Electrotechnology
Automotive & Heavy Machinery
Aerospace
Marine
Metals
me program
THE LIVING TOOLBOX

Australian Government
Department of Defence
Defence Materiel Organisation

YEAR 7/8

MANDATORY TECHNOLOGY

SOFTWARE DESIGN CONTROL TECHNOLOGIES

MECHATRONICS

E-PORTFOLIO

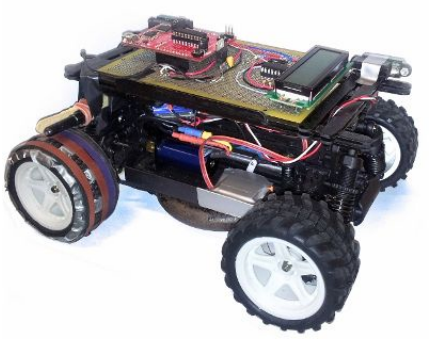
STUDENT NAME:

CLASS:

TEACHER:

Mechatronics

What is Mechatronics?



Mechatronics is a combination of precision engineering, electronic control and systems thinking in designing products and production processes. Mechatronics is the science exists at the interface between the other five disciplines:

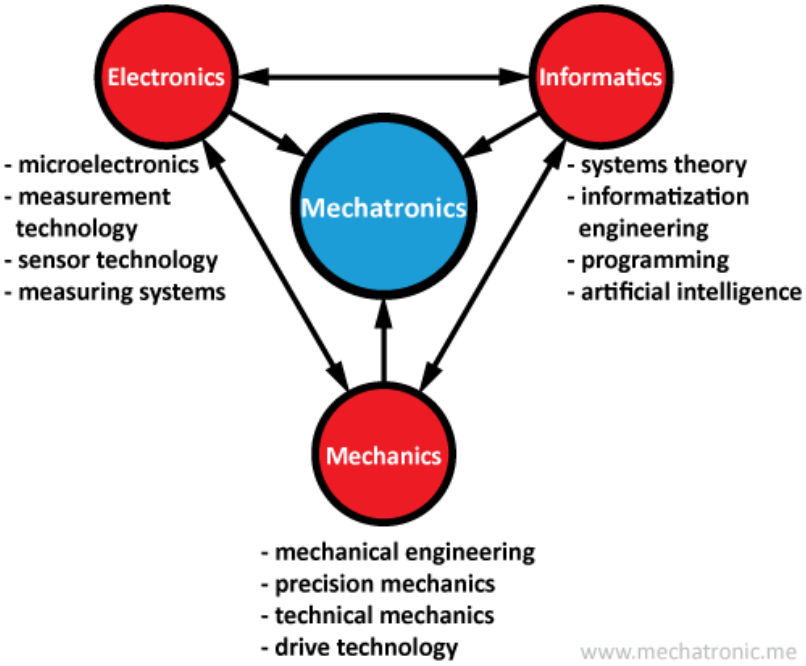
- mechanics
- electronics
- informatics
- automation
- robotics

It is one of the most dynamically developing fields of technology and science. The word "mechatronics" appeared for the first time in 1969 in Japan.

mechatronics = **mecha**nics + elec**tronics** + computing

Mechatronics is an interdisciplinary field, combining in a synergistic manner with the classical knowledge of mechanical engineering, hydraulics, pneumatics, electrical electronics, optics and computer science.

The aim of mechatronics is improving the functionality of technical systems and the creation of new concepts of machinery and equipment with built-in "**artificial intelligence**".



View YouTube Video Click here

In this unit of work students will learn about **electronic systems** constructing a continuity tester and will also learn about Mechatronics Technologies through the application of programming a robotic Guard Dog using Lego Mindstorm technology.

Design Process

A) Exploring & Defining the Task

Electronic Systems - Continuity Tester

What is a Continuity Test?
In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit will not work.

Devices that can be used to perform continuity tests include multimeters like the one to the right, which measure current and specialised continuity testers. In this unit each student will construct their very own continuity tester.

Design Situation: Students are required to problem solve an electrical fault where wires have been incorrectly connected. The production of a cheap alternative to a multimeter is required for Mechatonics students in order to fault find future electronics based projects.

Task 1:Design Brief:
Write your own design brief based on the design situation above in the space below:

Design Parameters:
Task 2: Materials/Components
Students will be provided with a Jiffy Box and all the components that are available in the electronics cupboard. View the circuit diagram provided by the teacher and indicate what other electrical components may be required. List all other materials which will be used in the construction of this project.

Task 3: Design Considerations:

Read the following list of design considerations carefully. Tick the box to identify the most important factors you will need to consider to ensure the success of your project. In the right hand column add comments about each of the important design considerations you identified.

Organisation

Questions to consider: What will I have to do to make this project successful?

☐ Time	e.g. finished by week 6	
☐ Budget	e.g. cannot exceed $...	
☐ Material available	e.g. timber, plastic	
☐ Equipment available	e.g. disc sander, drill	
☐ Technical skills	e.g. using a saw	

Function

Questions to Consider? What does the product have to be able to do to be successful?

