History of Computer and Electrical Engineering

Inventors and Milestones

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2750 BC

Electric Fish

Electric Blue Damsel Fish

The first time humans experienced electricity (other than lightning) was the shocks from electric fish. In fact, ancient Egyptian writing in 2750 BC referred to electric fish as 'Thunder of the Nile'

2700 BC

The Abacus

A Roman Abacus

The abacus is believed to have first appeared in Mesopotamia somewhere between 2700 and 2300 BC. It is known as the Sumerian abacus. The oldest existing counting board today is the 'salamis' tablet that was used by the Babylonians in around 300 BC

900 BC

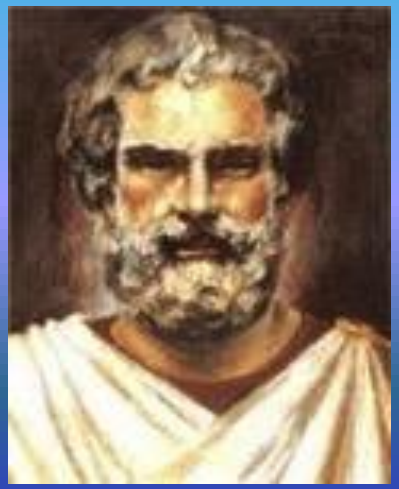
Magnetism observed by Magnus of Greece

Magnetite

It is believed that in 900 BC, a Greek shepherd named Magnus, when walking through a field of black stones (now known as magnetite), noticed that the stones pulled out the iron tip of his shepherd's staff and the nails from his sandals. Magnus is therefore considered one of the first to have experienced the phenomenon of magnetism

600 BC

Static Electricity perceived by Thales of Miletus



Thales of Miletus - Greek philosopher
(624 BC – 546 BC)

It is said that the Greek philosopher Thales of Miletus was the first known experimentalist on the static of electricity when he rubbed a rod of amber with cat's fur to attract light objects like feathers.

300 BC

Ancient to Modern Times Bioluminescence

Firefly

Firefly is of one of the many living organisms that produce light naturally via biochemical process (known as bioluminescence). Bioluminescence has been recorded as early as 300 BC by Aristotle, and all through the ages. In recent decades its study and scientific applications have come into greater prominence and under consideration are electrical applications, such as bioluminescent light bulbs and street lighting, as well as applications in defense, agriculture and medicine. Other organisms include glow worms, certain fungi, marine animals, and microorganisms.

1600

“Electricity” - The word invented by William Gilbert

William Gilbert - English physician and scientist

(1544-1603)

William Gilbert published his work “De Magnete” in 1600 which was widely accepted all over Europeas important scientific writing on electrical and magnetic phenomena. Gilbert distinguished between magnetism and static, invented the word ‘electricity’, and also coined terms such as ‘electric force’, ‘magnetic pole, and ‘electric attraction’.

1614

Napier's discussion of logarithms appears in a Latin publication

John Napier - Scottish mathematician (1550-1617)

John Napier is known as the discoverer of logarithms, who frequently used the decimal point in arithmetic and mathematics (the decimal system had been used much earlier in Indian mathematics and popularized by the Persian mathematician Al-Khawarizmi). Napier also invented a manually operated calculating device popularly called, "Napier's Bones". Napier's contribution to the development of logarithms is considered of great significance because it helped future scientists such as Kepler, Newton, and Laplace simplify and shorten

1623

Wilhelm Schickard designs and builds a calculating machine

Wilhelm Schickard - German astronomer (1592-1635)

Wilhelm Schickard, in two letters to Kepler dated 1623 and 1624, wrote about his design and construction of a calculating machine. The design was not yet complete and needed additional springs and wheels. Later in 1642, Blaise Pascal independently designed and built a mechanical calculator, which came to be known as Pascal's Calculator that could primarily add and subtract, but also multiply and divide through a more laborious process.

1642

Blaise Pascal independently designs and builds the mechanical calculator

Blaise Pascal - French Mathematician, physicist, inventor (1623-1662)

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1663

Electric generator invented by Otto Van Guericke

Otto Van Guericker - German Scientist, Politician, Inventor (1602-1686)

The first electric generator invented by Otto van Guericke in 1663 produced electricity by applying friction against a revolving ball of sulfur. Later, in 1672, he observed that the electricity produced in this manner made the sulfur ball glow. He is therefore said to be the first to have seen electroluminescence.

1675

Attraction and repulsion of electric force observed by Robert Boyle

Robert Boyle - Irish Scientist, Philosopher, Inventor (1627-1691)

Robert Boyle discovered that attraction and repulsion were mutual and that electric force could be transmitted through a vacuum. He created the first air pump and was the first scientist to arrive at scientific conclusions through experimentation and observation. He is most famous for 'Boyle's Law' which states that a decrease in the volume of a gas results in a proportional increase in pressure.

1705

Francis Hauksbee makes a glass globe glow with static electricity

Francis Hauksbee - English Scientist
(1666-1713)

In 1705, Francis Hauksbee discovered that light could be produced by friction, when he placed a small amount of mercury in a glass globe, removed some of the air to create a vacuum and then rubbed the globe to build up a charge. The glow that the experiment produced was extraordinary at the time and was a precursor to the development of neon lighting and mercury vapor lamps.

1729

Conduction of Electricity discovered by Stephen Gray

Stephen Gray - English dyer and Scientist (1666-1736)

Stephen Gray is known to have pursued science as a hobby. His most important finding, published in 1732, was the discovery of electrical induction and the difference between conductors and insulators.

1733

Two types of electricity are discovered by Charles François du Fay

Charles François du Fay - French Chemist (1698-1739)

Charles François du Fay became most famous for his discovery that there are two types of electricity, which he named ‘vitreous’ and ‘resinous’, later renamed as ‘positive’ and ‘negative’. Du Fay’s work published in 1733 is considered outstanding because it clarified many unexplained phenomena related to electricity

1745

The Leyden jar independently invented by E. Georg Von Kleist

E. Georg Von Kleist - German Physicist (1700-1748)

E. George Von Kleist invented the Kleistian jarin 1745. Some months later Pieter Van Musschenbroek of Leyden University invented, independently, a similar device called the Leyden jar. The Leyden jar is now referred to as a capacitor. Both scientists are credited with what is considered a contemporaneous invention.

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The Leyden jar independently invented by Pieter Van Musschenbroek

Pieter Van Musschenbroek – Dutch Scientist (1692-1761)

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1747

William Watson discharges a Leyden jar through a circuit

Sir William Watson – English Physician and Scientist (1715 - 1787)

When Sir William Watson discharged a Leyden jar through a circuit in 1747 a new understanding of current and circuit was created for the first time. He showed that by coating the jar inside and outside with lead foil its capacity to store charge was increased. Watson and Benjamin Franklin were contemporaries who coined the words 'positive' and 'negative' for the two types of electricity identified earlier by Du Fay as "vitreous" and "resinous", respectively.

1752

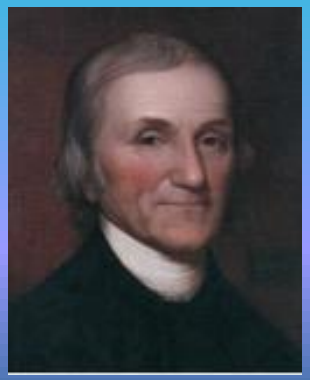
Benjamin Franklin conducts famous ‘kite experiment’ to study electricity

Benjamin Franklin – American Scientist and Inventor (1706 - 1790)

Benjamin Franklin, one of the founding fathers, won great fame for his study of electricity. He developed the theory of ‘positive’ and ‘negative’ electricity, showed the effect of pointed bodies in drawing off electricity, studied the identity of lightning and electricity, and recognized the potential of using iron rods to protect buildings. His famous kite and key experiment drew down electricity from the clouds and charged a Leyden jar.

1767

Joseph Priestley publishes 'The History and Present State of Electricity'



Joseph Priestly – English Theologist, Chemist, and Educator (1733 - 1804)

Joseph Priestley's 700-page text 'The History and Present State of Electricity' was a highly influential publication, especially the second half which described in detail existing theories of electricity and future research potential. Priestley discovered that electricity followed Newton's inverse-square law of gravity.

