2025

Basic Principles and Applications of Semiconductor Technology

LEAVING CERTIFICATE ENGINEERING PRESCRIBED TOPIC 2026

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Ollscoil Teicneolaíochta na Sionainne: Lár Tíre Iarthar Láir

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1 Introduction

Understanding how materials interact with electricity is fundamental to nearly every type of modern technology, from the power lines that deliver energy to our homes to the microprocessors that run our computers and smartphones. Broadly speaking, materials can be divided into three major categories based on the way they respond to electrical energy ; conductors, insulators, and semiconductors. Although this classification appears simple, each category reflects important physical properties that govern the movement of electrons, and together they form the foundation of contemporary electronics and electrical engineering.

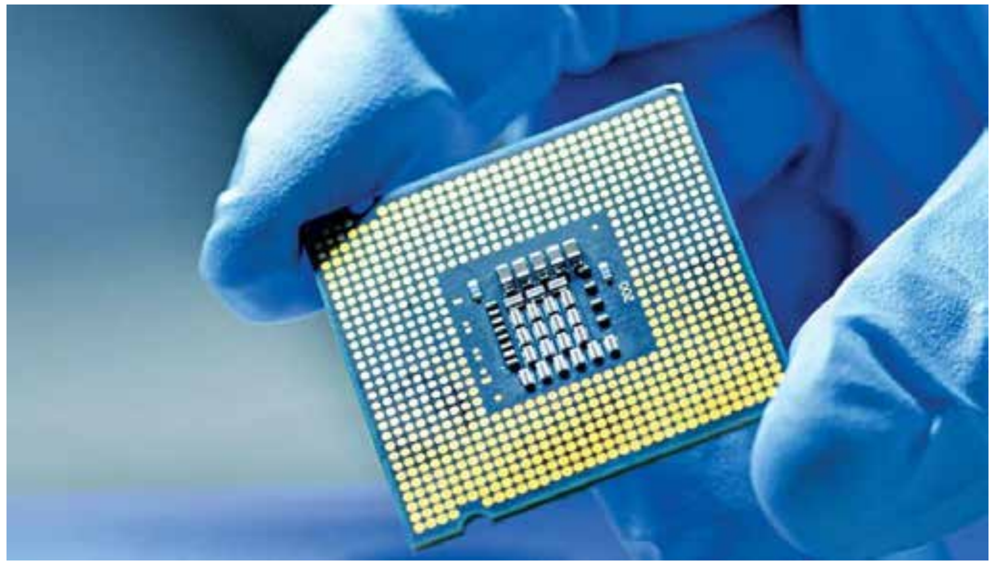

Figure 1 Silicon Based Microprocessor (TSMC)

The first and most intuitive category are **electrical conductors**. These are materials—copper and aluminium being familiar examples—that readily allow the flow of electrical current. Their atomic structure contains electrons that are only loosely bound to individual atoms, enabling them to move freely throughout the material. This freedom of movement allows electrical energy to be transmitted efficiently and with minimal resistance, which is why conductors are used extensively in wiring, circuitry, and power distribution systems. Without high-quality conductors, reliable electrical infrastructure would be impossible.

At the opposite end of the spectrum are **electrical insulators**. Materials such as rubber, glass, or certain plastics hold their electrons tightly, preventing them from moving freely. This resistance to electron flow allows insulators to serve a critical protective function: they keep electrical energy where it is supposed to be and shield us—and electrical components—from unintended currents and dangerous short circuits. Their ability to block electricity is just as important as a conductor's ability to carry it.

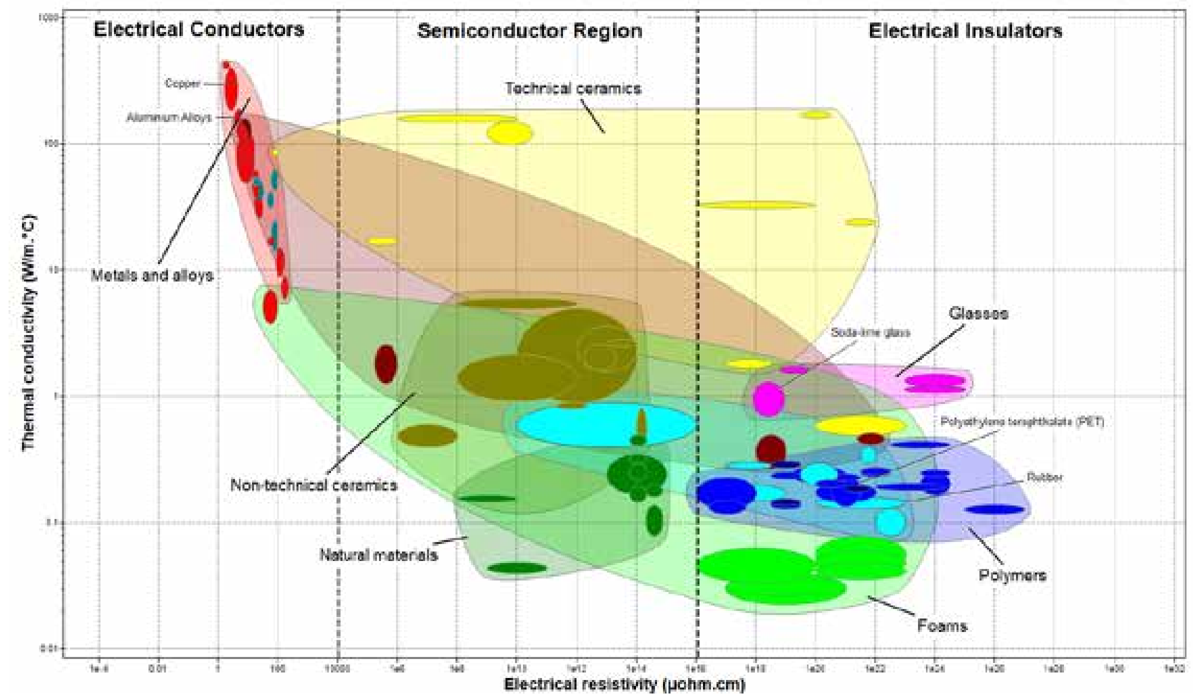

Figure 2. Thermal Conductivity v's Electrical Resistivity (© Granta Edupack).

The ability of a material to either block electricity (insulators) or allow electricity (conductors) is measured by property called electrical resistivity. This is not to be confused with resistance, which is a variable. Electrical resistivity is defined as property of a material that quantifies how strongly it opposes the flow of electric current. Conductors have low values and insulators have high values as shown in Figure 2.

