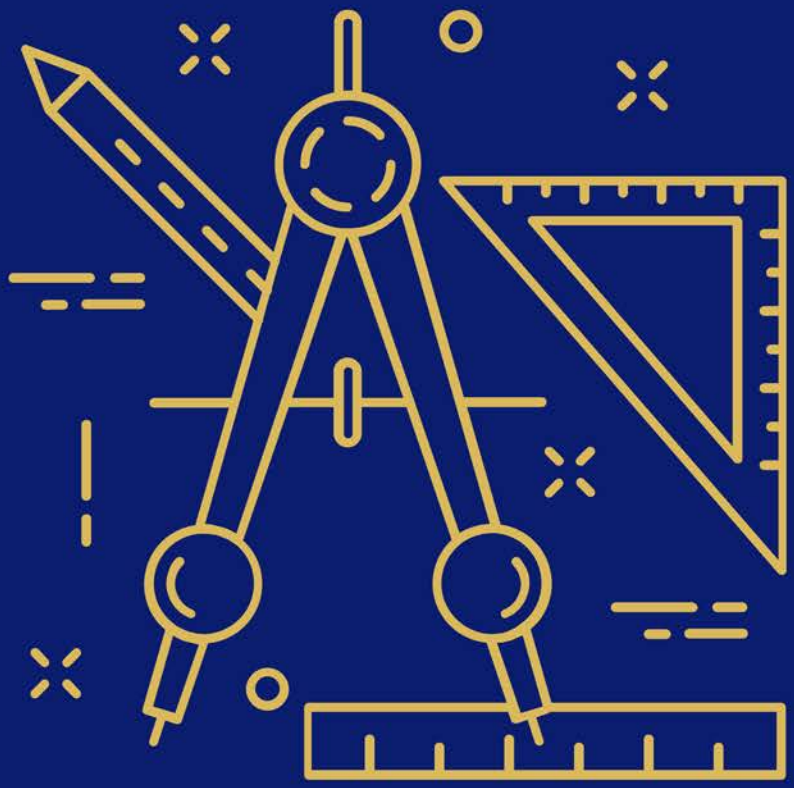
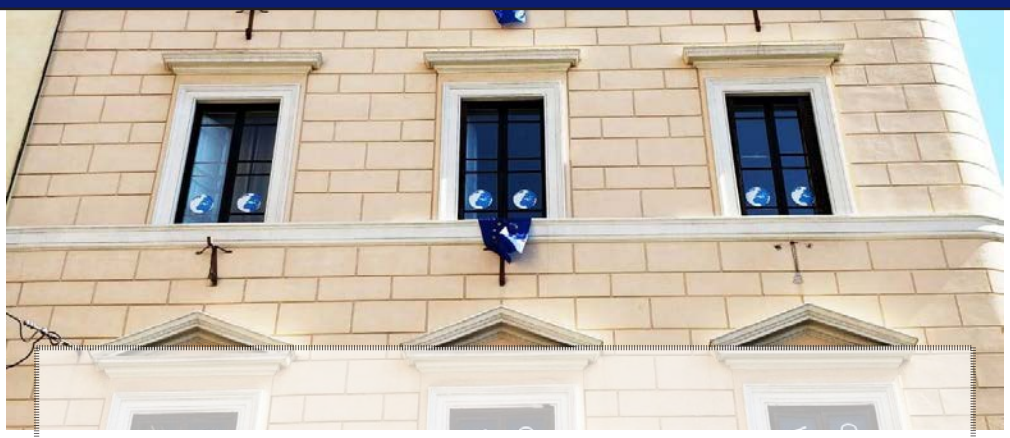
UNIVERSITÀ TELEMATICA
INTERNAZIONALE UNINETTUNO

