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https://en.wikipedia.org/wiki/Group_(mathematics)
Introduction to Applied Mathematics

1. Title of Module: Introduction to Applied Mathematics

2. Overview:

The objective of this module is to introduce students to Applied Mathematics in a fun and exciting way. The module is intended to stimulate interest and understanding of Mathematics, Science, Technology and Information Technology and relate classroom content to real life situations. Student's problem solving skills acquired from Junior Cycle will be developed further as they evaluate information, analyse problems and determine a path leading to solutions. The module includes scope for project work where students will learn to communicate and work together and be given an opportunity to present work to their peers and teachers. The programme can be employed as a stand-alone Transition Year Module or used as an introduction to Leaving Certificate Applied Mathematics.

3. Aims

- To develop and promote students mathematical and numeracy skills.
- To develop and promote students problem solving and mechanical reasoning skills
- To develop students interpersonal skills through project coordination, teamwork and completion.

4. Learning Intentions:

- Knowledge

On completion of this module students should know:

i. how vectors, velocity time graphs, forces, pulleys and projectiles relate to everyday life
ii. how to form mathematical models from physical problems
iii. how to apply mathematical calculations
• **Skills**

On completion of this module students should be able to:

i. solve a problem using more than one strategy  
ii. develop high level solutions for a given design task  
iii. deliver a presentation to their classmates  
iv. give and receive constructive feedback on completed work  
v. demonstrate good teamwork skills

• **Understanding**

On completion of this module students should understand how to:

i. analyse and solve problems logically by breaking them down into constituent parts  
ii. conduct Internet research and evaluate Internet websites

5. **Areas of Study:**

Introduction to Mechanics by study of the following units:

• Vectors  
• Velocity/Time Graphs  
• Forces  
• Pulley  
• Projectiles

Simulations, Student Assignments, Group & Individual Presentations to be incorporated where appropriate.
6. **Time Allocation:** These times are guidelines only.

- **Option 1**
  i. 11 week programme (22 class periods, Approximately 14.5 Hours)

- **Option 2**
  i. 15 week programme (30 class periods, Approximately 20 Hours)

7. **Module Content:** Option 1 (11 Week Programme)

- Module Overview: lesson 1
- Introduction to Mechanics: lesson 2
- Vectors: lessons 3 - 5
- Velocity-Time Graphs: lessons 6 - 9
- Investigations: lesson 10
- Forces: lesson 11
- Friction: lessons 12 - 13
- Pulleys: lessons 14 - 16
- Investigation/Demonstration: lesson 17 - 18
- **Option 1 - Project:** lessons 19 - 22

Extra Material for **Option 2** (15-week course)

- Projectiles: lessons 19 - 24
- Investigation/Demonstration: lesson 25
- **Option 2 - Design Brief:** lessons 26 - 30

The content are guidelines only as the choice of topics and the order in which they are taught is at the teacher's discretion.

The depth of treatment will depend on the students. The standard of Ordinary Level Leaving Certificate exam questions might be a good guide.
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Content</th>
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</table>
| **1. Module Overview** | Introduction  
Outline of module  
Project Options |
| **2. Introduction to Mechanics** | Speed, Distance, Time  
Velocity, Displacement  
Acceleration  
*Note: This content will overlap with the Junior Science Curriculum.* |
| **3 - 5. Vectors** | Vector properties  
Addition of vectors  
Resolving vectors  
Practical application of vectors in real life  
*Note: Geogebra or similar simulation programs (e.g. Angry Birds) may be used to explain and reinforce content.* |
| **6 - 9. Velocity – Time Graphs** | Review prior knowledge; JC Maths (Trigonometry & Equations)  
Using & extracting information from velocity-time graphs  
Deriving equations of motion (UVAST)  
Completing Leaving Certificate Ordinary level questions from V-T graphs on data gathered and recorded |
| **10. Investigation/Demonstration** | Introduce freefall and reaction time  
Simple freefall & reaction time experiments e.g. dropping objects from 2 metres  
Measurement of time taken |
| **11. Forces** | Review prior knowledge; JC Science (Forces), JC Maths (Equations)  
Types of forces included: Friction, Reaction, Tension, Weight  
Newton’s laws of motion. Vector nature of $F=ma$  
*Note: Students need to be familiar with simultaneous equations* |
| **12. to 13. Friction** | Friction as experienced on a horizontal table  
Effect of different surfaces on friction  
Coefficient of friction |
### Introduction to Applied Mathematics

