

CE 107 MATERIALS

Co-ordinator: Dr J.B. Newman, Room 434, Email j.newman@imperial.ac.uk

Lecturers: Dr J B Newman, (JBN)
Dr B Shollock,
Dr R Murphy,
Dr V Enjily
tba
Mr A Low

Structure: 40 lecture hours and 6 laboratory hours

Links: This module provides information relevant to structural design to be covered in Years 2, 3 and 4.

Aims

To introduce the properties and use of various materials in construction.

SYLLABUS

Metals (16 lecture hours by Dr B Shollock)

The basics of physical metallurgy in the context of structural steels, comprising: atomic and metallic bonding, the crystallographic nature of metals, mechanical testing, alloys and solid solutions, strengthening mechanisms, phase transformations and grain size control. Steel manufacture. Welding. Corrosion. Brittle fracture. Steel specifications. The causes and prevention of in-service failures.

Concrete (16 lecture hours by Dr J B Newman)

Cements (manufacture, chemical and physical aspects, types, hydration, structure of pastes, volume changes). Aggregates (production, properties). Properties of fresh concrete (setting and hardening, heat of hydration, workability, bleeding and segregation, compaction, curing, concreting in hot and cold weather). Properties of hardened concrete (Behaviour under various stress states, durability, intrinsic cracking). Mix design. Special concretes (lightweight, high density, high performance), Specifications.

Timber (2 lecture hours by Dr R Murphy and 2 lecture hours by Dr V Enjily)

Production and structure. Response to stress (stress-strain relationships, creep, ductility, fatigue, fracture resistance). Volume changes. Durability. Introduction to engineering principles, structural properties, design and construction.

Plastics/Composites (4 lecture hours – lecturer tba)

Reasons for selection. Properties of matrix. Types of composites. Properties. Methods of production. Applications. Design methods.

Selection of materials (2 lecture hours by Mr A Low)

Selection of appropriate materials in practice for construction

Assessment

One 3 hour examination at the end of the session containing 10 questions, 4 in Section A (Metals), 4 in Section B (Concrete), 2 in Section C (Timber and Plastics/Composites). A total of 6 questions are to be answered with not less than 2 questions in each of Sections A and B and not less than 1 question in Section C.

Recommended Textbooks/Reading

- Detailed handouts during lectures
- Illston, JM & Domone, PLJ (Eds.), Construction Materials: Their nature and behaviour (General: including Metals, Concrete, Timber, Plastics/Composites)
- Llewellyn, DT, Steels : Metallurgy and Applications (Metals)
- Callister, WD, Materials Science and Engineering : an Introduction (Metals)
- Neville, AM, Properties of concrete, 4th Ed. (Concrete)
- Desch, HE & Dinwoodie, JM, Timber - Structure, Properties, Conversion and Use, 7th Ed. (Timber)
- Dinwoodie, JM, Timber: Its nature and behaviour (Timber)
- Hollaway, L, Polymer Composites for Civil and Structural Engineers (Plastics/Composites)
- Gordon, JE, The New Science of Strong Materials (Plastics/Composites)
- COMPACT computer-aided learning material on the Departmental computer network (Concrete)

Learning outcomes

At the end of the module a student should be able to appreciate the principal engineering properties of a range of materials used in Civil Engineering and their relevance to the processes of selection, design and construction.