Syllabus

Civil Engineering
Architectural Engineering
Construction Project Management
Quantity Surveying

Year 1 & Year 2

Kings Cornerstone International College

Unit 1: Individual Project (Pearson-set)

Unit code	**R/615/1387**
Unit type	**Core**
Unit level	**4**
Credit value	**15**

Introduction

The ability to define, plan and undertake a project is a critical set of skills needed in various roles within the construction industry. Identifying appropriate information and analysing this, to formulate clear results or recommendations, is required to underpin many of the processes that inform construction projects.

The aim of this unit is to support students in using and applying the knowledge and skills they have developed through other areas of their studies to complete and present an individual project. In addition, this unit will provide students with key study skills that will support them in further study.

Students will be able to identify, define, plan, develop and execute a successful project by working through a clear process. They will develop a project brief; outlining a problem that requires a solution, as well as a project specification, the specific requirements of which the final outcome must meet. They will research the problem, undertaking a feasibility study, and consider a range of potential solutions using critical analysis and evaluation techniques to test, select and contextualise their preferred solution. Students will provide a work and time management plan, keeping a diary of all activities, reflecting on their process and their learning throughout the project.

***Please refer to the accompanying Pearson-set Assignment Guide and the Theme Release document for further support and guidance on the delivery of the Pearson-set unit.**

Learning Outcomes

By the end of this unit, a student will be able to:

1 Formulate a project that will provide a solution to an identified problem

2 Manage a project within agreed timescales and specification; documenting the process throughout

3 Evaluate potential project management solutions

4 Produce a project report and deliver a presentation of the final project outcomes.

Essential Content

LO1 **Formulate a project that will provide a solution to an identified problem**

Project identification

Research methods

Feasibility studies

Brief and specification

LO2 **Manage a project within agreed timescales and specification, documenting the process throughout**

Resources and resource planning

Costs and cost planning

Work plan:

Gantt charts

Project Evaluation and Review Technique (PERT) charts

Critical Path Method (CPM).

Project tracking:

Progress tracking

Milestones.

LO3 **Evaluate potential project management solutions**

PERT analysis

CPM analysis

LO4 **Produce a project report and deliver a presentation of the final project outcomes**

Report formats

Presentation techniques.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Formulate a project that will provide a solution to an identified problem</td><td rowspan="5">LO1 and LO2

D1 Evaluate the relationship between project identification, feasibility and project planning, with consideration of the impact of project scope on time and resources</td></tr>
<tr><td>P1 Select an appropriate construction-based project, giving reasons for your choice

P2 Identify the main components of a project specification</td><td>M1 Explain why the project specification is of fundamental importance to a successful project outcome</td></tr>
<tr><td colspan="2">LO2 Manage a project within agreed timescales and specification, documenting the process throughout</td></tr>
<tr><td>P3 Identify potential resources, costs and timescales

P4 Describe a range of appropriate techniques for generating realistic potential solutions</td><td>M2 Prepare and update a project management plan, using standard systems of time and resource tracking</td></tr>
</table>

Pass	Merit	Distinction
LO3 Evaluate potential project management solutions		
P5 Explore project management strategies to determine suitability for a given project **P6** Justify the selection of your preferred solution, making reference to your initial project specification	**M3** Compare the outcomes of your initial planned resources, timescales and costs against actual outcomes	**LO3 and LO4** **D2** Appraise your own performance in managing the project; draw conclusions and make recommendations that would further improve your performance in the future
LO4 Produce a project report and deliver a presentation of the final project outcomes		
P7 Produce a written report identifying each stage of the project **P8** Utilise appropriate forms of referencing and citation in the preparation of a written report **P9** Prepare a presentation of your final project outcomes, utilising industry standard software	**M4** Present your final project outcomes and recommendations to a selected audience	

Recommended Resources

Textbooks

BALDWIN, A. (2014) *Handbook for Construction Planning and Scheduling*. London: Wiley-Blackwell.

BUSSEY, P. (2015) CDM 2015: *A Practical Guide for Architects and Designers*. London: RIBA.

CIOB (2010) *Guide to Good Practice in the Management of Time in Complex Projects*. London: Chartered Institute of Building.

GOETSCH, D.L. (2011) *Construction Safety & Health*. London: Pearson.

KELLY, J. and MALE, S. (1992) *Value Management in Design and Construction: The Economic Management of Project*. London: Taylor & Francis.

LAWSON, B. (2005) *How Designers Think: The Design Process Demystified*. London: Routledge.

POTTS, K. and ANKRAH, N. (2014) *Construction Cost Management: Learning from Case Studies*. London: Routledge.

WYATT, D. (2007) *Construction Specifications: Principles and Applications*. New York: Delmar.

Unit 2: Construction Technology

Unit code	**Y/615/1388**
Unit type	**Core**
Unit level	**4**
Credit value	**15**

Introduction

The basic principles of construction technology have not changed for hundreds of years. However, the materials and techniques used to achieve these basic principles are constantly evolving; to enable the construction industry to deliver better quality buildings. Scarcity of resources and the continuing demand of more sophisticated clients, end users and other stakeholder interests, are driving the construction industry to provide buildings which facilitate enhanced environmental and energy performance, and greater flexibility, in response to ever increasing financial, environmental, legal and economic constraints.

This unit will introduce the different technological concepts used to enable the construction of building elements; from substructure to completion, by understanding the different functional characteristics and design considerations to be borne in mind when selecting the most suitable technological solution.

Topics included in this unit are: substructure, superstructure, finishes, building services and infrastructure components. On successful completion of this unit a student will be able to analyse scenarios and select the most appropriate construction technology solution.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Explain the terminology used in construction technology

2 Describe the different techniques used to construct a range of substructures and superstructures, including their function and design selection criteria

3 Identify the different types of civil engineering/infrastructure technology used in support of buildings

4 Illustrate the supply and distribution of a range of building services and how they are accommodated within the building.

Essential Content

LO1 Explain the terminology used in construction technology

Types of construction activity:

Low, medium and high-rise buildings, domestic buildings, for example house, flats and other multi-occupancy buildings, commercial buildings, for example offices and shops, industrial buildings, for example, light industrial and warehouses.

Construction technology terminology:

Loadbearing and non-loadbearing, structural stability, movement and thermal expansion, durability, weather and moisture resistance, aesthetics, fire resistance, sound insulation, resistance to heat loss and thermal transmission, dimensional co-ordination and standardisation, sustainability and scarcity of availability, on-site and off-site construction, legal requirements, buildability, health & safety.

Construction information:

Drawings, specification, schedules, CAD, Building Information Modelling (BIM).

Sustainability:

Supply chain

Lifecycle

'Cradle-to-grave'

'Cradle-to-cradle'

Circular economies.

LO2 **Describe the different techniques used to construct a range of substructures and superstructures, including their function and design selection criteria**

Pre-design studies:

Desk-top, Site Reconnaissance, Direct Soil Investigation techniques.

Substructure functions and design considerations:

Different methods for gathering disturbed and undisturbed samples, influence of soil type on foundation design, including water and chemical content, potential loads, position of trees and the impact on foundations, economic considerations, legal considerations (health & safety work in excavations), building regulations, plant requirements.

Types of foundations:

Shallow and deep foundations, strip and deep strip foundations, pad foundations, raft foundations, piled foundations (replacement and displacement piles).

Types of superstructure:

Traditional construction, framed construction: steel, composite concrete and steel, timber.

Walls; roofs; structural frames; claddings; finishes; services.

Walls:

External walls: traditional cavity, timber frame, lightweight steel.

Cladding: panel systems, infill systems, composite panel systems, internal partition walls.

Roofs:

Pitched and flat roof systems, roof coverings.

Floors:

Ground floors, intermediate floors, floor finishes.

Staircases:

Timber, concrete, metal staircases, means of escape.

Finishes:

Ceiling, wall and floor finishes.

LO3 **Identify the different types of civil engineering/infrastructure technology used in support of buildings**

Site remediation and de-watering:

Contamination management: cut-off techniques, encapsulation.

Soil remediation: stone piling, vibro-compaction.

De-watering: permanent sheet piling, secant piling, grout injection freezing, temporary techniques, such as pumping, wells, electro-osmosis.

Substructure works:

Basement construction: steel sheet piling, concrete diaphragm walls, coffer dams, caissons, culverts.

Superstructure works:

Reinforced concrete work: formwork, reinforcement, fabrication, concrete, steel.

LO4 **Illustrate the supply and distribution of a range of building services and how they are accommodated within the building**

Primary service supply

Cold water

Gas

Electricity.

Services distribution

Hot and cold water

Single-phase and 3-phase electricity

Air conditioning ductwork.

