Electronic Engineering Fundamentals

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Who am I?

My name is **Jinling Yu (俞金玲)**.
I am a professor at School of Physics and Information Engineering at Fuzhou University.

The website of me:物理与信息工程学院 (fzu.edu.cn)

Course Arrangement and Outline

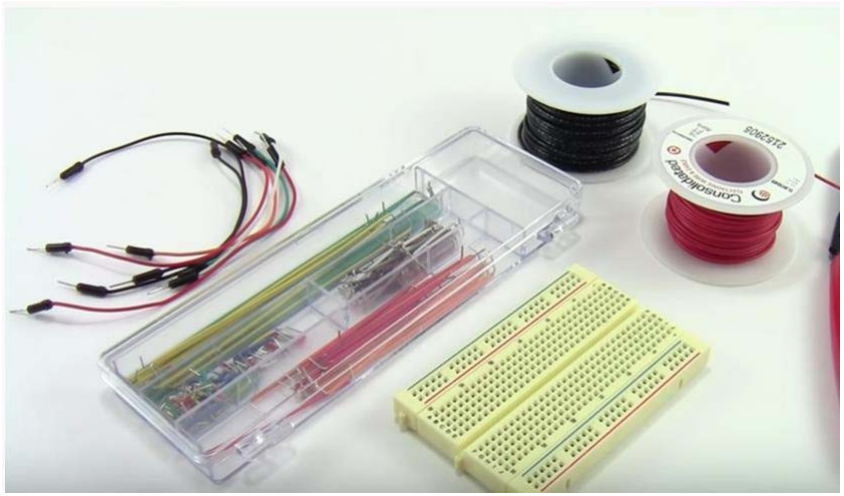
This course will be teached by me and Mr. Diao.
He is a Lecturer at Maynooth University.

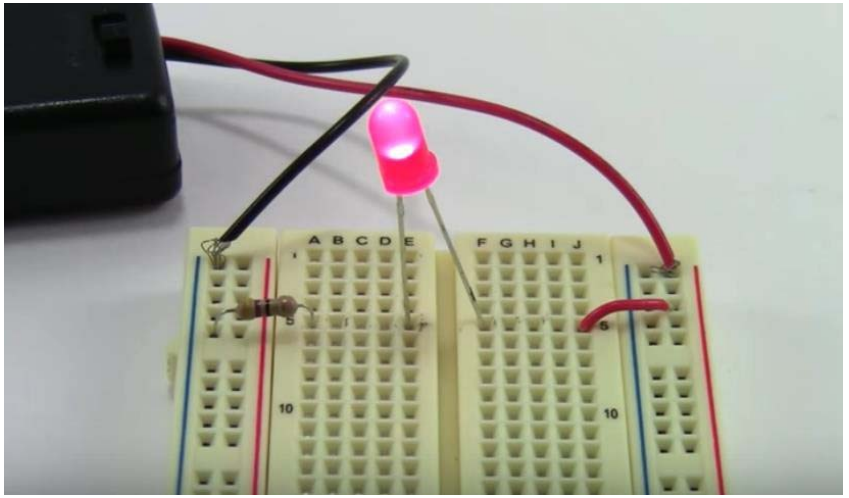
The first half of the course will be teached by me, and the another half of the course will be teached by Mr. Diao.

This module consists of

- Lectures (34 credit hour)
- Lab sessions (24 credit hour)
- Tutorials (14 credit hour)

Laboratories





Missed labs cannot be repeated, in general.

Lab Arrangement

Week	Time	Content	Credit hour	Students
The first experiment （Week 10） Tuesday	2021/11/2 18:30-21:30	Lab: Resistance, Current and Voltage	4	Electronic Information and Software Engineering
The second experiment （Week 11） Tuesday	2021/11/9 18:30-21:30	Lab: Kirchhoff's Current and Voltage Laws	4	Electronic Information and Software Engineering
The third experiment （Week 12） Tuesday	2021/11/16 18:30-21:30	Lab: Source and Thevenin's Theorem	4	Electronic Information and Software Engineering
The fourth experiment （Week 13） Tuesday	2021/11/23 18:30-21:30	Lab: Inductors, Capacitors and Oscilloscopes	4	Electronic Information and Software Engineering
The fifth experiment （Week 16） Tuesday	2021/12/14 18:30-21:30	Lab: Diodes and Rectification	4	Electronic Information and Software Engineering
The sixth experiment （Week 17） Tuesday	2021/12/21 18:30-21:30	Lab: Communications I and II	4	Electronic Information and Software Engineering

Tutorial Arrangement

课次 (Slot)	周数 (Week)	日期 (Date)	教 学 内 容 (Teaching Content)	教学形式 (Delivery Method)	计划课时数 (No. of Periods)
1	Week 5 Friday	2021-10-1	Tutorial: Electrostatics & Ohms Law	T	2
2	Week 9 Friday	2021-10-29	Tutorial: Circuit Analysis I	T	2
3	Week 11 Friday	2021-11-12	Tutorial: Circuit Analysis II	T	2
4	Week 15 Friday	2021-12-10	Tutorial: signal and Modulation	T	2
5	Week 18 Friday	2021-12-31	Tutorial: Telecommunications	T	2
6	Week 19 Friday	2022-1-7	Tutorial: Ethics and health	T	2
7	Week 20 Friday	2022-1-14	Tutorial: Electricity grid	T	2

Arrangement of tutors

Group number	students	Group leader	tutor
1	832101101-832101115	王文锐	Jinling Yu (俞金玲）
2	832101116-832101130	周文轩	张宗恒
3	832101201-832101215	王心怡	兰尔铭
4	832101216-832101230	陈冠廷	苏宸巧
5	832101301-832101315	王学彬	陶乐溪
6	832101316-832101330	陈璐歆	聂宇鑫

Lab Reports

Reports with **high similarity scores** will be heavily penalised (either you copied, or you were copied)

Moodle ***Turn-it-in*** will be used. ***Turn-it-in*** allows for checking submitted pieces of writing for potential instances of plagiarism, unclear referencing etc.