☐ Size or shape	e.g. portable	
☐ Safety	e.g. no sharp edges	
☐ Comfort	e.g. lightweight	
☐ Strength & durability	e.g. withstand heavy use	
☐ Ease of use	e.g. practical	
☐ Ease of cleaning	e.g. access	
☐ Environmentally friendly	e.g. recycled materials	

Aesthetics

Questions to Consider? What qualities will you need to consider so that the user will appreciate the product?

☐ Sound	e.g. quiet, noisy	
☐ Smell	e.g. fragrant, smelly	
☐ Touch	e.g. smooth, silky	
☐ Sight	e.g. eye-catching	
☐ Taste	e.g. bitter, sweet, sour	
☐ Mood	e.g. dramatic, calm	
☐ Pattern	e.g. repeated, stripes	
☐ Texture	e.g. abrasive, spongy	
☐ Colour	e.g. contrasting, cool	
☐ Size	e.g. petite, large	
☐ Shape	e.g. moulded, flat	

Task 4: Establishing Criteria for Success:

As well as finishing on time and within budget the three most important design considerations for my project to be successful are:

i) _____

ii) _____

iii) _____

Task 5: Word Bank:

Criteria for Success (Time)	Criteria for Success (i)	Criteria for Success (ii)	Criteria for Success (iii)
Criteria for Success (Budget)			

Research – Continuity Tester

Task 6: Work Health and Safety - Electronics Safety Tutorial

Answer the following questions by referring to the safety instruction sheets in the reference workbook. You may use other sources of information where necessary.

1. Electronics activities primarily involve working with projects that use low voltage. List THREE (3) typical home or communication appliances using low voltage electronic components.

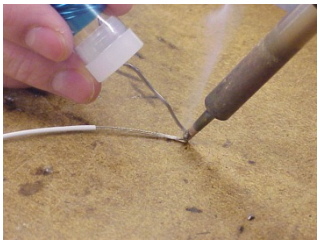
2. Describe FOUR (4) hazards that may be encountered in electronics activities.

3. Tools and materials should be stored appropriately to prevent personal injury. Describe possible injuries to yourself that can occur from incorrectly stored equipment in the electronics workroom.

4. When soldering the fumes given off may be harmful if inhaled in excessive amounts. What steps can be taken to minimise this happening?

5. The general use of electricity inherently includes hazards that require precautions to be implemented. Describe FOUR (4) aspects of electrical safety that must be observed at all times.

Task 7: Soldering Techniques



Answer the following questions by referring to the Soldering Tips and Techniques section from the reference workbook.

1. What are the four important requirements to ensure a good solder?

2. When a soldering iron has reached its correct operating temperature what should the operator do before using?

3. When soldering what should you do regularly to maintain good quality soldering?

4. They say that there are three rules to be observed when soldering?

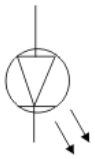
5. What is meant by the term Tinning?

6. How much solder should be added to the soldering joint?

View Basic Soldering Techniques video Click here

Task 8: Research of Components Continuity Tester

Fill in the vacant area on the grid with the correct response.

Component	Sketch	Symbol	Function
Battery			
Resistor			
Diode			A diode allows electricity to flow in one direction only and blocks the flow in the opposite direction.
L.E.D.			
Buzzer			

Task 9: Literacy/Research Task

Students are to research issues relating to sustainable energy consumption. They must then develop arguments to the proposal that; '***Mining and sustainable energy industries must work together to ensure our energy future'.*** Below is a template to assist you in setting out a research assignment using exposition text types. Use the template below to plan your exposition.

Word Bank:
Sustainable
Electricity
Fossil Fuels
Energy
Pollution

Pronouns
I, We, us

Modality
Should, must, may

Conjunctions
For example
These include
As shown by
For instance, such as
Moreover
Furthermore
Another reason
In addition
Consequently
Causes
Leads to
Brigs out
Results in
Otherwise
Since
If … then
Unless
On the other hand

Rhetorical questions?
e.g1 If all the fossil fuels were used up where would be source alternative sources of energy?
e.g.2 If we stopped mining where would the miners find work?

Statement/thesis:

Paragraph 1

Paragraph 2

Paragraph 3

Conclusion

Hints:
The introductory paragraph (statement/thesis) clearly states the topic/issue and the main points of the argument.

Each paragraph deals with one key point/reason that is introduced in the topic sentence.

Verbs are used when expressing opinions, eg1. I think ___ we should stop all mining!

We believe that mining and alterative energy industry need to work together.

Each topic sentence is supported by evidence and examples.

The points and reasons are organised in a logical order, beginning with the most important.

Use correct terminology (jargon)

Keep the exposition in the present tense

Task 10: Literacy/Research Task

Using your plan complete your final research assignment using the exposition text type.

Task 11: Steps in Production

In the table below record what you managed to achieve during the week.