Services accommodation:

Raised access flooring

Suspended ceilings

Partitioning

Rising ducts.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Explain the terminology used in construction technology</td><td rowspan="3">D1 Evaluate how the functional characteristics and design selection criteria impact on the eventual design solution</td></tr>
<tr><td>P1 Describe the differences between residential, commercial and industrial buildings

P2 Explain how the functional characteristics and design selection criteria are informed by proposed building use

P3 Discuss the ways in which sustainability can be promoted in building projects</td><td>M1 Apply the terminology used in construction technology to a given building construction project</td></tr>
<tr><td colspan="2">LO2 Describe the different techniques used to construct a range of substructures and superstructures, including their function and design selection criteria</td></tr>
<tr><td>P4 Describe the pre-design studies carried out and types of information collected for a given construction site

P5 Explain the functional characteristics and design criteria for primary and secondary elements of a building substructure and superstructure</td><td>M2 Analyse how site conditions impact on the design of foundations

M3 Illustrate how the component parts of an element allow it to fulfil its function</td><td rowspan="3">LO2 and LO3

D2 Prepare a design report identifying superstructure, substructure and civil engineering structures necessary for a given building construction project</td></tr>
<tr><td colspan="2">LO3 Identify the different types of civil engineering/infrastructure technology used in support of buildings</td></tr>
<tr><td>P6 Describe techniques used for remediating the site prior to construction commencing

P7 Describe the types of substructure works carried out by civil engineers</td><td>M4 Compare different types of structural frame used to carry the primary and secondary elements of the superstructure</td></tr>
</table>

Pass	Merit	Distinction
LO4 Illustrate the supply and distribution of a range of building services and how they are accommodated within the building.		
P8 Describe the supply arrangements for primary services **P9** Explain the distribution arrangements for primary services	**M5** Demonstrate the elements of the superstructure used to facilitate the primary services	**D3** Appraise how the distribution of the primary services impact on the overall design of the building

Recommended Resources

Textbooks

BRYAN, T. (2010) *Construction Technology: Analysis and Choice*, Oxford: Blackwell.

CHARTLETT, A. and MAYBERY-THOMAS, C. (2013) *Fundamental Building Technology*. 3rd ed. Abingdon: Routledge.

CHUDLEY, R. et al. (2012) *Advanced Construction Technology*. 5th ed. Harlow: Pearson Education Limited.

CHUDLEY, R. and GRENNO, R. (2016) *Building Construction Handbook*. Abingdon: Routledge.

FLEMING, E. (2005) *Construction Technology: An Illustrated Introduction*. Oxford: Blackwell.

Unit 3: Science & Materials

Unit code	**D/615/1389**
Unit type	**Core**
Credit value	**15**

Introduction

Science and material performance are intrinsically linked through the need to create structures and spaces that perform in both mechanical operation and in providing human comfort.

This unit aims to support students to make material choices to achieve the desired outcomes of a brief. This is approached from the perspective of materials being fit for purpose; as defined by testing standards and properties, but also by consideration of the environmental impact and sustainability. Awareness of Health & Safety is considered alongside the need to meet legislative requirements.

The topics covered in this unit include: Health & Safety; storage and use of materials; handling, and problems associated with misuse and unprotected use; environmental and sustainable consideration in material choices; and human comfort performance parameters. Material choice is developed through the understanding of testing procedures to establish conformity to standards and define performance properties. The performance of materials to satisfy regulations and provide appropriate comfort levels is addressed through design and calculations.

Upon successful completion of this unit students will be able to make informed decisions regarding material choices; based on understanding the structural behaviour of materials established through recognised testing methods, sustainability, context of build, and Health & Safety. Students will also be able to perform the calculations necessary to establish anticipated performance of the materials in-use and therefore determine their compliance with regulations and suitability.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Review health & safety regulations and legislation associated with the storage, handling and use of materials on a construction site

2 Discuss the environmental and sustainability factors which can impact on and influence the material choices for a construction project

3 Present material choices for a given building using performance properties, experimental data, sustainability and environmental consideration

4 Evaluate the performance of a given building in respect of its human comfort requirements.

Essential Content

LO1 **Review health & safety regulations and legislation associated with the storage, handling and use of materials on a construction site**

Regulations and guidance:

Health & safety management regulations

Design management regulations

Provision and use of equipment regulations

Control and management of hazardous materials through storage, movement and use.

Materials handling and installation:

Risk assessments and method statements (qualitative and quantitative)

Materials storage: moving materials safely; working in confined spaces; working at height

Occupational health risks associated with materials: asbestos-related and respiratory disease; dermatitis and skin problems; musculoskeletal disorders; hand arm vibration

Personal Protective Equipment (PPE).

LO2 **Discuss the environmental and sustainability factors which can impact and influence the material choices for a construction project**

Environmental considerations:

Lifecycle assessment

Environmental profile methodology

Environmental product declaration and certification

Embodied energy

Waste management: the economics and technologies of construction waste disposal.

Sustainability:

Resource availability and depletion: renewable and non-renewable materials

Reuse and recycling of construction and demolition waste

Waste and Resources Action Programme (WRAP).

Environmental assessment methods:

Building Research Establishment Environmental Assessment Method (BREEAM)

Leadership in Energy and Environmental Design (LEED)

Green Star

Estidama, or other forms of environmental assessment

Construction Industry Research Information Association.

LO3 **Present material choices for a given building using performance properties, experimental data, sustainability and environmental consideration**

Material testing:

Testing methods, interpreting test data

Codes and standards.

Structural behaviours

Performance properties: strength, elasticity, toughness, hardness, creep, fatigue, porosity, brittleness, density, thermal conductivity, durability

Inherent material properties.

Relationship between material properties, behaviour and use

LO4 **Evaluate the performance of a given building in respect of its human comfort requirements**

Human comfort provision:

Indoor environmental quality: thermal, illumination, sound, ventilation

Thermal losses and gains

Passive and active design: design solutions, environmental benefit vs implementation cost

Calculations of u-values, lux levels, acoustic and ventilation.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Review health & safety regulations and legislation associated with the storage, handling and use of materials on a construction site		
P1 Explain how regulations impact on the use, storage and handling of a selection of vocationally typical construction materials	**M1** Assess how risk assessments can be used to address significant hazards posed by selected materials or activities	**D1** Discuss how multiple regulations and legislation would apply to a given site activity, highlighting how to plan and manage for safe handling and use

Pass	Merit	Distinction
LO2 Discuss the environmental and sustainability factors which impact on and influence the material choices for a construction project		
P2 Explain material environmental profiling and lifecycle assessment Use a relevant material to exemplify your explanation **P3** Discuss the benefits of product declaration and environmental certification	**M2** Produce a waste management plan for a given project, taking into account a typical range of relevant waste materials	**LO2 and LO3** **D2** Illustrate how the use of sustainable practices and considerations for material choice can improve the environmental rating of the completed building
LO3 Present material choices for a given building using performance properties, experimental data, sustainability and environmental consideration		
P4 Present the results of relevant testing procedures to identify performance characteristics of selected construction materials **P5** Discuss the results in terms of the material properties and regulatory requirements, highlighting any unexpected results and why these may occur **P6** Select construction materials for a given building based upon their performance properties in use	**M3** Assess the effects of loading structural materials and compare the behaviours and performance of materials which could be used for the same function	

Pass	Merit	Distinction
LO4 Evaluate the performance of a given building in respect of its human comfort requirements.		
P7 Define a material selection strategy with regard to human comfort requirements **P8** Identify materials for a selected area within a building and explain how these contribute to a balanced indoor environment	**M4** Perform calculations which relate to a selected area (lux levels, u-values, acoustic and ventilation)	**D3** Evaluate how the use of passive or active strategies can minimise energy, materials, water, and land use

Recommended Resources

Textbooks

BLANC, A. (2014) *Internal Components*. Abingdon: Routledge.

BUXTON, P. (2015) *Metric Handbook: Planning and Design Data*. Abingdon: Routledge.

CASINI, M. (2016) *Smart Buildings: Advanced Materials and Nanotechnology to Improve Energy*. Duxford: Woodhead Publishing.

CLAISSE, P.A. (2015) *Civil Engineering Materials*. Kidlington: Butterworth-Heinemann.

DEAN, Y. (1996) *Materials Technology* (Mitchells Building Series). Abingdon: Routledge.

DORAN, D. and CATHER, B. (2013) *Construction Materials Reference Book*. Abingdon: Routledge.

EVERETT, A. (1994) *Materials. (Mitchells Building Series)*. 5th ed. Abingdon: Routledge.

KATIB, J.M. (2009) *Sustainability of Construction Materials*. Abingdon: Woodhead Publishing Ltd.

LYONS, A. (2014) *Materials for Architects and Builders*. 5th ed. Abingdon: Routledge.

PACHECO-TORGA, F. and JALALI, S. (2011) *Eco-Efficient Construction and Building Materials*. London: Springer.