Turn-it-in will be used also for the assignments.

Course Outline

Assessment Structure

- Lectures
- Lab sessions (15%) – lab reports
- Assignments (10%)
- 2-hour end of year exam (75%)

Important!

Late submission of assignments and laboratory reports will be subject to a penalty of **10%** of the assessment grade **for each day** (or part thereof) overdue.

All assignments & lab reports will be submitted on Moodle.

Fundamentals of Electronic Engineering

Engineering is a way of thinking - a methodical approach to solving technical problems and creating new solutions.

The *laws of physics cannot lie*, engineers can only understand them and try to bend them to achieve a certain function.

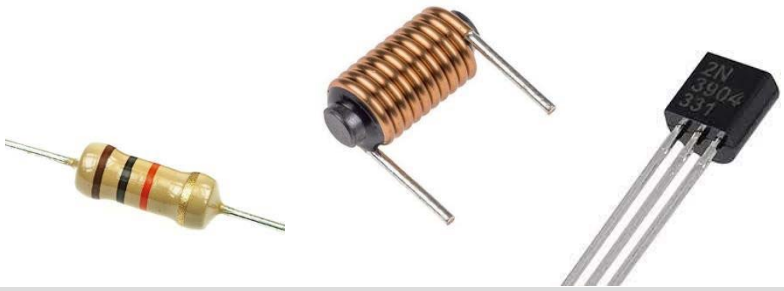
Understanding the *limitations of the technology*, and understanding the way the technology designers work, is essential if you wish to create new capabilities.

Fundamentals of Electronic Engineering

Electrical engineering tends to focus on *power generation and distribution*.

Electronic engineering focuses on applications, particularly in areas where we want to *control things, perform calculations, or cause an effect*.

Transistors, *resistors*, *capacitors*, *inductors*, *diodes* are the primary tools of an electronic engineer.



and so . . .

Successfully communicating to engineers or any techie requires:

Precision of language: a 2 cm long part is not the same as a 2.01 cm long part. All options must be defined.

Understanding of limitations: just because you want something to work in a certain way, doesn't mean it can or will.

Engineers deal with the art of the possible not the impossible.

and so . . .

The state of the art keeps changing.

What was impossible yesterday, might be possible tomorrow.

and so . . .

The state of the art keeps changing.

What was impossible yesterday, might be possible tomorrow.

1st Generation
(1G)

2nd Generation
(2G)

3rd Generation
(3G)

4th Generation
(4G)

So why do this module?

Why do this module?

Electronic Engineering & Robotics students

- The art of solving problems with Electricity and Electromagnetic Fields
- Learn how to analyse basic circuits

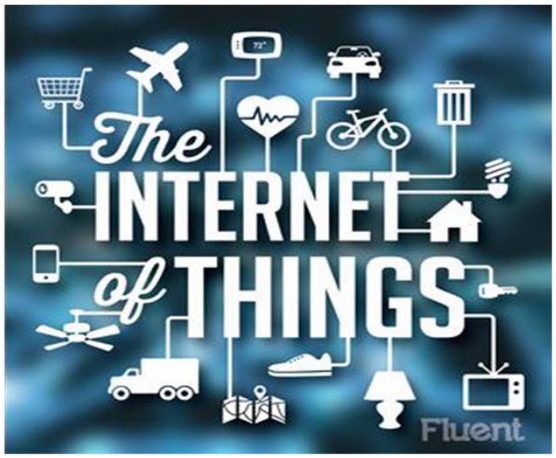
Why do this module?

Computer Science & Multimedia Mobile students

- Most computers need electricity
- Often you'll have to work with hardware
- Processors are just collections of transistors

Why do this module?

The future is “**smart**” with the **Internet of Things** (IoT)



What do we hope you will learn:

- An **understanding of electricity** and **how we build circuits**.
- How to make sure you get the most energy from a battery (**efficiency**).
- A bit **on radio waves**, and how we **communicate** across long distances.

- Cross some of the **linguistic/cultural boundaries** between techies and designers.

Course Outline

Introduction and Motivation: Electronics in Society, Scientific Notation and Exponents, Engineering Notation

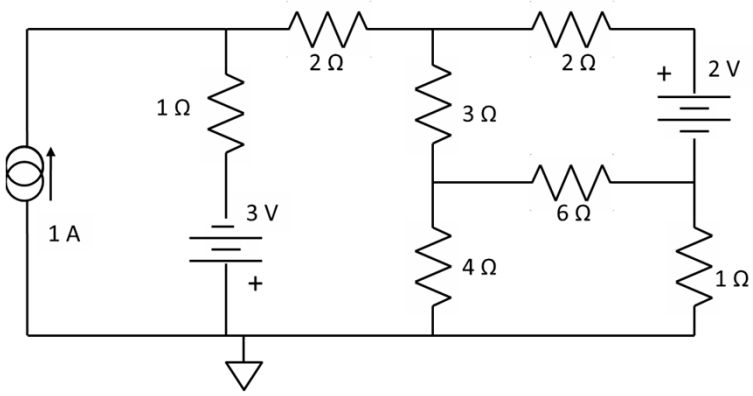
Basic Electromagnetics: Charge, Vectors and Coulombs Law and Applications

