SUMMARY SHEET

COURSE/SUBJECT TITLE: **Access Diploma in Engineering – Electrical Principles** No: (Syllabus Alternative if appropriate) **XJ0/3/TE/001**

LEVEL: **3** BOARD/EXAMINING BODY: **CERTA**

LECTURERS: **James Irvine BSc CPhys MInstP**

GENERAL APPROACH TO DELIVERY - Special requirement of this subject.
There is a CD-ROM with material for use in this subject

SUMMARY OF LEARNING ACTIVITIES: (These should relate to Schemes of Work activities).

Very Frequent - Approximately every week
Frequent - Approximately 1 - 2 times per month
Occasional - Approximately 1 - 2 times per term
Rare - Less than occasional
Never - Never (just as it says).

	Very Frequent	Frequent	Occasional	Rare	Never		Very Frequent	Frequent	Occasional	Rare	Never
Lectures		✓				Dictation					✓
Video		✓				Group-work		✓			
Class Discussion		✓				Role-play					✓
I.T. Usage		✓				Visits			✓		
Practical Work	✓					Student Seminars			✓		
Individual Research			✓			Field Course					✓
Worksheets Assignments	✓					Other (please state)			Posters cards small whiteboards		

AIMS

- To develop knowledge and understanding of Electrical Engineering.
- To encourage enjoyment and satisfaction in the study of Electrical Engineering.
- To give a flavour of future study in Electrical Engineering, and to give a good basic foundation for that study.
- To promote Electrical Engineering as a possible career choice.
- To prepare students for an A2 examination.

CONTRIBUTION TO THE COLLEGE MISSION

Excellence

The delivery of the course will focus on an outstanding programme of study with a variety of resources and activities designed to prepare students to achieve their maximum potential in the examination

Integrity

The course will be delivered in such a way that students develop a sense of honesty and respect for themselves, their peers, teachers, and resources. A high degree of trust will be delivered and will be expected from all participants.

Commitment

The course will aim to encourage the highest standards of teaching and learning. The care of and nurture of students as individuals will be at the heart of the teaching strategy.

Respect

The course will be delivered in a framework of mutual respect and support. Participants will use expensive and valuable resources and be expected to use resources carefully and for their correct purposes.

Being Supportive

Electrical Engineering will be taught in a dedicated laboratory with a wide range of professional equipment. The room will be maintained as a professional working environment. Health and safety will be a priority at all times, and safe working practices will be expected as a matter of course.

Effectiveness

The course will be supported using high quality resources that represent good value for money.

Enterprise

Forward looking and innovative in our approach to all College activities. New techniques for effective teaching will be tried.

Responsiveness

The course will be responsive to the needs of students, and activities will be modified where necessary to take into account the feelings of students.

ASSESSMENT

Formative assessment will be by question and answer in class. Summative assessments will involve written homework tasks, practical reports, tests, examinations. Feedback will be given as appropriate to the class or to individuals. Extra help will be given to individuals as needed.

Assessment will be more than the minimum guidelines set by the Science Department Assessment Policy. Students will know what assessments there are as these are set out in the notes. Review of progress will be made carried out at the end of each topic.

Formal assessment will be:

- By examination at the end of each semester.
- Internal assessment practical skills.

LEARNING ACTIVITIES

These will consist of a mixture of theory lessons, demonstrations, and practical sessions. Teaching and learning strategies will be differentiated to address different learning styles. Student will not normally be required to copy notes in class as these are given out as hand-outs. However they are encouraged to make their own supplementary notes as appropriate.

As well as teacher exposition, class discussion and problem solving in small groups will form a major part of the course. Students are encouraged at all times to take ownership of the work and to participate actively in all activities. Students will be expected to review their work at the end of each topic. Students will be encouraged to read around the subject over and beyond what is covered in the lessons.

ICT will form an integral part of the delivery of the course.

Provision will be made for gifted and talented students by offering:

- Participation in appropriate master classes, lectures, etc.

DIFFERENTIATION

A variety of teaching and learning styles will be delivered as a matter of course. These will include (in no particular order):

- **Auditory** – listening to teacher and others.
- **Visual** – demonstrations and videos.
- **Interpersonal** – working in small groups.
- **Intrapersonal** – working on one's own.
- **Kinaesthetic** – practical work.
- **Logical** – working on problems.