PACHECO-TORGA, F. et al. (2013) *Eco-efficient Construction and Building Materials, Life Cycle Assessment (LCA), Eco-Labelling and Case Studies*. London: Springer.

THOMAS, R. (ed.) (2006) *Environmental design: An Introduction for Architects and Engineers*. 3rd ed. London: Taylor & Francis.

Unit 4: Construction Practice & Management

Unit code	**R/615/1390**
Unit type	**Core**
Unit level	**4**
Credit value	**15**

Introduction

The aim of this unit is to develop and provide students with a holistic understanding of construction practice and management processes. Students will investigate and research the modern construction industry, both from the practical skills embedded within the industry through to its linkage with development on-site and the connection with construction management; including roles within the industry.

The unit compares and investigates small, medium and large construction companies within the market place and how construction processes, for development, have evolved.

Students will also explore how Health & Safety has evolved within the industry, including how the major stakeholders, from companies to site operatives, have embedded Health & Safety into their preferred areas of development and careers. In addition, students will explore Building Information Modelling and how it fits into construction processes/sequences ranging from domestic to large-scale and design and build projects.

The knowledge from this unit will provide students with an understanding of modern construction and management; the skills, management of people and projects, and how Health & Safety have changed the perception of the construction industry.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Describe the construction industry with reference to company structures and other activities

2 Explain different types of construction companies in the market and their relationships within the tendering process

3 Discuss the key stages in a construction project, and how Building Information Modelling informs the different stages

4 Analyse how the construction industry has developed suitable collaboration strategies in support of greater recognition of Health & Safety.

Essential Content

LO1 **Describe the construction industry with reference to company structures and other activities**

Understanding of the construction industry:

Historical development of the construction industry

Professional and other institutes, including societies

Links between professional, technical and skills professionals

Contractor and head office structure

Site structure and organisation

Types of contractual work tendered by companies.

LO2 **Explain different types of construction companies in the market and their relationships within the tendering process**

Company types:

Professional relationships between companies

Contract tendering

Tender process.

LO3 **Discuss the key stages in a construction project, and how Building Information Modelling informs the different stages**

Master programmes and contract planning techniques

The role of Building Information Modelling (BIM) on the construction

Modern procurement methods within construction

Sustainability

LO4 **Analyse how the construction industry has developed suitable collaboration strategies in support of greater recognition of Health & Safety**

Key stakeholders in the construction process

BIM and collaboration

Health & safety within the construction industry:

Pre-construction regulations and legislation

Site safety.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Describe the construction industry with reference to company structures and other activities		
P1 Explain how the construction industry has developed and encompassed professionalism within its structures **P2** Demonstrate the scope and linkage between all parties within a construction organisation **P3** Identify the type of contractual work tendered by contractors	**M1** Analyse how the construction industry has developed overall in terms of company structures, it's employees and contracted work	**D1** Critically evaluate how construction companies have developed their structure and business ethos
LO2 Explain different types of construction companies within the market and their relationships within the tendering process		
P4 Identify the different types of construction companies in the market **P5** Explain the relationship between different construction organisations	**M2** Analyse the Analyse the relationships between construction companies through contracts and tendering.	**D2** Compare the factors that influence contract relationships between different organisations involved in tendering.

Pass	Merit	Distinction
LO3 Discuss the key stages in a construction project, and how Building Information Modelling informs the different stages		
P6 Identify, with examples, modern construction processes and sequences used within today's industry, highlighting the way they respond to sustainability needs **P7** Explain contract planning techniques used within micro and macro projects **P8** Identify where BIM impacts upon operations and construction companies	**M3** Analyse how construction has developed in terms of innovation, designs, and within contracts for micro and macro projects, and the interrelationship with BIM	**D3** Provide a detailed analysis of how the construction industry has evolved in terms of innovative construction methods and contracts
LO4 Analyse how the construction industry has developed suitable collaboration strategies in support of greater recognition of Health & Safety.		
P9 Explain how Health & Safety has now become an integrated part of the construction process **P10** Describe the government legislation which has benchmarked Health & Safety within construction **P11** Discuss the role of collaboration and communication in ensuring safe working practices	**M4** Demonstrate how the construction industry has benefited through changes in Health & Safety legislation	**D4** Evaluate the impact of Health & Safety legislation, how it has evolved the drivers for it, and its advantages or weaknesses within construction

Recommended Resources

Textbooks

GRIFFITH, A. and WATSON, P. (2003) *Construction Management: Principles and Practice*. Hampshire: Palgrave Macmillan.

HARRIS, F. and MCCAFFER, R. (2013) *Modern Construction Management*. Chichester: Wiley-Blackwell.

KYMMELL, W. (2007) *Building Information Modeling: Planning and Managing Construction Projects*. New York: McGraw Hill Professional.

OTTOSSON, H. (2012) *Practical Project Management for Building and Construction*. Boca Raton: CRC Press.

Websites

www.ciob.org.uk	Chartered Institute of Building (General Reference)
www.rics.org	Royal Institute of Chartered Surveyors (General Reference)

Unit 5: Legal & Statutory Responsibilities in Construction

Unit code	**Y/615/1391**
Unit level	**4**
Credit value	**15**

Introduction

The construction industry is perceived to be a dangerous, noisy and disruptive area of work which impacts on the use of land and buildings. It is, however, governed by a range of areas of law to ensure that professionals; such as architects, quantity surveyors and contractors, comply with legal and statutory requirements to design, construct and deliver buildings and alterations using safe working practices and utilising land appropriately.

This unit will introduce the different areas of law that are relevant to the construction industry throughout the development process. This includes applying for planning approval to undertake construction activities and using building control regulations to evaluate building design and alterations at the preconstruction stage. The unit will explore the laws of occupiers' liability, trespass and nuisance to manage construction activities on-site, and the legal aspects of the sale and leasing process involved in the disposal of buildings; using the law of contract and land law.

Topics included in this unit are: planning law, building control regulations, insurance, the law of tort and the law of contract and land law.

On successful completion of this unit students will be able to apply legal and statutory requirements and processes common to the construction sector.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Examine the process used to obtain planning permission for the construction and alteration of buildings

2 Discuss the processes and regulations used to control design and to ensure safe buildings

3 Assess the laws used to ensure that construction sites operate safely and consider adjoining land-users

4 Analyse how the law of contract and land law are used to sell and lease land and buildings.

Essential Content

LO1 **Examine the process used to obtain planning permission for the construction and alteration of buildings**

Gaining planning permission:

The legal framework, legislation and regulatory agencies involved in applying for planning permission

Types of development and types of permitted development where approval is not required

Stages and requirements of the application process, including statutory and public notification requirements

Approval process and conditions.

Appealing planning decisions:

The right of appeal open to applicants and the general public, and legal timeframes for appeal

The stages in planning appeal processes, and procedures and notification periods.

Planning enforcement:

Notification processes and procedures

Right of appeal and timeframes.

LO2 **Discuss the processes and regulations used to control design and to ensure safe buildings**

Building control systems:

History and development.

Legal framework, legislation and regulatory agencies.

Requirements of building control and regulations:

Building regulation standards and areas of jurisdiction

Obtaining approval and right of appeal processes

Approvals, inspection and compliance

Enforcement and dangerous buildings.

LO3 **Assess the laws used to ensure that construction sites operate safely and consider adjoining land-users**

Administration of the law:

Courts, personnel, sources of law, including legislation and case law, speciality courts and alternative dispute resolution methods.

Occupiers' liability:

Duty of care, breach of duty, damage, defences, dangerous premises, visitors, children, independent contractors, trespassers and non-visitors, case law and legislation.

Vicarious liability:

Recognising who is an employer and an employee and application of the course of employment rule.

Independent contractors, general principles and non-delegable duties.

Trespass to land:

Intrusion, possession, defences, remedies, including damages, injunction and ejectment

The operation of the construction industry and trespass

Mitigating measures and the Considerate Contractors Scheme.

Nuisance:

Private nuisance, including interference, unlawfulness, impact of continuity, sensitivity and locality, liability, defences and remedies

Public nuisance, including the operation of the construction industry, nuisance mitigating measures and the Considerate Contractors Scheme.

Insurance:

Types of insurance, including public liability insurance

Employers' liability insurance

Contractors' All Risks insurance

Latent Defects insurance

Machinery insurance

Personal accident insurance and contract bonds.

LO4 **Analyse how the law of contract and land law are used to sell and lease land and buildings**

History and development of land ownership:

Types of land ownership and registration of ownership

Tenure restrictions on ownership, including restrictive covenants and easements.

Law of contract and property conveyancing:

Key stages in the law of contract, including offer, intention, capacity and consideration

The stages and requirements of the property conveyancing process.

Landlord and tenant law:

Legislation, construction and types of leases

Lease terms and conditions, rent and repair responsibilities and management of other agreed terms

Terminating and ending a lease

Lease disputes and mediation processes.