1776

James Watt's first steam engines installed in commercial enterprises

James Watt - English mechanical engineer and inventor (1736-1819)

James Watt recognized that contemporary engines wasted a great deal of energy and began developing design enhancements to improve their efficiency, thus creating radically better, cost-effective steam engines. His work had an immense impact on the industrial revolution, spurring an era of rapid growth in transportation, agriculture, and manufacturing that led to unprecedented economic prosperity in Great Britain, the United States and other countries. His improvements to the steam engines paved the way for other innovations through the 19th and 20th centuries. Watt developed the concept of horsepower. The SI unit of power, the watt, was named in his honor.

1779

Laplace presents the Laplace transform and its applications to differential equations

Pierre-Simon Laplace - French mathematician (1749-1827)

Pierre-Simon Laplace was most famous for developing what became widely known as the Laplace transform – highly useful integral transform in mathematics and electrical engineering. His transform allowed circuit analysis to be generalized to include any periodical electrical signals and not be limited to purely sinusoidals. His scholarly work made significant contributions to the development of various branches of science including statistics, probability theory, mathematics, physics, and astronomy. His five-volume work, Traité de Mécanique Céleste, (Celestial Mechanics) which offered a comprehensive mechanical interpretation of the solar system, made him famous, earning the title of "Isaac Newton of France".

1785

Coulomb's Law first published

Charles-Augustin de Coulomb - French Physicist (1736-1806)

Charles-Augutin de Coulomb is known for his work on electricity, magnetism and friction, but is mainly recognized for having developed 'Coulomb's Law' which was essential to the development of the theory of electromagnetism. He also invented the magnetoscope, magnetometer, and a torsion balance. The SI unit of electric charge, the coulomb, was named in his honor.

1790

Luigi Galvani discovers electrical basis of nerve impulses

Luigi Galvani - Italian physician and physicist (1737-1798)

Luigi Galvani was the first to demonstrate the electrical basis of nerve impulses when he made frog muscles twitch by jolting them with an electric spark in the 1790's. He was one of the earliest pioneers of bioelectricity. His research into the effects of electricity on animal tissue paved the way for the invention of the voltaic pile.

1800

Alessandro Volta invents the 'Voltaic Pile', the first electric battery

Alessandro Volta - Italian physicist (1745-1827)

Count Alessandro Volta invented the 'voltaic pile', the first electrical battery, which was basically a pile of metal discs through which electricity flowed. Volta's experiments, published in 1800, proved that electricity could be transmitted through wires continuously. He also made discoveries in electrostatics, meteorology, and pneumatics. His discoveries revolutionized the study of electricity and circuitry. The 'volt' which is a measurement of potential difference was named after him to honor his contributions to the science of electricity.

1820

Hans Christian Oersted discovers that electric currents produce magnetic fields

Hans Christian Oersted
Danish physicist and chemist
(1777-1851)

Oersted transformed the study of electromagnetism when he discovered that electric currents produce magnetic fields. In 1820, while presenting a lecture, Oersted noticed a compass needle deflected from magnetic north when an electric current from a battery was switched on and off. A few months later he began more thorough investigations which soon led to the publication of his findings. The oersted (Oe), the CGS unit of magnetic H-field strength, is named in his honor.

1821

Michael ay builds first electric motor

Michael Faraday
English chemist and physicist
(1791-1867)

Faraday studied the nature of electricity and became known for his understanding of electromagnetism. In 1831 he discovered that moving a magnet inside a wire coil produces electricity (induction), he built the first electric motor based on magnetic induction. This concept profoundly changed the course of human history. Later, he built the first generator and transformer. The words ion, electrode, cathode, and anode were coined by Faraday. A unit of measuring capacitance, the 'farad' is named after him to honor his scientific contributions to electricity.

1822

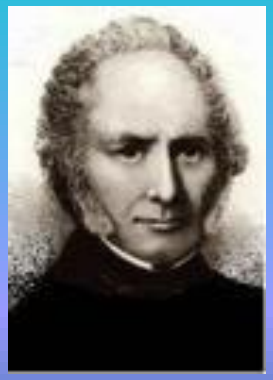
Fourier's 'The Analytical Theory of Heat' makes groundbreaking inroads into the study of mathematical physics

Jean-Baptiste Joseph Fourier
French mathematician and physicist
(1768-1830)

Fourier greatly influenced research of mathematical physics when he published Théorie analytique de la chaleur (The Analytical Theory of Heat) in 1822. He propounded that the conduction of heat in solid bodies could be analyzed in terms of infinite mathematical series, which were then named 'Fourier series' in his honor. His work had great impact on the theory of functions of a real variable, an important field in modern mathematics, and gave circuit theory new analysis techniques using Fourier series. 'Fourier transform' and 'Fourier's law of conduction' are also named after him.

1825

William Sturgeon invents the first electromagnet

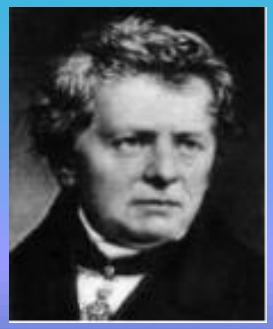


William Sturgeon
English physicist and inventor
(1783-1850)

In his first experiment conducted in 1825, Sturgeon displayed the power of the electromagnet by lifting nine pounds with a seven ounce piece of iron. The electromagnet was wrapped with a wire through which current from a single-cell battery was sent. The ability to regulate the electromagnet through the passing or stopping of current through the coil, led to using electrical energy to produce controllable machines and to developing large-scale electronic communications.

1827

Ohm's law appears in the famous work "The Galvanic circuit investigated mathematically"



Georg Simon Ohm
German physicist and mathematician
(1789-1854)

Ohm is best known for the law named after him, Ohm's law, the most simple and widely used law in electricity. He published his law in his famous work, "The Galvanic Circuit investigated mathematically" after his extensive and extraordinary research into the mathematical relationship between voltage (potential), current, and resistance in an electrical circuit. A unit of measuring resistance, the 'ohm' is named after him to honor his scientific contributions to electricity.

1827

Ampère coins the word ‘Electrodynamics’ in his famous publication on the subject

André-Marie Ampère
French physicist and mathematician
(1775-1836)

Ampère was a self-taught polymath, best known as being the first to have attempted a theoretical explanation and mathematical description of the connection between electricity and magnetism. He applied mathematics in generalizing physical laws, the most important of which was the principle that came to be known as ‘Ampère’s law’. Ampère’s contributions laid the groundwork for the science of electrodynamics, now referred to as electromagnetics. The ‘ampere’, the unit of measurement of current is named in his honor.

1832

Hippolyte Pixii develops first AC generator

Hippolyte Pixii
French instrument maker
(1808-1835)

In 1832, Hippolyte Pixii, based on the principle of magnetic induction discovered by Faraday, built an early version of the AC generator. Later on a suggestion by André Marie Ampère, he added a commutator which converted the AC into DC current, which was preferred in those days. Although Pixii may not have fully appreciated electromagnetic induction at the time, his device led to the future development of more advanced devices.

1832

Electric telegraph developed by Samuel Morse

Samuel F.B. Morse
American inventor
(1791-1872)

Samuel Morse studied to become a painter but was later intrigued by the idea that human communication was possible through electricity and began to develop the electric telegraph which led to the invention of the single-wire telegraph system, giving birth to the first practical application to electricity. Later, co-invention of the famous Morse code in 1838. Later he constructed a telegraph line connecting Washington D.C. and Baltimore and on May 24, 1844 he sent the first electrically transmitted message (groups of dots and dashes) which said "What hath God wrought!"

1833

Christie invents what later comes to be known as the 'Wheatstone Bridge'

Samuel Hunter Christie
British scientist and mathematician
(1784-1865)

In 1833, Christie published a paper on the magneto-electrical conductivity of various metals, in which he published his 'diamond' method for comparing the resistances of wires of various thicknesses. It was the first description of the instrument that came to be known later as the 'Wheatstone Bridge' when Charles Wheatstone proposed it, in 1843, as a method for measuring resistance in electrical circuits – even though Wheatston acknowledged it as Christie's invention.