This differentiation will be planned in individual lesson plans.

Differentiation by outcome will be planned on this scheme of work under the model of:

- **Access** – the core expectation of material that must be covered for successful study.
- **Progress** – the expectation of students to grasp more difficult concepts
- **Challenge** – encouragement of students to tackle extension tasks appropriate to prepare students for a Grade A.

Internal Assessment

Students will be frequently assessed using the following methods:

- Informal question and answer in class;
- Lesson assessments (classwork to you) which will be marked together and the marks collected;
- Topic Questions (from past papers) which are done as homework;
- Short tests every two weeks;
- Topic Tests;
- Mock examinations.

Students who under-perform will be offered support in workshops. Consistent under-performance due to lack of effort and commitment may lead to students being referred for disciplinary action.

External Assessment

This will be carried out using:

- Examinations at the end of each Semester, in January and June.
- Practical Assessments

KEY SKILLS

All of the material lends itself to key skills in:

- Numeracy – calculations, graphical, and data analysis.
- Communication – in written form, presentation, and oral work.
- ICT – use of computers to design circuits, present work, process data, interactive learning, and presentation.

These skills will be developed as a matter of course.

Personal, Learning, and Thinking Skills (PLTS)

Students will be encouraged to develop their personal, learning, and thinking skills under the following headings:

- Creative thinkers (CT);
- Effective participators (EP);
- Independent enquirers (IE);
- Reflective learners (RL);
- Team workers (TW);
- Self-Managers (SM).

Every Child Matters (ECM)

Outcomes are in the scheme of work:

- Be healthy (BH);
- Stay safe (SS);
- Enjoy and achieve (EA);
- Make a positive contribution(PC);
- Achieve economic well-being (AW).

Skills for Life (S4L)

- Numeracy (N)
- Literacy (L)
- ICT

Appropriate activities will be indicated in the scheme of work.

Skills for the Workplace (STEM)

- Communication and interpersonal skills (CI)
- Problem Solving (PS)
- Using initiative (UI)
- Working to deadlines (WD)
- Organisation (OS)
- Team working (TW)
- Learning and Adaptation (LA)
- Numeracy (N)
- Diversity and Difference (VD)
- Negotiation Skills (NS)

Appropriate activities will be indicated in the scheme of work.

Scheme of Work – Access level 3 Electrical Principles

Course: Access Electrical Principles	Semester 1	Teacher(s): James Irvine

Lesson	Topic/Subject Area	Key Teaching Methods/Learning Activities	Resources [including ILT]	Identify S4L and ECM	Links to skills etc.	Syllabus/Unit [Cross Referenced to Lesson Plan]	Assignment/Assessment Activities / Differentiation
2. Sept 8th BE_01 BE_02	**Topic 1 Basic electricity** Measurement of voltage and current Ohm's Law $V = IR$ Conductance $G = 1/R$ Power $P = VI$ Practical to investigate simple ohmic conductors. As an extension, students can do the experiment on power	Formal teaching ICT work Video-clips Demonstration Group work Practical work ICT work Support	Bird pp 6 – 11 Notes pp 1 – 14 Practical: Voltmeters, ammeters, high powered resistors, power supplies.	**ECM** Enjoy and achieve Make a positive contribution **PLTS** CT, SM, EP **Employer** Numeracy, making circuits	**KS**: WO M E IT	BE_01 Rev_02	Tutorial Questions Assessment of understanding of Electrical Engineering symbols and technical words Numerical skills in standard form. Access: Understand and use electrical symbols. Use simple equations Progress: Set up a circuit Harvest data Challenge: Derive $P = I^2 R$

3 **Sept 15th** BE_03 BE_04	Students will: Revise Ohm's Law; Recognise conductance as the reciprocal of resistance. Understand that not all components obey Ohm's Law Use data-logging equipment to measure the VI characteristic of a bulb. Calculate single resistor equivalents in series and parallel circuits; Recognise and use E24 series, colour codes, and BS1852 code. Understand Kirchhoff's Laws. Extension: use $R = R_o(1 + \alpha\theta)$	Formal teaching Demonstration ICT work Group work	Bird pp 11 – 12 Bird pp 20 – 21 Bird pp 36 – 41 Work-book 1 Bulb, voltmeter, ammeter, variable power supply. Voltage sensor, current sensor, data-loggers, computers.	**ECM** Enjoy and achieve Make a positive contribution Stay safe **PLTS** CT, SM, TW **Employer** Use of data-logger and ICT	**KS**: WO M E IT	BE_03 BE_04	Tutorial Questions Assessment in use of simple equations. Assessment of data-logging skills using ICT Assessment of numerical calculations. Identification of those who need extra support. Extension: *use of* $R = R_o(1 + \alpha\theta)$ Access: Recall Ohms Law Recognise VI characteristics Progress: Calculate single resistance equivalents for parallel circuits Challenge: Derive the equations for series and parallel circuits.