Construction activity and party and boundary walls:

Types of wall, including party walls, party structures, boundary and retaining walls

Key legislation, regulations and case law

Trespass and nuisance considerations

Procedures and obligations on neighbour notification and agreement.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Examine the process used to obtain planning permission for the construction and alteration of buildings</td><td rowspan="5">LO1 and LO2

D1 Evaluate the impact of planning systems and building regulations agencies in managing the development of land and buildings</td></tr>
<tr><td>P1 Explain the key legislation and agencies in the planning process

P2 Explain how planning decisions are made and processes available to appeal and monitor them</td><td>M1 Analyse the role of planning systems and agencies in managing the development of land and buildings</td></tr>
<tr><td colspan="2">LO2 Discuss the processes and regulations used to control design and to ensure safe buildings</td></tr>
<tr><td>P3 Explain the key legislation and agencies in the building control process

P4 Discuss how building decisions are determined and the processes available to appeal and monitor them</td><td>M2 Analyse the application of building regulations in low and medium rise residential and commercial buildings.</td></tr>
</table>

Pass	Merit	Distinction
LO3 Assess the laws used to ensure that construction sites operate safely and consider adjoining land-users		
P5 Explain how the law of trespass and nuisance relate to the construction industry **P6** Discuss how the laws of occupiers' liability and vicarious liability apply to the construction industry	**M3** Produce a plan for a contractor to manage the legal impacts of a large urban construction project	**D2** Design a detailed plan for a contractor to reduce the legal impacts of a large urban construction project
LO4 Analyse how the law of contract and land law are used to sell and lease land and buildings.		
P7 Analyse how land law has evolved to shape modern land ownership and the role of contract law in buying and selling property **P8** Discuss how landlord and tenant law is used to manage property	**M4** Evaluate how the application of land law and landlord and tenant law control the disposal and use of property	**D3** Assess the impact of land law and property law in the development and disposal of a large urban construction project

Recommended Resources

Textbooks

CARD, R., MURDOCH, J. and MURDOCH, S. (2011) *Real Estate Management Law*. 7th ed. Oxford: Oxford University Press.

CLOUGH, R.H., SEARS, G.A., SEARS, K.S., SEGNER, R.O. and ROUNDS, J.L. (2015) *Construction Contracting: A Practical Guide to Company Management*. 8th ed. Hoboken: John Wiley & Sons.

MASON, J. (2016) *Construction Law*: *From Beginner to Practitioner*. London: Routledge.

UFF, J. (2013) *Construction Law*. London: Sweet & Maxwell.

Unit 6: Construction Information (Drawing, Detailing, Specification)

Unit code	**D/615/1392**
Unit level	**4**
Credit value	**15**

Introduction

To achieve successful projects in the built environment requires a range of different types of information: to describe the project, quantify the materials, provide clear instructions for assembly and erection, and to allow for accurate costing and management. Throughout the process of design, construction and post-occupancy management, information is critical.

Through this unit students will develop their awareness of different types of construction information and their uses in the process. Students will engage in the production, reading and editing of construction information, in order to understand how this information informs different stages of the process. Using industry standard tools and systems, students will consider the ways that information may be shared and, through this, the value of collaboration in the information process.

Topics included in this unit are: construction drawing, detailing, Computer Aided Design (CAD), Building Information Modelling (BIM), schedules (door, window, hardware, etc.), specifications, schedules of work, bills of quantities and information distribution and collaboration.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Evaluate different types of construction information in the context of diverse project types

2 Develop construction drawings, details, schedules and specifications in support of a given construction project

3 Interpret different types of construction information in order to explain a construction project

4 Assess ways in which construction professionals collaborate in the production of construction information.

Essential Content

LO1 **Evaluate different types of construction information in the context of diverse project types**

Construction drawings

Site plans

Floor plans, roof plans, ceiling plans

General arrangement

Elevations

Assembly drawings

Component drawings/details

Schedules

Door schedules

Window schedules

Hardware schedules

Specifications

Performance specification

Outline specification

Full specification

Specification templates/standards

LO2 **Develop construction drawings, details, schedules and specifications in support of a given construction project**

Computer Aided Design (CAD)

Templates

Title blocks

Annotation

Building Information Modelling (BIM)

Specification software

Bills of quantities

Schedules of works

LO3 **Interpret different types of construction information in order to explain a construction project**

Reading construction drawings

Information co-ordination

Clash detection

'Red-lining'

LO4 **Assess ways in which construction professionals collaborate in the production of construction information**

Project roles

Information production

Hierarchy of roles and information

Project collaboration

Document sharing/distribution

Online/cloud-based collaboration

Building Information Modelling (BIM).

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Evaluate different types of construction information in the context of diverse project types</td><td rowspan="5">LO1 and LO2

D1 Justify the use of specific types of construction information in support of a given project</td></tr>
<tr><td>P1 Explain the use of construction information in the context of a project

P2 Describe the different types of construction information and their uses</td><td>M1 Compare different types of construction information to identify their suitability in specific contexts.</td></tr>
<tr><td colspan="2">LO2 Develop construction drawings, details, schedules and specifications in support of a given construction project</td></tr>
<tr><td>P3 Develop a set of general arrangement drawings, selected details and door/window schedules

P4 Produce an outline bill of quantities</td><td>M2 Compose a schedule of works</td></tr>
</table>

Pass	Merit	Distinction
LO3 Interpret different types of construction information in order to explain a construction project		**LO3 and LO4** **D2** Propose corrections to construction drawings and specifications using industry standard forms of notation
P5 Relate a set of construction drawings to a specification **P6** Evaluate construction drawings and details to identify 'clashes'	**M3** Critique a body of construction information, identifying errors and discrepancies	
LO4 Assess ways in which construction professionals collaborate in the production of construction information.		
P7 Assess the types of information produced by different participants in a construction project **P8** Examine the relationship between different bodies of information and how they work in conjunction	**M4** Compare the roles of CAD and BIM in the collaborative production of construction information	

Recommended Resources

Textbooks

CHING, F.D.K. (2014) *Building Construction Illustrated*. Chichester: John Wiley & Sons.

CHUDLEY, R. (2016) *Building Construction Handbook*. Abingdon, Oxon: Routledge.

Construction Specifications Institute (2011) *The CSI Construction Specifications Practice Guide*. Chichester: John Wiley & Sons.

HUTH, M.W. (2009) *Understanding Construction Drawings*. Delmar Cengage.

KALIN, M. and WEYGANT, R.S. (2010) *Construction Specification Writing: Principles and Procedures*. Chichester: John Wiley & Sons.

KUBBA, S. (2008) *Blueprint Reading: Construction Drawing for the Building Trade*. McGraw-Hill.

Websites

www.designingbuildings.co.uk	Designing Buildings Wiki (General Reference)
www.thenbs.com	The NBS Knowledge (General Reference)
www.csinet.org	CSI (General Reference)

Unit 22: Group Project (Pearson-set)

Unit code	**D/615/1408**
Unit type	**Core**
Unit level	**5**
Credit value	**15**

Introduction

While working in a team is an important skill in construction projects, collaboration goes beyond just teamwork. The success of a project relies not only on the ability of each person in a team to do their work, but on each individual's awareness of how their work relates to the work of others, how to ensure that information is shared effectively and that roles and responsibilities are clear.

Through this collaborative project-based unit, students will explore how to define roles within a collaborative team, recognising the skills (and 'skills gaps') of each member of the group. Together students will work to develop a construction project; based on their research and analysis, in response to the Pearson-set 'theme'.

Content in this unit will typically include role identification and allocation, collaborative structures, human resources management, project management, procurement, tender documentation, information/data sharing, meetings, Health & Safety, project costing and Building Information Modelling.

***Please refer to the accompanying Pearson-set Assignment Guide and the Theme Release document for further support and guidance on the delivery of the Pearson-set unit.**

Learning Outcomes

By the end of this unit, students will be able to:

1 Assess individual and group skills in order to allocate roles within a collaborative team

2 Plan a construction project, based on the Pearson-set theme, in collaboration with others to ensure good practice in resource management, staffing and project scheduling

3 Prepare tender documentation; undertaking work appropriate to a defined role within a team

4 Evaluate own work, and the work of others, in a collaborative team.

Essential content

LO1 **Assess individual and group skills in order to allocate roles within a collaborative team**

Roles and responsibilities:

Skills auditing

Belbin Team Inventory

Myers Briggs Personality Type Indicator.

Human resources management:

Core job dimensions (skill variety, task identity, task significance, autonomy, feedback)

Job design (job rotation, job enlargement, etc.).

LO2 **Plan a construction project, based on the Pearson-set theme, in collaboration with others to ensure good practice in resource management, staffing and project scheduling**

Project planning:

Setting goals

Defining 'deliverables'

Task definition

Identifying risks/risk management

Communications planning.

