ELECTRICAL & COMPUTER SYSTEMS ENGINEERING
What is ECSE?

Using the physical phenomena of electricity and electromagnetism to solve problems!
What is ECSE?

Using the physical phenomena of electricity and electromagnetism to solve problems!

Does something use electricity?
  • Yes? An electrical engineer was involved!
Greatest Engineering Achievements of the 20th Century

US National Academy of Engineering
(http://www.greatachievements.org/)

- Electrification
- Automobile
- Airplane
- Water Supply and Distribution
- Electronics
- Radio and Television
- Agricultural Mechanization
- Computers
- Telephone
- Air Conditioning and Refrigeration
- Highways
- Spacecraft
- Internet
- Imaging
- Household Appliances
- Health Technologies
- Petroleum and Petrochemical Technologies
- Laser and Fiber Optics
- Nuclear Technologies
- High-performance Materials
14 GRAND CHALLENGES

US National Academy of Engineering
(www.engineeringchallenges.org/)

Advance Personalized Learning
Make Solar Energy Economical
Enhance Virtual Reality
Reverse-Engineer The Brain
Engineer Better Medicines
Advance Health Informatics
Restore and Improve Urban Infrastructure
Secure Cyberspace
Provide Access to Clean Water
Provide Energy from Fusion
Prevent Nuclear Terror
Manage the Nitrogen Cycle
Develop Carbon Sequestration Methods
Engineer the Tools of Scientific Discovery

4 themes: SUSTAINABILITY, HEALTH, SECURITY, JOY OF LIVING
Electronics Design

Design and develop solutions using a wide variety of components:

- Analog (resistors, capacitors, inductors, transistors etc)
- Digital components (microchips)

Basis to enable all other areas of ECSE

ECE2131 Electrical circuits
ECE3161 Analogue electronics
Power generation/distribution

Providing safe and reliable energy supply:
- How do we generate it?
- How do we distribute it efficiently?
- How to incorporate distributed generation?
- How to incorporate energy storage?

Make Solar Energy Economical
Provide Energy from Fusion

ECE2131 Electrical circuits
ECE3051 Electrical energy systems
Computer systems

Design, develop and manufacture large and small scale computing devices

- Personal computers (Laptops, Desktops)
- Supercomputers
- Smart phones
- Specialised microprocessors

Engineer the Tools of Scientific Discovery

Advance Health Informatics

Advance Personalized Learning

Enhance Virtual Reality

- ECE2071 Computer organisation and programming
- ECE2072 Digital systems
- ECE3073 Computer systems
Telecommunications

Design and enhance telecommunication systems
- IoT
- cybersecurity

Making information transmission faster, more accurate, more reliable, more secure, more efficient, more cost effective

Secure Cyberspace
Engineer the Tools of Scientific Discovery

ECE2111 Signals and systems
ECE3141 Information and networks
Biomedical systems

Applying engineering principles to biology for medical purposes

- Diagnosing diseases e.g. EEG, ECG, MRI, CT, X-Rays
- Prosthetics and implants e.g. bionic eye, robotic hand
- Wearable technology - health parameters monitoring

Reverse Engineer the Human Brain
Engineer Better Medicines
Advance Health Informatics

All second year units
From 2021 Biomedical Engineering is also offered as a standalone degree
(https://www.monash.edu/engineering/future-students/undergraduate-study/specialisations/biomedical)
https://wyss.harvard.edu/media-post/human-organs-on-chips/
Automation and control

Design, build and operate automated systems
- Water supply, chemical plants, medical equipment, factories, traffic control systems, autonomous farm systems
- Temperature control in buildings, autopilot in planes
- Smart cities

Restore and improve urban infrastructure

ECE2111 Signals and systems
ECE4132 Control system design
https://www.youtube.com/watch?v=RRkwG6YzJJA
Robotics & Artificial Intelligence

Create autonomous and intelligent systems

- Sense environmental inputs giving useful interactions as outputs
- Much research into to mimicking the function of the human brain

Probably used in all grand challenges!
Reverse Engineer the Human Brain

All second year units and relevant technical electives

https://www.youtube.com/watch?v=8tq1C8spV_g
https://www.youtube.com/watch?v=fn3KWM1kuAw
AlphaGo – The Movie: https://www.youtube.com/watch?v=WXuK6gekU1Y
Engineering is multi-disciplinary

Most engineering projects require teams of people from different backgrounds and disciplines.

Electrical engineers are almost always required.
Frequently Asked Questions

Q: Is there a lot of “coding” in ECSE?

Q: I’ve heard ECSE is the “hardest” discipline, is that true?

Q: Where can I work if I’m an ECSE graduate?