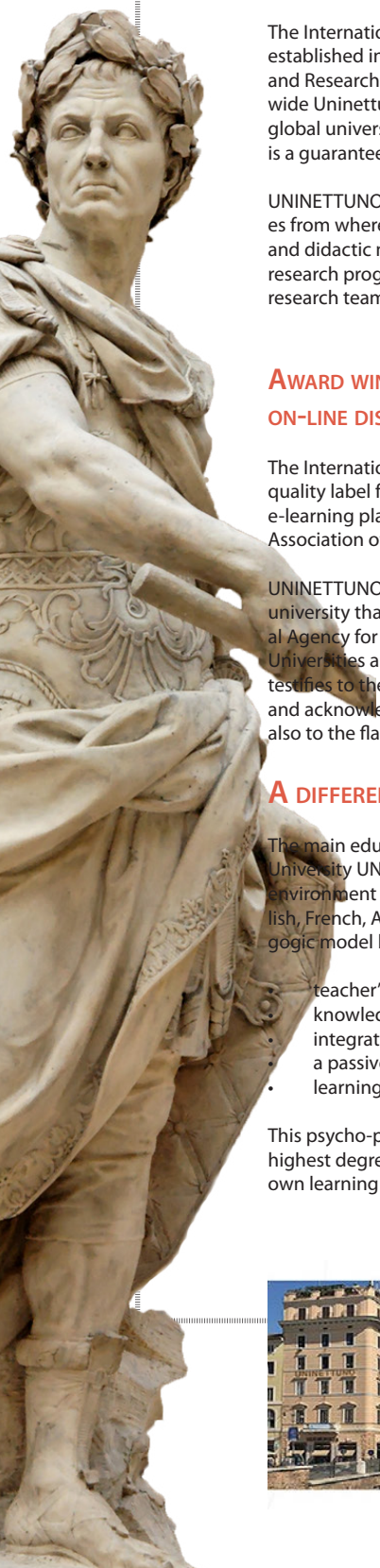


University Uninettuno

# MASTER OF STEM EDUCATION

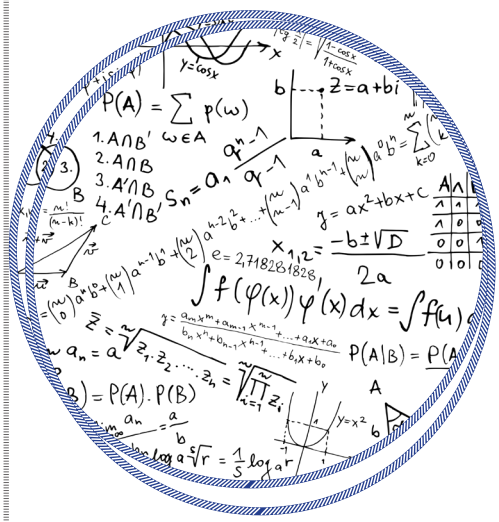
## MSc (STEM)





The International Telematic University **UNINETTUNO** is a distance teaching university established in 2005 and recognized by the Italian Ministry of Education, University and Research. It delivers academic titles having legal status in Italy, Europe and world-wide Uninettuno is a global online University with over 23,000 students. A leading global university in distance education, the online teaching proposed by Uninettuno is a guarantee of quality, professionalism and innovation.

UNINETTUNO students, coming from more than160 countries, can access their courses from wherever they are with no limits of space and time: the psycho-pedagogic and didactic model was born from the results achieved by 25 years of international research programs and was realized by the Rector Prof. Maria Amata Garito and by her research team.



## Award winning University for excellence in on-line distance learning

The International Telematic University UNINETTUNO is awarded the E-excellence quality label for the best didactic and psycho-pedagogical models adopted on its e-learning platform. The quality label is awarded to the UNINETTUNO by European Association of Distance Teaching Universities (EADTU).

UNINETTUNO is among the three best Universities, furthermore, the only distance university that got the grade "B – fully satisfactory" by the evaluation of Italian National Agency for the Evaluation of
Universities and Research Institutes (ANVUR). The outcome gained
testifies to the excellence of its teaching and organizational model, which is shared and acknowledged by both the International and the Italian scientific community, and also to the flaws of the other Italian distance institutions in terms of teaching quality.

## A different learning experience

The main educational tool of the International Telematic
University UNINETTUNO is the Internet-based learning
environment where teaching and learning are carried on in 6 languages—Italian, English, French, Arabic, Greek, Polish — and it allows implementing a new psycho-pedagogic model by Prof. Maria Amata Garito© that is characterized by the shift from:

- teacher's central role to the student's central role;
- knowledge transfer to knowledge creation;
- integration between practice and theory;
- a passive and competitive learning to active and collaborative learning.

This psycho-pedagogic model by Prof. Maria Amata Garito© is characterized by the highest degree of flexibility for the student. By this model, the student can build his own learning path in function of his educational needs and of his skill-level.

# UNIVERSITY UNINETTUNO ROMA

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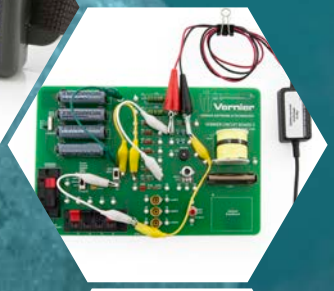
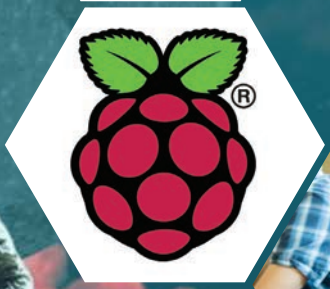
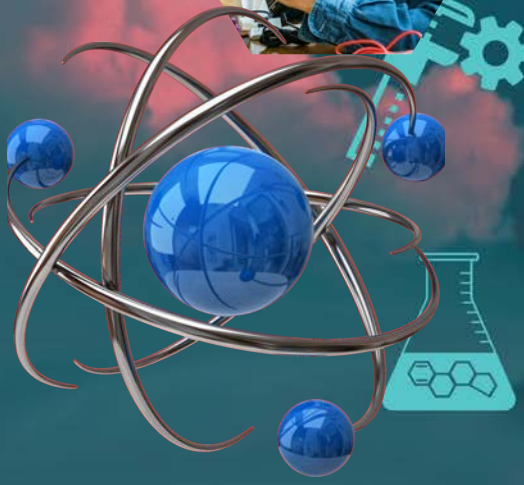
ONLINE LEARNING

# STEM WITH VERNIER



# STEM Integration
## to Support 21st Century Skills

Incorporating STEM in the 4 Cs

### 1 Critical Thinking
Present a science problem to your students, ask them to predict a change or outcome, and then explain why they made that prediction.

### 2 Creativity
Ask students to use prior knowledge to explain a science phenomenon. Have them test their ideas by collecting data and comparing results.