STEPS	DATE COMPLETED	RECORD OF PRODUCTION
1		
2		
3		
4		
5		
6		
7		
8		
9		

Task 12: Automation

Answer the following questions by referring to Automation section from the reference workbook.

1. What is the purpose of Automation?

2. How has Automation changed the nature of work?

3. What are some of the impacts of Automation on society?

4. List three advantages of Automation.

5. List three disadvantages of Automation.

Mechatonics – Guard Dog Robot
A) Exploring & Defining the Task

Cyberguard

Cyberguard can automatically patrol up to 126 hours per week. Cyberguard detects and reports suspect conditions to a central console along with real-time video.

During its tour, it sniffs the air for traces of smoke or toxic gas, monitors temperature and humidity levels, scans for intruders, tracts valuable assets and inspects 'virtual seals' for barrier integrity.

A sophisticated on board computer collects and analyses data allowing increased sensitivity while minimising false alarms.

Watch Cyberguard Video

Design Situation:

You have been asked to develop a robotic Guard Dog system for an office complex which will check and see if doors have been left open without authorisation. The robotic Guard Dog must repeatedly check two doors and set off an alarm if they have been left open. The Robotic Guard Dog prototype has been produced using Lego Mindstorm materials, it is now your job to program the robot to do its task.

Task 13:Design Brief:

Write your design brief in the space below:

_____

_____

_____

Task 14: Establishing Criteria for Success:

Indicate the three most important criteria for the success of this project:

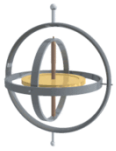
i) _____

ii) _____

iii) _____

Task 15: The Technologies of AR. Drone Quadcopter

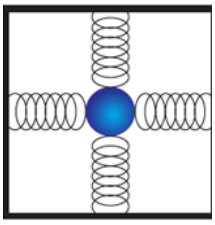
Answer the following questions by referring to the Technologies of AR. Drone Quadcopter section from the reference workbook.



Gyroscopes

1. What do gyroscopes measure?

2. The gravity defying part of a gyroscope is in relation to the effects of precession. Explain the effect of precession.

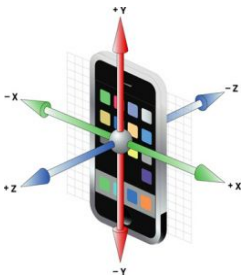


Accelerometers

3. What is 1 g a measurement of in an accelerometer?

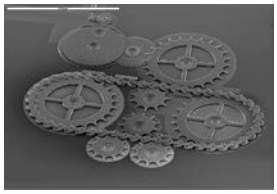
4. What is acceleration?

5. What do accelerometers measure?



6. When you move an iPad or iPhone what will the accelerometer measure?

The Technologies of AR. Drone Quadcopter Cont...

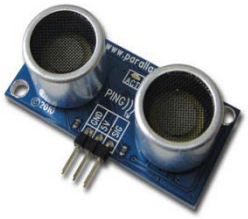


MEMS

6. What are MEMS?

7. What are MEMS used for?

8. How is a MEMS accelerometer different to a mechanical spring based accelerometer?



Ultrasonic Sensors

9. What is the theory of ultrasonic sensors based upon?

10. Explain how do Ultrasonic sensors work?

11. What are Ultrasonic Sensors used for in the AR. Drone Quadcoptor?

B. Generating & Developing Ideas

Task 16: Planning

Using the spaces below design the program to make the Guard Dog robot meet the design brief, by drawing the logo controls as in the sample shown below.

Design 1

Design 2

Aboriginal Perspective

Task 17: Communicating Ideas - Graphics

In the space below sketch four (4) different contemporary Aboriginal graphical art designs which depict modern robotics with traditional Aboriginal art. Use the Aboriginal perspective section in the reference workbook as a guide.

Idea No 1 Good points ❑ ❑	**Idea No 2** Good points ❑ ❑
Idea No 3 Good points ❑ ❑	**Idea No 4** Good points ❑ ❑

Task 18: Selection

I have chosen Idea No. _____ to develop because _____

Task 20: Steps in Construction

Text Type: Procedural

In the table below record the main steps required to complete each stage of programming your robot. Layout your responses using a procedural text type. If you do not remember how to write a procedural text refer to the reference workbook.

Stage	Procedure
1	• Learn how to use the lego Mindstorm software.
2	
3	
4	
5	
6	

Task 21: Evaluation

To help you arrive at some conclusions about your work, carefully answer the following questions.

1. Did you do anything differently to your planned design?

_____

_____

2. What were the difficulties that you encountered whilst making your design?

_____

_____

_____

3. Complete the following table.

Good features of my program design	**Bad features of my program design**

4. Indicate on the line below, by draw a dot in the appropriate location, how successful you think you have been in achieving your goal as stated in the design brief?

Very successful **Not very successful**

5. What would you change about your design if you had to make it again?

_____

_____

6. How well did you do with the four criteria's for success that you set earlier?