Q: Difference between Electrical & Mechatronics?
Q: I’ve heard ECSE is the “hardest” discipline, is that true?
Q: I’ve heard ECSE is the “hardest” discipline, is that true?
Q: Where can I work if I’m an ECSE graduate?

Telecoms/networking (Telstra, Optus, Vocus, nbnCo, Cisco, Ericsson, Nokia), software (Google, Oracle, Atlassian), banks (NAB, ANZ, Goldman Sachs), defence, construction, mining, consultancy firms (EY, Accenture, PwC, KPMG, Deloitte), smaller engineering firms, energy retailers (Origin, Energy Australia), government departments/businesses (PTV Transurban, DELWP, Aus Post), universities (Monash, RMIT, Sydney, UWA), high schools, research institutions, own businesses

Engineers (product, systems, operations), security analysts, business analysts, data analysts, project managers, program directors, consultants, product managers, business development managers, account managers, technical pre-sales, customer experience, procurement/vendor managers, technical writers, quality control, lawyers, entrepreneurs

Team managers, general managers, senior managers, CTO, CEO

University lecturers, researchers, high school STEM teachers
Q: Where can I work if I’m an ECSE graduate?

<table>
<thead>
<tr>
<th>Field</th>
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<tbody>
<tr>
<td>Finance</td>
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<td>Legal/Regulatory</td>
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<td>Procurement</td>
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[Image of FAQ text and a blue figure]
## Electrical vs Mechatronics

<table>
<thead>
<tr>
<th>Year</th>
<th>Electrical</th>
<th>Mechatronics</th>
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</thead>
<tbody>
<tr>
<td>2nd year</td>
<td>ECE2071 Computer organisation &amp; programming</td>
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<tr>
<td></td>
<td>ECE2072 Digital systems</td>
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<tr>
<td></td>
<td>ECE2131 Electrical circuits</td>
<td>ECE2131 Electrical circuits</td>
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<tr>
<td></td>
<td>ENG2005 Advanced engineering mathematics</td>
<td>ENG2005 Advanced engineering mathematics</td>
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<td></td>
<td>ECE2111 Signals &amp; systems</td>
<td>MEC2402 Design methods</td>
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<td>ECE2191 Probability models in engineering</td>
<td>TRC2201 Mechanics</td>
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<tr>
<td>3rd year</td>
<td>ECE3161 Analogue electronics</td>
<td>ECE3161 Analogue electronics</td>
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<td>ECE3091 Engineering design</td>
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<td>ECE3073 Computer systems</td>
<td>TRC3200 Dynamical systems</td>
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<td></td>
<td>ECE3141 Information and networks</td>
<td>TRC3600 Modelling and control</td>
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<tr>
<td></td>
<td>ECE3121 Engineering electromagnetics</td>
<td>TRC3500 Sensors and artificial perception</td>
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<td>Level 4 ECSE technical elective</td>
<td><strong>ECE4179 Neural networks and deep learning</strong></td>
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<td>4th year</td>
<td>ECE4094 Project A</td>
<td>TRC4000 Final year project 1</td>
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<td>ECE4095 Project B</td>
<td>TRC4001 Final year project 2</td>
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<td>ECE4099 Professional practice</td>
<td>TRC4002 Professional practice</td>
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<td>ECE3051 Electrical energy systems</td>
<td>TRC4800 Robotics</td>
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<td>ECE4132 Control system design</td>
<td><strong>ECE4076 Computer vision</strong></td>
</tr>
<tr>
<td></td>
<td>Level 4 ECSE technical elective</td>
<td><strong>ECE4078 Intelligent robotics</strong></td>
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Have great ideas?

You can design and build a lot of your own stuff!

Many startups on Kickstarter etc. require electrical systems!

Background in software is a bonus.
Want to know more?

Check out these documents

Course progression map for 2021 commencing students

Bachelor of Engineering Technical electives
(Refer to https://handbook.monash.edu/2021/aos/AIENGMNR02 for the AI minor as it is slightly different compared to what is listed in the above document.)

2021 Engineering Undergraduate Course Guide
https://read.uberflip.com/i/1243668-2021-monash-engineering-undergraduate-course-guide/35?

Check out some videos

What is Electrical and Computer Systems Engineering?
http://www.youtube.com/watch?v=ecSGSkhA48c

What do you study in ECSE at Monash?
http://www.youtube.com/watch?v=w8--WinaOu8

Where do ECSE graduates work? What are they doing now?
http://www.youtube.com/watch?v=QM0gK7B_fic

What do Monash ECSE students have to say?
http://www.youtube.com/watch?v=CFe5mQJug3Y

https://www.youtube.com/watch?v=ckTTtS_yWJQ

Spark Night Award 2017
https://www.youtube.com/watch?v=nO4E_SmNgMl