4 **Sep 22nd** WF_01 WF_02	**Students will:** Recall the nature of alternating current and compare it to direct current. Recognise and use technical terms associated with AC. Recognise and use the equations $V_{rms} = \frac{V_{pk}}{\sqrt{2}}$ and $I_{rms} = \frac{I_{pk}}{\sqrt{2}}$ Recall that the CRO is used to display AC waveforms. Recognise that it plots a voltage-time graph. Measure peak to peak voltage and the time period from the CRO Derive quantities such as *V*rms and frequency. Extension: *Oscilloscope: Impossible or really useful?*	Formal teaching Demonstration Group work Practice Questions	Work Book 2 WF_01 and 02 Bird pp 178 – 179 Bird pp 11 – 18 CRO, batteries, power supplies, signal generators	**ECM** Enjoy and achieve Make a positive contribution Stay safe **PLTS** CT, SM, RL **Employer** Use of CRO	**KS**: WO M E IT	Syllabus 1.1 Notes WF_01 and WF_02	Tutorial Questions Assessment of technical understanding Assessment of understanding of square roots. Access: State that a CRO displays alternating waveforms. Define amplitude and period. Progress: Relate peak and RMS values. Understand instantaneous and average values. Challenge: Derive the RMS values

5 **Sept 29th** WF_03	**Students will:** Distinguish between unidirectional and alternating waveforms. Understand that sine wave is the most natural waveform Look at different waveforms. Define instantaneous values. Extension: Use calculus to find the area under the graph Test on Basic Electricity	Formal teaching Group work Practice questions Practical work Examination	Work Book 2 WF_03 Bird pp 185 – 193 CRO, AC generator, signal generator	**ECM** Enjoy and achieve Make a positive contribution Stay safe **PLTS** CT, SM, EP IE, RL **Employer** Numeracy skills	**KS**: WO M E IT	Syllabus 1.1 and 1.2 WF_03	Tutorial Questions Test on Basic Electricity Numerical calculations using standard form. Conversions between units Topic Questions 4 TMA_01 given out Identification of those who need extra support. Access: Define instantaneous values Explain that sine waves are not the only wave-form. Progress: Distinguish between alternating and unidirectional waveforms. Recognise the form factor Challenge: Use graphical techniques to work out effective values.

6 **Oct 6th** WF_04	Students will: Use the idea of a rotating phase vector. Recognise and use $v = V_0 \sin \omega t$ to calculate instantaneous values. Work out the resultant from two phasors. Modify the equation to take into account the phase angle. Recognise and use $v = V_0 \sin(\omega t \pm \phi)$ Use accurate drawing or calculation to solve problems with phasor diagrams. Extension: Research some phase vector tutorials and animations	Group work Formal teaching Group work Demonstration ICT research work	Work Book 3 Bird pp 184 – 189 Laptop computers	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, SM, RL **Employer** Numeracy skills	**KS**: WO M E IT	Syllabus 2.1 – 2.4 WF_04	Tutorial Questions Understanding of circular motion concepts Use of trigonometry Access: Resolve phasors by accurate drawing. Progress: Resolving phasors by calculations. Challenge: Link phasors with SHM and circular motion

7 **Oct 13th** AC_01 AC_02	**Students will:** Recall that a capacitor is a charge store. Describe the properties of a capacitor. Recognise and use the equation $Q = CV$ To explain how capacitors allow the passage of AC, but not DC. Note: High voltages will be used in the super-capacitor experiment. Although the current from the supply is very low, the presence of a capacity will ensure a big belt. Extension: Research the physics of capacitors.	Formal teaching Group work Practical Practice Questions ICT work	Bird pp 54 – 55 P 195 Work-pack 4 EHT supply; bin-liner, aluminium foil. Coulomb meters, battery, multimeter to read capacitance. Signal generator, 2.2 μF capacitor, multimeters. Small bulb	**ECM** Enjoy and achieve Make a positive contribution Stay safe **PLTS** IE, CT, EP **Employer** Numeracy skills Data harvesting Graphical interpretation	**KS**: WO M E IT AfL	Syllabus 3.1 and 3.2 AC01	Tutorial Questions Numerical work Use of standard form Practical skills Identification of those who need extra support. Access: Recognise that a capacitor allows AC to pass but blocks DC. Progress: Recognise different capacitor properties. Challenge: Explain how a capacitor holds charge and energy.

