# ELB044 - ElectroTechnology
# Module Specification

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|---|---|
| **Principally taught by** | Electronic & Electrical Engineering |
| **Modular weight** | 10 |
| **ECTS Credit** | 5 |
| **Credit Level** | 5 |
| **Exam weighting** | 80 |
| **SAP Restriction** | Some elements of assessment cannot be reassessed in SAP (Re-assessment involving laboratory work and coursework is not available during the Special Assessment Period.) |
| **Prerequisite modules** | None |
| **Availability** | Module is available to any student meeting pre-requisites, but numbers will be restricted and priority will be given to students for whom the module is listed in their Programme Regulations. |
| **Responsible Examiner** | Dr F. Gonzalez-Longatt |
| **Delivery Period** | Semester 2 |

## 1. Aims and Summary

To introduce to the students of other disciplines the fundamental principles and concepts of electrotechnology.

## 2. The intended learning outcomes are that on completion of this module the student should be able to:

At the end of the module the students should be able to:

**(1) Knowledge and Understanding**

- Use the fundamental laws and theorems for circuit analysis. Learn how the laws of electromagnetism are applied to the design of induction motors, synchronous generators and transformers and understand the electromechanical power conversion process.

**(2) Skills and Attributes**

**(i) Intellectual**

- Analyse ac and dc electrical circuits and predict their performance. Understand and apply the fundamental laws of electromagnetism to different types of electrical machines, and be able to predict their performance in real life situations.

**(ii) Practical**

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- Determine the equivalent circuit parameters and the performance of a single phase transformer in the laboratory. Compare the theoretical and practical results under load conditions and build confidence in the understanding of, and the application of theory to practice. Work safety by taking adequate precautions when testing power equipment under laboratory conditions.

**(iii) Transferable**

- Analyse complex electrical circuits in logical steps and apply the fundamental laws of electrical circuit analysis and electromagnetism, to other problems (systems, networks etc.). Write technical reports.

## 3. Indicative Content

- DC CIRCUITS - Circuit elements. Ohm's law, Kirchhoff's laws, Thevenin's and Norton's theorems, mesh and nodal analysis. Energy storage and power dissipation/transfer.

- AC CIRCUITS - Sinusoidal excitation, peak and r.m.s. values, phasors. Reactances and impedance. Applications of circuit theorems to AC circuits. Real power, reactive power and volt amps. 3 phase fundamentals.

- ELECTRICAL MACHINES FUNDAMENTALS - Ampere's and Faraday's laws. Magnetic circuit analysis. Eddycurrent and hysteresis losses in ferromagnetic materials. Transformers. DC machines (motor and generator). Induction motors. Synchronous generators..

## 4. Lecture Plan

| Week | Beginning | Lecture plan | Notes / support session | Lecturer |
|---|---|---|---|---|
| 1 | 03.02.13 | LECTURE 1: Electrical Current, Voltage, Resistance, Resistivity, Temperature Coefficient of Resistance etc.<br>LECTURE 2: Ohm's law, Kirchoff's Laws, Circuit elements R, L, C, V, I. definition of nodes, branches and meshes. | | FGL |
| 2 | 10.02.13 | LECTURE 3: Equivalent values of R, L, C when connected in series and parallel.<br>LECTURE 4: Power dissipated in R energy stored in L and C. | | FGL |
| 3 | 17.02.13 | LECTURE 5: Transient and Steady-State analysis of DC circuits with R, L, and C.<br>LECTURE 6: Thevenin's equivalent circuit (TEC.) | | FGL |
| 4 | 24.02.13 | LECTURE 7: Norton's equivalent circuit (NEC).<br>LECTURE 8: Power calculation in relation to TEC and NEC. | | FGL |
| 5 | 03.03.13 | LECTURE 9: Maximum Power Transfer in DC circuits<br>LECTURE 10: AC fundamentals, definition of reactances and impedance. | | FGL |
| 6 | 10.03.13 | LECTURE 11: ac resonant circuits, variation of impedance with frequency etc.<br>LECTURE 12: Maximum power transfer in AC circuits | | FGL |
| 7 | 17.03.13 | LECTURE 13: Mesh and nodal analysis of DC and AC circuits<br>LECTURE 14: Faraday's Law Of Electromagnetic Induction, Single Phase Transformer, Voltage and MMF Equations, And The Equivalent Circuit of a Practical Transformer. | | FGL |
| 8 | 24.03.13 | LECTURE 15: Eddy current and Hysteresis losses in AC and machines including transformers.<br>LECTURE 16: Magnetic circuit analysis, energy and forces in magnetic circuits. | | FGL |
| 9 | 28.04.13 | LECTURE 17: Single phase generator<br>LECTURE 20 DC machines | | FGL |
| 10 | 05.05.13 | LECTURE 19: Rotating magnetic field and principles of operation of induction motors.<br>LECTURE 20: Induction motor torque/speed characteristics and torque control in slip ring induction motors. | | FGL |
| 11 | 12.05.13 | LECTURE 21: Revisions | | FGL |
| 12 | 19.05.13 | LECTURE 22: Solution of a Past Exam Paper | | FGL |

## 5. Essential Reading

Course notes and on-line resources

## 6. Teaching and Learning

| Activity Type | Hours | Comments |
|---|---|---|
| Practical classes and workshops | 4 | |
| Tutorial | 12 | |
| Lecture | 24 | |
| Guided independent study | 60 | |
| **TOTAL** | **100** | |

– **2 Lectures** and **1 tutorial** per week for 12 weeks.

– **4 hours of laboratories**.

Remaining 60 hours are for self-study, writing coursework and revision for examinations.

## 7. Assessment

| Assessment Title | Weight | Assessment Type | Exam Semester | Exam length |
|---|---|---|---|---|
| Coursework | 20% | Coursework | | |
| Exam 1 | 80% | Exam | 2 | 2 hrs |
| **TOTAL** | **100%** | | | |

One two-hour written examination paper (80%) and one coursework laboratory report (20%).

## 8. Method of Feedback

1. **Feedback given to students in response to assessed work**
   The assessed coursework is a formal report which is submitted individually, based on the transformer experiment. The requirements of the formal report are discussed in detail during a lecture/tutorial period.

2. **Developmental feedback generated through teaching activities**
   All tutorial questions are solved in class and discussed in depth, during the tutorial periods. The solutions of the tutorial questions take place a week after the students have had enough time to attempt them on their own or in groups.

## 9. Recommended Reading


– WARNES, L. A. A. (Lionel A. A.)., 1998. *Electronic and electrical engineering*:[principlesand practice]. Macmillan.