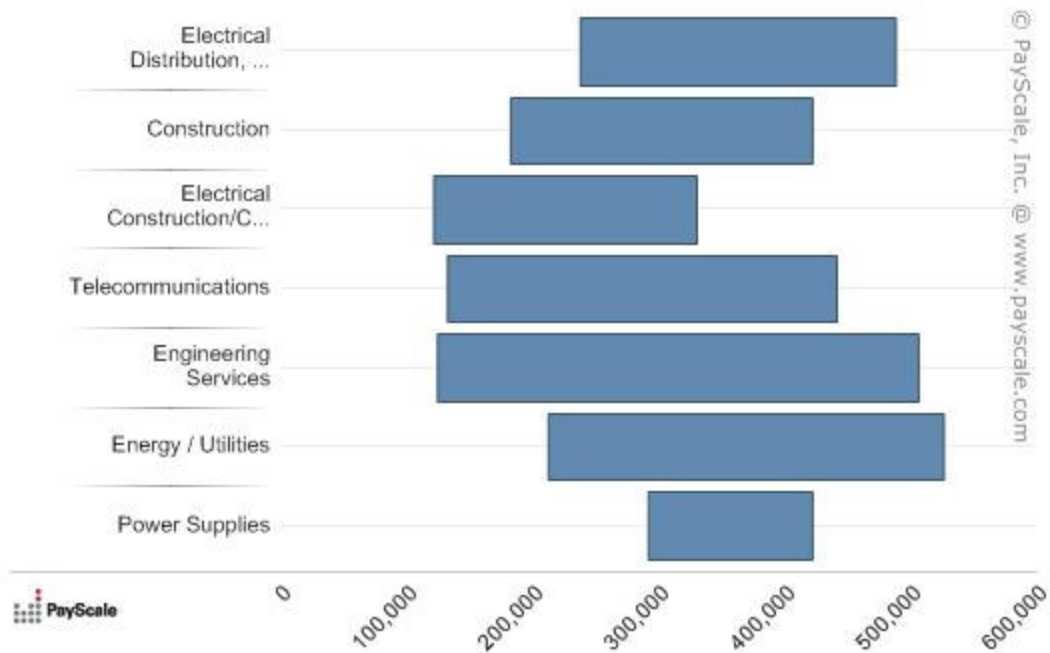
Typical Salary Data for Electrical Engineers (by City)



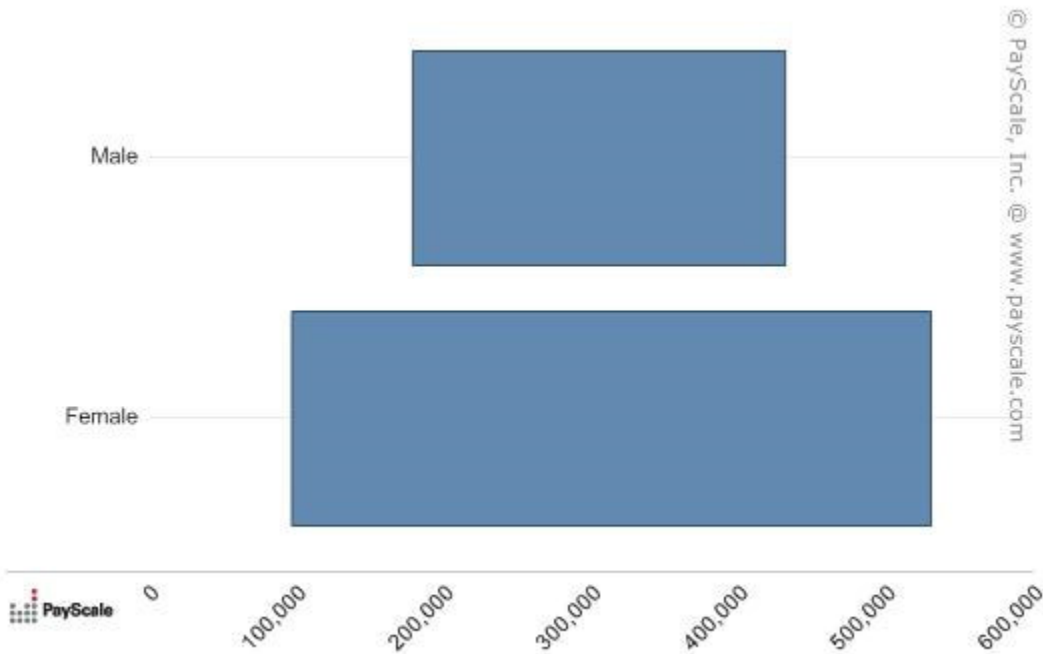
Typical Salary Data for Electrical Engineers (by Type of Employer)



Popular Industry & Salary Range



Gender Profile for Electrical Engineers



Areas of Research in Electrical Engineering

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

Control systems play very important role in guiding space flight, airplane, satellite, missiles, industrial machinery, industrial robots, and even household items such as refrigerators.



Digital signal processing (DSP) is concerned with the representation of signals by a sequence of numbers or symbols and the processing of these signals. Digital signal processing and analog signal processing are subfields of signal processing. DSP includes subfields like: audio and speech signal processing, sonar and radar signal processing, sensor array processing, spectral estimation, statistical signal processing, digital image processing, signal processing for communications, control of systems, biomedical signal processing, seismic data processing, etc.

The main applications of DSP are audio signal processing, audio compression, digital image processing, video compression, speech processing, speech recognition, digital communications, RADAR, SONAR, seismology, and biomedicine.

Specific examples are speech compression and transmission in digital mobile phones, room matching equalization of sound in Hifi and sound reinforcement applications, weather forecasting, economic forecasting, seismic data processing, analysis and control of industrial processes, computer-generated animations in movies, medical imaging such as CAT scans and MRI, MP3 compression, image manipulation, high fidelity loudspeaker crossovers and equalization, and audio effects for use with electric guitar amplifiers.

Maglev, or magnetic levitation, is a system of transportation that suspends, guides and propels vehicles, predominantly trains, using magnetic levitation from a very large number of magnets for lift and propulsion. This method has the potential to be faster, quieter and smoother than wheeled mass transit systems. The technology has the potential to exceed 6,400 km/h (4,000 mi/h) if deployed in an evacuated tunnel.[8] If not deployed in an evacuated tube the power needed for levitation is usually not a particularly large percentage and most of the power needed is used to overcome air drag, as with any other high speed train.

The highest recorded speed of a maglev train is 581 kilometres per hour (361 mph), achieved in Japan in 2003,[9] 6 km/h faster than the conventional TGV speed record. This is slower than many aircraft, since aircraft can fly at far higher altitudes where air drag is lower, thus high speeds are more readily attained.

Linear motor concept from Electrical Engineering is key to Maglev.

Reference

This report has been compiled based on the following publications.

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- <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>
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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 our 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.

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