Module Title: Technical Report for FDP	**Module Code: AR7407** **Level: 7** **Credit: 30** **ECTS credit: 15**	**Module Leader: John Carter** **Additional Tutors:** Trish Andrews, Pat Borer, Gwyn Stacey, Louise Halestrap and visiting tutors and lecturers from the professions
Pre-requisite: Integrated Design 1 and 2 and Architectural analysis through writing 1		Pre-cursor: None
Co-requisite: None		Excluded combinations: None
Is this module part of the Skills Curriculum? No		University-wide option: No
Location of delivery: Centre for Alternative Technology		

Main aim(s) of the module:

This module offers students the opportunity to systematically and rigorously develop the technical design solutions associated with the FDP comprehensively and to a high level of resolution. In doing so students will draw from previous learning and expand this understanding and develop the ability to apply such knowledge and understanding in an integrated manner as part the design process and in a way that enhances the architecture.

Main topics of study:

Structure and construction:

- Structural principles and design strategies, advantages and challenges of systems
- Construction materials, including external and internal finishes, and their assembly and characteristics including durability and sustainability
- Embodied energy assessment calculations
- Introduction to elemental costing calculation and financial implication of design choices and construction systems

Energy and environmental design and assessments:

- Thermal design strategies (including insulation, thermal mass, passive solar, day-lighting, ventilation and cooling).
- Thermal transmittance calculations
- Calculation of the relative heat loss through the different construction elements, heat loss through infiltration and ventilation and heat gains from passive sources.
- Estimates of the whole-building specific heat loss (in W/K) and peak heat loss in kW (boiler size).
- Annual heating requirement (in kWh/a and KWh/m2.a) calculations
- Daylight design and assessment methods
- Principles for estimating electrical loads and the annual electricity consumption.
- Introduction to environmental and/or energy assessment tools, benchmarking and simulation modelling etc.

Comfort & Users:

- Principles of accessible environments
- Indoor air quality and ventilation and thermal comfort.
- Principles of acoustics (e.g. reverberation times and acoustic separation)

Services:

- Principles of heating, cooling and ventilation.
- Principles of artificial lighting strategy, lighting layouts.
- Renewable energy and FiT and RHI.
- Strategies for water supply and sewage, grey water and rainwater disposal.
- Principles of fire prevention and resistance and safe escape configurations

Learning Outcomes for the module - at the end of this module, students will be able to demonstrate:
(note reference numbers e.g. GC3.1, relate to ARB criteria of accreditation)

Knowledge of

1. principles associated with designing optimum visual, thermal and acoustic environments (GC9.1)
2. systems for environmental comfort realised within relevant precepts of sustainable design (GC9.2)
3. strategies for building services and ability to integrate these in a design project (GC9.3)

Understanding of

4. the impact of buildings on the environment , and the precepts of sustainable design (GC5.2)
5. the role of the architect within the design team and construction industry, recognising the importance of current methods and trends in the construction of the built environment (GC6.2)
6. the investigation, critical appraisal and selection of alternative structural, constructional and material systems relevant to architectural design (GC8.1)
7. strategies for building construction, and ability to integrate knowledge of structural theories and construction techniques (GC8.2)
8. the physical properties and characteristics of building materials, components and systems, and the environmental impact of specification choices (GC8.3)

Ability to

9. understand the constructional and structural systems, the environmental strategies and the regulatory requirements that apply to the design and construction of a comprehensive design project (GC1.2)
10. ability to evaluate materials, processes and techniques that apply to complex architectural designs and building construction, and to integrate these into practicable design proposals;
11. 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)
12. understand the cost control mechanisms which operate during the development of a project (GC10.2)
13. prepare designs that will meet building users' requirements and comply with UK legislation, appropriate performance standards and health and safety requirements (GC10.3)

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

- Key principles will be conveyed to students in lectures, seminars and workshops
- Group and one-to-one tutorials with specialist industry professionals and academic staff will support students in their development of their technological design
- Students will be required to further their understanding of the subject areas introduced by academic staff through self-direct research and learning
- Interim formative submissions will enable students to learn and apply the lessons learnt from the feedback to their technology design and final submission

Reading and resources for the module:
Core

Ballard Bell, V. & Rand, P. (2014). *Materials for Architectural Design 2.* Laurence King
Frampton, K. Edited: Cava, J. (2001). *Studies in Tectonic Culture: The poetics of Construction in Nineteenth and Twentieth Century Architecture*. MIT Press.