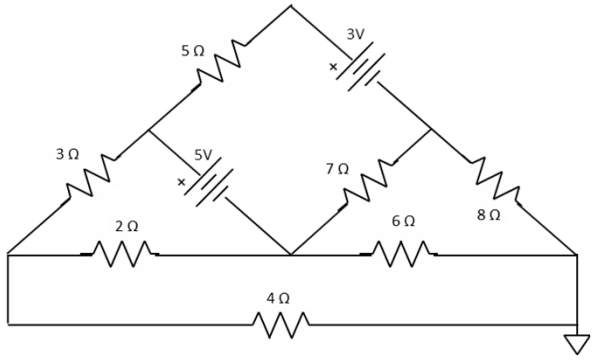
Electricity: Voltage and Current, Resistance and Conductance, Resistivity, Fundamental Relations: Ohm's Law, Energy, Power

Very Simple Circuit Analysis: Voltage Division, Current Division, Series and Parallel Circuits

More Circuit Analysis: Kirchhoff's Laws, Circuit Theorems, Source Transformations: Thevenin's Theorem & Norton's Theorem

Even more circuits analysis: Multiloop Circuits, Nodal Analysis, Mesh Analysis





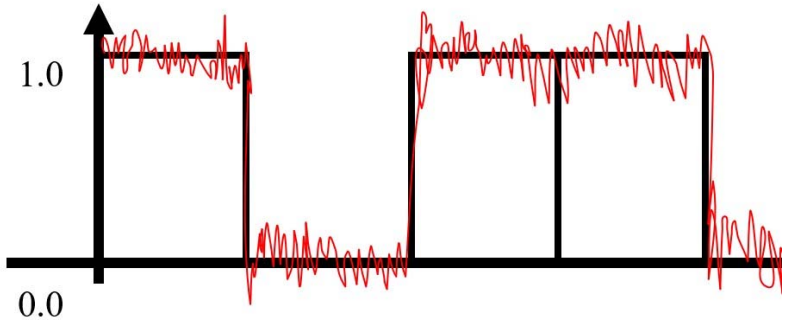
Course Outline

Basic Electronics: Ideal Diodes, Transistors, simple circuits

Electrical Safety: at home and at work

The Environment, Social Responsibility: the impact of our decisions on our peers and the environment

Communication: communication networks, principles of wireless communications, receivers and transmitter



Course Outline

What you need to succeed at this course:

- a little bit of maths (basic maths will be enough)
- a little bit of physics (not a lot)

- a lot of mental flexibility (many new concepts)
- an ability to ask questions (and listen to answers)

The rest we do from scratch.

How to Fail the Module?

- **Do not turn up for your labs** or don't do your assignments (instant loss of 25%)
- **Do not turn up for your lectures** … Moodle has the slides but I will provide the additional information you need..

  Take notes!!!
- **Do not ask questions** I am happy to answer any questions you have..

Engineering Notation

We need to speak a common language so as to understand the numbers we use in engineering. Without the right notation, it's meaningless.

- What's the temperature?
- The temperature outside is 16.

16 oranges? **We need units** so as everyone, from any discipline or any country will know exactly what we mean.

The temperature is also usually a 'normal' number.

However, through science, we often have to deal with very large and very small numbers.

Engineering Notation

Many quantities use very big or very small numbers so we need a convenient way to deal with this too.

Scaling units (down)

m	milli (10^{-3})
μ	micro (10^{-6})
n	nano (10^{-9})
p	pico (10^{-12})
f	femto (10^{-15})

Scaling units (up)

k	kilo (10^{+3})
M	mega (10^{+6})
G	giga (10^{+9})
T	terra (10^{+12})

Scaling down normally uses lower case, scaling up big case.

However in general be careful of mixing "m M" because they mean very different things…

Fundamental Units

1. Kilogram (kg): the unit of mass.
2. Ampere (A): the unit of current.
3. Metre (m): the unit of distance.
4. Second (s): the unit of time.
5. Kelvin (K): the unit of heat.
6. Mole (mol): the unit of amount of a substance.
7. Candela (cd): the unit of light.

Derived Engineering Units-Examples

Watt (W): the unit of power. $(m^2)(kg)(s^{-3})$

Newton (N): the unit of force. $(m)(kg)(s^{-2})$

Joule (J): the unit of energy, heat. $(m^2)(kg)(s^{-2})$

Hertz (Hz): the unit of frequency. (s^{-1})

Celsius (^oC): an unofficial unit of heat. (K-273.15)

Coulomb (C): the unit of electric charge. (s)(A)

Volt (V): the unit of voltage, potential difference. $(m^2)(kg)(s^{-3})(A^{-1})$

Ohm (Ω): the unit of electrical resistance. $(V)(A^{-1})$

Farad (F): the unit of electrical capacitance. $(C)(V^{-1})$

Siemens (S): the unit of electrical conductance. (Ω^{-1})

Henry (H): the unit of electrical inductance. $(V)(s)(A^{-1})$

Use of Engineering Units

- ***In every course, the incorrect use of units will result in lost marks!***

- This is due to the fact that I won't know whether your answer is right or wrong or out by a factor of 1000 or whether you knew what you were doing.