8 **Oct 20th**	Half term test Last chance test for underperforming candidates	Examination		**ECM** EA PC **PLTS** RL	M, E,		Test Identification of those who need extra support.
AC_02	To understand the concept of reactance in a capacitor. To explain how the reactance decreases with increasing frequency. To recognise and use the equation $X_C = \frac{1}{2\pi fC}$	Formal teaching Group work Practical Practice Questions ICT work	Bird pp 54 – 55 P 195 Work-pack 4 Signal generator, 2.2 µF capacitor, multimeters.	**ECM** Enjoy and achieve Make a positive contribution Stay safe **PLTS** IE, CT, EP **Employer** Numeracy skills Data harvesting Graphical interpretation	**KS**: WO M E IT AfL	Syllabus 3.1 and 3.2 AC02	Tutorial Questions Numerical work Use of standard form Practical skills Identification of those who need extra support. Access: State that reactance decreases as the frequency goes up. Progress: Use the equation for reactance. Challenge: Derive the reactance equations
Half Term							

Lesson	Topic/Subject Area	Key Teaching Methods/Learning Activities	Resources [including ILT]	Identify S4L and ECM	Links to work experience and/or vocational relevance	Syllabus/Unit [Cross Referenced to Lesson Plan]	Assignment/Assessment Activities/Extension Differentiation
9 **Nov 3rd** AC_04	Use simple phasor diagrams. Explain the phase shift in a reactive capacitor circuit. Demonstrate the phase shift practically.	Group work Practical work Formal Teaching	Work-book 4 Bird pp 195 – 196	**ECM** Enjoy and achieve Make a positive contribution **PLTS** CT, EP, TW **Employer** Numeracy skills Data harvesting Graphical interpretation	M, E, WO, AfL	Syllabus 3.1 and 3.3 AC_03	Tutorial Questions. Practical skills. Use of numerical skills TMA_02

10 Nov 10th AC_04	Students will: Recall that an inductor produces a magnetic field. Understand that inductors have an inductance. Explain that inductors have a reactance due to their inductance.	Group work Formal Teaching Practical work ICT work	Bird pp 91 – 93 Work-book 5 Inductors, laptop, picoscope sensor and software. Inductor, multimeters, signal generators	**ECM** Enjoy and achieve Make a positive contribution **PLTS** CT, EP, TW **Employer** Data harvesting and interpretation of data from graphs	WO, M, E Lab skills	Syllabus 3.2, 3.3, and 3.4 AC_04, AC_05	Tutorial Questions Observation of practical skills, presentation of data in tables and graphs. Data processing from graphs Access: Recall that inductors are electromagnetic devices. Recall that reactance increases as frequency increases. Progress: Recognise and use the reactance equation. Interpret data from graphs. Challenge: Derive the inductor equation

11 Nov 17th AC_05	Students will: Understand the reactance of an inductor; Recognise and use the equation $X_L = 2\pi fL$ Measure the reactance with different frequencies Extension: Explain the role of the magnetic field in storing energy in an inductor.	Group work Formal Teaching Practical work ICT work	Bird pp 91 – 93 Work-book 5 Inductor, multimeters, signal generators	**ECM** Enjoy and achieve Make a positive contribution **PLTS** CT, EP, TW **Employer** Data harvesting and interpretation of data from graphs	WO, M, E Lab skills	Syllabus 3.2, 3.3, and 3.4 AC_05	Tutorial Questions Observation of practical skills, presentation of data in tables and graphs. Data processing from graphs Access: Recall that inductors are electromagnetic devices. Recall that reactance increases as frequency increases. Progress: Recognise and use the reactance equation. Interpret data from graphs. Challenge: Derive the inductor equation

