



University of
Nottingham

UK | CHINA | MALAYSIA

LECTURE 1A

Introduction

Electromechanical Devices

MMME2051

Module Convenor – Surojit Sen



- 2013 – BEng in **Instrumentation & Control** Engineering
- 2017 – MSc in **Automotive Engineering**
- 2022 – PhD in Hardware-in-the-Loop for **Electric Vehicle Motor Drives**
- Assistant Professor in **Electromechanical Engineering**

Research & Teaching Interests

- Automotive **Design & Motorsport**
- **Sustainable & Electrified** Powertrains (next-gen battery technologies, motor drives)
- **Formula Student & Solar Challenge**





- Module **overview** and **introduction**
- Overview of the **teaching calendar** and **content** over this semester
- What are the expectations from the **practical** and **assessment**



- *This module aims to explain how electricity and electronic principles can be used to achieve practical tasks in mechanical engineering, measure mechanical quantities and provide mechanical power.*
- *It also aims to give students an understanding of the importance of electrical and electronic subsystems in mechanical designs.*
- *A further aim is to prepare students for the use of electrical and electronic approaches within their individual and group project work.*

Learning Outcomes

Analyse simple **electrical** and **electronic circuits**

Describe and identify **electronic components**

Apply electrical and electronic principles to the **measurement** of a variety of **physical quantities**

Describe and analyse the operation of simple **electrical actuators** and **electrical machines**

The module is worth 10 credits (= 100 hours)

12x teaching weeks

- 2 hours lecture
- 1 hours seminar

36 hours

2x Labs

- Electronics
- Electrical

4 hours

4x Assessments

- 80% exam
- 8% Electronics Lab
- 8% Electrical Lab
- 4% ExamSys

5 hours

55

hours

self-study

≈

4.6

Hours/week



Lecture

- **Face-to-face**
- **Physics B1**
- **Thursdays 11am-1pm**

We will cover fresh lecture material for the week. Duration of lecture shall be broken into smaller 15-20 minute topics with breaks in between topics to ask questions.

Seminar

- **Face-to-face**
- **Physics B1**
- **Fridays 3pm-4pm**

Revise the lecture from the previous day and make an attempt at the exercise sheet of that week. Opportunity to clarify any conceptual doubts.

Labs

- **Face-to-face**
- **L2-110 & POPE-EEE**
- **Timetable!**

Students divided in groups – your timetable tells you when and where!

Module Timetable

w/c ↓	Week		Assessment	Deadline	Electromechanical Devices (MMME2051)			
	University	Teaching			Lecture	Seminar	Practical	
				Room →	Physics B1	Physics B1	L2-110 (Electronics Lab) & POPE-EEE (Electrical Lab)	
				Time →	Thu 11-13	Fri 15-16	Tue 9-11/11-13/14-16/16-18	
16-Jan	18							
23-Jan	19							
30-Jan	20	1			Electrical Engineering & Alternating Current	Revision		
06-Feb	21	2				Revision		
13-Feb	22	3				Revision		
20-Feb	23	4			Digital Electronics	Revision		
27-Feb	24	5				Revision		
06-Mar	25	6			Analog Electronics	Revision		
13-Mar	26	7	Lab Quiz (8%)	Friday 5PM		Revision	Electrical Lab (groups 1-4)	
20-Mar	27	8	Lab Quiz (8%)	Friday 5PM	Motor Control	Revision	Electrical (groups 5-8) & Electronics Lab (groups 1-2)	
27-Mar	28	9	Lab Quiz (8%)	Friday 5PM		Revision	Electronics Lab (groups 3-6)	
03-Apr	29	10			Easter Break			
10-Apr	30	11						
17-Apr	31	12						
24-Apr	32	13						
01-May	33	14			Boolean Algebra & Computers	Revision		
08-May	34	15	ExamSys (4%)		Past Exam Questions	Revision		
15-May	35	16				Revision		
22-May	36	17	Exam Period (single 2 hour exam 80% weightage)					
29-May	37	18						
05-Jun	38	19						



What is Electrical Engineering? Are all Electrical Circuits analog by nature?

What is DC? What is AC? What is 3-phase AC?

What are Kirchhoff's Current (KCL) and Voltage (KVL) Laws?

What is a Capacitor? What is an Inductor? What is Impedance?

How can we use Electricity to produce Mechanical motion?

What is an Induction Motor?