- Ways to go wrong:
  - Not using any units (most common)
  - Not using the right units (common)
  - Getting your scaling factors wrong (very common)

Communicating through Moodle

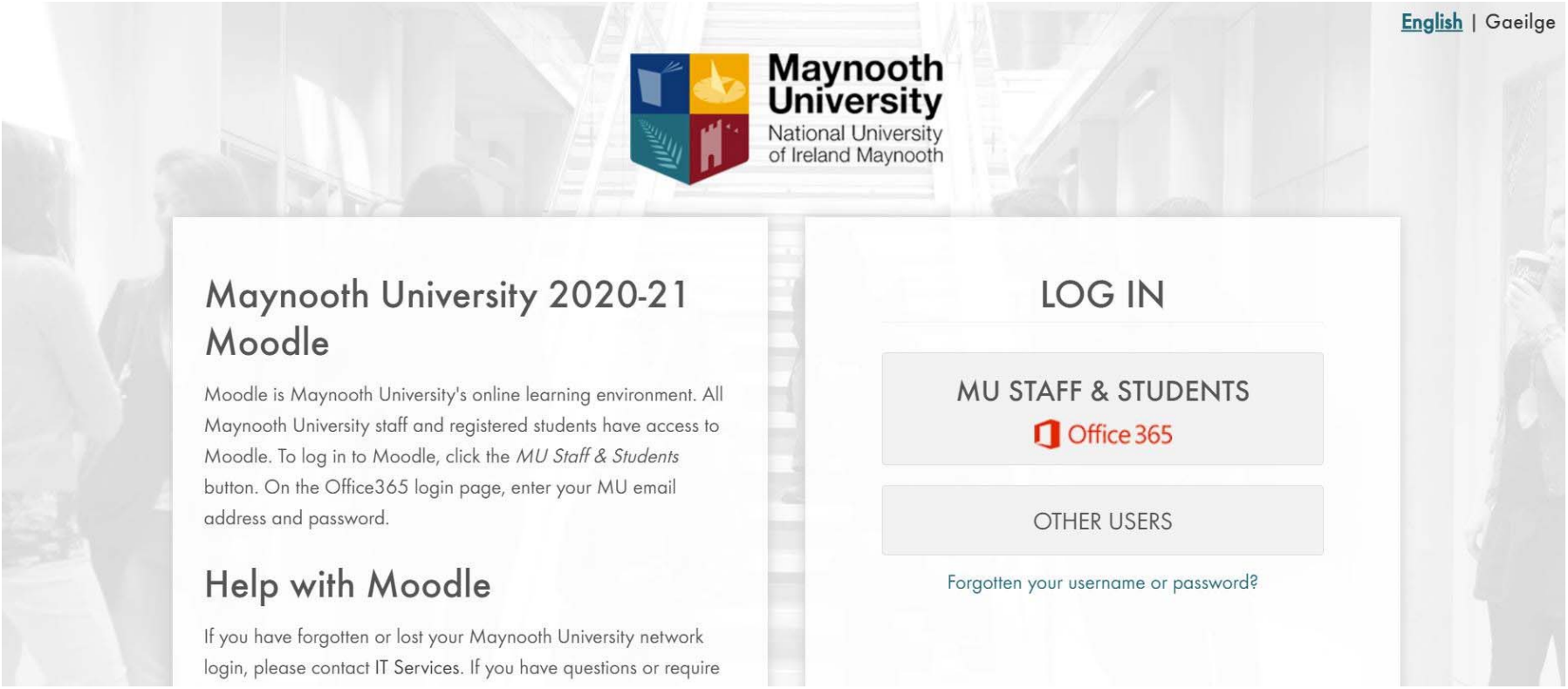
Moodle is the Virtual Learning Environment used at Maynooth International Engineering College (MIEC).

It is an online environment:

- with learning resources for the modules delivered
- where students and lecturers interact with each other