Between these two extremes lies the third, and by far the most fascinating category: **semiconductors**. These materials occupy a unique middle ground. Under some conditions, they behave like insulators, restricting the movement of electrons. Under other conditions—often influenced by temperature, light, or the intentional addition of specific impurities—they become capable of conducting electricity.

By carefully introducing small amounts of other elements, a process known as **doping**, engineers can fine-tune a semiconductor's behaviour with remarkable precision. This controlled manipulation allows semiconductor devices to switch, amplify, and regulate electrical signals in complex ways. From these simple principles arises the vast world of digital logic: transistors,

integrated circuits, microprocessors, memory devices, and more. The ability of semiconductor materials to toggle between conducting and insulating states enables us to build physical systems capable of executing the logical operations that form the base for all modern computing.

2 History of Semiconductors

The history of semiconductor devices reaches back to the early nineteenth century—long before the invention of the first transistor, with foundational studies of electrical and thermal phenomena conducted by researchers such as Thomas Johann Seebeck and Michael Faraday. In 1821, Seebeck discovered what is now known as the thermoelectric effect, observing that a temperature difference across two dissimilar metals could produce an electric current [1]. This early demonstration of a coupling between thermal and electrical energy hinted at deeper principles governing electron behaviour in solids.

A little over a decade later, in 1833, Faraday conducted systematic investigations into the electrical conductivity of materials and observed that certain substances exhibited conductivity that changed significantly with temperature [2]. This was one of the earliest recorded observations of what we now recognise as semiconducting behaviour. His work revealed that not all materials fit neatly into the categories of conductor or insulator, suggesting the existence of a third class with temperature-dependent properties.

These isolated discoveries, along with additional contributions from scientists such as Grove, Kelvin, and later, Hall, whose identification of the Hall effect in 1879 provided further insight into charge carrier movement [3], gradually converged into the theoretical foundations of what would become solid-state physics. Although these researchers could not have envisioned the technological revolution that their insights would ultimately enable, their studies laid the groundwork for understanding energy bands, carrier concentrations, mobility, and the complex interactions between electrons and the atomic lattice.

By the early twentieth century, the accumulation of these theoretical and experimental findings made it possible for physicists to systematically predict and manipulate the electrical properties of crystalline materials. This intellectual framework paved the way for the development of semiconductor rectifiers, diodes, and ultimately the transistor in 1947 shown in Figure 3.

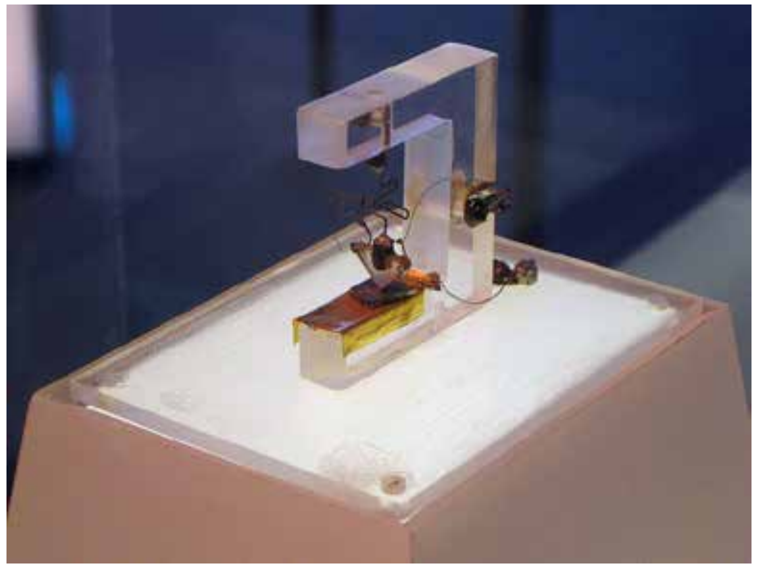

Figure 3 First Transistor Developed at bell labs in 1947 by Bardeen, Brattain and Shockley

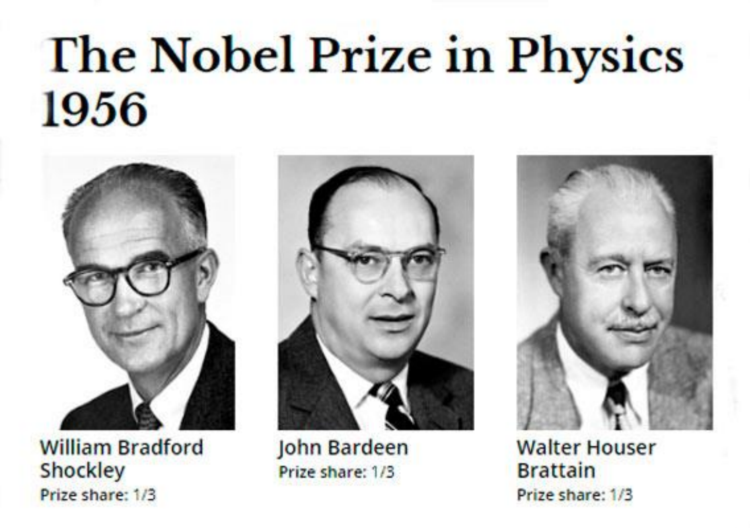

Figure 4. The Bell Labs team who shared the Nobel Prize for their contributions to solid state physics.

In retrospect, the early work of Seebeck, Faraday, and others did more than advance basic science; it started a chain of discovery that would lead to devices fundamental to modern life, enabling the computing, communication, and power-electronic systems on which our society depends [4].

3 Semiconductor manufacturing

As mentioned in the introduction semiconductors, are materials that are neither conductors nor insulators but instead somewhere in-between the two. Through a process called doping, these semiconductors can be made to either conduct or insulate in specific regions. This allows the creation of materials that can force electricity to follow specific paths, under specific circumstances. Semiconductors are primarily made from silicon slices (commonly known as silicon wafers) but can be made from other materials such as Germanium and Gallium Arsenide, which are used in more specialised applications. As stated by Sami Fransssila “Silicon wafer manufacture is a multistep process which begins with sand purification and ends up with final polishing and defect inspection. [5]”

3.1 Silicon Purification

The process of purification produces ~98% pure silicon, known as metallurgical grade silicon (MGS) from silica sand (made up of silica and oxygen, SiO_2), by carbon reduction in the reaction $SiO_2 + 2\,C \Rightarrow Si + 2\,CO$. This MGS then undergoes a further reaction converting it to gaseous trichlorosilane (HCl_3Si) $Si + 3\,HCl \Rightarrow HCl_3Si + H_2$. The gas is then purified by distillation before being converted back to a solid by decomposition onto hot silicon rods $2\,HCl_3Si + 2\,H_2 \Rightarrow Si + 6\,HCl$. Figure 5 shows main steps in silicon purification process.