1839

Photovoltaic effect discovered by Alexandre-Edmond Becquerel

Alexandre-Edmond Becquerel
French physicist
(1820-1891)

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1846

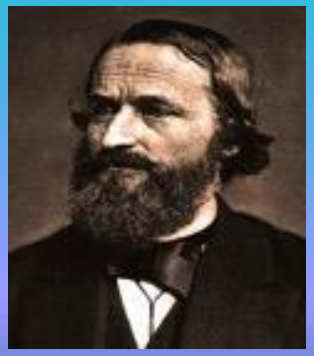
Alexander Bain patents the chemical telegraph

Alexander Bain
Scottish engineer and inventor
(1810-1877)

Alexander Bain, invented the first electrical clock, patented the basics of facsimile (fax), and developed chemical telegraph receivers and punch-tapes to speed up telegraph transmission. In 1846, Bain patented his greatest invention, the chemical telegraph which reproduced messages on electrochemically sensitive paper. The process was much faster than the Morse and other telegraphic instruments and was later modified to create the first facsimile.

1847

Gustav Kirchhoff announces Kirchhoff's laws

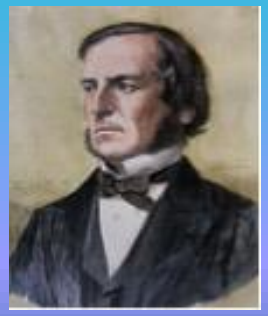


Gustav Robert Kirchhoff
German physicist
(1824-1887)

Kirchhoff, one of the greatest German physicists of his time, did groundbreaking research in electricity and thermodynamics. He announced Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) in 1847, which allow calculation of currents, voltages and resistances of electrical networks. KVL and KCL gave birth to circuit theory and today they are the most known laws of electricity. He demonstrated that current flows through a conductor at the speed of light. Also he helped to establish the theory of spectrum analysis and co-discovered two new elements, cesium and rubidium. Kirchhoff is also known for the Kirchhoff law of radiation.

1847

George Boole develops Boolean algebra and publishes a series of mathematical papers

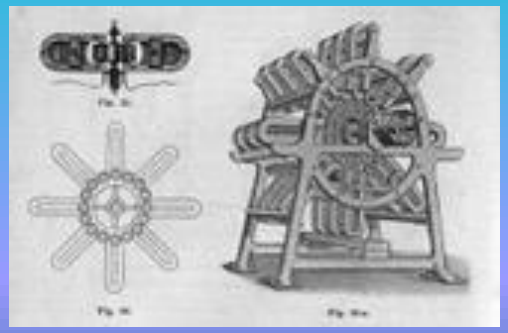


George Boole
English mathematician, philosopher, logician
(1815-1864)

George Boole, a professor at Queen's College, Cork, was most recognized for his work in the fields of differential equations and algebraic logic. He wrote, 'Mathematical Analysis of Logic' and developed a form of symbolic logic called Boolean Algebra which is fundamental in studying the foundations of pure mathematics. Boolean algebra also formed the basis for digital circuit design and led to modern-day digital computers and digital electronics.

1850

Floris Nollet invents and patents an electromagnetic generator



Nollet's generator
Floris Nollet - Belgian physicist, engineer, inventor
(1794-1853)

Nollet improved on Pixii's work and produced an electromagnetic generator which was capable of producing around 50 volts. The generator, which he patented in 1850, worked on steam power to decompose water by electrolysis. Nollet also designed large-scale generators for various purposes such as galvanization, limelight, and electric arcs. Nollet's generator was the first to be mass-produced by a manufacturing company.

1854

Charles Bourseul publishes his idea about the electrical transmission of sound

Charles Bourseul
French civil engineer and inventor
(1829-1912)

While working for the telegraph company in France as a young man, Bourseul made improvements to the telegraph system and began experimenting with electrical transmission of the human voice. He developed an electromagnetic microphone but his receiver could not convert electrical current back into the human voice. In 1854, Bourseul published his fundamental idea for the electrical transmission of sound in the magazine, "L'Illustration de Paris". His pioneering work led to the invention of the telephone.

1855

Guillaume Duchenne uses AC for the first time in electrotherapy

Guillaume Duchenne
French neurologist
(1806-1875)

In 1855 Guillaume Duchenne, a pioneer in the development of electrodiagnosis and electrotherapy, announced his preference for alternating current (AC) over direct current (DC) to trigger muscle contractions. He considered AC to be more effective in creating contractions that showed better results, irrespective of the whether the muscle was weak or strong which was not the case with DC current. Duchenne profoundly advanced research in electrophysiology and ushered in the era of modern neurology.

1858

First intercontinental and transatlantic telegraph line completed

Map of first transatlantic telegraph line

The first transatlantic, undersea telegraph cable was laid from western Ireland to eastern Newfoundland. The first communications across this line were made on August 16th, 1858, and now took minutes instead of days.

1865

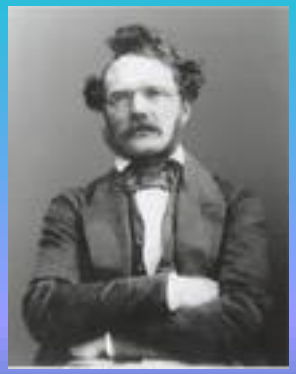
Maxwell publishes 'A Dynamical Theory of Electromagnetic Field' and his now famous equations which accurately describe electromagnetism

James Clerk Maxwell
Scottish Mathematical Physicist
(1831-1879)

James Maxwell's work laid the foundation for modern physics and credited with having presented the unified theory of electromagnetism, mathematically unifying Faraday's and Ampere's Laws. Know as Maxwell's Equations, they presented a solid foundation for any future work on electromagnetics, truly a brilliant conception by a young scientist!. Through his studies he concluded that electric and magnetic energy travel in transverse waves which propagate at a speed equal to that of light. He is best known for his famous 'Maxwell Equations'. Maxwell's most well-known works include 'A Dynamical Theory of the Electromagnetic Field', and 'A Treatise on Electricity and Magnetism' published in 1965 and 1873, respectively. His work led to studies in such fields as special relativity and quantum mechanics. The unit "maxwell" gives measure for the magnetic flux to honor him.

1867

Electric Dynamo - invented by Siemens



Ernst Werner von Siemens
German electrical engineer and inventor
(1816-1892)

Siemens co-invented the electroplating process in 1841, and developed an electric dynamo in 1867, independently. He also invented an advanced telegraph that replaced an earlier version which used the Morse code. He laid the first telegraph line and built the first electric railway in Germany. He was the founder and director of Siemens and Halske, a firm that made electrical apparatus, precursor of today's giant Siemens Corporation. In 1880 he built the first electric elevator. The unit of electrical conductance, the siemens, is named in his honor

1869

Helmholtz studies the phenomena of electrical oscillations

Hermann von Helmholtz
German physiologist and physicist
(1821-1894)

Helmholtz is lauded as one of the most multifaceted scientists of the 19th century who made contributions in physiology, physiological acoustics and optics, mathematics, chemistry, meteorology, theoretical mechanics, and electricity and magnetism. He researched and made breakthroughs on the subject of vision, tone, sound, and empiricism. In physics he earned a place in history for his work on the conservation of energy, electrodynamics and theories of electricity, hydrodynamics, meteorological physics, optics and the abstract principles of dynamics. The Helmholtz equation in mathematics is named after him.

1871

First electrically powered lighthouse inaugurated in England

Souter Lighthouse

Souter Lighthouse was the world's first lighthouse to be specifically designed and constructed to be powered by electricity. Using alternating electric current (AC), it was the most technologically advanced lighthouse of its day.

1873

Gramme demonstrates that his dynamo is reversible and can be used as an electric motor

Zénobe Gramme
Belgian electrical engineer
(1827-1901)

Gramme is credited with inventing the first practical direct current dynamo (generator) in 1869 which generated much higher voltages than previously known dynamos. In 1873 Gramme and Fontaine, his partner, accidently discovered that the dynamo was reversible and could be used as a motor. They had previously opened a factory to manufacture the Gramme dynamo, Gramme ring, Gramme armature and other devices. Zenobe Gramme's work laid the foundations for the modern electrical industry.