| 14 – 16. Pulleys | **Note:** Students predict “which would you expect to drop/rise.”
| **Determination of acceleration and tension** |
| 17 -18. Investigation/Demonstration | Demonstration of the effect of friction
| | Use pre-recorded videos to demonstrate effect of using a pulley |
| **Additional Material for Option 1 Module** |
| 19. to 22. Student Project | Assign teams for group work
| | Students may use online resources for research purposes
| | Students present completed project to their class group
| | Feedback on project provided by teacher and peers
| | *Sample projects:* PowerPoint/Prezi presentation, Video Clips, Interactive Poster/Portfolio, Podcast, Practical task (e.g. “Construct an apparatus to demonstrate the effects of friction between different surfaces”)* |
| **Additional Material for Option 2 Module** |
| 19. to 24. Projectiles | Review prior knowledge; resolving vectors and trigonometry
| | Terminology to include: angle of projection, maximum height, range, time of flight
| | Complete basic projectile problems |
| 25. Investigation/Demonstration | Using calculations and simulation programs such as Geogebra
| | Using Internet resources |
| 26. to 30. Design Brief | Assign teams for group work
| | Sample Briefs:
| | a. Design and build an apparatus that will project an object greater than 20 metres in length or 20 metres in height
| | b. Design an electronic target game with adjustable angle and initial velocity (Angry birds type design problem)
| | c. Design a game or educational program based on vectors
<p>| | d. Design and build an apparatus to demonstrate the effects of friction between different surfaces. |</p>
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|   | e. Produce a video or podcast representing or demonstrating an element of the module contents

*Students to present their completed design brief to their class group and expected feedback and evaluation of their presentation and brief to be provided*

*Note: Teachers are recommended to keep records, photos and videos of the student’s activities to be used as teaching and learning resources for future years.*

### 8. Development of Key Skills:

<table>
<thead>
<tr>
<th>Key Skill</th>
<th>How Evidenced</th>
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<tbody>
<tr>
<td>Information Processing</td>
<td>• Research&lt;br&gt;• Information analysis and Data Collating&lt;br&gt;• Computer Modelling</td>
</tr>
<tr>
<td>Critical and Creative</td>
<td>• Information analysis&lt;br&gt;• Imagination&lt;br&gt;• Original Design&lt;br&gt;• Computer Modelling</td>
</tr>
<tr>
<td>Thinking</td>
<td></td>
</tr>
<tr>
<td>Communicating</td>
<td>• Project coordination&lt;br&gt;• Working effectively as a member of a team&lt;br&gt;• Building confidence in decision making&lt;br&gt;• Presentation techniques</td>
</tr>
<tr>
<td>Working with Others</td>
<td>• Improved communication skills&lt;br&gt;• Working as a team member&lt;br&gt;• Assigning roles in group investigation&lt;br&gt;• Paying close attention to detail&lt;br&gt;• Following instructions precisely&lt;br&gt;• Confidence in decision making&lt;br&gt;• Time management</td>
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9. **Teaching & Learning Approaches:** A wide variety of methodologies should be used which may include cooperative learning, self-directed and independent learning, group work, pair work, discussion, debate, project work and research. Cross curricular linkage, application of skills and the use of ICT should be fostered.

10. **Assessment Approaches:**
    The module should be continually assessed over its duration. The following are some suggested approaches:
    - Peer to peer assessment
    - Oral Assessment
    - Project design and manufacture
    - Project demonstration / presentation
    - Project management
    - Time management
    - Homework & class exercises
    - Classroom based assessment

11. **Resources**
    - PDST resources for vectors, linear motion, forces and projectiles (including PowerPoint presentations, sample exercises, solution sheets, teacher notes etc.)
    - Digital projector & screen
    - Access to computers or laptops
    - Video & sound recording facilities
    - Digital time keeping device e.g. stopwatch
    - Geogebra or similar simulation programmes
    - YouTube links
    - Blocks, pulleys, sandpaper, trolleys, projectiles
12. **Related Learning:**

The module has strong cross curricular links to the following subjects:

a. Mathematics  
b. Physics  
c. Information Technology  
d. Engineering  
e. Technology

\[ x + 3y = 1 - 2z \]

https://en.wikipedia.org/wiki/Equation
The PDST is funded by the Teacher Education Section (TES) of the Department of Education and Skills (DES) and is managed by Dublin West Education Centre.

This resource is available to download from www.pdst.ie/publications