Communicating through Moodle

https://2021.moodle.maynoothuniversity.ie/login/index.php



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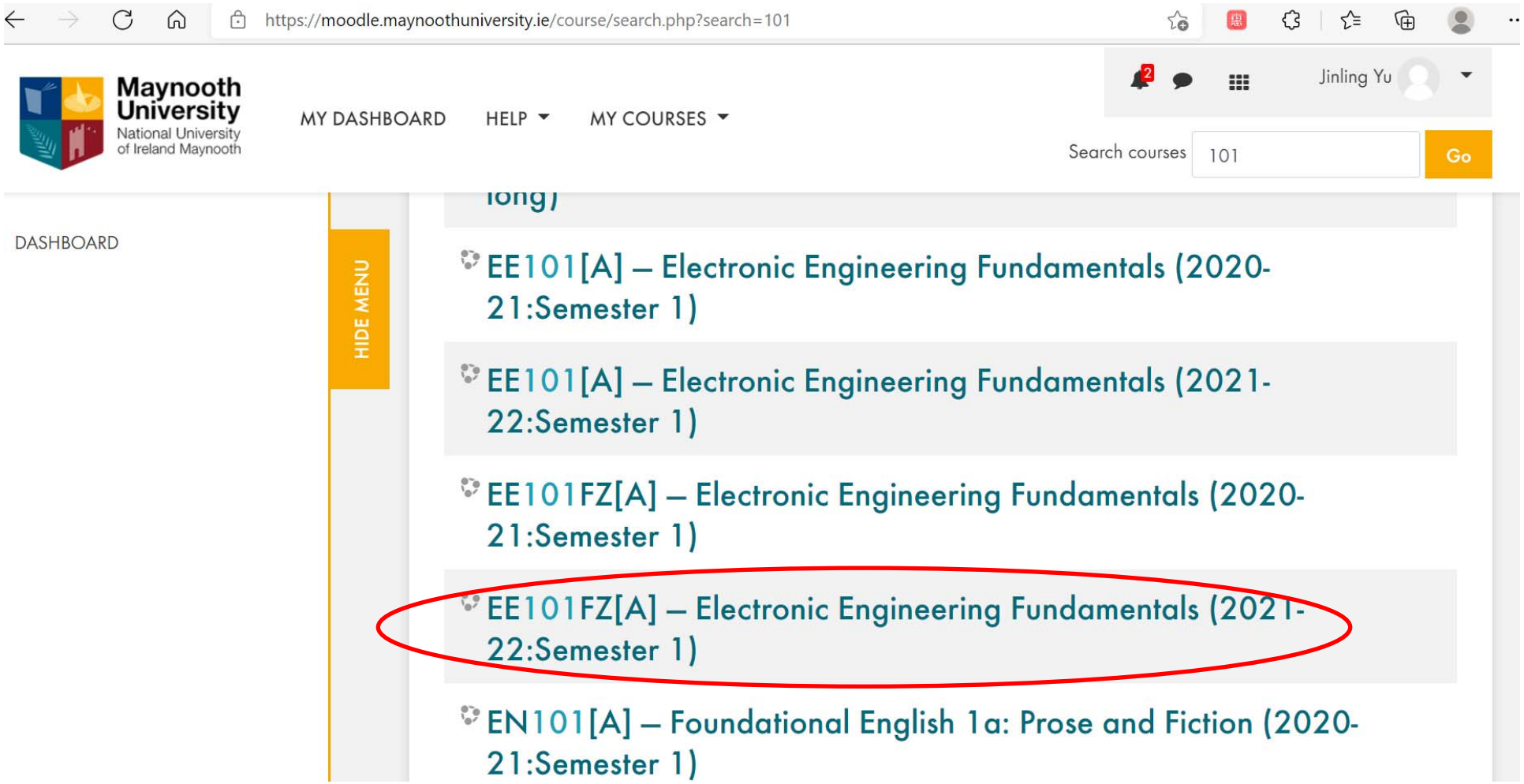

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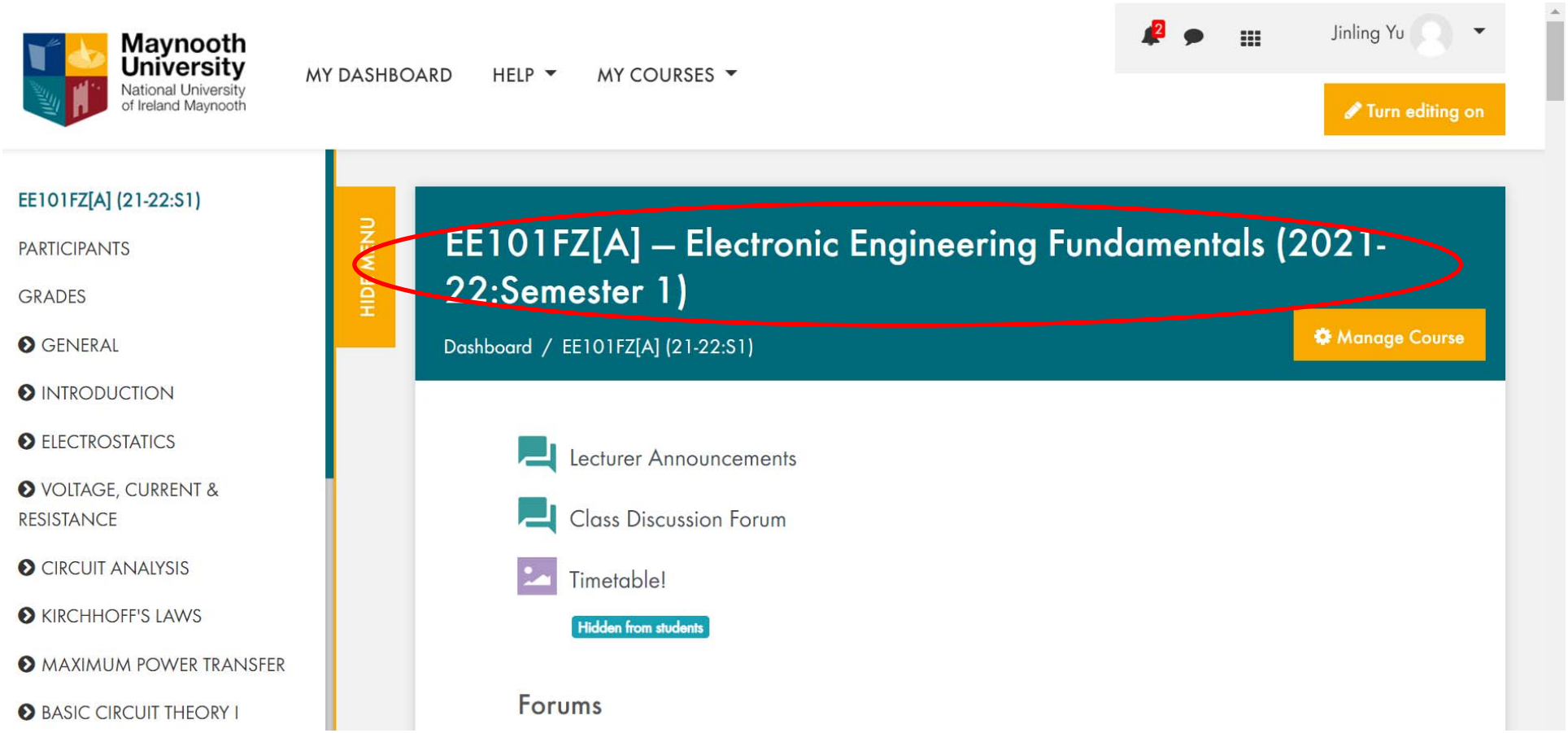