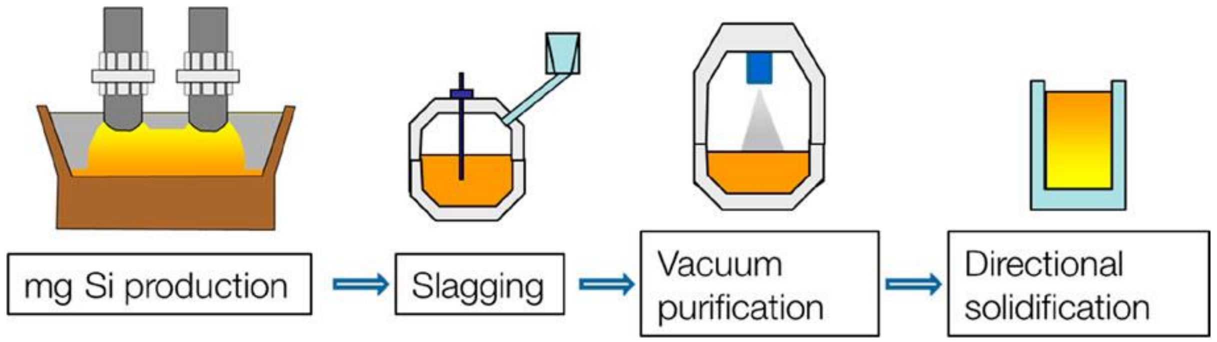

Figure 5. Sketch of the main steps in the upgrade of metallurgical silicon. Source: Del Cañizo et al. (2023).

This process yields an extremely high-grade polycrystalline material called electronic grade silicon (EGS) which is used to grow the crystals in the next phase.

3.2 The Czochralski method – Crystal growth

The next phase involves growing silicon crystals, which is achieved by filling a crucible with undoped EGS and a doping agent. The doping agent can be either pieces of doped silicon or doping elements such as Boron or Gallium (p-type acceptors) and Phosphorus or Arsenic (n-type donors). The crucible is then fired to ~1420 °C in a vacuum just above the melting point of silicon. A seed crystal is dipped into the molten mixture upon which the silicon solidifies. The crystal is then pulled upwards at a rate of ~90mm per hour while rotating (the silicon in one direction and the seed in the opposite) to form the silicon ingots that are then sliced into silicon wafers. [6]. Figure 6 illustrates Czochralski's method for growing crystals. The ingots are then annealed to refine the silicon and reduce defects, enhancing the electrical properties.

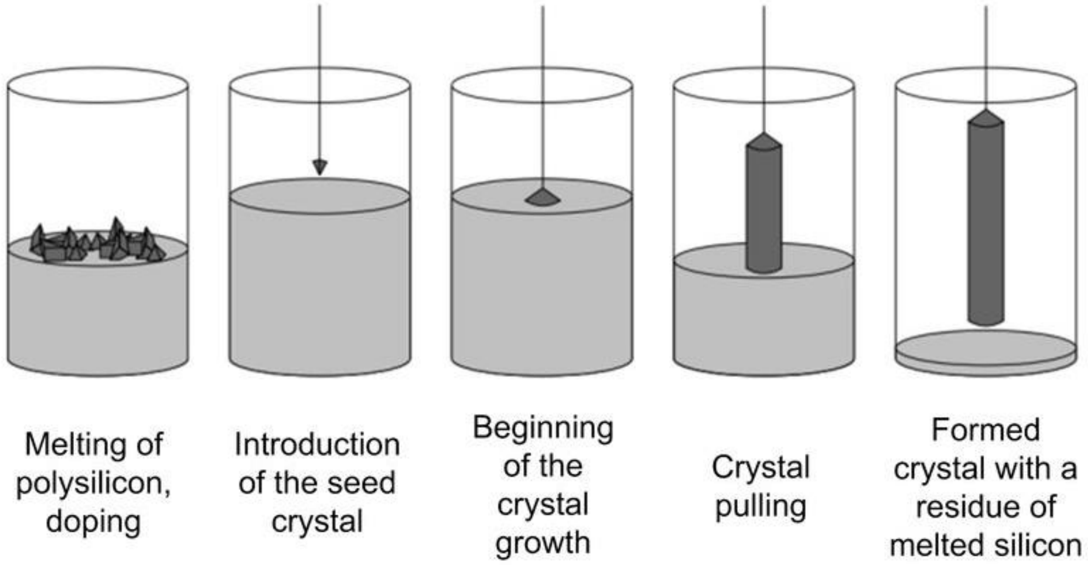

Figure 6. Czochralski method for growing silicon crystals diagram..

3.3 Making Silicon Wafers

Once the silicon ingots have cooled down they are ground down to the exact required diameter and cut into 500mm stocks. The orientation of the crystals in these stocks is then determined and the ingot is notched to indicate this orientation.

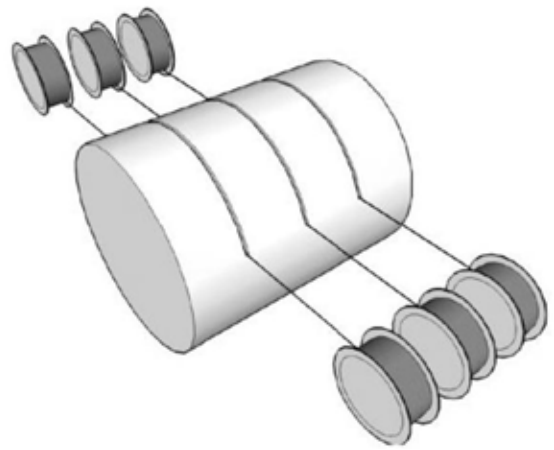

Figure 7. Multiwire saw. Source: Jorma Koskinen.

The silicon ingot stocks must now be sliced into very thin wafers using a wire saw such as that shown in Figure 7. This requires a saw with a very thin cutting surface. This is done using very long continuous lengths of extremely thin wire (in the 80 to 250 µm or micron range). The wire saw uses chemical and mechanical abrasion to cut the silicon ingot to thicknesses in the 000's of µm range, called wafers.

3.4 Lapping

At this stage the thin silicon wafers still contain a rough surface from the sawing process, which must be flattened. Flattening of the wafer is done by spinning the wafer between two large flat steel plates and an abrasive compound (i.e. alumina slurry) in a process called lapping. Figure 8 shows how this lapping process could be achieved. Lapping of the silicon wafers reduces the surface roughness to approximately 0.1 to 0.3 µm. The silicon wafers are brittle and at this thickness, prone to chipping, which could propagate across the wafer. To help prevent chipping while being handled downstream, the edges of the wafer are rounded and sometimes polished to improve mechanical strength, as breakage often starts at the edge of the wafer.