1876

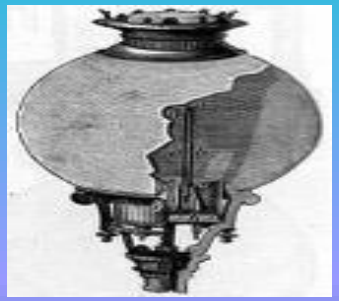
First electronic voice transmission made by Alexander Graham Bell

Alexander Graham Bell
Scottish-American scientist, inventor, engineer
(1847-1922)

Alexander Graham Bell is best known as inventor of the telephone, enabling a new age of the development of civilization. In 1865 Bell realized that speech could be transmitted by electric waves and within a decade had formulated the principle of transmission and reproduction. In 1876 his apparatus was developed enough to transmit a sentence that was clearly heard by his assistant. The first telephone message in history that was transmitted via electromagnetic waves was done on March 10, 1876 when Graham Bell sent his famous commanding message: "Watson, come here I want you". He won a patent for his invention after which he continued to invent new devices. The bel, one tenth of which is a decibel, was named in his honor.

1878

First electrical street lighting installed in Paris



Yablochkov Candle
Used for electrical street lighting in Paris

The first electric streetlights in Paris used arc lamps, or the "Yablochkov candle", in 1878. By 1881, some 4000 were in use, replacing gas lanterns on the poles.

Thomas Alva Edison
American inventor
(1847-1931)

1879

Edison invents first incandescent lamp

Edison was a prolific inventor holding a total of 1093 patents. Many consider him as the greatest inventor ever lived who demonstrated that inventiveness is a process! His inventions included the transmitter and receiver for the automatic telegraph, the carbon telephone transmitter, phonograph, and the first commercial motion pictures. In 1879 Edison created the first incandescent lamp and then developed an entire electrical distribution 'Direct Current' or DC system for light and power which resulted in the Pearl St. plant in New York City, the first permanent central electric-light power plant in the world. Despite his success in building the DC power station, he ended up losing to the Alternating Current (AC) choice for power distribution championed by Nikola Tesla and George Westinghouse. These three American pioneers (Edison, Tesla and Westinghouse) hotly debated the ac vs. dc choice for electric power distribution, which is considered one of the most interesting intellectual debates among innovators of electrical engineers.

1884

Poynting publishes work on the development of the Poynting vector and Poynting theorem

John Henry Poynting
English physicist
(1852-1914)

Poynting is best known for the Poynting vector resulting from his work on the flow of electromagnetic radiation in space, and the Poynting theorem which shows that the flow of energy at a point can be expressed by a simple formula in terms of the electric magnetic forces at that point. In 1903 he was the first to discover the Sun's radiation draws in small particles towards it, which was later named the Poynting–Robertson effect.

1884

The first great event of its kind, the "International Electrical Exhibition" held in Philadelphia

International Electrical Exhibition Poster 1884

An International Electrical Exhibition was organized by the Franklin Institute in Philadelphia in 1884. It featured historical as well as new exhibits by prominent inventors and scientists, including Thomas Edison and Nicola Tesla. Many new applications of electricity were demonstrated, some of them for the first time. Over 280,000 people attended and the newly established American Institute of Electrical Engineers, AIEE, held its first ever technical meeting at the Franklin institute towards the end of exhibition in Oct 1884.

1885

Ferraris demonstrates working model of an induction motor

Galileo Ferraris
Italian physicist and inventor
(1847-1897)

Ferraris conceived the idea of an AC motor and demonstrated a working model in his lab in 1885, and his paper was published by the Royal Academy of Sciences in April 1888, describing his AC polyphase motor and its operation. Although a pioneer in AC distribution systems for electric power, he deliberately did not patent his invention, convinced that the scientific and intellectual merits were more important than material gain. In fact he demonstrated it freely in his lab for all who were interested

1886

Hertz's experiments confirm existence of electromagnetic waves

Heinrich Hertz
German physicist
(1857-1894)

Hertz confirmed the existence of electromagnetic waves as theorized by Maxwell, and conducted many experiments to produce and study these waves, also known as hertzian waves or radio waves. In 1887, he was the first to report on the phenomena of the photoelectric effect of electrons. He conducted experiments by building an apparatus which produced and detected VHF/UHF radio waves. His discovery of electromagnetic waves ushered in the modern communication age, opening the way for the development of radio, television and radar communication systems,. The unit of frequency or cycles per second, 'hertz' is named in recognition of his scientific contributions.

1887

Oliver Heaviside simplifies Maxwell's equations

Oliver Heaviside (1850-1925)
English electrical engineer, physicist mathematician

A school dropout at 16, Heaviside educated himself in electricity and languages, aiming to become a telegrapher, encouraged by his uncle, Charles Wheatstone. Working on his own researches, Heaviside began publishing papers from 1872. He managed to greatly simplify Maxwell's 20 equations in 20 variables into 4 equations in 2 variables. He further developed the concept of operators which are today known as Laplace transforms. He developed the 'transmission line theory' which increased the transmission rate over transatlantic cables by a factor of 10. He invented and patented the coaxial cable in 1880. His 1902 prediction of a conducting layer in the atmosphere (later known as the Heaviside layer) was proven in 1923. He coined several terms in electromagnetism including conductance, inductance, impedance, reluctance and permeability. His genius changed the face of science, mathematics and telecommunications forever.

1893

All physical units including electrical units defined at the Fourth International Conference of Electricians in Chicago

SI UNITS

The Fourth International Conference of Electricians in Chicago held in 1893 introduced the International System of Electrical and Magnetic Units. The three base units, the international ampere, the international ohm, and the international volt were established at the 1893 event. This system was later modified in 1908, and then became obsolete in 1948 with the inclusion of electromagnetic units in the International System of Units (SI).

1893

Chicago host the grandest event in its history, The World Columbian Exhibition

The World Columbian Exhibition by night

The World Columbian Exhibition or the Chicago World Fair, held in 1893, was the grandest world event of the time with nearly 28 million visitors. An entire building had been devoted to innovative and groundbreaking electrical products which proved very popular with the public. However, a controversy arose at the time because of the tug-of-war between Thomas Edison and his bid to power the exhibition with direct current (DC) and George Westinghouse's proposal to do so with alternating current (AC) system developed by Nikola Tesla, which was ultimately selected because of its cost-effectiveness. General Electric (GE) disallowed the use of Edison's light bulb by Westinghouse at the exposition as a retaliatory act. Westinghouse, not to be defeated, developed its own light bulb – that invented by Reginald Fessenden which turned out to be more efficient and economical than GE's. The DC vs. AC rivalry between GE and Westinghouse during the exhibition and later has been termed the War of Currents. More than hundred years later, the debate is resurfacing again with renewed interest.

1893

Steinmetz is the first to analyze AC circuits using complex numbers

Charles Steinmetz
German-American electrical engineer and mathematician
(1865-1923)

Steinmetz advanced the development of alternating current (AC) which led to the expansion of the electric power industry in the United States. His pioneering discoveries in the understanding of hysteresis helped engineers design more efficient motors for use in industry. He was also known for his contributions to the study of steady-state analysis and transients in the theory of AC systems by using complex numbers and phasors in 1893, giving birth to ac circuit analysis theory. In the same year he published his main textbook on "Theory and Calculations of ac Phenomena".

1895

Röntgen accidently discovers X-rays

Wilhelm Röntgen
German physicist
(1845-1923)

In 1895, Röntgen noticed that an image cast by his cathode ray generator was projected way beyond the reach of the cathode rays. He had accidently discovered highly energetic electromagnetic radiation that could penetrate solid objects. A week after this realization, Röntgen photographed his wife's hand which clearly revealed her bones. His discovery of X-rays transformed medicine forever.

1895

Alexander Popov invents a wireless lightening detector

Alexander Stepanovich Popov
Russian physicist and inventor
(1859-1906)

Popov is recognized as having been the first to show how to use electromagnetic waves, though he did not apply for a patent. He is credited with having been the first to use an antenna for the reception and transmission of radio waves. On 7th May 1895, Popov presented a paper that described the wireless lightening detector he had built using a coherer to detect radio noise from lightening. Popov's lightening detector is regarded as the first radio receiver by many Eastern sources and 7th May is celebrated as "Radio Day" in Russia since 1945.

1896

Braun invents the CRT Oscillocope and in 1899 patents the sparkless antenna circuit

Karl Ferdinand Braun
German physicist and inventor
(1850-1918)

Braun invented the Cathode Ray Tube (CRT), also known as the 'Braun Tube' and the CRT Oscilloscope in 1997. The CRT was the primary electronic display device for radar, television and computers until the end of the 20th century. Braun also became very involved in wireless telegraphy and was recognized by the Nobel committee in 1909 for improving Marconi's transmitting system through his invention of the sparkless antenna circuit which linked transmitter power to the antenna circuit inductively.