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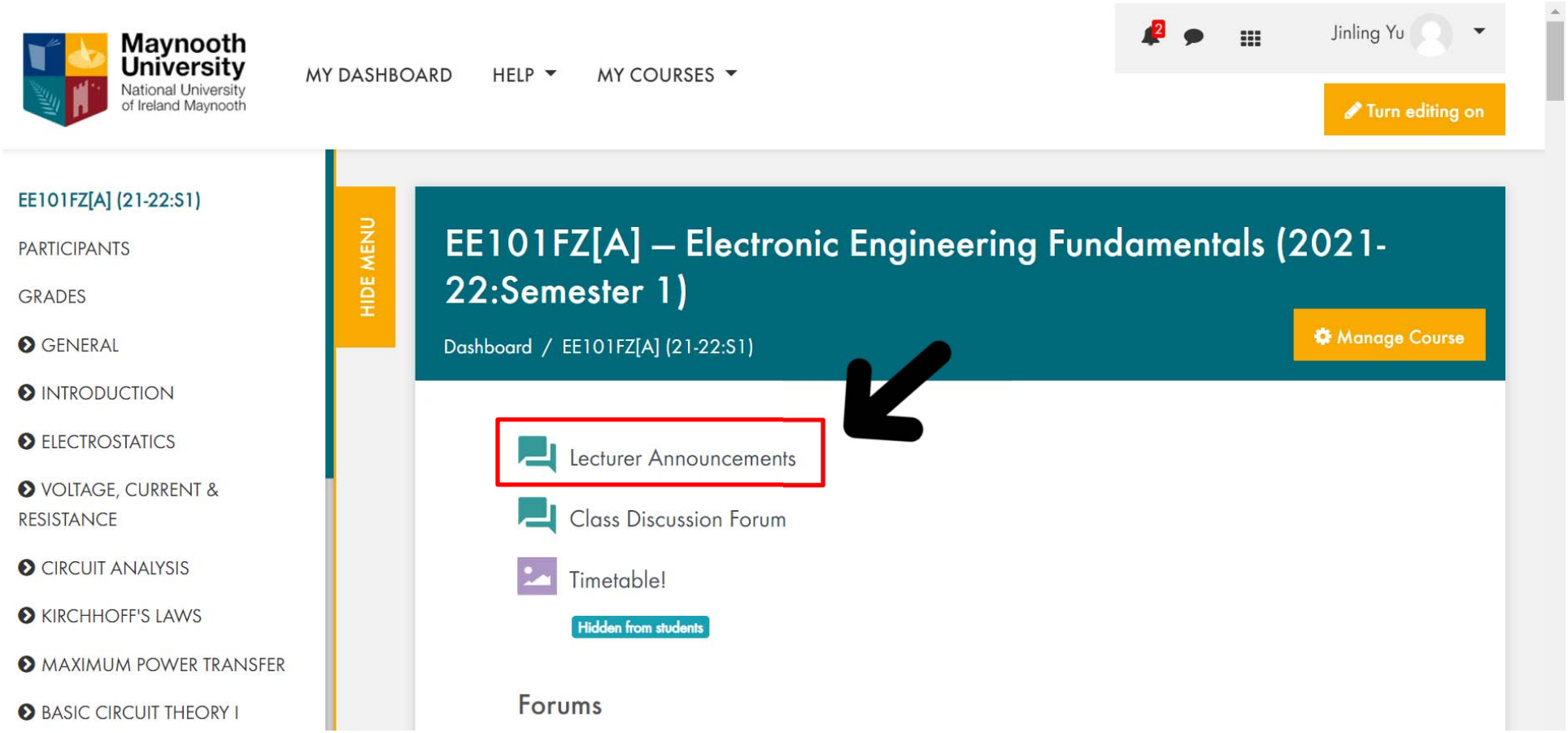

