

## **COURSE 1 ELECTRONICS AND COMMUNICATION TECHNOLOGY**

Course 1 is designed for those teachers who have never taught electronics but wish to introduce electronics into the Year 9 curriculum and possible expansion in year 10.

This aim is concurrent with the Trade Centres in Schools emerging technologies focus and underpinning concepts for the trades in electricity, electronics.

The aim of the course is not to produce electronic engineers but to have an emphasis on .having activities that can be readily transferred into the classroom and materials and resources for immediate classroom use.

The course leans heavily on ICT resources in order to be more efficient and successful. The common errors in soldering and components are eliminated via software solutions.

The five day training package is the preferred model.

Strategy for the course

1. Teacher professional development needs identified through a questionnaire
2. Pre-course and initial tasks or brief assignments sent to course participants

### **Day 1 Introductory activities and planning**

Introduction to the purpose and aspects of the professional development.

Outline of the course and general arrangements.

The reasons for having ECT in the curriculum and linkage with ICT

Review of each teachers requirements – balance between classroom activities and the design aspect of electronics. That is, the balance between skills and higher-order design. What can be achieved with students?

Outline of the assignments and accreditation routes

Outline of the assignment for the day

Practical activities using simulation via Circuit Wizard – General components, getting to know the concepts of a circuit and how to choose components.

Discussion of the use of microcontrollers and their advantages.

Where do microcontrollers come from and what is the advantage in school programs? – reinforce programming, problem solving, thinking skills. Links to industry such as home automation, automotive control.

Brief review of PIC chips, PICAXE, ATME and evaluation based on costs, programming, reliability, connection to real world requirements.

Discussion of how to define the basic concepts of systems that are fundamentally controller based.

Brief introduction to Intellecta as an ideal teaching platform

How to connect output devices / how to drive output devices

How to solder

How to connect input devices / how to make an input sensor as an example with Circuit Wizard

Explore the associated pedagogic issues

Undertake a simple practical project using a PICAXE system – use a developed kit to grasp the main concepts

Define a workable classroom activity

Complete first assignment and review needs analysis

Outline of the support structure

## **Day 2 Introduction to the day**

Review of school based projects which use discrete building blocks and/or controllers systems

Some basic electronics using Circuit Wizard. By now the basic concepts should be available:

Outline of the assignment for the day

A brief review of any new materials – as input or output devices (if appropriate)

Practical activities using various systems design software

Pedagogic issues related to planning ECT activities

Plan an ECT activity in a science, technology class in school and links to Trade Centres in Schools.

Use software to help create teaching and learning aids

Complete second assignment and review needs analysis

Agree targets and routes

Teachers select kit from a list of resources to undertake class-based activity

End of session

### **Day 3 Understanding electronics products**

Review progress in schools on ECT activities tried and assignments undertaken

Looking at systems and sub-systems and their functionality

Product analysis – understanding electronic products

Product analysis and designing ECT systems

The differences and similarities between PIC software functions and stand-alone functional building blocks. For example, use of timers, amplifiers, counters and building block equivalents. Need to think in terms of functional blocks and modules

Link these examples to Intellecta

Manufacturing ECT systems – using ICT applications

The systems approach to the use of test equipment and fault-finding

Manufacturing a PIC based system

Planning project work in school

### **Day 4 Different controllers and applications**

Some further electronics and/or re-visiting earlier sub-systems.

Tackling a completely new micro – ATMEL and using BASCOM to program. What questions do you need to ask, what resources, why do it ( is it based on cost or resources)

Use of ALtium software – using the base knowledge

Further use of microcontrollers technology and/or discrete building blocks in ECT projects

Product analysis and designing ECT systems continued

Planning project work in school to be completed

Pedagogic issues reviewed

Review of assignments and timescale

Summary course evaluation

The way forward - networking

Further information on some of the issues to be dealt with during the four days.

### **Day 5 – full day on using Circuit Software and making products**

Assignment related to a designing and making teaching activity, which is integrative in nature, provides opportunities for reflection and allows you to demonstrate a wide range of skills and techniques; to be started on the course and completed within 2 months.

Summary of attainment of course members:

As a result of participating in the “ECT Project”, the course member is a more confident and competent classroom practitioner within electronics and communications technology. The statements represent a summary of where the course member has been able to demonstrate improvements in their skills, knowledge and understanding and in their management of ECT activities.