1897

Thomson discovers the electron

Sir Joseph John Thomson
English nuclear physicist
(1856-1940)

J.J. Thomson revolutionized the world of physics when he discovered the electron in 1897. In 1894 Thomson began studying cathode rays and was able to experimentally calculate the ratio of the electrical charge to the mass of the particles. Thomson also researched positive rays in 1911 which greatly helped in the discovery of isotopes. He is recognized as inventor of the mass spectrometer. In 1906 Thomson was awarded the Nobel Prize in physics for discovering the electron and his research on "the conduction of electricity by gases".

1898

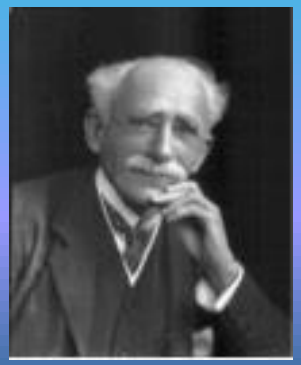
Valdemar Poulsen granted patent for the ‘telegraphone’

Valdemar Poulsen
Danish engineer
(1869-1942)

Poulsen started developing his idea for recording sounds magnetically by using magnetized steel piano wire to record and reproduce sounds. It led to the invention of the ‘telegraphone’, a magnetic wire recorder, which at first was meant to be a message-taking machine for telephones and was granted a patent 1898. His work laid the foundation for everything that records sound or data in the recording industry today. The arc converter he developed in1908 was also widely used in radio before the introduction of vacuum tube technology.

1904

Sir John Fleming invents the Thermionic (or Fleming) valve



John Ambrose Fleming
English electrical engineer and physicist
(1849-1945)

Sir Fleming developed electric lighting, the telephone, and wireless telegraphy, but is best known for his invention of the thermionic valve, also known as the Fleming valve, which converted electrical oscillations into continuous current. This was the first thermionic diode that laid the foundations of the modern electronics industry and remained dominant until the 1970s.

1906

Fessenden broadcasts world's first radio program over the air

Reginald Fessenden
Canadian inventor
(1866-1932)

Fessenden is considered Canada's most prolific inventors with over 200 patents to his credit. In 1906 he rewrote the history of wireless transmission when he broadcast the world's first radio program over the air. The concept he developed is today known as Amplitude Modulated (AM) radio. He was the first to establish consistent two-way wireless communication over the Atlantic. He also invented and received patents for many devices in the fields of high-powered transmission, sonar, and television.

1906

Audion vacuum tube invented by de Forest

Lee de Forest
American inventor
(1873-1961)

Lee de Forest produced many inventions, the most famous of which was the Audion vacuum tube in 1906. It was the first triode vacuum tube that enabled live radio broadcasting and became a key component of radio, telephone, radar, television, and computer systems. He is known for inventing the concept of 'feedback' in electrical engineering. De Forest is considered one of the fathers of the 'electronic age' and is credited with bringing sound to motion pictures.

1908

Campbell-Swinton publishes his idea for Cathode Ray Tube based electronic television

Alan Archibald Campbell-Swinton
American inventor
(1863-1930)

In 1908, Campbell-Swinton published an article in Nature on the concept of electronic vision from a distance, using Cathode Ray Tubes (CRT) at both the transmitting and receiving ends. Until then CRT had been experimented with only as a receiver. His proposals were described in his 1912 lecture at the Röntgen Society, which published them. A self-effacing man, Campbell-Swinton never patented his idea, but it went on to become standard in television technology and remained so until recent times.

1909

Marconi and Braun develop wireless telegraphy

Guglielmo Marconi
Italian electrical engineer and inventor
(1874-1937)

Marconi became famous for his pioneering research in long-distance radio transmission and the development of a radio telegraph system. He was the first to transmit signals across the ocean without using cables. He is recognized as the inventor of radio as he made a commercial success of radio by building on the work of previous experimenters and physicists. He shared the 1909 Nobel Prize in Physics with Karl Ferdinand Braun for the development of wireless telegraphy

1921

Metric Convention mandate extended to cover all physical measurements including electrical units

Seal of the International Bureau of Weights and Measures

In 1921, during the 6th meeting of the General Conference on Weights and Measures (CGPM), the mandate of the international treaty known as the 'Metric Convention', which coordinates international metrology and the development of the metric system, was extended to cover all physical units, including electrical units. Before this, the treaty had been concerned only with the measurements of mass and length.

1926

Receive patent for the inventions which would now be known as field-effect transistors (FET)

Julius Lilienfeld
Polish-American Physicist
(1882-1963)

In 1926, Julius E. Lilienfeld, a Polish-American physicist was granted a patent for a three-electrode structure using copper-sulfide semiconductor material, which today would be known as a field-effect transistor. In 1934, Oskar Heil, a German electrical engineer obtained a patent for controlling current flow in a semiconductor via capacitive coupling at an electrode – also, in fact, a field-effect transistor.

1931

Bush's Differential Analyzer becomes operational

Vannevar Bush
American engineer and inventor
(1890-1974)

In 1919, Bush and his team at MIT designed and built analog computers used to solve complex engineering problems. In 1931 Bush invented the Differential Analyzer and in 1935 he designed the 'Rockefeller Differential Analyzer' which was the most powerful computer in existence at the time. In 1938 he developed the 'Rapid Selector', a high-speed information retrieval device. In a 1945 article, "As we may think", Bush proposed what he called, "the Memex" which, years later, led to the invention and development of hypertext. Bush held over 49 electronics patents and urged government support for science which led to the establishment of the National Science Foundation.

1932

Chadwick discovers the neutron

Sir James Chadwick
English physicist
(1891-1974)

Sir Chadwick discovered the existence of neutrons, paving the way for the fission of Uranium 235 and the creation of the atomic bomb. He authored the final draft of the MAUD (Military Application of Uranium Detonation) Report and later headed the British team working on the Manhattan Project. Chadwick served as British scientific advisor to the UN Atomic Energy Commission. He was awarded a Nobel Prize for Physics in 1935.

1933

Frequency Modulated (FM) radio, invented by Armstrong

Edwin Howard Armstrong
American electrical engineer and inventor
(1890-1954)

Armstrong is best known for inventing the modern Frequency Modulation (FM) radio transmission in 1933. He also invented the regenerative circuit, the super-regenerative circuit, and the superheterodyne receiver, and developed an electronic oscillator. Armstrong held 42 patents and earned a reputation as "the most prolific and influential inventor in radio history".

1934

HEIL receives a patent for controlling the field-effect transistor

Oskar Heil
German Electrical Engineer
(1908-1994)

Oskar Heil, a German electrical engineer obtained a patent for controlling current flow in a semiconductor via capacitive coupling at an electrode – also, in fact, a field-effect transistor. Like the 1926 patent by Julius E. Lilienfeld, their two inventions paved the way for the inventions of today's field-effect transistor.

1935

Watson-Watt receives a patent for his RADAR device

Sir Robert Alexander Watson-Watt
Scottish engineer and developer of RADAR
(1892-1973)

Scientists in many countries were familiar with radio technology and early radio concepts in 1930. However operational pulsed radar systems were the brainchild of Watson-Watt who won a patent for his radar device in 1935. In 1936, when Watson-Watt became superintendant of Bawdsey Research Station, a new establishment under the Air Ministry, he and his team developed the system speedily and their work resulted in the installation of several radar stations on England's shores just before war broke out in 1939, which contributed crucially to Britain's victory.

1936

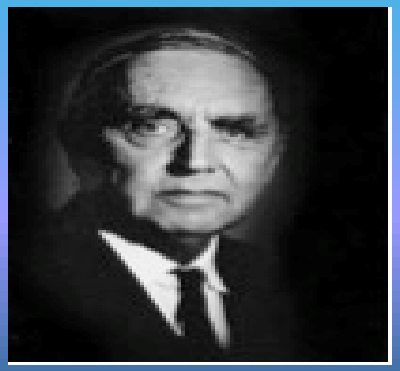
The Universal Turing Machine (precursor of the modern-day computer) introduced

Alan Turing (1912-1954)
English mathematician, logician, cryptanalyst, computer scientist

Turing published a paper, "On Computable Numbers, with an Application to the Entscheidungs Problem," in 1936 where he introduced the idea of a universal machine, later known as the 'Universal Turing Machine' and then the 'Turing Machine', capable of computing anything that could be computed. The Turing machine was a precursor of the modern computer. In 1950 he suggested the 'Turing Test' which still serves as a criterion for recognizing a machine's intelligence. He is considered the 'Father of Theoretical Computer Science and Artificial Intelligence (AI)'.