What is the difference between Electronics and Electrical Engineering?

What is the difference between Digital and Analog Electronics?

We know Computers talk in Binary, i.e., 0s and 1s. How do we get the computer to communicate large numbers?

How do we get computers to STORE data, in form of numbers?

What are logic gates, e.g., AND, OR, XOR?

How to convert between Digital and Analog values?



What is Analog Electronics?

How do we convert a physical signal, like weight, or force, into an electronic signal?

Why do we need to do the above?

What is an Operational Amplifier?



How do we control a motor?

What “things” of a motor can we really control? How fast does it go? How strongly does it go?

Do we only need Electrical Engineering to understand motors?

If not, what else do we need?



What is a computer?

What is an Integrated Circuit (IC), or “chip”?

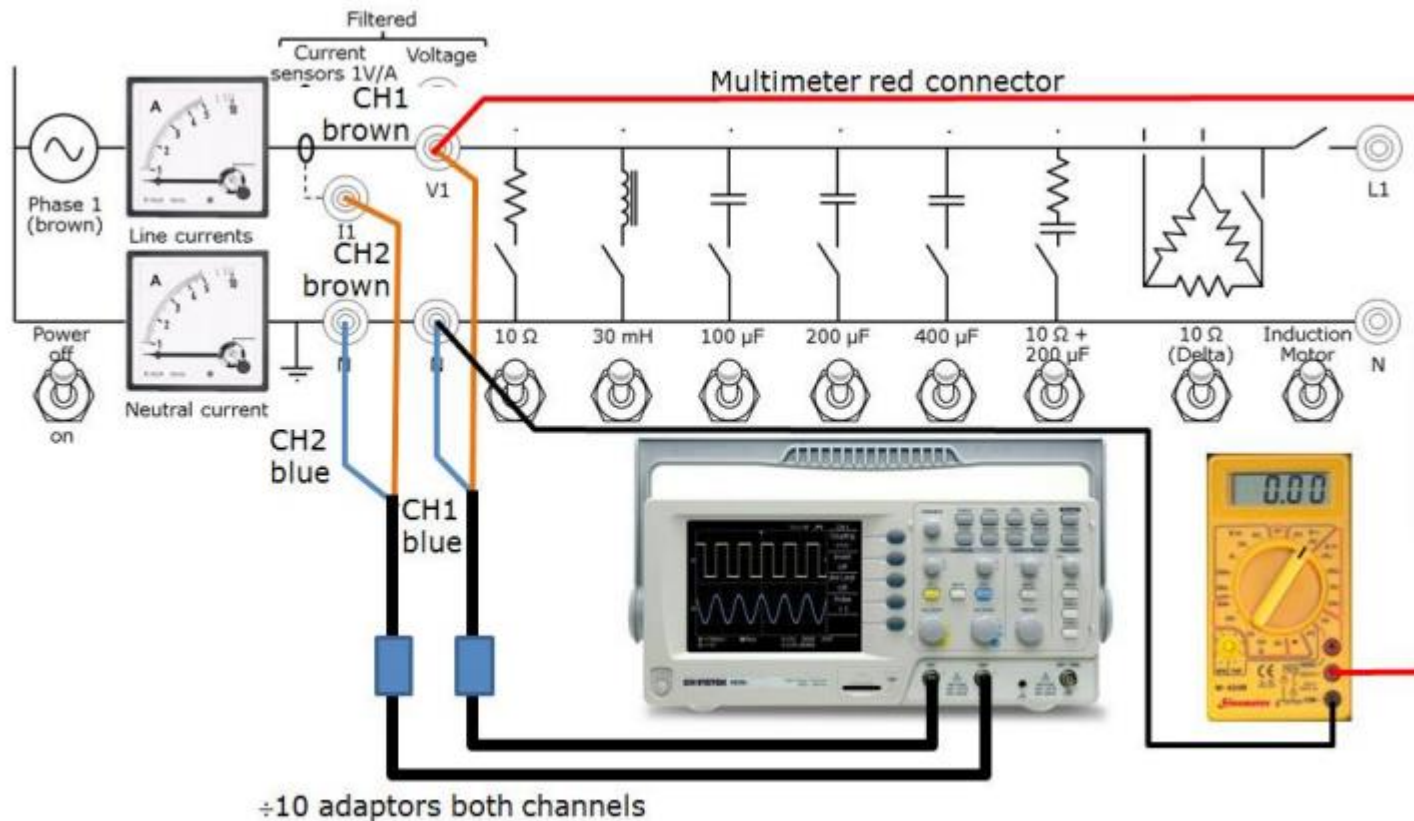
How have “chips” revolutionised the world?

