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| <b>Module Title:</b><br>Design and build project   | <b>Module Code: AR7404</b><br><br><b>Level: 7</b><br><br><b>Credit: 15</b><br><b>ECTS credit: 7.5</b> | <b>Module Leader:</b> Trish Andrews<br><br><b>Additional Tutors:</b> Louise Halestrap, John Carter, Gwyn Stacey, Pat Borer and visiting tutors and lecturers from the professions |
| Pre-requisite: None  |   | Pre-cursor: None  |
| Co-requisite: None   |   | Excluded combinations: None   |
| Is this module part of the Skills Curriculum? No   |   | University-wide option: No  |
| <b>Location of delivery:</b> Centre for Alternative Technology   |   |   |
| <b>Main aim(s) of the module:</b><br><br>The aim of this module is to develop an advanced understanding of the practical aspects of implementing designs and construction in practice. This module will offer students the opportunity to gain knowledge of a selection of sustainable building systems through hands-on building workshops. It will also offer students the opportunity to design a small structure that can be built at 1:1 scale by students at CAT and with the available facilities. Two to 4 designs from the cohort's submissions will be selected and built by groups of students, who will also analyse and develop an understanding of the costs and industry implications of such construction.   |   |   |
| <b>Main topics of study:</b><br><br><ul style="list-style-type: none"> <li>• Resource Limitations to materials</li> <li>• Natural and synthetic fibre Insulations</li> <li>• Moisture handling and materials in Renovation</li> <li>• Straw bale construction</li> <li>• Cementitious materials (limes and cements)</li> <li>• Hemp and binder construction and use in renovation</li> <li>• Composite materials and boards</li> <li>• Modular pre-fabricated building components</li> <li>• Timber use</li> <li>• Earth and clay building (e.g. Rammed Earth, Light Earth)</li> <li>• Environmental Assessment methods for materials (e.g. Life Cycle Assessment, Embodied Energy, Embodied Carbon)</li> <li>• Modern methods of sustainable construction</li> <li>• Environmental Impacts of materials (CO<sub>2</sub>, biodiversity)</li> <li>• Health impacts and safety issues of materials</li> <li>• Material's testing</li> <li>• Practical implications of use</li> </ul> |   |   |
| <b>Learning Outcomes for the module - at the end of this module, students will be able to demonstrate:</b><br><i>(note reference numbers e.g. GC3.1, relate to ARB criteria of accreditation)</i>  |   |   |
| <b>Knowledge of</b><br>1. Sustainable and natural building systems such as straw bale, lime and rammed earth construction  |   |   |
| <b>Understanding of</b><br>2. the impact of buildings on the environment , and the precepts of sustainable design (GC5.2)<br>3. the investigation, critical appraisal and selection of alternative structural, constructional and material systems relevant to architectural design (GC8.1)<br>4. strategies for building construction, and ability to integrate knowledge of structural theories and construction techniques (GC8.2)  |   |   |

5. the physical properties and characteristics of building materials, components and systems, and the environmental impact of specification choices (GC8.3)

**Ability to**

6. critically examine the financial factors implied in varying building types, constructional systems, and specification choices, and the impact of these on architectural design (GC10.1)
7. understand the cost control mechanisms which operate during the development of a project (GC10.2)
8. ability to evaluate materials, processes and techniques that apply to complex architectural designs and building construction, and to integrate these into practicable design proposals

**Teaching/ learning methods/strategies used to enable the achievement of learning outcomes:**

- the principles of the materials and construction systems will be learned through lectures and workshops and personal study
- students will also be able to apply the building theory into practice in hands-on workshops
- concurrently students will have the opportunity to develop a design for a small structure using sustainable building methods
- two to 4 designs will be selected and this provides a few students with the experience of building one of their designs. Every student will have the opportunity to see a design develop into a built structure.
- Students will also be required to consider within a structured report the costs and industry challenges that would apply to building such structures in practice.

**Reading and resources for the module:**

**Core**

Berge, B. (2000) *The ecology of building materials*. Oxford: Butterworth-Heinemann

McDonough, William; Braungart, Michael (2002) *Cradle to cradle: remaking the way we make things*. New York : North Point Press

Kibert, C. J.; Sendzimir, J.; Guy, G. B. (2001) *Construction ecology: nature as the basis for green buildings*. New York: Taylor & Francis.

Ryan, C. (2011). *Traditional construction for a sustainable future*. Abingdon, Oxon: Spon Press.

**Structures**

Silver, P. / McLean, W. / Evans, P. (2014) *Structural Engineering for Architects: A Handbook*. Laurence King

Millais, M. (2005). *Building Structures*. Abingdon: Taylor and Francis.

Popovic Larsen, O.; Tyas, A. (2003) *Conceptual structural design: bridging the gap between architects and engineers*. London: Thomas Telford

**Construction**

Bevan, R. and Woolley, T. (2008). *Hemp lime construction: A guide to building with hemp lime composites*. Bracknell, IHS BRE Press.

Borer, P. and Harris, C (1998) *Out of the Woods: Ecological Designs for Timber Frame Self Build*. Centre for Alternative Technology.

Broome, Jon and Richardson, Brian (1995) *The Self-build Book: How to Enjoy Designing and Building Your Own Home*. Green Earth Books.

Counsell, S. (1990) *The good wood guide: A friends of the earth handbook*.. London: Friends of the Earth.

Elizabeth L. and Adams C. Eds. (2000) *Alternative construction: contemporary natural building methods*. New York: Wiley

Galindo, M. (2012). *Wood: Architecture and design*. Salenstein, Switzerland: Braun.

Holmes, S. and Wingate, M. (2002). *Building with lime: A practical introduction*, 2nd revised edition. London, ITDG Publishing.

Lancashire, Robin and Taylor, Lewis (2011) *Timber frame construction: designing for high performance* (5th edition). High Wycomb: TRADA Technology.

Minke, G. and Mahlke, F.(2005). *Building with straw: Design and technology of a sustainable architecture*. Basel: Birkhauser.

Minke, G. (2006). *Building with earth: Design and technology of a sustainable architecture*. Basel: Birkhäuser.

Ryan, C. (2011). *Traditional construction for a sustainable future*. Abingdon, Oxon: Spon Press.

Walker, P. et al. (2005). *Rammed earth: Design and construction guidelines*: BRE Press.

Also refer to reading lists from other modules

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| <b>Assessment methods which enable students to demonstrate the learning outcomes for the module:</b> |   | <b>Weighting:</b> | <b>Learning Outcomes demonstrated</b> |
| Design & implementation report   |   | 100%              | 1-5 and 8                             |
| <b>Indicative learning and teaching time (10 hrs per credit):</b>                                    | <b>Activity</b>   |                   |                                       |
| 1. Student/tutor interaction, some of which may be online: hours 60                                  | Design tutorials, Workshops, Lectures, Seminars, Reviews    |                   |                                       |
| 2. Student learning time: hours 90   | Background research and preparation, Assignment preparation |                   |                                       |
| <b>Total hours 150</b>   |   |                   |                                       |