1937

Pulse Code Modulation system invented



Alec Reeves
English scientist
(1902-1971)

Reeves helped build the first cross-channel radio-telephone links while serving at the International Telephone and Telegraph (ITT) in Paris.He also invented and patented the Pulse Code Modulation (PCM) System in 1937, which has transformed modern-day communications and is indispensable to space photography. He pioneered the use of semiconductors and was one of the first scientists to consider light for communication which spurred development of the first practical optical fiber system.

1941

Zuse develops the world's first programmable computer

Konrad Zuse (1910-1995)
German civil engineer, computer pioneer, inventor

Zuse is popularly recognized in Germany as the "father of the computer," having built his first four computers, the Z1, Z2, Z3 and Z4 between 1936 and 1945. The world's first fully functional programmable computer, the Z3, was built in 1941. He also developed the S2 computing machine. The Z4 became the world's first commercial computer built by a company he founded, which is considered the world's first computer start-up. He created 'Plankalkül', the first high-level programming language which contained many features of modern programming languages.

1945

Bode publishes classic book on communication transmission

Hendrik Bode
American scientist, engineer, inventor
(1905-1982)

Hendrik Bode is widely recognized and respected for his pioneering work in modern control theory and electronic telecommunications. He made crucial contributions to design guidance and control of anti-aircraft systems, missiles, and anti-ballistic missiles. He also developed mathematical tools, known as Bode Plots, for the analysis of stability of linear systems. Bode's 1945 book, Network Analysis and Feedback Amplifier Design, is considered a classic work on communication transmission.

1945

Von Neumann proposes stored-program concept in computer design

John von Neumann
Hungarian-American scientist
(1903-1957)

Neumann made extraordinary contributions to mathematics, physics, economics, computing and statistics. He spearheaded the application of operator theory to quantum mechanics, in the development of functional analysis, and developed game theory and the concepts of cellular automata, the universal constructor, and the digital computer. Von Neumann also analyzed the structure of self-replication which preceded the discovery of the structure of DNA. In 1945 he wrote the First Draft of a Report on the EDVAC that proposed the stored-program concept in computer design.

1946

ENIAC, the first electronic digital computer inaugurated

John William Mauchly & John Presper Eckert
American physicist American electrical engineer
(1907-1980) (1919-1995)

In 1946 Mauchly and Eckert designed and built the world's first electronic digital computer, the ENIAC, which was one thousand times faster than the electro-mechanical machines of the time. It was meant for the U.S. armed forces. The two then founded the Eckert-Mauchly Computer Corporation (EMCC), also in 1946, and went on to build other computers such as the EDVAC, BINAC and UNIVAC, which was the first commercial computer. Their pioneering work in computer design and concepts had immense worldwide impact on the development of computers during the decade.

1947

Bardeen, Brattain and Shockley invent the transistor

John Bardeen (1908-1991)
American physicist and electrical engineer
Walter Houser Brattain (1902-1987)
American physicist
William Schockley (1910-1989)
American physicist

Shockley, Bardeen, and Brattain have changed the world with their invention of the semiconductor transistor, ushering in the age of technology. All three physicists worked at Bell Labsand were charged with the task of finding a solid-state alternative to the hitherto breakable glass vacuum tube amplifiers. Their groundbreaking work led to the invention of the electric transistor in 1947. Shockley began researching semiconductors and is known to have brought 'silicon to Silicon Valley'. His efforts and research were responsible for the 'junction transistor'. Bardeen suggested the 'surface states' theory. Three of them jointly won the Nobel prize in physics in 1956, and Bardeen later won his second Nobel prize for superconductivity effect.

1948

Publication of "A Mathematical Theory of Communication" launches the field of information theory and 'the information age'

Claude E. Shannon (1916-2001)
American electronics engineer, mathematician, cryptographer

Shannon made brilliant contributions to digital communications and information theory and is best known for the Shannon Sampling Theorem. When working at Bell Labs he wrote his famous work, "A Mathematical Theory of Communication" proposing the groundbreaking idea of converting any kind of data, whether pictures, text, or sound, into zeros and ones for error-free communication. Shannon's master thesis, "A Symbolic Analysis of Relay and Switching Circuits" laid the foundations for the modern switching theory. His ideas led to our information age.

1949

First telephone pager patented

An early Motorola pager

Al Gross patented the first telephone pager in 1949 and the Federal Communication Commission (FCC) approved its public use in 1958. With the rise of cellular technologies, pagers are on the decline but still popular in certain service areas and industries because of their reliability, cost-effectiveness and simplicity

1950

Landmark paper on error-detecting code and error-correcting code published

Richard Hamming
American mathematician
(1915-1998)

Richard Hamming's work in mathematics had great impact on computer science and telecommunications. Among his many contributions are the Hamming code, Hamming window, Hamming numbers, Hamming distance, and Hamming bound (sphere-packing). When working at Bell Laboratories, he did his best known work is on error-detecting and error-correcting codes which impacted coding theory, computer design and many areas of mathematics.

1951

Concept of 'microprogramming' first developed

Maurice Wilkes
British computer scientist
(1913-2010)

Sir Maurice Wilkes was responsible for several pioneering developments in computing. He built the EDSAC, the first computer with an internally stored program. In 1951 he published the first book on computer programming and proposed microprogramming, a system that has become ubiquitous in the computer industry. In 1974, Wilkes deduced that Local Area Networks (LAN) would be more efficient, if based on computer technology rather than telecommunications technology.

1951

EBR-1 in Idaho becomes the first nuclear power plant to produce electricity

EBR-1

On December 20, 1951, the Experimental Breeder Reactor-1 or EBR-1 located in Idaho, became the world's first nuclear power plant to generate electricity when it illuminated four 200-watt light bulbs in its first test. Later it produced enough electricity to power its building and continued to be used for experimental purposes until its 1964 decommissioning. The EBR-1 was declared a National Historic Landmark in 1965 and an IEEE milestone in 2004.

1952

Hopper invents first ‘compiler’ for computer programming language

Grace Hopper
American computer scientist
(1906-1992)

Hopper was one of the first programmers to develop the Harvard Mark I computer, when she worked at Harvard as a research fellow under a Navy contract. In 1952 she invented the first ‘compiler’ for a computer programming language, which facilitated the use of more human sounding language commands instead of repetitive commands. She coined the word ‘debugging’ (when an actual moth was removed from a computer) and came to be known as ‘Amazing Grace’ because of her remarkable achievements.

1952

Dummer develops and makes first public announcement of the Integrated Circuits (IC)

Geoffrey William Arnold Dummer
British electronics engineer
(1909-2002)

In his efforts to increase reliability by reducing the number of unreliable electrical connections between components, Dummer conceived the idea of multiple components on a single semiconductor chip. Today, he is credited with being the first person to conceptualize the idea of building electronic devices in a solid block with no connecting wires, now commonly called Integrated Circuits(IC) or microchip.In 1952 he presented his idea of future integrated circuits at a conference in Washington, DC. He has been called "The Prophet of the Integrated Circuit".

1953

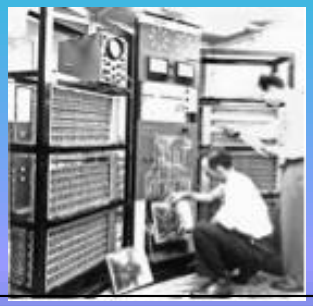
The first ‘maser’ designed and tested by Charles Townes

Charles Townes
American physicist
(1915-)

Charles Townes is known for his work on the theory and application of the maser (microwave amplification by stimulated emission of radiation). He designed and tested the first maser in 1953 and later worked on the laser. He went on to propose that the principles of maser could be used in the field of optics with the use of laser. He also studied quantum electronics in relation to maser and laser devices. In 1964 Townes was awarded the Nobel prize for physics along with the Russian scientists, Basov and Prokhorov.