Resource management:

Human resources

Physical resources

Supply chain

Waste management.

Project scheduling:

Scheduling tools

Milestones

Blocks.

LO3 **Prepare tender documentation; undertaking work appropriate to a defined role within a team**

Tender documentation:

Construction drawings

Specifications

Schedules of work

Cost plan

Health & safety legislation

Building Information Modelling.

LO4 **Evaluate own work, and the work of others, in a collaborative team**

Reflective practice:

Schön's 'The Reflective Practitioner'

Gibbs' 'Reflective Cycle'

Reflection vs Description.

Reflection in practice:

Project lifecycle

Post implementation review.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Assess individual and group skills in order to allocate roles within a collaborative team</td><td rowspan="2"></td></tr>
<tr><td>P1 Evaluate own skills and the skills of others through skills auditing and review

P2 Develop role descriptions and responsibilities within a team</td><td>M1 Discuss the allocation of roles within a collaborative team to meet overall project needs</td></tr>
<tr><td colspan="2">LO2 Plan a construction project, based on the Pearson-set theme, in collaboration with others to ensure good practice in resource management, staffing and project scheduling</td><td rowspan="5">LO2 and LO3

D2 Critically evaluate the relationships between project planning and tender documentation, highlighting ways in which tender information responds to project planning</td></tr>
<tr><td>P3 Develop a project plan to ensure successful achievement of completed project

P4 Illustrate resource planning (both physical and human) as well as time planning</td><td>M2 Interpret events and activities in a project plan in order to indicate milestones, and risks</td></tr>
<tr><td colspan="2">LO3 Prepare tender documentation; undertaking work appropriate to a defined role within a team</td></tr>
<tr><td>P5 Develop construction drawings and specifications

P6 Prepare a cost plan

P7 Produce a pre-construction Health & Safety method statement</td><td>M3 Evaluate the ways in which Building Information Modelling can provide greater efficiency in collaborative preparation of tender documentation</td></tr>
<tr><td colspan="2">LO4 Evaluate own work, and the work of others, in a collaborative team</td><td rowspan="2">D3 Critically evaluate the success of a project by considering individual and group working practices in relation to assigned roles and personality profiles</td></tr>
<tr><td>P8 Undertake a continual review of their own work, recording this throughout the project

P9 Evaluate their own working practices in relation to that of other members of the team, identifying areas of good practice</td><td>M4 Evaluate their own personality profile in relation to your working practices</td></tr>
</table>

Recommended resources

Textbooks

BALDWIN, A. (2014) *Handbook for Construction Planning and Scheduling*, London: Wiley-Blackwell.

BELBIN, M. (2010) *Team Roles at Work*. London: Taylor & Francis.

BENNETT, J. and PEACE, S. (2006) *Partnering in Construction: A Code of Practice for Strategic Collaborative Working*. Abingdon: Butterworth-Heinemann.

BOUCHLAGHEM, D. (2011) *Collaborative Working in Construction*. London: Spon Press.

CIOB (2010) *Guide to Good Practice in the Management of Time in Complex Projects*. 3rd ed. Chichester, West Sussex: John Wiley & Sons.

DAINTY, A. and LOOSEMORE, M. (ed.) (2012) *Human Resource Management in Construction: Critical Perspectives*. Abingdon: Routledge.

KELLY, J. and MALE, S. (1992) *Value Management in Design and Construction: The Economic Management of Project*. London: Taylor & Francis.

MYERS, S. and CHILDS, R. (2016) *Understanding Team Roles*. London: Nielson Book Services Limited.

POTTS, K. and ANKRAH, N. (2014) *Construction Cost Management: Learning from Case Studies*. London: Routledge.

WYATT, D. (2007) *Construction Specifications: Principles and Applications*. New York: Delmar.

Unit 23: Contracts & Management

Unit code	**H/615/1409**
Unit level	**5**
Credit value	**15**

Introduction

The successful management of a project relies upon ensuring that work is undertaken in accordance with the terms of the contract that exists between client and contractor. In construction, a contract is the legally binding agreement between the client (who wants a project built) and the main contractor (who is responsible for constructing the project). Time, quality and costs are covered by such contracts to ensure that a client receives a project that has been specified by their designer to a budget and at an agreed handover date for completion.

The overall aim of this unit is to provide students with a working knowledge of contracts, so they can manage a project team in accordance with the agreed terms and conditions of the contract. The principle person responsible for this is often the quantity surveyor and it is their responsibility to ensure compliance with the conditions of the contract.

On successful completion of this unit students will be in a position to run and administer a project using the contract terms and conditions that have been agreed between a client and the main contractor. In addition, students will have the fundamental knowledge and skills to progress on to a higher level of study.

Learning Outcomes

By the end of this unit students will be able to:

1 Discuss the requirements for a contract in meeting stakeholders' interests

2 Determine the criteria for the selection of a contract

3 Analyse different types of contract and their application to the built environment

4 Select and prepare an appropriate form of contract for a specific project, specifying the terms and conditions.

Essential Content

LO1 Discuss the requirements for a contract in meeting stakeholders' interests

Clients' requirements:

Statement of need, scope of services, responsibility for the design, design undertaken by an external architect, design to be undertaken by the contractor, liability for the design, professional indemnity for the design, performance bond, parent company guarantee, level of risk, the use of Building Information Modelling, strategic brief, required performance specification, procurement route, liability for overruns and delays, liability for cost overspends, level of quality required for the project, constraints on project duration, managing budgets and financial constraints to avoid overspends.

Public body requirements:

Level 2 Building Information Modelling, value for money (e.g. the Public Contracts Regulations 2015 or a local international agreement), local council purchasing strategy, pre-qualification questionnaires, compliance with equality legislation, Health & Safety and accident rates for main contractors, environmental management considerations, fair work practices, price benchmarking and cost targeting, engaged serial supply chain, efficiency and elimination of waste (e.g. a Buy Local scheme), Government International trade agreement, Private Finance Initiative 2 (PF2) and Public Private Partnerships (PPP).

LO2 Determine the criteria for the selection of a contract

Selection factors:

Time in terms of a quick start and shorter completion date; cost in terms of the financial size of the undertaking; quality; the level of risk to be apportioned across all stakeholders; client and main contractor balance of risk; fixed price or variable price; will the contactor be undertaking the design; warranties and guarantees for workmanship and materials specification; basis of contract sum and payment options (e.g. phased, monthly); employers control over sub-contractors, nominated or named; lump sum or re-measured costs against a schedule of rates.

Type of work to be undertaken:

Maintenance or capital works, size, value and complexity of the project to be undertaken; knowledge and expertise of the employer or client; location, within UK or internationally, European location.

LO3 **Analyse different types of contract and their application to the built environment**

The Joints Contracts Tribunal Suite of Contracts:

Traditional: JCT Standard Building Contract 2011 (the 'with Quantities' and 'without Quantities' versions), JCT Intermediate Building Contract 2011, JCT Minor Works Building Contract 2011

Traditional (re-measured): JCT Standard Building Contract 2011 (the 'with Approximate Quantities' version), JCT Measured Term Contract 2011

Design and Build: JCT Design and Build Contract 2011, JCT Major Project Construction Contract 2011

Construction Management: JCT Construction Management Appointment 2011, JCT Management Building Contract 2011

Partnering: JCT-Constructing Excellence Contract 2011, PPC2000 (2013 edition).

The New Engineering Contract suite:

New Engineering Contract (NEC3) and Engineering Construction Contract (ECC) and options A to F.

International Federation of Consulting Engineers Contract Suite (FIDIC):

Conditions of Contract for Works of Civil Engineering Construction: The Red Book (1987)

Conditions of Contract for Electrical and Mechanical Works, including Erection on Site: The Yellow Book (1987)

Conditions of Contract for Design-Build and Turnkey: The Orange Book (1995).

Other types of contract:

ICC Minor Works Version 2011, GC/Works series.

LO4 **Select and prepare an appropriate form of contract for a specific project, specifying the terms and conditions**

Contract documents:

Distinction between contract and non-contract documents; articles of agreement; conditions of and appendices to the different forms of contract; forms of contract used (construction and civil engineering projects); understand construction contracts in terms of supply chain management; supply chain management, nominated, named and other sub-contractors; suppliers, nominated and named sub-contractors; contract conditions; tendering arrangements; information requirements; main contract implications; forms and agreement; other sub-contractors; contract conditions; domestic; directly employed; tendering criteria.

Quality:

Materials; goods; standards of workmanship; specification; statutory obligations; methods of working; testing; defects and removal of defective work; quality assurance; other clauses of the contract, certificate of making good defects.

Specific conditions:

Articles of agreement; payment terms; variations; insurances; contractors' main responsibilities; testing and defects; architects/engineer instructions; risks.

Time:

Limitation of liability; possession; extensions of time; extensions and delays to contract period.