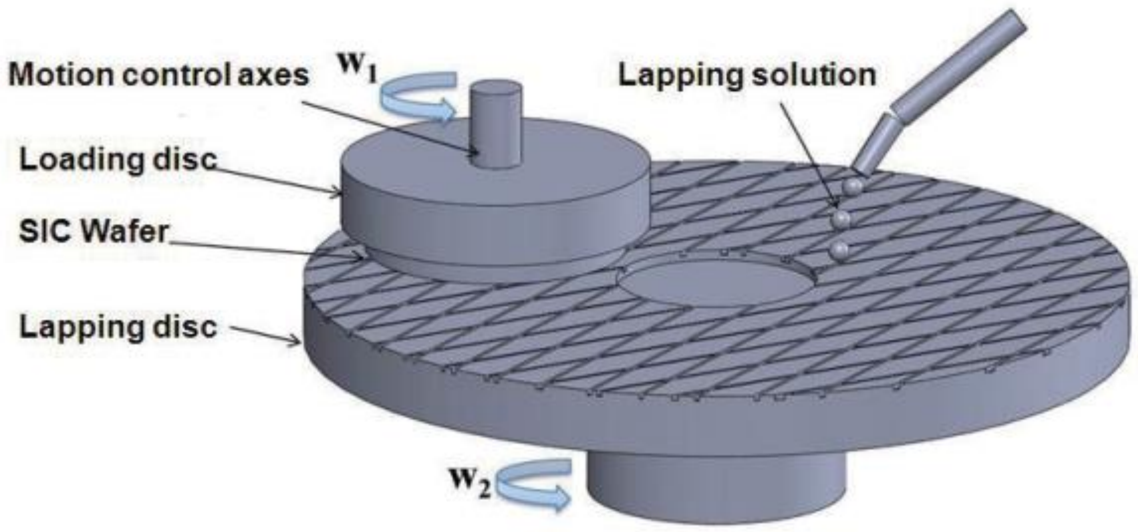

Figure 8. Lapping Principle. Source: Published in The 8th Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems 2013.

3.5 Marking and Cleaning

The final stages of producing silicon wafers involves marking the wafers with an identifying code or barcode using laser scribing. Etching to remove imperfections remaining from the lapping process. While either acidic or alkaline etches can be used only the acidic etches have any effect on the surface roughness, slightly lessening it. Finally, the wafers must be thoroughly cleaned to ensure no silicon dust from the marking process is left behind.

3.6 Deposition

Deposition involves depositing thin layers of materials onto the wafers using either chemical vapour deposition (CVD) or physical vapour deposition (PVD). Figure 9 below shows how CVD and PVD deposit material onto the wafers. These techniques give the manufacturer precise control over the thickness, properties and composition of each layer of material being deposited. [7].

The different layers stacked on top of each other allow different regions of the wafer to have different conductive properties, essentially allowing conductive, insulating and semiconductive areas on the same wafer. This is the process the production of complex circuitry and components with no moving parts. To ensure the deposition accuracy techniques such as Bulk and Surface Micromachining and the LIGA process (used to create high accuracy microstructures)

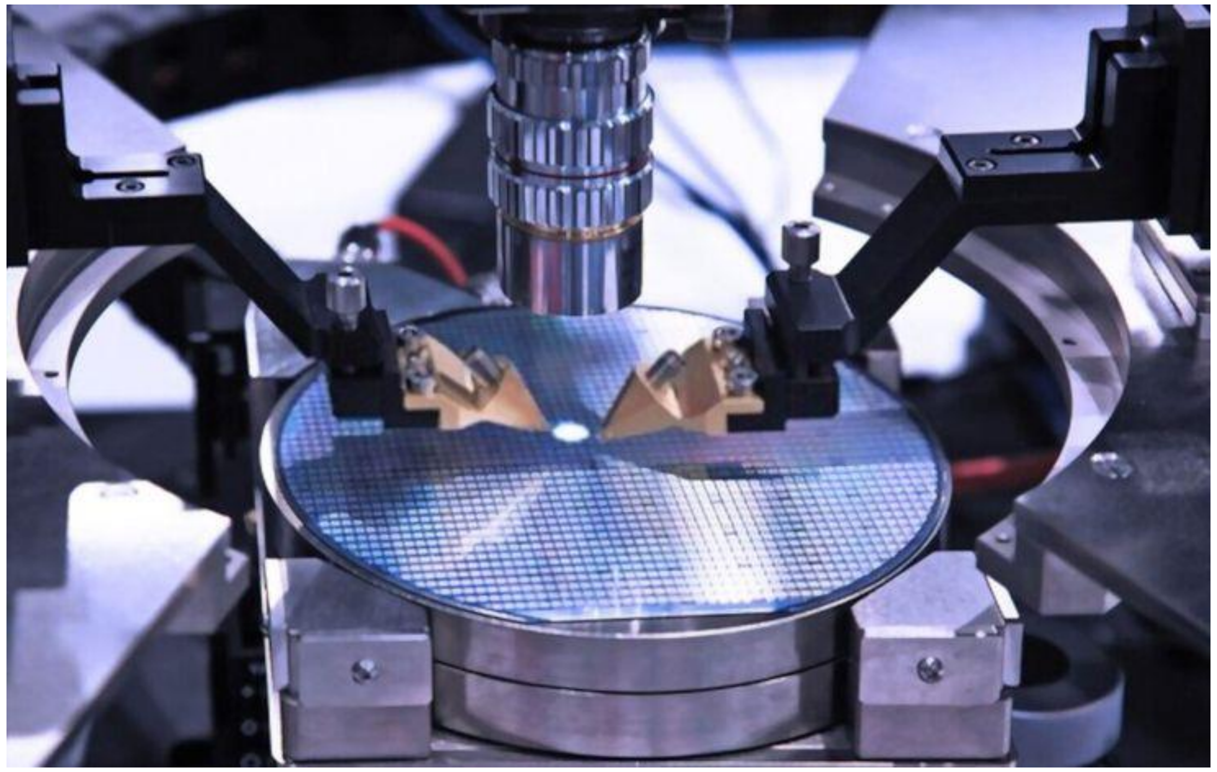

Figure 9. Silicon wafer undergoing CVD. Source: zupyak.com.

3.7 Packaging

The final steps involve cutting the wafer into the individual IC's (Integrated Circuits) and placing them into plastic packages with protruding conductive legs. Bonding wires are used to connect the legs to the silicon chip both mechanically and electrically inside the plastic package. The purpose of the package is to prevent damage to the silicon and the fragile bonding wires. The bonding wires also provide heat dissipation and shock protection for the chip. Figure 10 shows a typical microchip with the plastic package scratched away to reveal the silicon chip and bonding wires inside.