1953

Emergence of fully transistorized computers



TRADIC
Announced by Bell Labs
(1954)

The question of who exactly developed the first fully transistorized computer is debatable because in the 1950s several countries worked contemporaneously to build one. The University of Manchester's first experimental transistor computer was produced in 1953 but a full-sized version was ready in 1955. The experimental transistorized computer, TX-O, was built at the Lincoln Labs, MIT in 1953. Bell Laboratories in the U.S. built TRADIC in 1954 and Europe's Harwell CADET was operational in early 1955. Japan unveiled its first fully transistorized computer, the ETL Mark III in 1956. Thus, through the 1950s semiconductor devices gradually replaced vacuum tubes and digital computers were designed to be fully transistorized.

1954

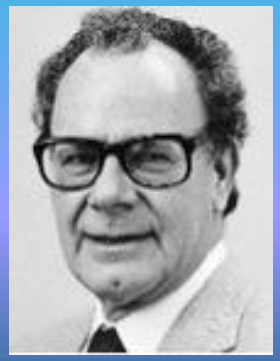
Kapany demonstrates optical fiber as a medium of low-loss light transmission

Narinder Singh Kapany
Indian-American physicist
(1926-)

Kapany and academic advisor Harold Hopkins published an article in the journal Nature, "A flexible fiberscope, using static scanning", in 1854 while at Imperial College, London. They demonstrated that low-loss light transmission could be achieved through a bundle of several thousand bent glass fibers. It was Kapany who coined the term 'Fibre Optics' in a now famous article he published in the Scientific American in 1960. Kapany has over 100 patents with major contributions in biomedical instrumentation, long-distance communications, solar energy, pollution monitoring, space instrumentation and more.

1957

Gould coins the term ‘LASER’



Gordon Gould
American physicist
(1920-2005)

Gould is one of the first scientists to have dabbled with the idea of lasers, and in fact coined the acronym when he wrote, “Some rough calculations on the feasibility of LASER: Light Amplification by Stimulated Emission of Radiation”. His optically-pumped laser amplifiers and gas-discharge-excited light amplifiers are still used widely in industrial, medical, and commercial applications. His patents also cover fiber optic communications.

1957

Backus invents FORTRAN

John Backus
American computer scientist
(1924-2007)

Backus invented the first, widely popular high-level programming language FORTRAN in 1957 which became a global language for science and engineering. He also invented the Backus-Naur form (BNF), which contributed significantly to the development of compilers. In 1993, he won the National Academy of Engineering's Charles Stark Draper Prize, the highest national prize awarded in engineering, for the invention of Fortran.

1957

First guide on the construction of a LASER published

Arthur Schawlow
American physicist
1921-1999

Schawlow is best known for his work on lasers and their construction and their use in spectroscopy. He collaborated with Charles Townes and proposed extending the principles and functions of maser (microwave amplification by stimulated emission of radiation) to optical wavelengths. In 1981, Arthur Schawlow won the Nobel prize for physics along with two other physicists Nicolaas Bloembergen and Kai Seigbahn.

1958

First integrated circuit invented

Jack Kilby
American electrical engineer
(1923-2005)

Jack Kilby created the Integrated Circuits (IC), or the microchip, which was to revolutionize the design and manufacture of computers and other electronics because it drastically increased efficiency while decreasing both size and cost. He also co-invented the first hand-held calculator based on integrated circuitry and the semi-conductor based thermal printer used in portable data terminals. Integrated circuitry transformed 20th century electronics. In 2000 Jack Kilby was awarded the Nobel Prize for physics.

1959

Integrated Circuits (IC) patented by Noyce concurrently with Jack Kilby

Robert Noyce
American physicist
(1927-1990)

Noyce invented the integrated circuit, commonly known as microchip, at the same time as Jack Kilby although both worked independently and received patents in 1959. He left an indelible mark as a brilliant computer industry pioneer who co-founded both the Fairchild Semiconductor Corporation in 1957 and later, Intel in 1968. During his career Noyce won 15 patents.

1960

Dacom Inc., unveils the first commercial digital fax machine

Dacom DFC-10

In the 1960s, two Lockheed engineers, Daniel Hochman and Don Weber, established Dacom Inc., and produced the first digital fax machine by developing their groundbreaking work in digital image compression which had originally been invented for satellite communications.

1962

Nick Holonyak, Jr. invents the LED

Nick Holonyak, Jr. (1928-)
American electrical engineer, educator, inventor

Holonyak, Jr. invented the light emitting diode (LED) in 1962 while working at the General Electric Company in Syracuse, New York. Holding 41 patents, his research work is prolific and includes other inventions, most notably the red light semiconductor laser or the laser diode. LED is now used widely and can be found in hundreds of devices all over the world. LED lighting is recognized as considerably more efficient, economical and environment friendly than incandescent or fluorescent lighting.

1962

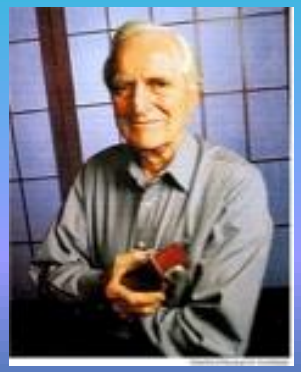
First commercial modem, the Bell 103 developed by AT&T

Bell 103 manufactured by AT&T
1962

The Bell 103 was the first commercial computer modem developed and manufactured by the American Telephone & Telegraphy (AT&T) Co. in 1962. It facilitated full duplex transmission, a speed of up to 300 bits per second over regular phone lines, and employed the frequency-shift keying (FSK) method of modulation.

1964

Engelbart invents the computer mouse



Douglas Carl Engelbart (1925-2013)
American engineer, inventor, internet pioneer

Engelbart was a visionary inventor who developed interactive computer and internet technologies. His innovation included actual examples of, or precursors to, hypertext, shared screen collaboration, mixed text graphics, multiple windows, on-screen video teleconferencing, and the mouse as an input device. Most of his inventions were developed at the Stanford Research Institute's Augmentation Research Center.

1965

Gordon Moore predicts the doubling of semiconductor performance approximately every two years (Moore's Law)Gordon Moore predicts the doubling of semiconductor performance approximately every two years (Moore's Law)

Gordon Moore (1929-)
American physicist, engineer, entrepreneur

Moore is a brilliant computer industry pioneer who co-founded both the Fairchild Semiconductor Corporation in 1957 and later, Intel in 1968, where he built his reputation as an expert in semiconductor materials, building block of all electronics. The doubling of semiconductor performance approximately every two years, which continues to be applicable, was predicted by Moore and came to be known as 'Moore's Law'.

1969

Charge-coupled device (CCD) invented

Willard Boyle (1924-2011)
Canadian Physicist
George Smith (1930-)
American physicist

Smith and Boyle were long time associates and friends who jointly invented the digital sensor called the Charge-Coupled Device (CCD) in 1969, while working at Bell Labs. The CCD turned light into electronic signals and led to the development of digital photography which has revolutionized cameras, camcorders, high-definition TV (HD), video-conferencing, medical diagnostics, and space and satellite imaging. Smith and Boyle won the Nobel Prize for physics in 2009.

1969

UNIX operating system developed by Thompson and Ritchie

Ken Thompson (1943-)
American computer scientist
Dennis Ritchie (1941-2011)
American computer scientist

Thompson and Ritchie jointly developed the UNIX operating system in 1969, simple software system designed to run on all computers, making open systems possible. The system was the foundation upon which the internet was built. Thompson and Richie created the B programming language related to the early implementation of the UNIX operating system, the C programming languagewas created later by Ritchie. C and UNIX were crucial for the development of several important inventionsincluding smart phones and smart tablets.

1969

First laser printer invented

The IBM 3800

Gary Keith Starkweather, an American engineer, invented the laser printer in 1969, at Xerox's Webster research center. The first commercial laser printer was the IBM 3800 released in 1976. It was a high-speed printer which was the first to combine laser technology and electrophotography.

1969

ARPANET is launched

The US Department of Defense's Advanced Research Program Agency (ARPA) established a communication network known as ARPANET whose technologies later became the technical foundations of the internet.

1970

CD-Rom is patented

American inventor, James T. Russell, patented the CD-ROM, as the first system capable of digital-to-optical recording and playback.