#### **1. Competency area - ECT Systems and functions**

The course member has demonstrated an understanding of:

- systems terminology (input, process, output and feedback) and matching sub-systems

- electronic functions including comparators, timing circuits, counters, logic and amplifiers, basic building blocks
- the design of simple sensors and the function of a range of output transducers
- the differences between analogue and digital systems
- the principles and uses of programmable systems
- the properties and applications of different communications media

## **2. Competency area - Components**

The course member has demonstrated an understanding of:

- components, their circuit symbols and the use of units (M, k, m,  $\mu$ , n and p)
- resistance, potential difference, voltage, current, analogue and digital signals
- how to calculate component values and choose components (eg resistors, transistors)
- the properties and uses of diodes, thyristors and transistors
- the properties and uses of input sensors (LDRs, thermistors, potentiometers, switches)
- the properties and uses of output devices (LED's, motors, buzzers, relays, loudspeakers)
- basic signal conditioning (e.g. matching circuits, debounce signals)
- the basic properties of some opto-electronic devices (reflective, slotted opto-switches)

## **3. Competency area - Designing and making ECT solutions**

The course member has demonstrated an understanding of and improved capability in:

- an analysis of existing electronic products in terms of inputs, processes, outputs
- an analysis of the requirements of an electronic system in terms of inputs, processes, outputs

- the use of a systems approach in the designing and modelling of electronic systems
- the design and manufacture of ECT systems including testing performance of systems and sub-systems
- using ICT and a range of test equipment with due regard to safety

#### **4. Competency area - Using ICT within the designing and making of ECT solutions**

The course member has demonstrated an understanding of and improved capability in:

- the use of software such as Circuit Wizard, PCB Design and Make and Altium Designer to generate schematics and PCB artwork.
- the use of circuit simulation and testing software to develop, explore and test ECT systems
- the use of CAD and CAD/CAM software and hardware to design and make printed circuit boards
- designing/modelling control systems (by flowcharts, textual commands, or graphical techniques)
- the use of computer and micro-controller applications to control ECT systems

#### **5. Competency area - Skills related to Management of ECT Related Activities**

Course members are more able to:

- manage a working environment and develop safe practices when working within ECT activities
- appreciate a range of teaching and learning strategies appropriate to ECT activities
- plan, develop, teach and evaluate ECT activities
- guide students in their own project management
- develop and use cross curricular links as appropriate

- involve D&T staff in the processes of long, medium and short term planning for ECT activities.
- secure and sustain effective teaching within ECT activities
- develop and maintain ECT resources and provide value for money
- ensure a safe working environment and be aware of the need to conduct risk assessments

## **COURSE 2 ENGINEERING AND COMMUNICATION TECHNOLOGY**

This course designed for those teachers who are technology teachers and wish to introduce CAD/CAM into the Year 9 curriculum and possible expansion in year 10.

The aim of the course is not to produce professional designers but to have an emphasis on .having activities that can be readily transferred into the classroom and materials and resources for immediate classroom use.

The teacher will be better equipped to conduct classes in these subject and be able to form valuable judgements on the subjects and resources.

The course leans heavily on ICT resources in order to be more efficient and successful

The five day training package is the preferred model.

### Strategy for the course

3. Teacher professional development needs identified through a questionnaire
4. Pre-reading and initial tasks or brief assignments sent to course participants

## **Day 1 Introduction to the course**

Introduction to the purpose and aspects of the professional development.

Outline of the course and general arrangements.

The reasons for having ECT in the curriculum and links with industrial design and manufacturing processes

Review of each teachers requirements – balance between classroom activities and the design aspect of modern engineering

Outline of the assignments and accreditation routes

Outline of the assignment for the day

Discussion of the use of CAD software and advantages

Need for basic sketching

Need for basic understanding of materials and processes

Overview of a generic CAD system and basic operations – sketching, adding features, assembly, 2D drawings, views, sections, documentation.

Practical activities using a CAD package – ProEngineer and getting to know the basic concepts and processes – screen, menus, location

Introduction to a 2D CAD package that has links to engrave, vinyl cutting- Brief review of how to transfer a design to a vinyl sign, engraving or 3D model.