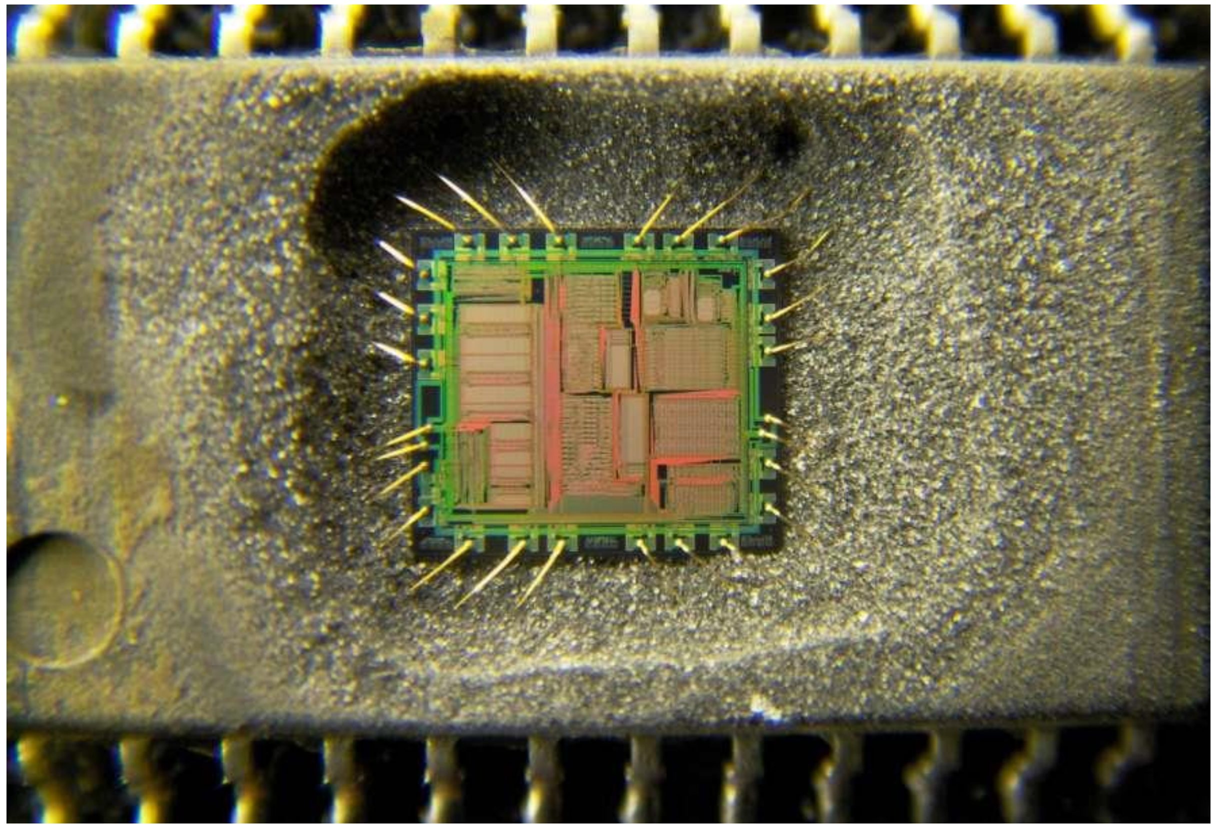

Figure 10. Close up of a microchip with the packaged scratched away to reveal the silicon and bonding wires.

It is common to produce the same chip in multiple package options to suit different applications with unique dimensions, pinouts and mounting types. Figure 11 shows a variety of chip packages. Some chips are designed with pins that push through holes in a printed circuit board (PCB) and soldered on from the rear of the PCB (through hole). Some sit on top of the PCB and are soldered on the same side as the chip (surface mount device, SMD). Others have large metal plates attached to the package to aid with electrical and thermal conduction. It is also common to produce packages with more than one type of a particular circuit embedded inside.

Furthermore some chips come in duel inline package (DIP) format (Through hole) or small outline package (SOP) format (SMD), where the legs run up and down the length of the chip on either side but do not run across the top or bottom. Others still come in quad flat package (QFA) with legs and quat flat no-lead (QFN) with no legs format (SMD). The quad flat packages have connections running along all four sides of the chip, with flat splayed legs for the QFA packages and conductive pads for the QFN packages.

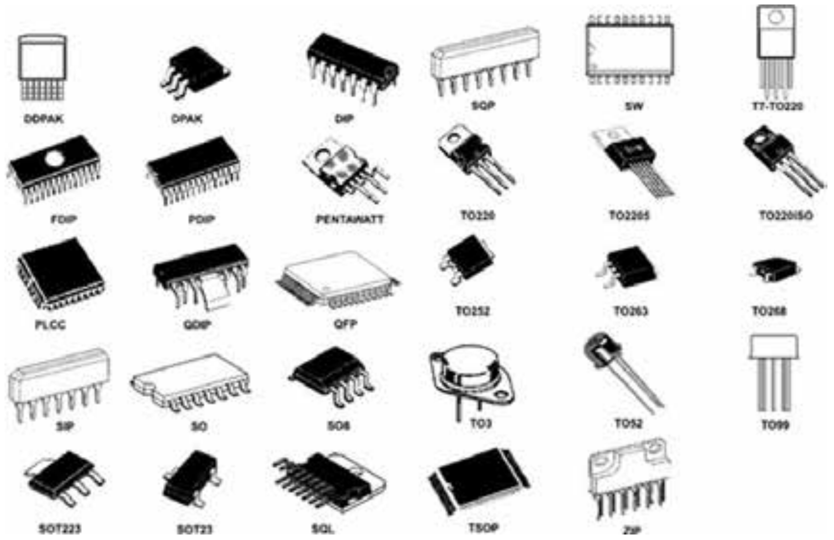

Figure 11. Common IC packages.[8] Sparkfun.

4 Applications of semiconductors in our modern world

Semiconductor technology is all around us in our homes, workplaces and areas of recreation. Every processor and piece of 'solid-state' electronics equipment uses this technology. LED lighting is an example of one particular hardware that is leading the way towards a more energy efficient lifestyle. Semiconductors are a core component of global infrastructure. As device sizes shrink and new materials and devices emerge, such as gallium nitride (GaN), PV panels, silicon carbide (SiC) and Schottky diodes, semiconductor applications will continue expanding, shaping the future of technology.