How do computers do what they do (Binary Algebra)?

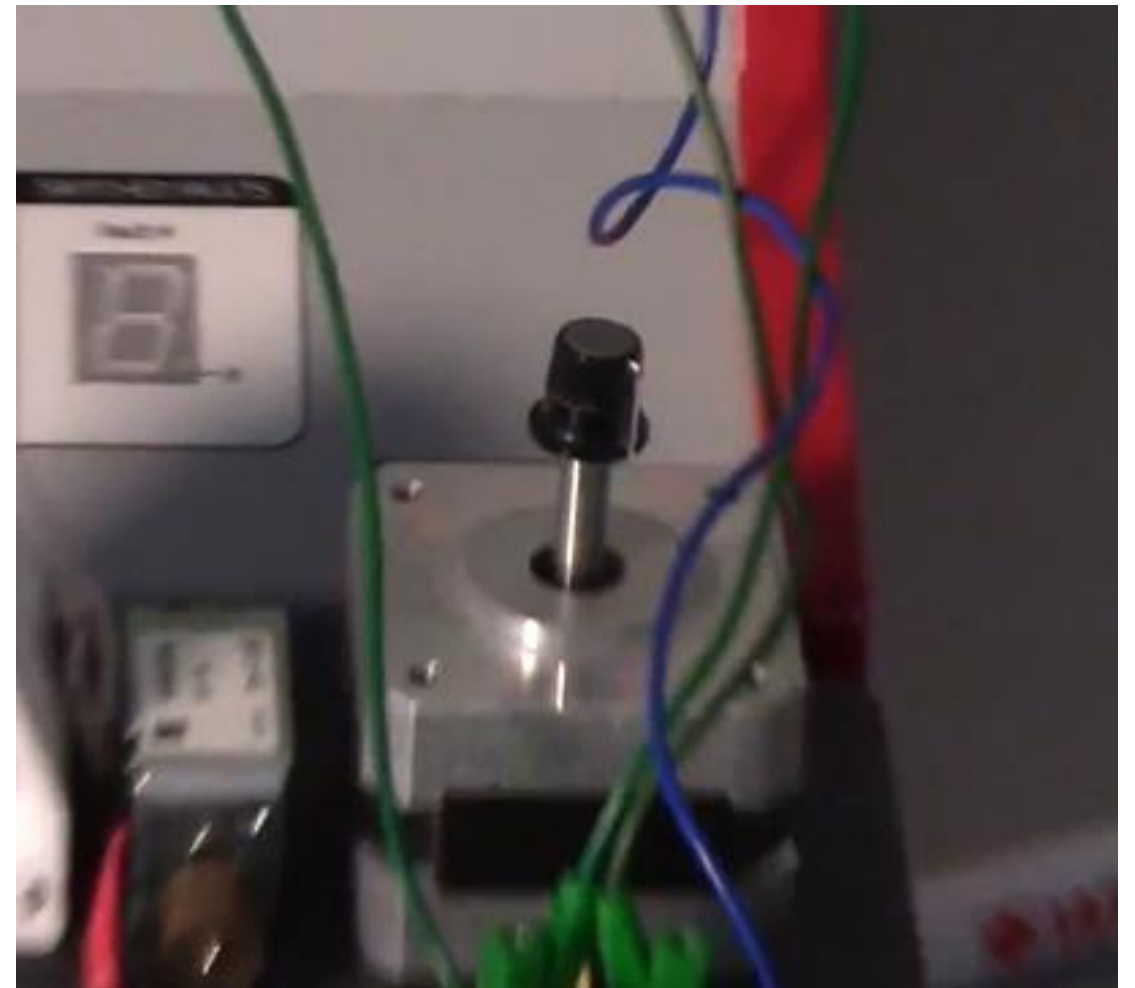
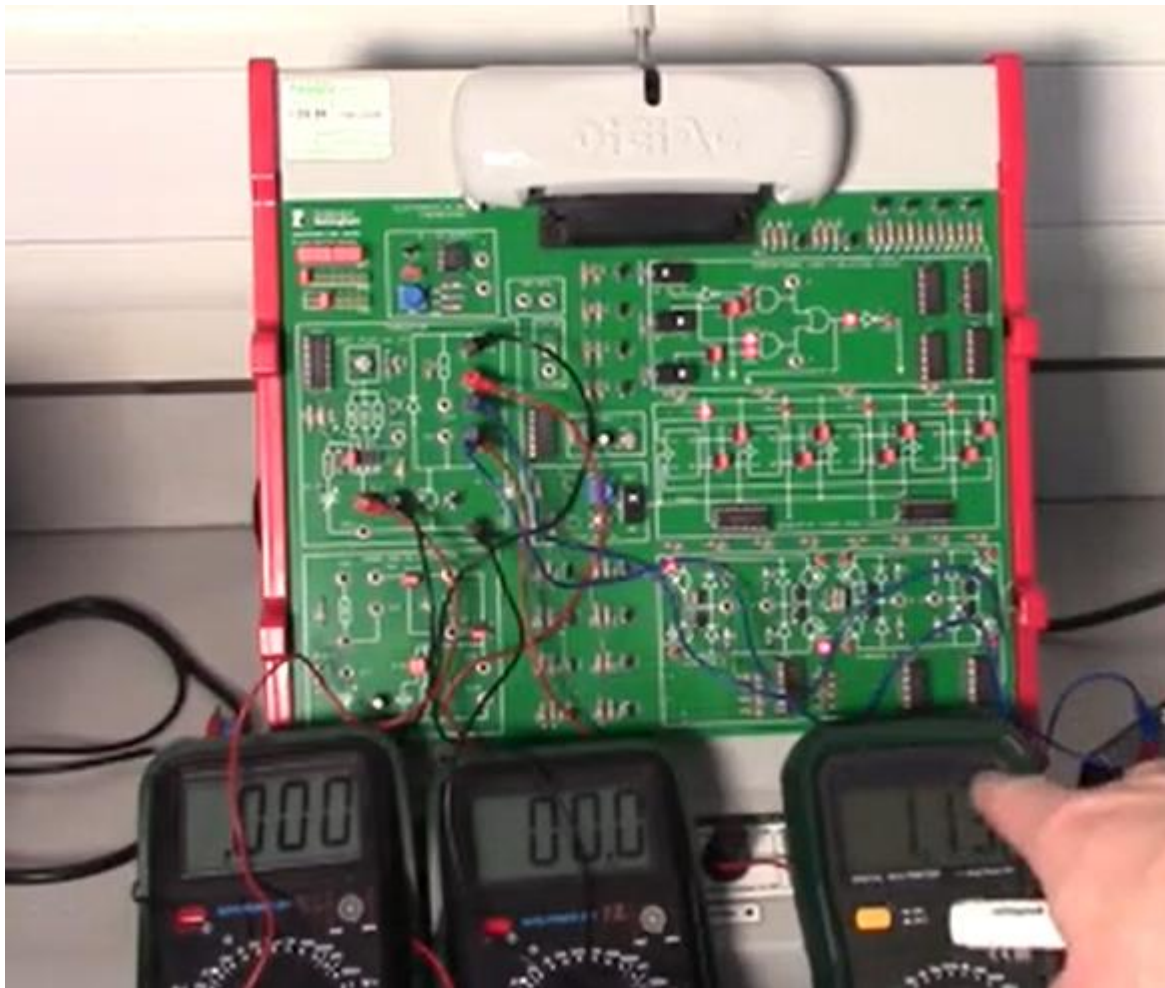
What is Binary Algebra?

Practical 1 (Electrical Engineering)

This will primarily focus on AC, 3-phase AC, and Induction Motors.



This will primarily focus on transistors, Op Amps, combinational & sequential logic.



MM2EMD formative exercise 2020 - do this before progress test



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You are on screen 10 of 20

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Q.3 (a) R-L network

10.



A 20 V, 60 Hz single-phase ac supply feeds a 25 Ω resistor and 80 mH inductor connected in series.

(a) Calculate the imaginary part of the complex impedance of the combined load (capacitor and resistor) in Ω .

Ω

(1 mark)



- Is this scary and overwhelming? Yes, and No!
- If you like EEE, awesome, you'll love this module!
- If you don't like EEE:
 - You can't get away without learning EEE in the modern world, unfortunately!
 - Good thing is, we will cover only the minimum!
- Please attend the lectures and seminars, and **ASK QUESTIONS!**
No question is a silly question, **NOT** asking is silly.