### 3 Collaboration
Foster a collaborative environment in your classroom and encourage students to learn skills from others to help them complete the task at hand from others..

### 4 Communication
Encourage students to clearly communicate their initial predictions, experimental design, and discoveries, along with data to back up their findings.

**The four Cs of 21st Century Skills are key pillars that students must know how to do to be successful in today's workforce.**

***Read the full blog post at vernier.com/stem-integration***

Vernier

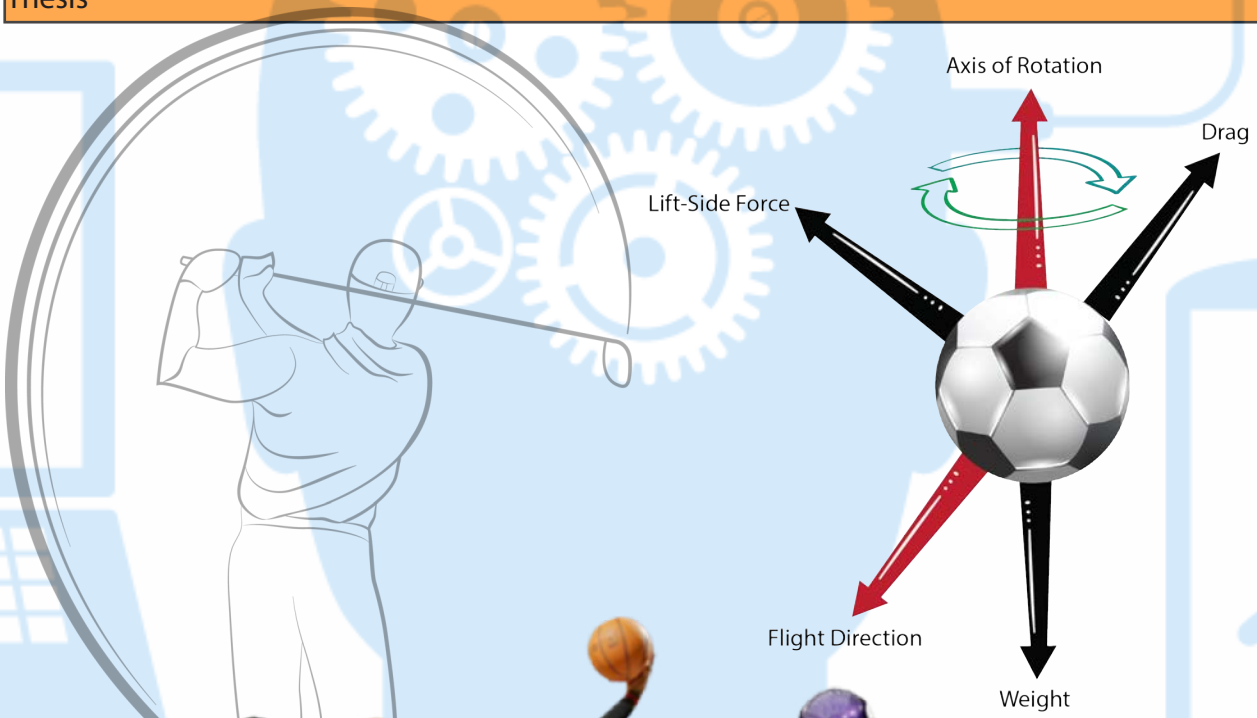
## Modules Available

The Masters Program consists of any combination of 8 modules plus a thesis of 20,000 words. You may chose any combination of modules except the thesis and research methods, which are both mandatory. Two modules are studies per semester over 2 years online. Assessment is through an end of module written report on an application of some aspect of the module in your own classrooms. Some modules also require a reflective report. There are no written examinations.

You do not need a physics or mathematic background as high school standard in either subjects is adequate. There is a strong emphasis on differentiated learning with a practical approach. To achieve your Masters Degree, you must pass each of the 8 modules which carry 12.5 ECTS, and the thesis which accounts for 20 ECTS.

The list of modules available from which you can choose are:

The Mechanics of Sports and Exercise
Data collection and manipulation for STEM
Investigating Wind Energy and Sustainable Technologies
Coding and Programming for STEM
STEM Engineering Projects
Data Mining Application
Digital Objects and Serious Games in Education
Robotics and Measurement in Education
Research Methods
Thesis




# The Mechanics of Sports and Exercise

## Module Content

The mechanic of sports and exercise will be viewed from the perspective of the of the physiology of the human body. With the use of datalogging sensors and video analysis capture, students will be able to take physical measurements of exercise routines and translate them back to lesson plan in STEM.

**PHYSIOLOGICAL SCENARIOS**
Anatomy and Physiology of Muscle Scenarios
and Cardio Vascular System;
The Stress Response;
Anatomy and Physiology of Endocrine and Female Menstrual System - Scenarios.