4.1 Semiconductors in Computing and Mobile Technology

Computers and mobile devices are fundamentally powered by integrated circuits (ICs) built from semiconductor materials like silicon and gallium arsenide. Modern microprocessors contain billions of transistors that carry out the logic operations required for computing, making an understanding of transistor behaviour, and the underlying semiconductor physics, essential for engineers. At the heart of nearly all digital logic circuits are MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors), which act as the basic switching elements. Real-world examples include the Apple A-series processors in iPhones, cutting-edge 3-nm chips produced by Samsung and TSMC, and high-performance computer processors such as Intel's Core i9 and AMD's Ryzen CPUs.

4.2 Telecommunications and Internet Connectivity

Modern communication systems depend heavily on semiconductor devices to transmit, receive, and process massive amounts of data at extremely high speeds. In everyday communication devices, advanced RF semiconductor chips enable 5G and emerging 6G networks to handle high-frequency signals with exceptional efficiency and reliability. Across utility and long-distance networks, semiconductor lasers power fibre-optic communication, converting electrical signals into light so information can travel quickly over vast distances with minimal loss as shown in Figure 12.

Figure 12. Fibre optic cable being run along side high voltage transmission lines.

Even common Internet technologies rely on semiconductors—Wi-Fi and Bluetooth chips inside routers, smartphones, and countless smart devices make wireless connectivity possible

4.3 Consumer Electronics

Semiconductor technology has enabled microcontrollers to become smaller, cheaper, and far more capable, allowing manufacturers to integrate intelligent control into countless everyday devices. Modern microcontrollers (MCUs) can be reprogrammed to change their functionality and are available in many variants optimized for speed, low power, or communication needs. When purchased in bulk, they cost only a few cents, making them ideal for managing the increasing number of smart features in household appliances. As a result, semiconductors are now found everywhere—from thermistors that shut off a kettle to the MCU that alerts you when the fridge door is left open. They also underpin home automation systems by enabling devices to connect to networks or apps. Beyond appliances, semiconductors power media devices like smartphones, cameras, and displays, as well as health trackers, wearables, and safety systems. Even converting household AC to device-ready DC relies on semiconductor-based power electronics.

4.4 Power Electronics and Energy Conversion

Power semiconductors play a crucial role in controlling high voltages and currents across modern energy systems, enabling efficient power conversion and management. They are essential in electric vehicles, where devices such as Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs) and Insulated Gate Bipolar Transistors (IGBTs) regulate power flow in DC motor controllers to deliver smooth acceleration and reliable performance. Inverters also depend on power semiconductor switches to convert DC electricity into AC, powering everything from solar energy systems to household appliances. Even everyday chargers for laptops and phones rely on semiconductor-based rectifiers and regulators to safely transform AC wall power into stable, low-voltage DC.

4.5 Medical and Healthcare Equipment

Semiconductors play a key role in modern health monitoring by enabling highly accurate sensing and imaging technologies. Devices such as pulse oximeters use infrared LEDs and photodiodes to measure blood oxygen levels non-invasively, while advanced medical imaging systems like MRI and CT scanners rely on specialized semiconductor detectors to capture detailed internal body data. Together, these technologies allow precise, real-time monitoring of vital signs and medical conditions, supporting improved diagnosis, treatment, and remote healthcare applications, as shown in Figure 13.

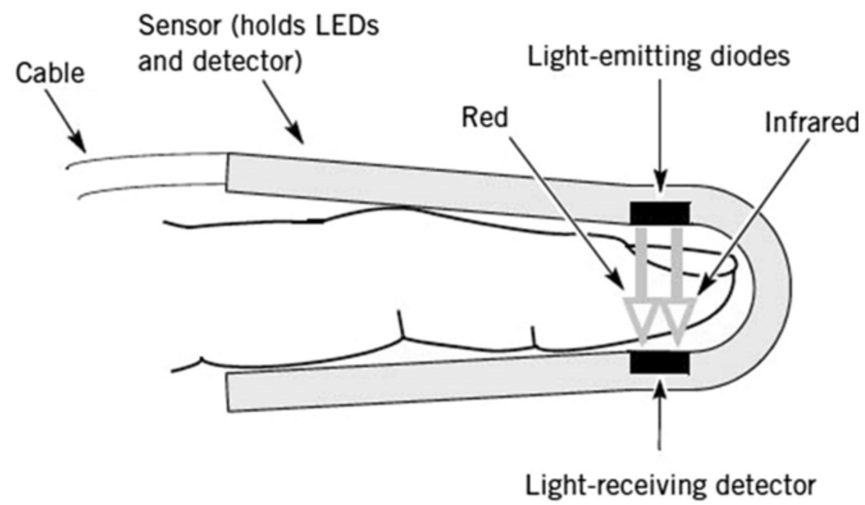

Figure 13. LED pulse measurement devices for medical applications.

5 Semiconductors in the Irish Economy

The semiconductor sector has become one of the most strategically important components of Ireland's modern economy, and its significance continues to expand year after year. As global demand for advanced chips and microelectronics accelerates, Ireland has positioned itself as a vital hub within Europe for both manufacturing and research.

Employment remains one of the clearest indicators of the sector's national impact. According to the Irish government's *Silicon Island* strategy, the semiconductor and wider microelectronics industry directly employs more than 20,000 people across this country. These positions span manufacturing, design and engineering roles, forming a highly skilled workforce. Within this figure, approximately 6,500 jobs are classified as highly technical, requiring expertise in areas such as process engineering, device physics, and digital systems design. A further 3,000 roles are dedicated to research and development, reflecting Ireland's growing focus on innovation-driven economic activity. Beyond these direct roles, the semiconductor sector supports a significant ecosystem of indirect employment. Industries such as logistics, equipment maintenance, construction, higher education, and specialized supply-chain services all benefit from the presence of major semiconductor firms, amplifying the sector's overall economic contribution.

Semiconductors also play a critical role in Ireland's export performance. The national semiconductor strategy reports that chip-related exports amount to approximately €13.5 billion annually. This makes the sector one of Ireland's most valuable export pillars and contributes substantially to the country's trade balance. Its share of total goods exports has also grown noticeably: semiconductors accounted for around 6% of Ireland's goods exports in 2022, roughly double their share compared with the preceding decade. This rise demonstrates how the sector has strengthened its position as global markets increasingly rely on advanced electronics for everything from telecommunications and data centres to automotive systems and consumer devices.