Discussion of how to define the basic design and manufacturing processes

Drawing, trimming, saving and transferring to a system

How to handle bit maps and graphic images from other software packages

Explore the associated pedagogic issues

Undertake a simple practical project sketching out a product and the final steps

Define a workable classroom activity that may be a vinyl cutting, 3d model or basic engraving

Complete first assignment and review needs analysis

## **Day 2 Review of design skills**

Introduction to the day

Review of school based projects which have used 2D Design V2, ProEngineer and other software products

Full day with ProE – producing a simple part and drawing.

Use of dimensions and views

Outline of the assignment for the day

A brief review of any new concepts in CAD

Practical activities using various systems design software

Pedagogic issues related to planning ECT activities

Plan an ECT activity in a science, technology class in school and links to Trade Centres in Schools.

Use software to help create teaching and learning aids. Screen captures, authoring tools – how to assist you in making a lesson plan

Complete second assignment and review needs analysis

Agree targets and routes

Teachers select kit from a list of resources to undertake class-based activity

End of session

### **Day 3 Generating activities**

Review progress in schools on ECT activities tried and assignments undertaken

Looking at ProE for another session – revolves and other features

Product analysis – understanding product options – fasteners, clamps, glues, rubber bands

Sketching out a design for a class – battery driven motor design

Product analysis and designing ECT systems

Exporting your first design into Roland software for manufacture

Discussion of processes – surfacing, drilling, finishing

Making your own part – sketch out a work plan and strategy

Making your first part

Planning project work in school

#### **Day 4 Expansion in CAD**

Some further CAD processes

Further use of CAD in terms of assemblies.

Use of self centering vice and other software

Introduction to other software such as Vcarve, PhotoVcarve

Product analysis and designing ECT systems continued

Planning project work in school to be completed

Pedagogic issues reviewed

Review of assignments and timescale

Summary course evaluation

The way forward – networking

Completing some extra skills – engraving and scanning.  
Advantages and use in classes

#### **Day 5 – full day on ProE, 2D Design and Roland**

Assignment related to a designing and making teaching activity, which is integrative in nature,

provides opportunities for reflection and allows you to demonstrate a wide range of skills and

techniques; to be started on the course and completed within 2 months

Summary of attainment of course members:

As a result of participating in the “ECT Project”, the course member is a more confident and competent classroom practitioner within the following areas of engineering and communications technology. The statements represent a summary of where the course member has been able to demonstrate improvements in their skills, knowledge and understanding and in their management of ECT activities.

#### **1. Competency area - ECT Engineering**

The course member has demonstrated an understanding of:

- engineering approaches to design, planning and documentation

Thinking about projects and link to trades and careers

## **2. Competency area - Components in ECT systems**

The course member has demonstrated an understanding of:

- Design processes

Properties of materials

Basic engineering concepts of fasteners, holes, screws, tapping, clamps

## **3. Competency area - Designing and making ECT solutions**

The course member has demonstrated an understanding of and improved capability in:

- an analysis of existing cad systems and processes

- an analysis of basic processes and skills

- the use of a systems approach in the design of a product

- the design and manufacture of ECT systems with modern CAM systems = thinking about manufacture in the design stages

- using ICT and a range of equipment with due regard to safety

## **4. Competency area - Using ICT within the designing and making of ECT solutions**

The course member has demonstrated an understanding of and improved capability in:

- the use of software to generate designs with a range of software systems

- the use of simulation and testing software to develop, explore and test ECT systems

- the use of CAD and CAD/CAM software and hardware to design and make printed circuit boards

- designing/modelling control systems (by flowcharts, textual commands, or graphical techniques)

## **5. Competency area - Skills related to Management of ECT Related Activities**

Course members are more able to:

- manage a working environment and develop safe practices when working within ECT activities
- appreciate a range of teaching and learning strategies appropriate to ECT activities
- plan, develop, teach and evaluate ECT activities
- guide students in their own project management
- develop and use cross curricular links as appropriate
- involve D&T staff in the processes of long, medium and short term planning for ECT activities.
- secure and sustain effective teaching within ECT activities
- develop and maintain ECT resources and provide value for money
- ensure a safe working environment and be aware of the need to conduct risk assessments