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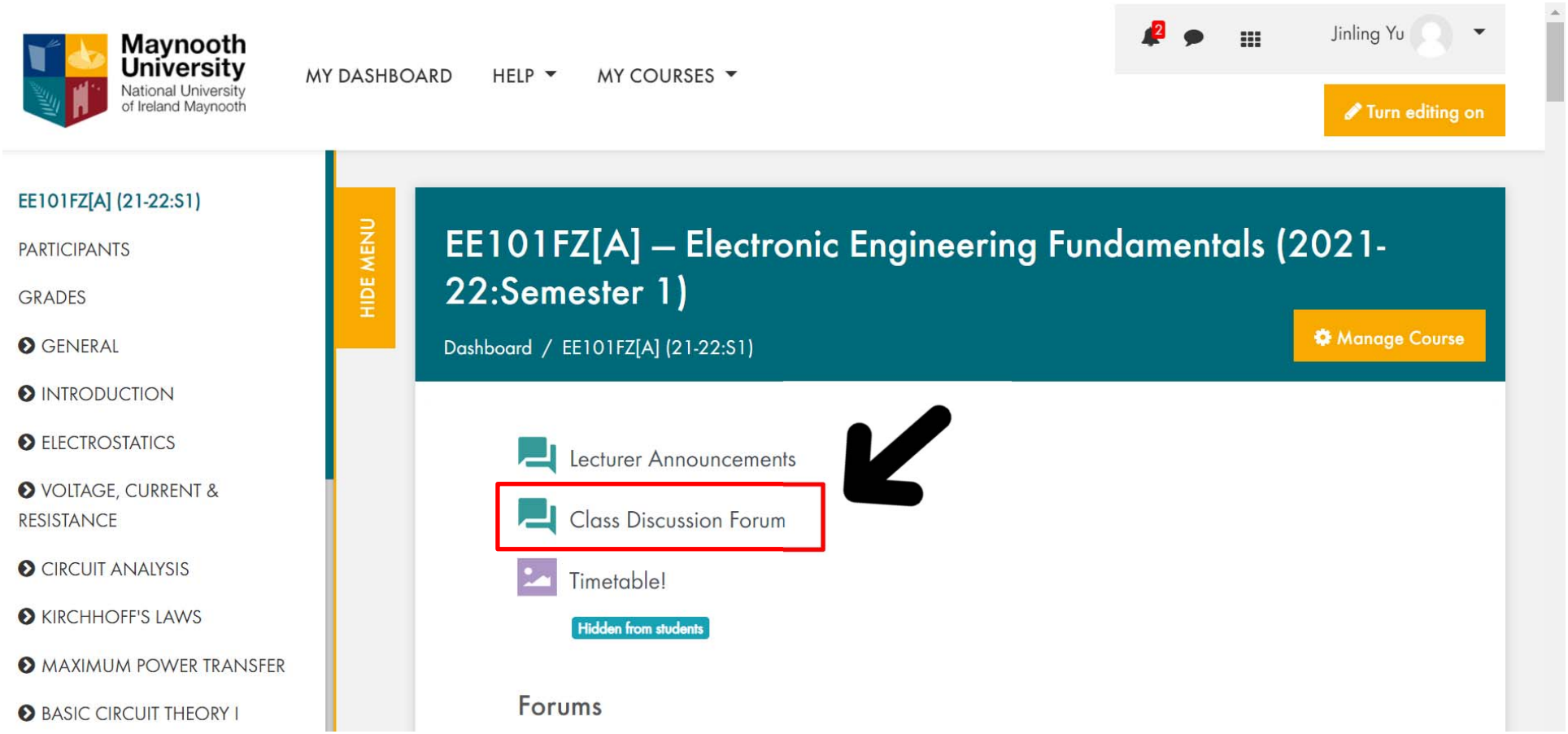

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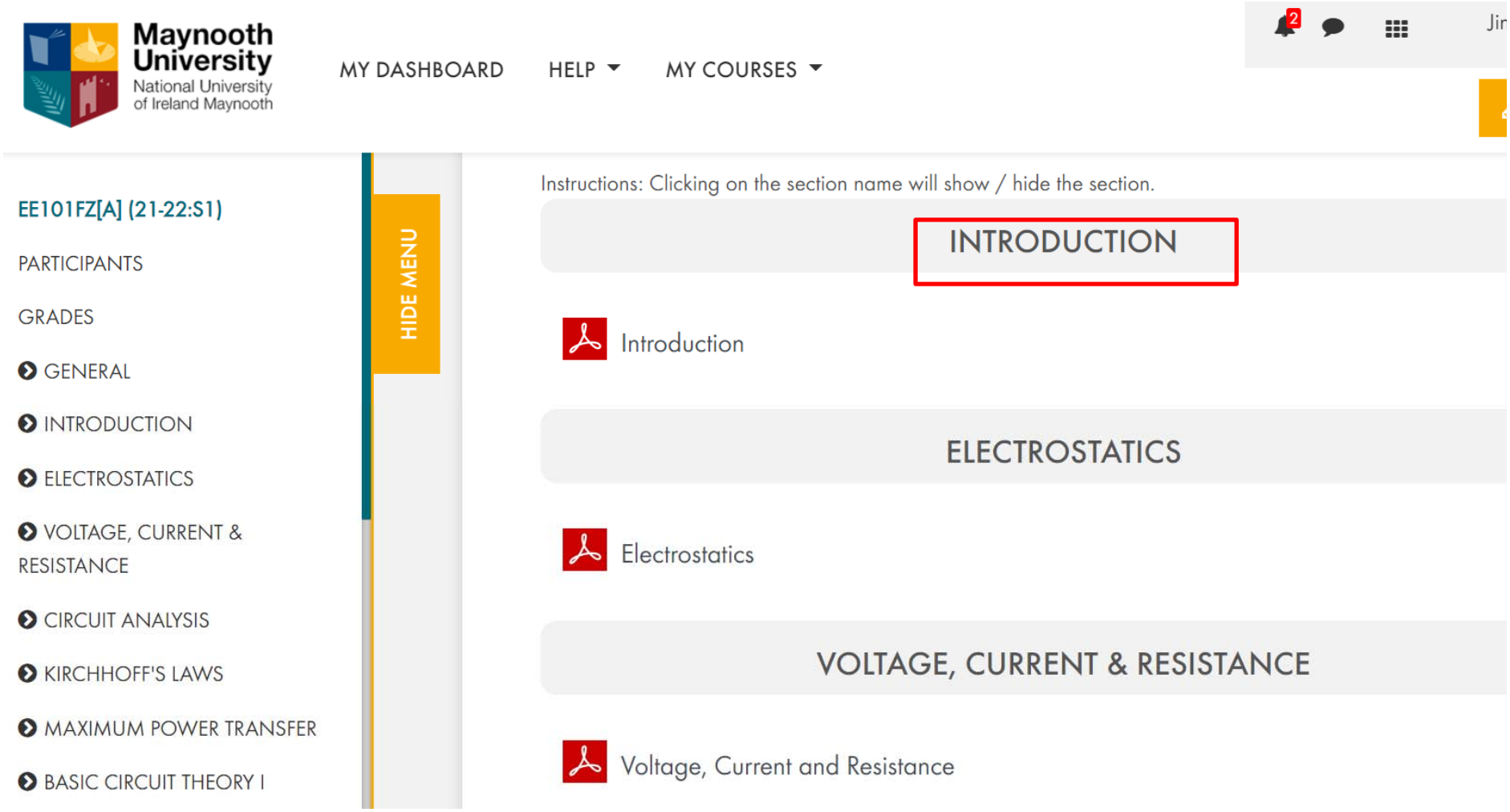