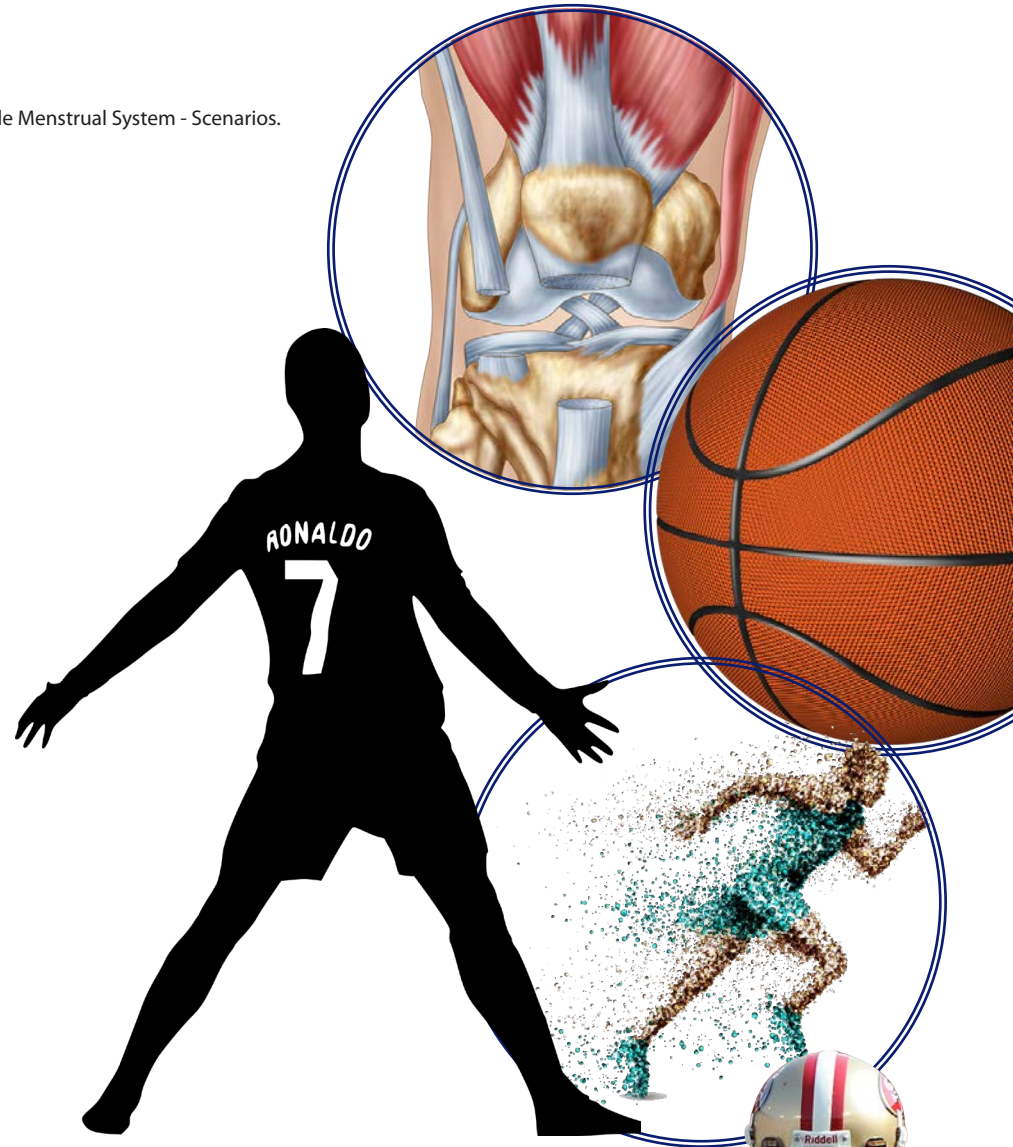
**EXERCISE TESTING**
Cardiopulmonary Exercise Testing;
Exercise Testing and Obesity.

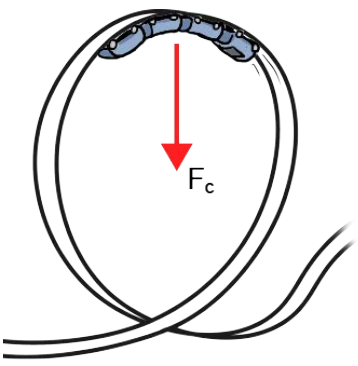
**MUSCULOSKELETAL PROBLEMS AND EXERCISE**
Bone Physiology;
The Gastro-Intestinal System and Exercise;
Musculoskeletal Stress and Exercise.

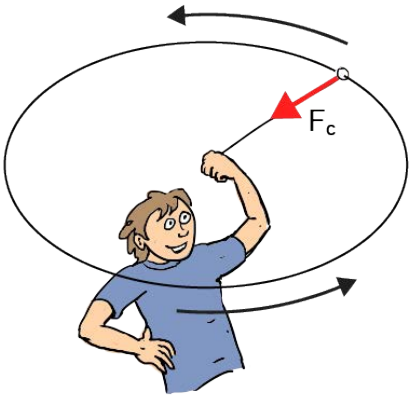
**EXERCISE**
Loss of Exercise Tolerance;
Gender differences in exercise;
Exercise Training;
Workplace Exercise;
Exercise at Altitude.