12 Nov 24th AC_06	**Students will:** Understand the phase relationship between voltages; Analyse simple *LR* circuits; Demonstrate the phase change in an *LR* circuit. Consider how the models work at low frequency, but do odd things at radio frequency. Investigate phase shift practically. Extension: Do a web investigation into the behaviour of components at high frequencies.	Formal Teaching Practice Questions ICT research Practical work	Work book 5 Bird pp 197 - 200 Inductors, multimeters, signal generators Computers	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, EP, TW **Employer** Numerical analysis. Use of spreadsheet Use of frequency generator ICT research	M, E, ICT, WO, AfL Lab skills M,	Syllabus 3.3 and 3.4 AC_06	Tutorial Questions Use of simple equations. Understanding of definitions. Numerical work including use of formulae, standard form, and constants. Practical Reports and interpretation of data. Use of ICT. Access: Recognise the phase relationship between and inductor and a resistor. Harvest data Progress: Calculate phase shift. Use spreadsheet to process data. Calculate phase angle Challenge: Assess the validity of the models at radio frequency.

13 **Dec 1st** AC_07	Students will: Work out the power in a resistive AC circuit. Work out power in circuits with reactive elements; Understand the power triangle. Demo to make an AC motor and make it work. Extension: Make an AC Motor from http://makezine.com/2008/08/17/how-to-make-an-ac-motor-g/	Formal Teaching Practice Questions Practical work ICT work	Work-book 6 Bird pp 208 – 211 Breithaupt pp 286 – 287 AC Motors Power supply, coils, compass pins, old pond pump rotor, small aluminium can, capacitor. C-cores, metal discs, pin, small metal plate.	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, EP, TW **Employer** Follow technical instructions	M, E, ICT, WO, AfL Lab skills	Syllabus 3.5, 3.6, and 3.7 AC_07	Tutorial Questions Practical Reports Harvesting data with data-logging equipment. Topic Questions 7 Use of equations, SI units, and standard form Practical Reports, interpretation and evaluation of data Access: Recall the definitions of apparent power, true power, and reactive power. Progress: Use the equations of power Explain the power triangle. Apply these to an AC machine Challenge: Prove the equations

14 **8th Dec**	**Practical Assessment** **TMA03** Phase change in LR Circuit	Assessed Practical work	TMA 03 sheet, signal generator, inductor, 3 multimeters.	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, EP, TW **Employer** Follow technical instructions	M, E, ICT, WO, AfL Lab skills	Syllabus 3.2, 3.3, and 3.4 AC_08	Written response to Tutor Marked Assignment 3

15 **15th** **Dec**	**Catch up week if needed** **Topics** Topic prepared and presented to the class. Using computer graphics and overhead camera. Equality and diversity focus – students will work in different groups. **Recapitulatory** Practice Questions	Group work Student presentation Practice Questions ICT work	Prepare a topic to present to the class as a short tutorial. Use presentation graphics. Use IT resources to research material Presentation Assessment of presentation Laptops	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, CT, EP **Employer** Make a presentation to an audience	M, E, ICT, WO, AfL		Presentation Team working; Communication of technical information; Group participation Response to past questions
Christmas HOLIDAY							

Lesson	Topic/Subject Area	Key Teaching Methods/Learning Activities	Resources [including ILT]	Identify S4L and ECM	Links to work experience and/or vocational relevance	Syllabus/Unit [Cross Referenced to Lesson Plan]	Assignment/Assessment Activities
16 Jan 5th **2015** CT_03	**Catch up week if needed** **Topics** Topic prepared and presented to the class. Using computer graphics and overhead camera. Equality and diversity focus – students will work in different groups. **Recapitulatory** Practice Questions	Group work Student presentation Practice Questions ICT work	Prepare a topic to present to the class as a short tutorial. Use presentation graphics. Use IT resources to research material Presentation Assessment of presentation Laptops	**ECM** Enjoy and achieve Make a positive contribution **PLTS** IE, CT, EP **Employer** Make a presentation to an audience	M, E, ICT, WO, AfL		Presentation Team working; Communication of technical information; Group participation Response to past questions

17 **Jan 12th**	Revision Week/Topics
18 **Jan 19th**	Revision Week
19 **Jan 26th**	Semester 1 Examination

You can find an Excel version of the blank Scheme of Work here , but not there.