1971

First microprocessor invented

Federico Faggin
Italian-American physicist (1941-)
Marcian Edward 'Ted' Hoff, Jr.
American electrical engineer (1937-)
Stanley Mazor
American electrical engineer (1941-)

Faggin, Hoff and Mazor worked together at Intel Corporation when they developed the world's first microprocessor. In 1960 Faggin invented the Metal Oxide Semiconductors (MOS) process which was intended to become the basis for the production of all modern integrated circuits. The microprocessor was an immense technological feat that completely transformed the evolving digital revolution.

1971

Texas Instruments introduces its first pocket calculator

TI's Canon Pocketronic

The Canon Pocketronic used chips developed by Texas Instruments and was one of the first "pocket" calculators. It was introduced in early 1971. This calculator was developed from the Texas Instruments Cal Tech experimental calculator, which is why Texas Instruments was granted the patent for the hand-held calculator.

1971

Intel introduces its first commercial microprocessor

Intel's 4004 microprocessor

Intel introduced its first commercial 4-bit microprocessor in 1971 at the cost of about $60.

1973

Cooper demonstrates first hand-held mobile phone

Martin Cooper
American inventor (1941-)

Cooper pioneering work in radio spectrum management won him recognition as one of the most influential inventors of his age. While at Motorola, Cooper was the first to develop a "handheld mobile phone". The U.S. patent office names Cooper as the main inventor of the 'radio telephone system' filed in 1973. Known as the 'father of the cell phone', Cooper also formulated the Law of Spectral Efficiency, or 'Cooper's Law'. It is said that Cooper was the fist person on the planet to have made a cell phone call!

1974

First Personal Computer, the 'Altair 8800' developed

Henry Edward Roberts
American electrical engineer, entrepreneur, medical doctor
(1941-2010)

Roberts was co-founder of Micro Instrumentation and Telemetry Systems (MITS) in the 1960s, which produced calculators that became very popular, and electronic kits for model rocketry enthusiasts. In 1974 he developed the first Personal Computer PC), the Altair 8800, using the new Intel 8080 microprocessor. It sparked the interest of many, including Bill Gates and Paul Allen, who joined MITS to develop the software. Their efforts resulted in the Altair BASIC, after which they formed Microsoft Corporation to market their software

1974

The word ‘nano-technology’ is coined by Norio Taniguchi

A nanocircuit on a fingernail

Norio Taniguchi, a scientist from the Tokyo University of Science, first used the term ‘nano-technology’, in a conference in 1974. However, the famed American physicist, Richard Feynman, is said to have conceived the concept in his lecture, “There’s plenty of room at the bottom”, in 1959. The term ‘nanotechnology’ was independently used by K. Eric Dexler, an American engineer in his 1986 book, “Engines of Creation: The Coming Era of Nanotechnology”.

1975

First digital camera invented by Steven Sasson of Eastman Kodak

Steven Sasson
American electrical engineer
(1950-)

Sasson is recognized as the inventor of the first digital camera in 1975, which he built using a charge-coupled device image sensor. However, the toaster-sized prototype took only black and white pictures of 0.01 megapixels. Thereafter, digital cameras continued to develop rapidly especially in the 1990s and 2000s when they replaced film cameras. Now they have become a ubiquitous feature in all smart phones

1979

First automatic analog cellular system introduced in Tokyo, Japan

A Cell Tower

The first automatic analog cellular systems develop by Nippon Telegraph and Telephone (NTT) in 1979 in Tokyo, Japan. Then in 1981 cellular system was developed by Nordic Mobile Telephony (NMT). The first analog cellular system commercially deployed in North America was the Advanced Mobile Phone System (AMPS) in1983. The 1990s were the era of 'second generation' mobile phone systems with mainly two rivals in the global market - the GSM standard developed in Europe and the CDMA standard of the U.S. The first GSM network was launched in Finland in 1991.

1981

The first IBM PC (IBM 5150) is introduced

William C. Lowe (1941-2013)
American IBM Executive and visionary

Lowe, while at the International Business Machines Corporation (IBM) Corporation,he developed a new, innovative machineknown as SCAMP, which came to be known as the 'world's first portable computer (PC)'. One year later the PC was commercially viable, and in 1981, the first PC in the worldwas ready to be mass-marketed. To save time during the development phase, the operating system was outsourced to Microsoft and the processor to Intel.

1985

Gates releases Windows 1.0

William Henry Gates (1955-)
American computer programmer and entrepreneur

Bill Gates established Microsoft Corporation at just 19 years of age, in partnership with his friend Paul Allen. They began adapting the programming language BASIC (thus far used on large computers), for microcomputers. Later, Microsoft licensed their operating system MS-DOS, whose first version appeared in 1980, to International Business Machines Corporation (IBM). The Windows operating system started to be developed in the early 1980's, was officially launched in November 1985, and went on to become a ubiquitous feature in over 80% of the world's computers.

1988

First undersea fiber optic cable goes into operation

TAT-8 revolutionized telecommunications in 1988. It was the first transatlantic fiber optic communications cable, carrying 40,000 telephone circuits between USA, England and France. It was constructed in 1988 by a consortium led by AT&T Corporation, France Télécom, and British Telecom. The system became operational in 1988 and retired from service in 2002.

1989

The World Wide Web (WWW) invented by Berners-Lee

Sir Timothy Berners-Lee
British computer scientist
(1955-)

Tim Berners-Lee is credited with inventing the World Wide Web (www), a global hypertext project, while working at CERN in 1989. Recognizing the potential of joining hypertext with the internet, he proceeded to design and build the first web browser and web server in 1990. His specifications of URIs, HTTP, and HTML were further developed as web technology expanded.

1991

The World Wide Web (WWW) becomes publicly available

Tim Berners-Lee published a summary of the World Wide Web (WWW) project on a newsgroup, 'alt.hypertext', on August 6, 1991, coining the word www. The web became available first time to the public at large on August 23rd, 1991.

1996

Hotmail launched

MSN Hotmail Logo

One of the world's first free webmail services, Hotmail, was introduced in 1996 by Sabeer Bhatia and Jack Smith in Mountain View, California. Microsoft launched it as MSN Hotmail when it acquired the webmail service in 1997.

1996

Pilot 1000 and Pilot 5000 launched

The Pilot 1000

The Pilot 1000 and Pilot 5000 were the first Palm Personal Digital Assistants (PDAs) to be launched by Palm, Inc. in 1996.

1997

FLAG becomes operational

The Fiber-Optic Link Around the Globe (FLAG) cable system was first placed into commercial service in late 1997. It is a 17,500-mile-long optical fiber that connects the United Kingdom, Japan and many other countries between them.

1997

Jobs becomes CEO of Apple Computer Inc. and oversees development ofiPod, iPhone, iPad, iMac and iTunes

Steven Paul 'Steve' Jobs (1955-2011)
American entrepreneur and inventor

Steve Jobs was a visionary technology leader with unmatched business acumen. He co-founded Apple Computer (later Apple Inc.) that became the most valued company in the world. He led the development of the Mackintosh computer in 1984 which became very popular as the first commercially successful computer to use the graphical user interface (GUI).He revolutionized the world of electronics through the development of innovative technologies that included the iPod (2001), iPhone (2007), iPad (2010), and MacBook. Steve Jobs is said to have changed the world!

2002

Internet-based Mobile phones

In 2002, the first mobile phones to bring GPRS internet services to the mass market were produced along with the first camera phones.

2011

IBM's Watson wins Jeopardy

IBM Watson

In 2011, for the first time in history, a computer machine named Watson won a national quiz show in the U.S., Jeopardy, playing against its two human competitors combined– former highest winners Brad Rutter and Ken Jennings. During the competition Watson was not connected to the internet. Watson was developed by IBM as an Artificial Intelligent (AI) computer system that can understand natural language and analyze unstructured data. It is a cognitive system using natural language processing, hypothesis generation and evaluation, and dynamic learning.

2013

Mobile-cellular penetration reached 96% globally

International connectivity on the rise

In 2013, the United Nation reported that mobile-cellular penetration rates stood at 96% globally with 128% in developed countries and 89% in developing nations. In the same year about 2.6 billion people were online, i.e. 40% of the world's total population. Fixed broadband prices dropped by 82% between 2008 and 2012 making fixed broadband services more affordable, leading to an increased penetration.

2014

For the first time mobile apps are used more than PCs to access internet in the U.S.

Mobile Devices

In January 2014, for the first time ever in the U.S., more mobile devices and apps were used to access the internet than the indispensable PC. In January 2014 55% of internet usage originated from mobile devices and 45% from PCs.