**DATA LOGGING**
Data Gathering for EKG;
Physiology and Sensors
Inferential Statistics;
Designing Lesson Plans with Data Loggers

**THE PHYSICS OF SPORTS**
Speed and Acceleration
Newtonian Football
Rotational Motion and the Free Kick
Aerodynamics in Sports
Energy and Power in Sports
Projectile Motion in Sports




# Investigating Wind Energy and Sustainable Technologies

## Module Content

There are many forms of renewable energy . Most of these renewable energies depend in one way or another on sunlight. Wind and hydroelectric power are the direct result of differential heating of the Earth's surface which leads to air moving about (wind) and precipitation forming as the air is lifted. This module looks at wind and renewable energies and provides you with the expertise to produce interesting and stimulating lesson plans for your students. The coursework is designed around three key dimensions of learning:
*Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts.*

**INTRODUCTION TO RENEWABLE ENERGY**
The different forms of energy.
What is future for renewable energies?
Future trends in renewable energy.

**WHAT IS ENERGY?**
Measuring energy.
Measuring energy content in fuels by mass.
Energy transfer.
Energy in the human body.

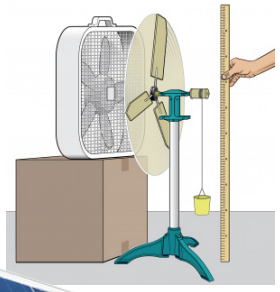
**DOING AN ENERGY AUDIT**
Measure electricity usage by several devices in your classroom and at home.
Make a plan for how you will conduct a home energy audit.
Calculate energy usage per person in your home.
Consider ways to conserve energy at home and school.
Determine ways your classroom, school, or home could become more efficient.

**EXPLORING WIND TURBINES**
Explore how wind turbines turn.
Predict variables that affect how fast a wind turbine turns.
Investigate the effect of fan speed on the power output of a wind turbine.
Build a turbine and measure energy output as different variables change.

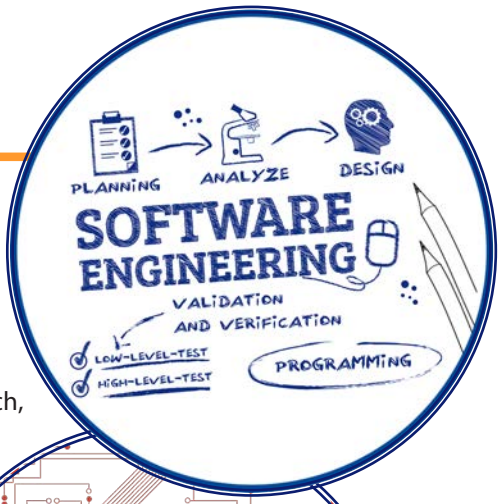
**MECHANICAL POWER**
Identify the units that are used to measure power.
Measure the power generated by a wind turbine.
Determine the relationship between wind turbine blade pitch and power generated.
Power Curves.
Efficiency of turbines

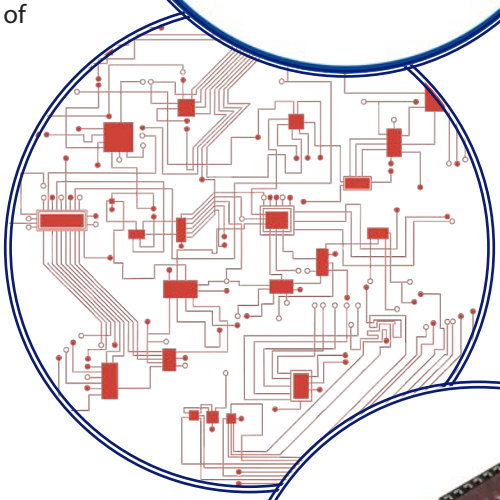
**POWER & ENERGY**
Understand the difference between power and energy.
Calculate the amount of electrical energy generated by a wind turbine during a time period.
Build a wind farm.

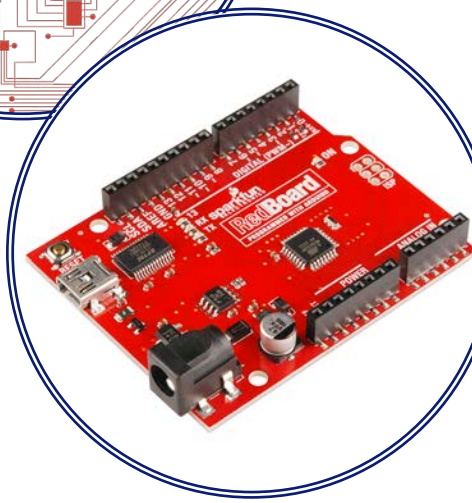
**SOLAR PANELS**
Understand how solar panels can be used to generate electricity.
Predict variables that affect how much electricity is generated by a solar panel.
Make observations and draw conclusions after testing your predictions.
Calculate the efficiency of a solar panel.
Use the Energy Sensor to determine current, potential (voltage), resistance, and power.
Determine how solar panel power output varies depending on the resistance (load) in a circuit for a given light source.
Determine how power output of turbine varies depending on the resistance (load) in the circuit.
Compare internal resistance and optimal load.



# Coding and Programming





## Module Content

The model will discuss contemporary areas related to programming and teaching tools. Important issues in programming teaching pedagogies will be discussed. The module will cover the fundamental syntax of programming languages like Easy Java Simulations (Ejs), Python 3 , Geogebra, Ocrtave Scratch, S4A, Arduino etc . The module will focus on presentation of examples of applications of programming –teaching languages as tools in education process to enhance teaching and learning

**ARDUINO, RASBERRY PI AND SENSOR TECHNOLOGY**
Introduction to Arduino.
Using Vernier sensors with Arduino.
Calibrating sensors.
Using motors with Arduino.
Projects and ideas with Arduino.