Costs:

Loss and expense; performance damages; performance bonds; retention; bonus for early completion; termination; price adjustments.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Discuss the requirements for a contract in meeting stakeholders' interests		
P1 Explore the contractual requirements of a project for a private client **P2** Explain the contractual requirements for a public body for an infrastructure project	**M1** Contrast the contractual requirements of a public and a private stakeholder for a major project	**D1** Critically evaluate the contractual requirements for a public body in compliance with legislation
LO2 Determine the criteria for the selection of a contract		
P3 Assess how time, cost and quality affect the selection of a contract **P4** Evaluate the ways in which time and quality affect the cost of a project	**M2** Analyse a project in terms of the selection criteria for a contract that satisfies the requirements of a client	**D2** Evaluate a project in terms of risk for all stakeholders

Pass	Merit	Distinction
LO3 Analyse different types of contract and their application to the built environment		
P5 Analyse the factors that influence the selection of a contract used to control and manage a project	**M3** Compare forms of standard contracts in terms of meeting a balanced risk	**LO3 and LO4** **D3** Justify the selection of a contract in meeting the strategic values of a client
LO4 Select and prepare an appropriate form of contract for a specific project, specifying the terms and conditions.		
P6 Revise a standard contract in meeting the requirements of a client **P7** Present the rationale for defining selected terms and conditions in the preparation of a contract	**M4** Compare the terms and conditions of similar contracts in meeting clients' requirements **M5** Discuss how collaboration between contractors and sub-contractors influence contractual arrangements	

Recommended resources

Textbooks

CHAPPELL, D. (2015) *Construction Contracts Questions and Answers*. 3rd ed. London: Routledge.

CHAPPELL, D. (2012) *Understanding JCT Standard Building Contracts*. London: Routledge.

GODWIN, W. (2013) *International Construction Contracts: A Handbook*. Oxford: Wiley.

HUGHES, W., CHAMPION, R. and MURDOCH, J. (2015) *Construction Contracts Law and Management*. 5th ed. London: Routledge.

HUGHES, W.B. (2015) *Construction Contracts*. London: Routledge.

Unit 26: Advanced Construction Drawing & Detailing

Unit code	**H/615/1412**
Unit level	**5**
Credit value	**15**

Introduction

The information required to construct buildings and infrastructure is at the heart of the construction process. As structures become more complex, the types of information required become equally complex. The ability to produce, manage and understand construction information continues to be a key skill at all levels of the industry.

The aim of this unit is to provide students with an in-depth consideration of the way that construction information is created, managed, and shared throughout the lifecycle of a built asset. In addition to understanding the types of information required for complex projects, students will explore the development and use of standards to ensure consistency and interoperability of data captured and shared, both in a geometric and non-geometric fashion.

Through this unit students will engage in the ways construction drawing and detailing have evolved and will be able to gain knowledge and skills in documenting projects using modern methods and technologies.

Learning Outcomes

By the end of this unit, students will be able to:

1 Assemble complex construction information packages to meet diverse project needs

2 Integrate design and construction information data from multiple sources

3 Evaluate the relationship between CAD and BIM data in the production and management of construction information

4 Prepare construction information packages for a given complex building project.

Essential content

LO1 **Assemble complex construction information packages to meet diverse project needs**

Standards:

Office standards (templates, formats, etc.)

Industry standards (formats, information packages, etc.)

Classification systems (Uniclass, Omniclass, etc.)

Common Arrangement of Works (CAWS)

Best practice drawing and detailing

File formats and use of complex technology to create standards, both organisational and project-based.

General arrangement drawings:

Splitting complex plans, match lines

Room/space delineation

Annotation

Cross-referencing.

Detail drawings:

Identifying detail needs

Detail annotation

Level of Definition (Level of Detail)

Linking specification data with drawing data

The definition of graphical and non-graphical data in the context of BIM.

LO2 **Integrate design and construction information data from multiple sources**

Drawings:

Creating drawings from traditional systems, such as Computer Aided Design (CAD) software and BIM authoring software

The differences between traditional 2D drafting and 3D modelling

The use of 3D modelling as a source to create 2D drawings

Linking 2D drawings and data into 3D modelling tools.

Specifications:

Specification writing

Linking specification data within a BIM authoring platform. Schedules or data sheets:

Schedules from traditional means

Creating schedules from BIM authoring platform

Creating co-ordination reports from BIM Co-ordination platform.

Detailing:

Creating details from 2D CAD software

Creating detail drawings from 3D BIM authoring platform

Information management within BIM authoring platform

Details which link to 3D data.

LO3 **Evaluate the relationship between CAD and BIM data in the production and management of construction information**

Design information:

CAD design drawings and the use of modelling tools to inform building shape and form

BIM authoring solutions which link to design data

Advanced digital tools that automate shape and form

Co-ordinating CAD and BIM data to review detailed design solutions prior to construction

Co-ordinating discipline-specific design information.

Construction information:

Linking CAD data to BIM authoring software

Using BIM authoring software to manage and produce information

Using open file formats (e.g. Open BIM) to ensure all data can be transferred across differing platforms

Understand the term 'project information model (PIM)'.

Handover and post-occupancy information:

Transfer the information from a project information model to the asset data

Linking CAD data to a facilities management tool

Archiving data at handover

Updating data through the life of a project

Updating drawings or model information through the life of a project

Maintenance and repair data.

LO4 **Prepare construction information packages for a given complex building project**

Design stages and data drops:

Allocating tasks to a particular supplier

Defining information or data deliverables over the lifecycle of a given project

Defining what type of information should be shared and how this is stored and managed at all stages of a project.

Construction information packages:

Design responsibility matrix

Reviewing CAD and BIM information at all times through the life of a project

Defining the data deliverable for a given project

Reviewing co-ordination issues during the construction stages

Transferring ownership of BIM data to differing sources.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Assemble complex construction information packages to meet diverse project needs</td><td rowspan="4">LO1 and LO2

D1 Create a consistent set of standards for both a complex construction project and an organisation, recognising ways to retain consistency and clarity within the information shared and created to avoid error and duplication</td></tr>
<tr><td>P1 Discuss the importance of defining standards to create and manage construction drawings

P2 Evaluate the importance of consistent and accurate information in regard to creating construction drawings for a complex project</td><td>M1 Analyse how a consistent set of standards can drive greater efficiencies throughout a project

M2 Utilise both BIM and CAD methodology to ensure construction information packages are correct and clear for a complex project</td></tr>
<tr><td colspan="2">LO2 Integrate design and construction information data from multiple sources</td></tr>
<tr><td>P3 Assess ways in which construction information can be created in both a traditional and a digitally integrated fashion</td><td>M3 Analyse the difference between CAD and BIM systems in the creation of design and construction information for a given project</td></tr>
</table>

Pass	Merit	Distinction
LO3 Evaluate the relationship between CAD and BIM data in the production and management of construction information		
P4 Evaluate the advantages of using a BIM-based system to create complex construction information **P5** Discuss ways in which BIM authoring tools can consistently create accurate drawings and details for a complex project	**M4** Review the ways in which BIM data can be accurately created and maintained throughout all stages of a complex project	**LO3 and LO4** **D2** Critically evaluate ways in which BIM data can support more accurate information on a complex project
LO4 Prepare construction information packages for a given complex building project		
P6 Create a set of construction documents for a complex building project using defined standards **P7** Demonstrate how information created in a non-graphical way can be utilised within a BIM authoring platform **P8** Discuss how drawing packages can be organised within the context of a BIM authoring platform	**M5** Analyse how construction information packages can be created accurately in line with detailed requirements outlined by a given client for a complex construction project	

Recommended resources

Textbooks

CROTTY, R. (2012) *The Impact of Building Information Modelling: Transforming Construction*. London: Spon Press.

EASTMEN, C., TEICHOLZ, P., SACKS, R. and LISTON, K. (2011) *BIM Handbook: A Guide to Building Information Modelling for Owners, Managers, Designers, Engineers and Contractors*. 2nd ed. Oxford: John Wiley & Sons Inc.

FAIRHEAD, R. (2013) *Information Exchanges: RIBA Plan of Work 2013 Guide*. London: RIBA Publishing.

SHEPHERD, D. (2015) *BIM Management Handbook*. London: RIBA Publishing.

Websites

www.theb1m.com	The B1M (General Reference)
www.bimtaskgroup.org	The BIM Task Group (General Reference)
www.bimtaskgroup.org	The BIM Task Group 'COBie UK 2012' (General Reference)
www.thenbs.com	NBS 'BIM (Building Information Modelling)' (General Reference)

Electives

Unit 7: Surveying, Measuring & Setting-out

Unit code	**H/615/1393**
Unit level	**4**
Credit value	**15**

Introduction

Infrastructure and new buildings are essential requirements of modern life. In both construction and civil engineering there is a need to conduct initial surveys to assist the design team in establishing a clearly defined starting point. Once designed, the priority becomes to 'set out' the structures to the required accuracy to facilitate the construction process. Finally, 'as built' surveys are necessary to assist future maintenance and improvements to the built asset.