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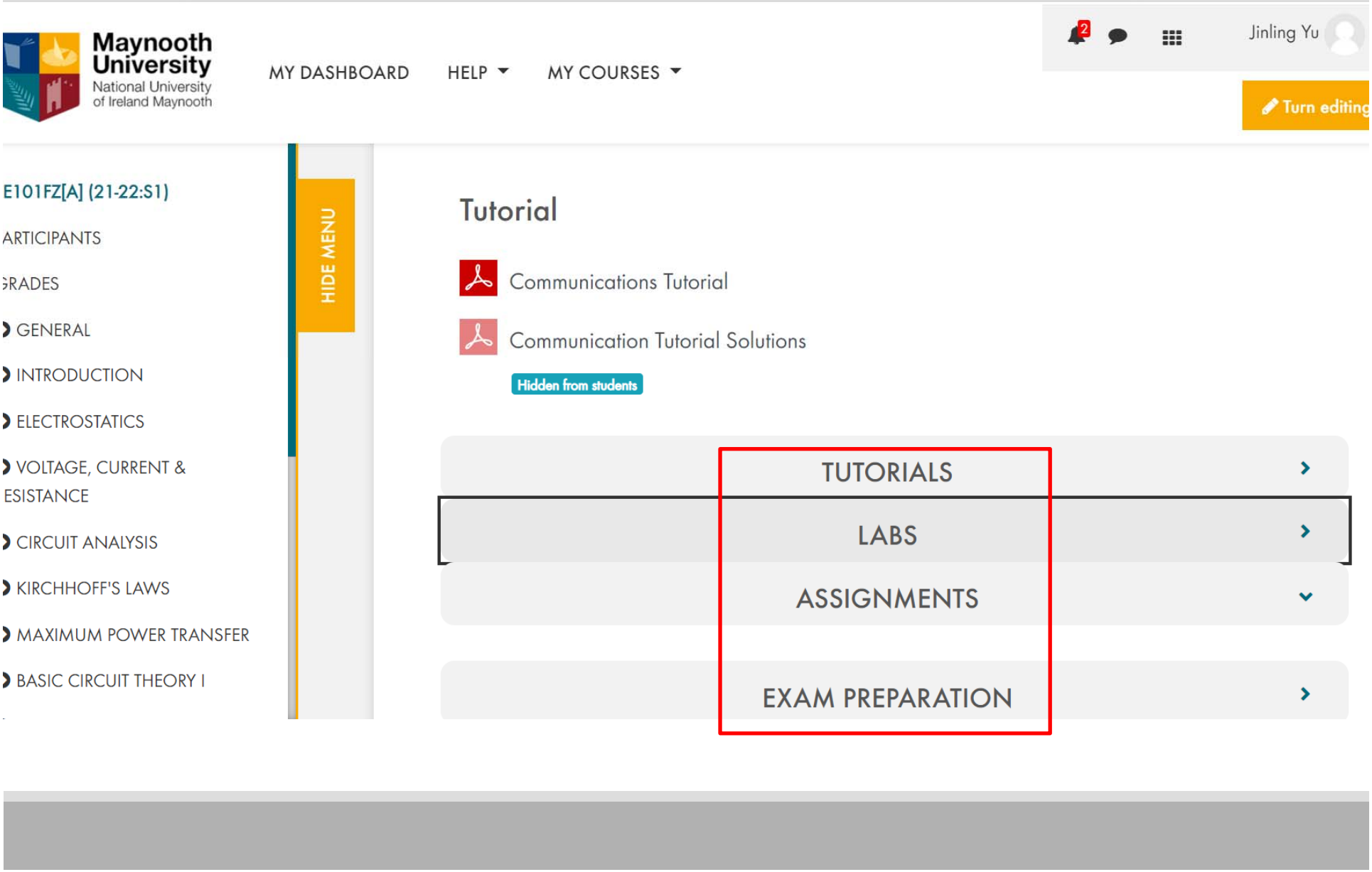

Summary

- Course Outline & Content
- Assessment Criteria
- The importance of this module
- Engineering Notation
- Communicating through Moodle