**SCRATCH CODING**
Introduction to Scratch 3 programming.
Designing music videos, animations, and video games.
Making natural connections between the digital and physical worlds.
Integrating sensors with Scratch.

**GOOGLE WORKBENCH**
Introduction to Workbench
Coding blocks with Workbench
Connecting sensors and other devices like micro:bit and SAM labs blocks using Bluetooth® wireless technology
Publishing data to Google Sheets.
How to integrate into your lesson plans

**PYTHON 3**
Introduction to Python
Basic Connection Setup and Data Collection
Setting Defaults and Passing Arguments
Elements of programming.
Projects using live sensor data.

**JAVA Script**
Introduction to Java Script
Using sensing technologies in Java
Connecting sensors via BLE
Exporting data as CSV

**LabVIEW**
Introduction to LabVIEW
LabVIEW graphical programming.
Engineering Projects with NI LabVIEW.

# Data Mining, AI & Applications

## Module Content


Introduction to basic principles of Artificial Intelligence and Machine Learning for educational purposes. The module also connects with some STEM content in the Coding Module, particularly Scratch 3. The module also introduces basic operations of some software packages such as IBM SPSS, RapidMiner and Azure.

Data analytics, the analysis of both large and small data sets, has become a fundamental source of valuable information derived from ever increasing volumes of structured and unstructured data. Data analytics applications cover a variety of organizations and industries, and remains mission critical for industry as it turns information into an asset for deriving insight and making decisions. This reflects the need for companies to do business more smartly, enabled by business intelligence. Based on these critical needs, the module is designed so that teachers can integrate machine learning content into their lesson plans.

**INTRODUCTION TO RAPIDMINER**
Fundamentals of RapidMiner
How to build simple programmes.
Overview of functions of RapidMiner.

**WHAT IS BUSINESS INTELLIGENCE?**
How can BI be used to help gain competitive advantage?
Investigating BI and applications.
Critical applications in the areas of ETL, Databases, and BI.

**TEXT MINING & WEB CONTENT MINING**
The state of the art and research trends in text mining and web content mining.
Practical methods in obtaining data.
Sentiment analysis of text from social media such as Twitter
Practical limitations of current information extraction techniques and the vision for the future.

**WORKING WITH DATA**
Data Pre-Processing and Exploration.
Properties of data.
How to visualise data.
How pre-processing can enhance the information content of data.
Data preparation to both clean the data set and expose its information content.

**DATA VISUALISATION**
Tools to provide striking visual representations of data.
Creating infographics from data.
Using Tableau for presentation of data.

**STATISTICS**
Probability & Statistical Inference.
Summarize large sets of data, including grouped data.
Central tendency and dispersion and their definitions and properties.
Common distributions such as the normal, binomial, Poisson and exponential distributions.
Multivariate analyses – Manova, Mancova.
Analysis of Variance and Analysis of Covariance and other statistical tests.
Using SPSS and Excel to analyse data.

# STEM ED

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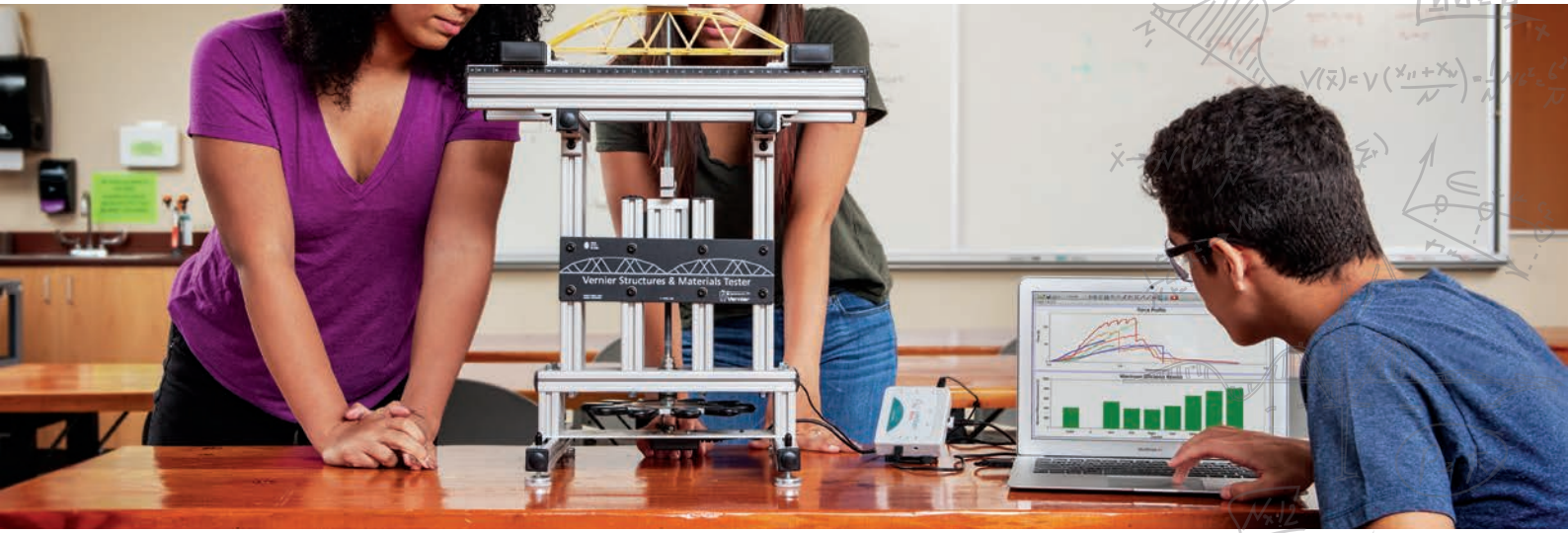
# STEM Engineering Projects