This unit explores the techniques used to set up controls and conduct topographic surveys. It also covers communication of results and methods of Setting-out structures.

On successful completion of this unit students will be able to set up and assess the accuracy of control points. From these or any other control points the students will be able to complete a topographic survey or set out a structure. The students will also be able analyse errors in Setting-out and surveying.

Learning Outcomes

By the end of this unit, a student will be able to:

1 Undertake a survey to establish a station network for horizontal and vertical control

2 Explain the process of undertaking a topographic survey

3 Apply industry standard techniques in the production, transferring and staking out of co-ordinates of multiple construction elements

4 Prepare a report on the causes of errors and techniques to improve accuracy, including the use of digital data.

Essential Content

LO1 Undertake a survey to establish a station network for horizontal and vertical control

Description of types of control points

Primary controls, first and second order

Secondary control

Different methods of marking control points

The use of local, national and grid control available

Conducting a closed traverse

Carrying out a full closed traverse survey for horizontal and vertical controls

Methods for checking accuracy of the traverse

Matching the control station accuracy to national standards or recommendations

Calculations to obtain corrected co-ordinates

LO2 Explain the process of undertaking a topographic survey

Purpose of a topographic survey

Links to initial control

Techniques to communicate a completed survey

Cut and fill information obtained from a survey

Methods of completing a topographic survey

Equipment to be used to capture topographic details

Use of free station and GPS to complete the survey

Coding systems for features to be surveyed

Data transfer techniques.

LO3 **Apply industry standard techniques in the production, transferring and staking out of co-ordinates of multiple construction elements**

Examples of construction elements

Building outlines, centre lines of structural elements, boundary locations from national co-ordinates, road centre lines, drainage and hard landscape features.

Setting-out techniques

Holistic view of setting from the whole to the part

Use of free station, reference lines, stake out, tie distances within a total station program

Techniques to obtain Setting-out data, including data transfer

Process of Setting-out structures and offsetting lines of structural elements

Horizontal and vertical control of construction, both initially and as the work commences.

LO4 **Prepare a report on the causes of errors and techniques to improve accuracy, including the use of digital data**

Errors in surveying and Setting-out

Instrumentation error: prism constants, reflector heights, atmospheric influences, calibration certification, free station errors, discrete Setting-out

Human errors: alignment of levelling staffs and hand- or tripod-mounted prisms, physical Setting-out constraints

Improvement of accuracy:

Use of technology to provide checking methods

Testing procedures for instrumentation to be used in Setting-out and surveying

Comparing accuracy of set out element to nationally recognised standards.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Undertake a survey to establish a station network for horizontal and vertical control</td><td rowspan="5">LO1 and LO2

D1 Assess the accuracy of a network in the production of a topographic survey</td></tr>
<tr><td>P1 Describe the types of control networks that are available for surveying, including examples of local and national stations

P2 Carry out a closed traverse survey of a network, including at least five stations

P3 Calculate corrected co-ordinates and heights for the stations and explain the stages used</td><td>M1 Calculate and compare the accuracy achieved in a closed traverse survey</td></tr>
<tr><td colspan="2">LO2 Explain the process of undertaking a topographic survey</td></tr>
<tr><td>P4 Explain the process of conducting a topographic survey for a given plot of land, including initial control

P5 Describe, with examples, common coding systems and data exchange processes, including communicating final outcomes</td><td>M2 Review the content of a topographic survey, including analysis of its suitability to assist the design team in completing the design</td></tr>
</table>

Pass	Merit	Distinction
LO3 Apply industry standard techniques in the production, transferring and staking out of co-ordinates of multiple construction elements		
P6 Extract and transfer the required data from a given project to a total station in order to allow Setting-out to commence **P7** Complete a full Setting-out operation on a given project by utilising a total station free station programme, including both horizontal and vertical control	**M3** Analyse the accuracy achieved from a Setting-out operation from tie distances recorded, total station stored data and another means	**D2** Analyse both the accuracy achieved and the techniques used during the practical exercise
LO4 Prepare a report on the causes of errors and techniques to improve accuracy, including the use of digital data.		
P8 Prepare a report on the common causes of errors in both Setting-out and surveying **P9** Compare the accuracy of Setting-out data to national standards	**M4** Evaluate the causes of errors in surveying, Setting-out and data transfer	**D3** Analyse the techniques used to improve accuracy, including the implication of Setting-out errors and the application of industry standard technology/software

Recommended Resources

Textbooks

IRVINE, W. and MACLENNAN, F. (2005) *Surveying for Construction*. 5th ed. London: McGraw-Hill.

SCHOFIELD, W. and BREACH, M. (2007) *Engineering Surveying*. 6th ed. Oxford: Elsevier.

SADGROVE, B.M. (2007) *Setting-out Procedures for the Modern Built Environment*. London: Ciria.

UREN, J. and PRICE, W. (2010) *Surveying for Engineers*. 5th ed. Basingstoke: Palgrave Macmillan.

Websites

ice.org.uk	Institution of Civil Engineers (General Reference)
tsa-uk.org.uk	The Survey Association (General Reference)

Unit 17: Principles of Public Health Engineering

Unit code	**F/615/1403**
Unit level	**4**
Credit value	**15**

Introduction

The role of a public health engineer is a very important and diverse one in the construction process. They design systems for water supply and sanitation that help buildings work better for occupants, owners and the environment. This may vary from a drainage system in a hospital to a water supply system in a high rise apartment building.

This unit introduces students to the principles of public health engineering. Students will develop a broad understanding of domestic hot and cold water services, sanitation and rainwater systems that serve large commercial and complex multi-zone buildings.

On successful completion of this unit students will be able to calculate, design and select appropriate pipework systems and plantroom equipment for hot and cold water services, sanitation and rainwater systems for large commercial buildings.

Learning Outcomes

By the end of this unit, students will be able to:

1 Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings

2 Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment

3 Develop sustainable design strategies for public health engineering

4 Design and specify water and sanitation services for large non-domestic buildings.

Essential content

LO1 **Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings**

Cold water:

Sources of water: water quality, hardness, water treatment, corrosion

Distribution systems: direct and indirect systems, boosted cold water systems, water storage, pressure reduction and control, domestic sprinkler systems.

Hot water:

Hot water production: local vs central, vented and unvented, calorifiers, plate heat exchangers, local heaters

Distribution systems; secondary circulation, pumps and balancing, trace heating, avoidance of dead legs.

Above ground drainage:

Sanitary pipework systems: attributes, primary ventilated stack system, secondary ventilated stack system, ventilated and unventilated branches, stub stacks, pumped drainage systems

Kitchen and laboratory drainage.

Rainwater systems:

Rainwater pipework systems: gravity and siphonic systems, gutters and roof outlets, paved area drainage, sound attenuation, soakaways.

LO2 **Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment**

Cold water:

Water regulations, categories of fluid, contamination risks, air gaps and backflow prevention, legionella prevention and monitoring, disinfection and flushing of systems, British Standards and codes of practice, commissioning and maintenance.

Hot water:

Legionella prevention, thermal balancing, hot water temperatures, legionella prevention vs scalding, building regulations, mixers and blending of hot water, thermostatic control, safety features for unvented hot water.

Above ground drainage:

Limits of stack system, trap seal loss, high rise building drainage, invert levels, secondary venting, air admittance valves (AAV), positive air pressure attenuators (PAPA), offsets and vent termination. Sewer capacities

Building regulations and codes of practice.

Rainwater systems:

Green, brown and blue roofs, pitched roof types, rainfall intensities, Sustainable Urban Drainage Systems (SUDS), rainwater attenuation.

Building regulations and codes of practice

LO3 **Develop sustainable design strategies for public health engineering**

BREEAM and LEED

Water flow rates and leak detection methods: requirements and solutions

Water consumption and water conservation measures: types and techniques

Hot water generation: Combined Heat and Power (CHP) overview and solar thermal overview

Grey water recycling systems: benefits and pitfalls

Rainwater harvesting systems: requirements and uses.

LO4 **Design and specify water and sanitation services for large non-domestic buildings**

Cold water systems:

Cold water storage requirements, cistern sizing, probability theory and loading units, cold water pipe sizing, pressure, flow rates and velocity, booster set sizing.

Hot water systems:

Hot water generator sizing, reheat/recovery period, storage, semi-storage or instantaneous, hot water flow and return pipe sizing, circulating pump size, mass flow rate and pressure drop.

Above ground drainage systems:

Stack and drain sizing, invert level calculations and relevant falls of pipework.