Ireland's semiconductor capacity also holds increasing geopolitical relevance. As part of Europe's broader technological sovereignty agenda—embodied by initiatives such as the EU Chips Act (2023). Ireland plays a strategic role in supporting a more resilient and independent European semiconductor ecosystem. The *Silicon Island* strategy reflects this ambition by seeking further investment, encouraging expansion of domestic capabilities, and exploring the possibility of hosting a leading-edge semiconductor fabrication facility. Collectively, these efforts underline Ireland's growing significance in a sector that is essential to the global economy and to Europe's technological future, as shown in Table 1.

Table 1 Key players in the Irish Semiconductor Industry

	-ADI was one of the first semiconductor companies in Ireland: it opened a facility in Limerick as early as 1976. -In 2023, ADI announced a €630 million investment in its Limerick operation to expand wafer manufacturing and R&D, bringing with it 600 new high value jobs. -According to Ireland's national semiconductor strategy, ADI employs 1,900 people in Ireland across R&D and manufacturing.
	-Intel established its major presence in Ireland in 1989, choosing Leixlip (Co. Kildare) for a large manufacturing campus, with later developments in Shannon. -Intel now employs close to 4900 people in Ireland with a total investment to date in excess of €30 billion.
	The company established its presence in Limerick in 2008, making it a relatively recent entrant to Ireland's mature semiconductor landscape. -Its footprint expanded significantly after the acquisition of SensL Technologies in 2018, giving the company a second site in Cork. -Both the Limerick and Cork facilities operate as design centres and have been designated as long-term R&D hubs for onsemi.

6 Semiconductors – The global race for materials.

As with all technologies, Semiconductors have their advantages and disadvantages. When discussing semiconductors, we must discuss the strategic importance of the materials used in their manufacture. The concentrations of the Rare Earth Elements (REE) required for advanced semiconductor device manufacture are not equally distributed throughout the world, as shown in Table 2 . This gives certain countries very significant influence over the production and sale of these materials. The world's largest producers of REE by far is China.

Table 2. Rare Earth Elements and their countries of manufacture.

Element	**Applications**	**Most Commonly Found**
Germanium	Transistors, Photodetectors, IR optics	China, Canada, Finland, Russia, USA
Gallium	Power Electronics	China, Russia
Europium	Red and Blue Phosphors for LED Displays	China, Mongolia, Russia, USA
Scandium	Superconductors, Capacitors, Specialised transistors	China, USA, Norway, Finland, Russia
Neodymium	Magnets for Electrical Motors/Generators	China, USA, Myanmar, Australia
Cerium	Wafer Polishing compounds	China, USA, Australia

China is not only the largest miner of these Rare Earths Ores, but is also the largest refiners of these materials, first to their Rare Earth Oxides (REO) and finally to their Rare Earth Metal (REM) forms. It is these highly processed, final products that are then sold on global commodity markets at significant premiums compared to prices paid in the domestic Chinese markets. This has allowed for a rapid growth of the semiconductor industry in China despite US embargos over the last two decades. This is particularly noticeable in the area of electric vehicle manufacturing with China producing 70% of the worlds Electric Vehicles in 2024 [9], as shown in Figure 14.

Figure 14. EV Automakers.

New Chinese EV companies including BYD, Geely, SAIC Motor, Chery and Changan Automobile all operated in 2024 with revenues from $20 to $107 billion. These companies are now competing on the global markets with the traditional vehicle producing economies such as Germany and USA.

7 Summary

Semiconductors are the foundation of nearly all modern technologies, enabling the operation of computers, smartphones, communication networks, medical equipment, and energy systems. Semiconductor devices process information, manage energy conversion, support high-speed communication, and enable everything from LED lighting to electric vehicles. As technologies such as artificial intelligence, automation, renewable energy, and advanced telecommunications continue to expand, the importance of semiconductors to global society will only increase. They are essential not only for consumer convenience but also for national infrastructure, scientific research, and economic development.

For Ireland, the semiconductor sector is a major contributor to economic growth and technological capability. The industry employs more than 20,000 people, including thousands of specialised engineers and researchers, and supports a broad ecosystem of suppliers, logistics firms, and educational institutions. Key global players, such as Intel, Analog Devices, and onsemi, have established manufacturing and R&D operations in Ireland, anchored by long-term investments that exceed tens of billions of euros. Semiconductor exports, valued at approximately €13.5 billion annually, account for around 6% of Ireland's goods exports. As Europe strengthens its semiconductor resilience through initiatives like the EU Chips Act, Ireland's strategic position and expertise will ensure the industry remains central to national competitiveness and future economic growth

8 References [TBD]

[1] J. M. Ziman, *Principles of the Theory of Solids*. Cambridge, UK: Cambridge Univ. Press, 1972.

[2] "A History of the World Semiconductor Industry," IET, 1990. ISBN: 9780863412271.

[3] E. H. Hall, "On a New Action of the Magnet on Electric Currents," *American Journal of Mathematics*, vol. 2, no. 3, pp. 287–292, 1879.

[4] B. G. Streetman and S. Banerjee, *Solid State Electronic Devices*, 7th ed. Upper Saddle River, NJ, USA: Pearson, 2015.

[5] Sami Franssila, Introduction to Microfabrication, 2nd ed. John Wiley & Sons, 2010, p. 36.

[6] "how do you make silicon wafers into computer chips," www.universitywafer.com, Oct. 01, 2018. https://www.universitywafer.com/how-to-make-silicon-wafers-into-computer-chips.html

[7] inquivix, "From Silicon to Microchips: An In-depth Look at the Wafer Fabrication Process | Semicon Society," SemiconSociety Blogs, Feb. 29, 2024. https://semiconsociety.com/from-silicon-to-microchips-wafer-fabrication-process/ (accessed Nov. 20, 2025).

[8] "Integrated Circuits - SparkFun Learn," Sparkfun.com, 2025. https://learn.sparkfun.com/tutorials/integrated-circuits (accessed Nov. 20, 2025).

[9] IEA, "Executive summary – Global EV Outlook 2025 – Analysis - IEA," *IEA*, 2025. https://www.iea.org/reports/global-ev-outlook-2025/executive-summary

9 Why pick a course in Engineering ? : F.A.Q.

The following are questions we are often asked by students who are thinking of picking a course in engineering. We hope that some of these answers will help you make up your mind.

What makes for a good engineer ?

An engineer is someone who is inquisitive about how things work, why and how they are made, and wonders if they could be improved upon. They tend to be good at thinking logically and like problem solving.

What is an engineer (answer from ChatGPT) ?

"An engineer is a professional who applies scientific and mathematical principles to design and create solutions for technical problems. Engineers work in various fields, such as civil, mechanical, electrical, chemical, aerospace, and computer engineering, among others. They use their knowledge and skills to design, analyse, test, and improve systems, structures, devices, and processes."

Are there good job prospects for engineers ?