## Module Content

Science, Technology, Engineering and Mathematics (STEM) are critically important disciplines for modern society. They empower our citizens in so many important ways. Science and Mathematics provide answers to the fundamental questions of nature and enable us to understand the worldaround us.The STEM Engineering Module is designed to be both theoretical as well as practical to enable the student to develop a broad-based understanding of the ever expanding STEM discipline.

**BIOMEDICAL ENGINEERING**
Biotech and the pharmaceutical industry
DNA and who am I?
Concepts of human medicine, physiology, genetics, microbiology, and public health
Structures and interactions of human body systems and explore the prevention, diagnosis, and treatment of disease

**CREATIVE ENGINEERING DESIGN**
Evaluate the strength of model bridges and engineered structures.
Utilizing both load and displacement sensors for stress & strain.
Experimenting with different designs.
Deflection of a Rectangular, Center-Loaded Beam.
Beam Modulus of Elasticity.
Study of Trusses.
Designing bridges

**ENGINEERING AND THE HUMAN BODY**
The trigonometry of the heart.
The mechanics of muscles.
The physics of movement.
Our amazing skeleton.
The wiring system of the body.
Friction and the body.

**ENVIRONMENTAL ENGINEERING**
Solar panels, Hydrogen and Turbine technologies.
Measuring affects on outputs on solar panels.
Building solar chargers in the classroom.
Energy Resources and Consumption.
Earth Systems and Resources/Air and Water.
Project based learning in your classroom.

**USING LabVIEW**
Advanced NI LabVIEW programming.
Writing more advanced NI LabVIEW programs.
Collecting and analyzing data and manipulating results
Advanced sensor integrations.

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# Digital Objects and Serious Games in Education

## Module Content

In recent years, electronic games have assumed an important place in the lives of children and adolescents. Children acquire digital literacy informally, through play, and neither schools nor other educational institutions take sufficient account of this important aspect. Multimedia design for training and education should combine the most powerful features of interactive multimedia design with the most effective principles of technologically-mediated learning.

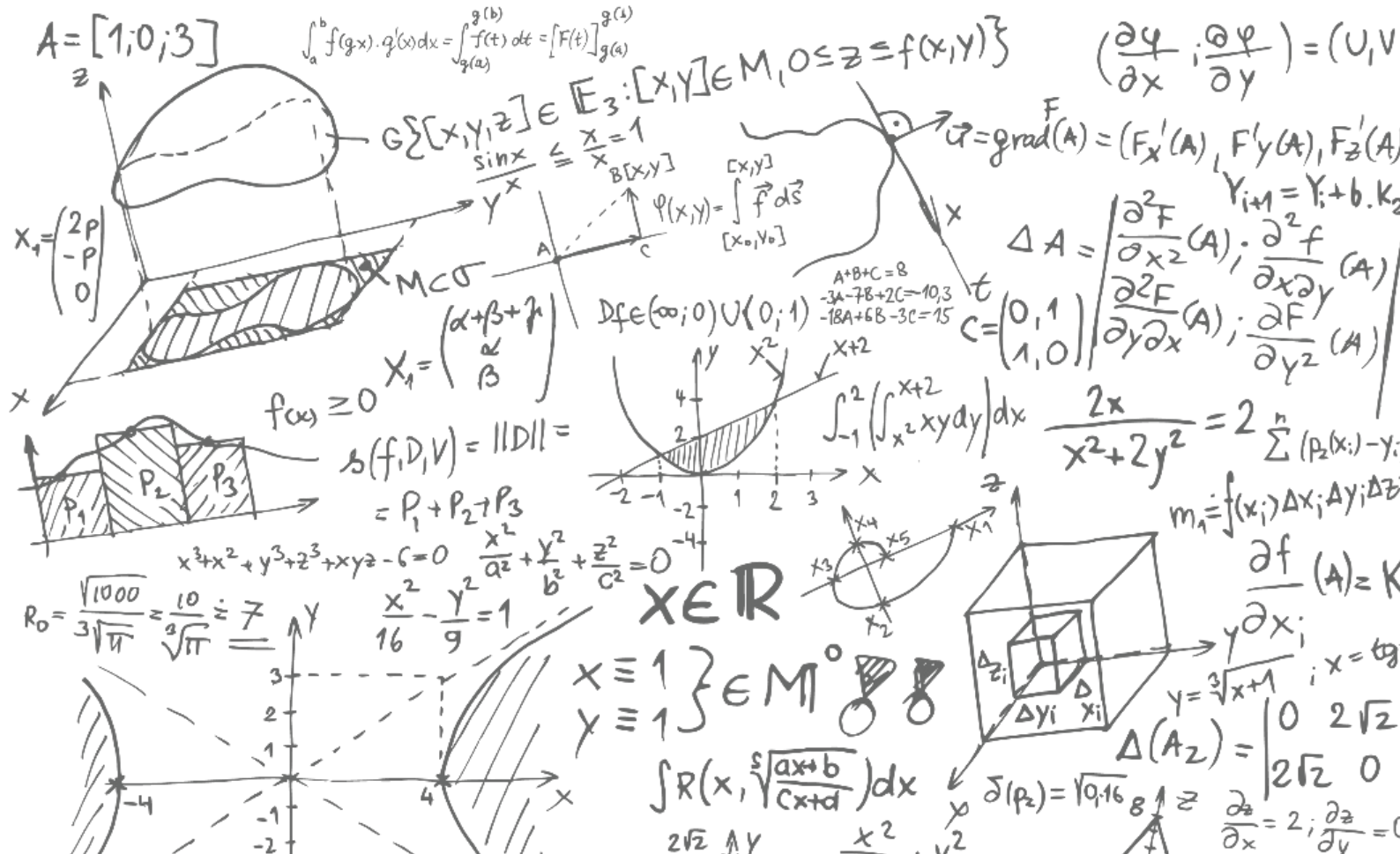
**DEVELOPMENT OF APPLICATIONS FOR MOBILE LEARNING**
The design and development of A mobile learning application.
Using WordPress for blogging
Using WordPress to build websites
SEO and Google Analytics
Produce mobile content using Skipplipp