Construction

Bachman, L R. (2002). *Integrated Buildings: The Systems Basis of Architecture*. John Wiley & Sons
Dawson, S. et al (ed.) (1989–2005). *Architects Working Details Volumes* 1-10 BRE/ CRC
Õsterreichisches Institut für Baubiologie und –ökologie (2008) *Passivhaus-Bauteilkatalog: Ökologisch bewertete Konstruktion*. Wien: Springer
Richarz, Clemens; Zeitler, Friedemann; Schulz, Christina (2007) Ener*gy-efficiency upgrades: principles, details, examples*. Basel: Birkhäuser ; Munich : Edition Detail

Smith, Peter (2004) *Eco-refurbishment: a guide to saving and producing energy in the home*. Oxford: Architectural Press.
Yates, Tim (2006) *Sustainable refurbishment of Victorian housing: guidance, assessment method and case studies*. Watford: BRE Trust

Water
Grant N., Moodie M. & Weedon, C. (2012), *Choosing Ecological Sewage Treatment*. CAT Publications, Machynlleth.
Harper P. and Halestrap L. (1999) *Lifting the Lid. An Ecological Approach to Toilet Systems*. CAT Publications, Machynlleth.
LaGro J.A. (2008) *Site Analysis: A Contextual Approach to Sustainable Land Use*. John Wiley and Sons, Hoboken.
Ludwig F., Kabat P., van Shaik H., van der Valk M. (2009) *Climate Change Adaptation In The Water Sector*. Earthscan, London.

Services
Cantor J. and Harper G. (2011)*Heat Pumps for the Home*. The Crowood Press, Marlborough.
Santamouris M. (editor) (2007). *Advances in passive Cooling*. (BEST (Buildings, Energy and Solar Technology)). Earthscan, Abingdon
Harvey, L. D. D., (2010) *Energy and the New Reality 1: Energy Efficiency and the Demand for Energy Services*. Earthscan. London,

Energy generation
Boyle, G. (ed.) (2012) *Renewable Energy: Power for a Sustainable Future.* 3rd edition. Oxford University Press, Oxford.
CIBSE (2006). *Renewable energy sources for buildings* TM38, London: The Chartered Institution of Building Services Engineers.
EEBPH (2004). *Renewable energy sources for homes in urban environments* Energy Efficiency Best Practice in Housing, Energy Saving Trust.
Elliott, D. (2007). *Sustainable energy: opportunities and limitations.* New York: Palgrave Macmillan.
Faber Maunsell (2004). *London Renewables: integrating renewable energy into new developments: toolkit for planners, developers and consultants* London: Greater London Authority.
Harvey, L. D. D., (2010) *Energy and the New Reality 2. Carbon-Free Energy Supply*. London Earthscan.
MacKay, D. J. C., (2009) *Sustainable Energy - Without the Hot Air.* Cambridge: UIT. (*www.withouthotair.com*)
Manwell J. F., McGowan A. G. and Rogers A. L.(2009)*Wind Energy Explained*. 2nd edition. Wiley-Blackwell, Oxford.
Messenger, R. & Ventre, J., (2010) *Photovoltaic Systems Engineering*. 3rd edition. CRC Press, Oxford.
Smith, Adrian, Kern, Florian, Raven, Rob and Verhees, Bram (2013) *Spaces for sustainable innovation: solar photovoltaic electricity in the UK. T*echnological Forecasting & Social Change.
Ruyssevelt, P. & Burton, S. (2005). *Low or zero carbon energy sources: final report* Building Research Technical Report 3/2005, London: Office of the Deputy Prime Minister.
Smith, P. F. (2003). *Sustainability at the cutting edge: emerging technologies for low energy buildings.* Oxford: Architectural Press.
TCPA (2006). *Sustainable energy by design.* London: Town and Country Planning Association.
Twidell, J. and Weir, T. (2015) *Renewable Energy Resources.* 3rd edition. Taylor and Francis, Oxford.
van Loo, S. and Koppejan, J., (2008)The *Handbook of Biomass Combustion and Co-firing* Earthscan, London

Energy modelling, management and monitoring
Barrow, C. (1999) *Environmental Management: Principles and Practice,* Routledge, Oxford (reprinted 2005).
Bell, S. and Morse, S. (2008). *Sustainability Indicators: Measuring the Immeasurable?*2nd edition, Earthscan, London.
BSRIA and UBT (2009) *The Soft Landings Framework: for better briefing, design, handover and building performance in-use*. BISRIA, Berkshire.
Henson J.L.M. & Lamberts R. (2011). *Building Performance Simulation for Design and Operation*. Spon Press, Abingdon.
Jankovic L. (2012). *Designing Zero Carbon Buildings Using Dynamic Simulation Methods*. Routledge, Abingdon.

Also refer to reading lists from other modules		
Assessment methods which enable students to demonstrate the learning outcomes for the module:	**Weighting:**	**Learning Outcomes demonstrated**
Technical report associated with FDP	100%	1-13

Indicative learning and teaching time (10 hrs per credit):	**Activity**
1. Student/tutor interaction, some of which may be online: hours 70	Tutorials, Workshops, Lectures, Seminars, Studio work, Reviews
2. Student learning time: hours 230	Background research and preparation, Assignment preparation,
Total hours 300	