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## Definitive Module Document (DMD)

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**Module Code:** 1AAD0018

### Title of Module

**Full Title:** Materials and Electrical Science

**Short Title:** Mat & Elec Science

## MODULE

1AAD0018 (A 05/6)

Materials and Electr...

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**Version:** 1

**Credit Points:** 15

**Level / ECTS Level:** 1

**First Offered:** 1/9/2004 00-00-00

### 6. Home Department:

AAD

### 7. Departments(s) contributing to teaching:

### 9. Module Aims:

\* develop an understanding of the scientific principles, general properties and appropriate uses of engineering materials for given engineering environments.

\* develop an understanding of the fundamental principles of electrical circuits and the characteristics and properties of electromechanical machines.

### 10a. Learning Outcomes: Knowledge and Understanding:

\* be able to identify the structure of metals, polymers and ceramics, explain relationships with mechanical and physical properties and recognise their use and limitations in engineering environments.

\* be able to explain electronic principles, analogue and digital circuits and review the operation of electromechanical machines.

### 10b. Learning Outcomes: Skills and Attributes:

\* select materials for applications based on the behaviour of the major classes of engineering materials

\* select appropriate mechanical testing procedures for the evaluation of engineering materials.

\* use electronic test equipment to measure electrical properties of practical systems.

### 11. Module Content

#### 11a Module Content:

This course encompasses (i) electrical science (fundamental concepts of electrical units and relationships, basic AC & DC circuit theory, digital systems and electro-mechanical machines) and (ii) engineering materials (classification

of materials, mechanical and physical properties, structure of materials, testing, materials selection for metals, polymers and ceramics.

Please refer to the teaching plan for a more detailed description.

#### **11b. Further details on how the learning outcomes of the module will be achieved:**

Materials.

1. Classification of materials - metals polymers & ceramics, composites, natural materials. Summary of common physical and mechanical properties and the relative properties of the classes of materials.
2. Structure of materials - atomic and/or molecular bonding in each class of material, periodic table; crystalline structures of metals, alloys and cements/concrete; defects in crystals.
3. Properties and evaluation of materials - elastic and plastic deformation, tensile & compressive strengths, modulus, ductility, toughness, hardness, fatigue strength, specific properties, corrosion resistance.
4. An introduction to practical materials, their properties and selection- metals (Steels, cast-irons, aluminium and its alloys, copper and its alloys); polymers (Thermoplastics, thermosets, elastomers); Ceramics (general & engineering ceramics and semiconductor materials.)

Electrical Science

1. Fundamental concepts; electric and magnetic fields; conduction and resistance; units of volts, amps and watts; circuit symbols, basic circuit elements, EMF and PD, resistance, inductance, capacitance and their units; voltage and current relationships; power and energy.
2. DC circuit theory; resistors and capacitors in series/parallel, Kirchoff's laws, voltage and current dividers; 1st order transient response.
3. AC circuit theory; single-phase generation; sine, square, triangle waveforms, Fourier concept; frequency, period, rms, and peak; the behaviour of discrete R, L and C circuit elements; introduction to phasor diagrams and their manipulation. Series RLC circuits and resonance.
4. Introduction to digital systems; basic logic functions, gates and truth tables.
5. Machines and transformers; electro-mechanical energy conversion and power flow through a machine; 3-phase basics. Introduction to ac and dc machines and their applications.

Attendance. Full attendance and participation is anticipated in order to gain full benefit from the stated programme.

#### **12. Language of Delivery:**

English

#### **13. Language of Assessment:**

English

#### **14. Assessment Details (Academic):**

Coursework: 40

Exam: 60

Other: Typically, assessment will consist of-

Two assessed laboratory, essay or phase test assignments, one from each of the titular component sections and valued at 20% each.

A written examination comprising unseen questions from each section.

Overall pass required, subject to a maximum grade of E2 if not both coursework and examination are passed.

#### **Assessment Notes:**

#### **15. Locations(s):**

UH HATFIELD

#### **16. Pre and Co-Requisite:**

Pre-Requisite

Co-Req

Prohibited

#### **17. Subject Board of Examiner/s:**

#### **18. Comments**

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