At the time of writing of this handout, yes there are. However by the time you might be graduating as an engineer, it could be June 2026, 26 or 27. Who can tell what the jobs market will be like then, which goes for any course you might pick. What we can say is engineering is broad disciplined qualification and graduate engineers are usually in good demand.

Is there work placement on the courses ?

All of our three year level 7 and four year level 8 courses come with a minimum of 5 months work placement, usually in 3rd year. The two year level 6 in Agricultural Mechanisation also features work placement.

Why should I not focus on the C.A.O. points ?

You should pick a course on the basis of what you are going to be studying in college for 2, 3 or 4 years, and the area/industry sector you see yourself working in, after you graduate. C.A.O. entry points constantly change and it's unfortunately a common mistake to select your course based on this year's points. Select your courses (10 Level 6/7 and 10 Level 8 courses) in the genuine order of the one you most want to do first. If you don't get the points, so be it. You go onto your second choice and so on.

If you make a mistake in the order by which you select your courses, you may be stuck with a course you'd least prefer ahead of one you'd prefer. Unfortunately T.U.S., or any 3rd level educator cannot help you in this case.

If I pick a Level 6 or 7 course can I progress onto a higher level course ?

Yes, nearly all of our courses are designed with the ladder or opportunity in mind. This means that a student who passes a two year Level 6 course can go onto the 3rd year of Level 7 course (or into 3rd year of a Level 8) where a suitable one exists. Likewise a student who passes a three year level 7 course can go into the 4th year of a Level 8 course. Check the detail of each specific course on our website or prospectus to see the progression options.

What are the minimum entry requirements ?

For our Level 6 & 7 courses ;

A minimum of 5 O6/H7 grades in five Leaving Certificate subjects, including Mathematics and English or Irish.

For our Level 8 courses ;

A minimum of 2 H5 & 4 O6/H7 grades in six Leaving Certificate subjects, including English or Irish and a minimum of an O4 in Mathematics

What Leaving Cert subjects do I need to secure an engineering course ?

There are no mandatory subjects that you have to have for any of our engineering courses, apart from the generic minimum entry requirements as detailed above. You don't have to have engineering to study an engineering course here in T.U.S. However the majority of our students would have one or more of the following suitable subjects. It means there's a good chance that they can think and study like an engineer. Don't worry if you don't have some or any of these subjects. We won't assume you do in first year.

- Engineering
- Technology
- Design and Communication Graphics
- (TBC on next page)

- Physics
- Physics and Chemistry
- Construction Studies
- Agricultural Science
- Applied Mathematics

Do I need Higher level maths to enter an engineering course in TUS Midwest ?

No you don't. The majority of our first year students on any engineering course will have ordinary level maths. Most of our first years will start off feeling that they are not too confident in maths.

With so many courses (26) on offer how do I pick the right one ?

Keep on attending open days or marketing events in third level institutes and universities such as Engineering Week 2023. If you have a relation or friend who is or was on an engineering course, talk to them about their experience. Get into the detail of the list of modules or subjects to learn the difference between each type of engineering course. Don't be lead by just the nice photo or video. If you can, visit an engineer at their workplace to see what it is they do as a career. Ask your guidance counsellor or teachers at school for advice. Read, watch relevant videos and be inquisitive.

10 TUS Midwest Engineering Courses

We have 27 engineering courses across three departments, at 4 different levels.

10.1 Department of the Built Environment

Course :	Built Environment (Common Entry) (Hons)
Level :	8
Course Code :	US883
CAO Points :	300

Course :	Civil Engineering
Level :	7
Course Code :	US760
CAO Points :	206

Course :	Civil Engineering Management (Hons)
Level :	8
Course Code :	US886
CAO Points :	327

Course :	Construction Management (Hons)
Level :	8
Course Code :	US885
CAO Points :	280

10.2 Department of Electrical and Electronic Engineering

Course :	Electrician Apprenticeship
Level :	6 (Cert)
Course Code :	n/a
CAO Points :	n/a

Course :	Electrical Engineering
Level :	7
Course Code :	US750
CAO Points :	250

Course :	Electrical Engineering (Honours)
Level :	8
Course Code :	US900
CAO Points :	348

Course :	Electronic Engineering with Computer Systems
Level :	7
Course Code :	US751
CAO Points :	217

Course :	Electronic Engineering with Computer Systems (Honours)
Level :	8
Course Code :	US903
CAO Points :	279

Course :	Robotics and Automation Engineering
Level :	7
Course Code :	US753
CAO Points :	215

Course :	Robotics and Automation Engineering (Hons)
Level :	8
Course Code :	US902
CAO Points :	301

Course :	Renewable & Electrical Energy Engineering
Level :	7
Course Code :	US752
CAO Points :	270

Course :	Renewable & Electrical Energy Engineering (Hons)
Level :	8
Course Code :	US901
CAO Points :	336

10.3 Department of Mechanical and Automobile Engineering

Course :	MAMF (Fitter) Apprenticeship
Level :	6 (Cert)
Course Code :	n/a
CAO Points :	n/a

Course :	Motor Mechanic Apprenticeship
Level :	6 (Cert)
Course Code :	n/a
CAO Points :	n/a

Course :	Agricultural Mechanisation
Level :	6
Course Code :	US651
CAO Points :	257

Course :	Agricultural Engineering
Level :	7
Course Code :	US769
CAO Points :	311

Course :	Road Transport Technology and Management
Level :	7
Course Code :	US775
CAO Points :	311

Course :	Automotive Engineering & Transport Management (Hons)
Level :	8
Course Code :	US915
CAO Points :	255

Course :	Engineering (Common Entry) (Hons)
Level :	8
Course Code :	US904
CAO Points :	n/a (new)

Course :	Engineering Technology Management
Level :	7
Course Code :	U779
CAO Points :	246

Course :	Engineering Technology Management (Hons)
Level :	8
Course Code :	US909
CAO Points :	329

Course :	Mechanical Engineering
Level :	7
Course Code :	US771
CAO Points :	301

Course :	Mechanical Engineering (Hons)
Level :	8
Course Code :	US911
CAO Points :	337

Course :	Precision Engineering
Level :	7
Course Code :	US774
CAO Points :	213

Course :	Precision Engineering (Hons)
Level :	8
Course Code :	US914
CAO Points :	245

Course :	Process & Engineering Management (Hons)	
Level :	8 (Add-on)	
Course Code :	US914	
CAO Points :	N/a	

10.4 TUS Midlands Midwest Prospectus

A link to the full TUS Midlands and Midwest can be found at ;

https://tus.ie/undergrad/prospectus/

Scan here to view and download the full TUS prospectus.

Thank you and the best of luck in your leaving cert exams in June and your continuing education in the third level sector.