**GAMING WITH APP INVENTOR**
Using MIT App Inventor to create learning apps.
The pedagogical approach of App Inventor.
Gamification scenario using Alice, Kodugames, EjsReader and other digital tools

**AUGMENTED REALITY IN EDUCTION**
The benefits of AR in education.
Investigation deep learning programmes.
Google Sky Map.

**TECHNOLOGY ENHANCED LEARNING**
Development of online learning strategic plans.
Pedagogical concepts and instructional design models.
Evaluation of  a range of formal online learning environments.
Fundamental models and concepts of online learning.
Construct prototype online courses.

**END OF MODULE PROJECT**
Reflect and apply learning to participant's own professional practice.
Development of a online line learning tool.
Peer review of the projects.



# Robotics and Measurement in Education

## Module Content

Coding in the classroom has become an important way to introduce problem solving, nurture creativity, increase critical thinking, and build confidence, all while learning a new language. This module will investigate a range of coding solutions—from entry-level block-based languages to advanced instrument-control programming. With Vernier technology and an appropriate coding application, students can create code to control robots, incorporate sensor input, and create sensor-controlled projects. The benefits of coding extend beyond their practical applications in the job market. When students learn to code, they learn to organize, express, and share their ideas in a whole new way. You will teach your student learn entry-level coding skills and advanced coding that extend beyond the screen as they program robots to interact with the physical world.

**ENTRY LEVEL CODING**
Introducing graphical blocks for coding.
Develop simple programming code.
Practice writing code, uploading, running, and troubleshooting code when problems arise.
Adding comments to programs.
Controlling robot kits by IR Remote Control.
Utilising the Ultrasonic Sensors
Practice using variables, "if-then-else" blocks and loops.
Write code to add personality or personalize your robot.
Using and programming in Lego Mindstorms

**WORKING WITH ARDUINO**
Introduction to Arduino technology.
Connecting sensors to Arduino.
Connecting sensors to Arduino using a breadboard.
Graphing sensor data.
Using analog and digital sensors.
Coding in Arduino
Projects and ideas.

**WORKING WITH JAVA SCRIPT and R**
Introduction to coding in Java Script
Introduction to coding in R
Applications of using R for data mining
Designing and running simple programmes.

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# Research Methods & Thesis

The aim of the module is to introduce students to the principles of good research practice and to prepare them for the research process required of a master's dissertation. The research dissertation is a requirement for all taught masters students and involves the application of relevant research methods to an approved topic within the student's discipline area. Good research design and evidence of sound research practice are central to the dissertation. The purpose of this module is to ensure that all students are familiar with appropriate research theory and are provided with training in research methodology and techniques. The module will introduce students to the principal theoretical perspectives involved, to quantitative and qualitative techniques, research design, fieldwork, data analysis and ethical considerations in research. Students will also receive training in referencing, critical reading skills, academic writing, proposal writing and the use of computer based analysis packages.

### RESEARCH METHODS SYLLABUS

Data analysis and presentation of information.
Developing the research proposal.
Ethical questions in research. Research codes of practice.
Introduction to research methods, research concepts and methodologies.
Planning the research process.
Preparing the thesis.
Qualitative research: principles, methods and practice.
Quantitative research: principles and approaches
Qualitative Methods;
Quantitative Methods;
Using SPSS or Excel to Analyse Data;
Inferential Statistics;
Correlations;
Regression Analysis;
Using NVivo.

### PROJECT/THESIS

Production of a project that is based on your areas of work. It can be a in the form of a portfolio or a piece of research you wish to carry out. Indicative length of project is 20,000 words.

The International Telematic University UNINETTUNO was acknowledged by UNESCO as one of the universities working and orienting its action towards the achievement of the United Nations 17 "Sustainable Development Goals (SDG)", namely the globally-shared objectives fixed to end poverty, to protect the planet, promote gender equality, protect and support cultures and grant wellbeing for all.

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