Rainwater systems:

Surface water run-off calculations, storm return periods/rainfall intensities, gutter and roof outlet sizing, attenuation tank sizing.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Explain the different types of domestic water services systems and above ground drainage that serve large commercial and complex buildings</td><td rowspan="5">LO1 and LO2

D1 Critically analyse different water and sanitation systems and plant choices, explaining how such choices may impact on the building’s construction and performance</td></tr>
<tr><td>P1 Identify the main hot & cold water and sanitation systems for commercial buildings

P2 Describe the main plant items for water and sanitation systems</td><td>M1 Illustrate the operation of a hot & cold water and sanitation system for a given building type</td></tr>
<tr><td colspan="2">LO2 Identify relevant design considerations for buildings when selecting water, drainage pipework, plant and equipment</td></tr>
<tr><td>P3 Explain the current legislation and codes of practice that influence the design and selection of water and sanitation systems

P4 Identify relevant design fundamentals that are needed in order to undertake the design of water and sanitation schemes for buildings</td><td>M2 Analyse the relationship between design fundamentals and legislative requirements needed for an effective public health design of a building</td></tr>
</table>

Pass	Merit	Distinction
LO3 Develop sustainable design strategies for public health engineering		**LO3 and LO4** **D2** Evaluate the impact of incorporating a sustainable public health scheme within a building design
P5 Identify the main drivers, both economic and legislative, for sustainable design in public health engineering **P6** Produce a design strategy for a public health engineering installation in a given context	**M3** Compare sustainable design strategies for public health engineering in relation to a given context	
LO4 Design and specify water and sanitation services for large non-domestic buildings		
P7 Explain the parameters that inform the design of public health engineering services for a building **P8** Produce drawings and specification for water and sanitation services in a large non-domestic building	**M4** Calculate the required plant and pipe sizes for a public health engineering design	

Recommended resources

Textbooks

BUTLER, D. and DAVIES, J. (2010) *Urban Drainage*. 3rd ed. London: Spon Press.

CHADDERTON, D. (2012) *Building Services Engineering*. 6th ed. London: Routledge.

CIBSE (2014*) CIBSE Guide G: Public Health and Plumbing Engineering*. London: Chartered Institution of Building Services Engineers.

GARRETT, R.H. (2008) *Hot and Cold Water Supply*. 3rd ed. Chichester, West Sussex: Wiley-Blackwell.

HALL, F. and GREENO, R. (2015) *Building Services Handbook*. 8th ed. London: Routledge.

CHARTERED INSTITUTE OF PLUMBING AND HEATING DESIGN (2002) *Plumbing Engineering Services Design Guide*. Hornchurch, Essex: CIPHE.

WATER REGULATIONS ADVISORY SCHEME (WRAS) (2000) *Water Regulations Guide*. 2nd ed. Gwent: WRAS.

Unit 18: Civil Engineering Technology

Unit code	**J/615/1404**
Unit level	**4**
Credit value	**15**

Introduction

This unit explores the role of professional civil engineers, their essential involvement in the construction and maintenance of infrastructure, and the key technologies they apply. The technologies and processes of civil engineering, in the development of highways, bridges, drainage systems, substructure and superstructure, are crucial to support contemporary societies.

Topics included in this unit are: earthwork activities, temporary and permanent dewatering procedures, methods and techniques used to create substructures, highways and superstructures and the common hazards, technical problems and solutions associated with modern civil engineering activities.

On successful completion of this unit students will be able to describe, analyse and evaluate modern civil engineering procedures, apply this skill and knowledge to the design of infrastructure and produce solutions to address hazards and problems encountered in civil engineering projects.

Learning Outcomes

By the end of this unit, students will be able to:

1 Explain the methods and techniques used in civil engineering for earthworks and substructures

2 Present a site safety plan, risk assessment and method statement for a given civil engineering activity

3 Evaluate a given civil engineering problem and propose a solution

4 Prepare a design proposal for a new infrastructure project.

Essential content

LO1 **Explain the methods and techniques used in civil engineering for earthworks and substructures**

Earthworks activities, use and specification of earthmoving equipment

Formation of cuttings and embankments:

Groundwater problems and techniques used to deal with issues of ground and slope stability

Temporary and permanent dewatering techniques

Techniques used in deep excavations and trenching works

Methods and techniques used to create complex foundations

Methods and techniques used in piling works

Methods and techniques used in drainage works

Methods and techniques used in culvert construction

Methods and techniques used in underpasses and utilities.

LO2 **Present a site safety plan, risk assessment and method statement report for a given civil engineering activity**

Health & safety legislation and codes of practice relative to civil engineering site activities, hazards, risks and safety arrangements for excavations:

Hazards, risks and safety arrangements for working in confined spaces

Hazards, risks and safety arrangements for working on structures

Hazards, risks and safety arrangements for working within temporary works on highways

Roles and responsibilities of all parties in civil engineering projects.

Site safety plans

LO3 **Evaluate a given civil engineering problem and propose a solution**

Civil engineering environmental contexts

Civil engineering quality contexts

Civil engineering geotechnical contexts

Civil engineering economic contexts

LO4 **Prepare a design proposal for a new infrastructure project**

Methods and techniques used to create bridges and the different specifications of bridges:

Flexible highway construction foundation criteria and related geotechnical parameters

Methods and techniques used to create flexible highways

Methods and techniques used in highway link and junction design

Methods and techniques used in flexible pavement design.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Explain the common methods and techniques used in civil engineering earthworks and substructures		
P1 Discuss earthworks activities, equipment and techniques **P2** Describe methods and techniques used to create complex foundations, piling works and drainage works **P3** Describe methods and techniques used in culvert construction, underpass construction and provision for utilities	**M1** Analyse methods and techniques used in large complex earthmoving operations and deep excavations	**D1** Evaluate methods and techniques used to deal with issues of ground and slope stability
LO2 Present a site safety plan, risk assessment and method statement for a given civil engineering activity		
P4 Identify the hazards, risks and safety arrangements for excavations, working in confined spaces, working on structures and for working within temporary works on highways **P5** Develop and present a site safety plan, risk assessments and method statements for a given civil engineering activity	**M2** Discuss Health & Safety legislation and codes of practice related to civil engineering sites	**D2** Justify a site safety plan, risk assessments and method statements report for activities related to a given civil engineering project

Pass	Merit	Distinction
LO3 Evaluate a given civil engineering problem and propose a solution		
P6 Evaluate the environmental, quality, geotechnical and economic contexts of a given civil engineering problem **P7** Propose a solution to a given civil engineering problem	**M3** Illustrate how the environmental, geotechnical, quality and economic contexts of a problem are addressed through a proposal	**LO3 and LO4** **D3** Justify the selection of specific features in the development of a civil engineering solution to a given problem
LO4 Prepare a design proposal for a new infrastructure project		
P8 Describe methods and techniques used in highway design **P9** Develop a civil engineering design proposal for a new infrastructure project	**M4** Analyse methods and techniques used to create bridge foundations, flexible highway construction foundation criteria and related geotechnical parameters	

Recommended resources

Textbooks

CHUDLEY, R. and GREENO, R. (2012) *Advanced Construction Technology*. 5th ed. Harlow: Pearson.

CHUDLEY, R. and GREENO, R. (2014) *Building Construction Handbook*. 10th ed. Oxford: Butterworth-Heinemann.

MANLEY, S., CHARTERS, M., FRANCIS, C., TOPLISS, S. and DOYLE, M. (2008) *Construction*. Harlow: Pearson.

ROGERS, M. and ENRIGHT, B. (2016) *Highway Engineering*. 3rd ed. Oxford: John Wiley & Sons.

Websites

www.standardsforhighways.co.uk	Standards for Highways (General Reference)
www.ice.org.uk	Institution of Civil Engineers (General Reference)
www.icevirtuallibrary.com	Institution of Civil Engineers 'Virtual Library' (General Reference)

Unit 21: Site Supervision & Operations

Unit code	**Y/615/1407**
Unit level	**4**
Credit value	**15**

Introduction

The construction of buildings and infrastructure involves many different types of work and many different people. The skills required to successfully manage the diverse groups of people on a building site, and to monitor and assess their work, is critical to both the success of the project and to ensure the safety of those working.

Through this unit students will develop the skills and techniques necessary to manage the people and processes of a building site, ensuring the quality of work, safe working practices and the interactions of different 'trades'.

Topics covered in this unit include: evaluating construction information, monitoring quality, identifying and notifying of defects, sustainable methods of construction, site safety regulations, Health & Safety regulations, people management, performance management, site meetings, contractor and sub-contractor relations.

Learning Outcomes

By the end of this unit students will be able to:

1 Evaluate construction information to determine quality requirements

2 Prepare a report on defects and recommended remedial actions

3 Assess a pre-construction Health & Safety plan for a given construction project, in relation to local and national regulations

4 Discuss methods for evaluating and improving the performance of site staff.

Essential content

LO1 Evaluate construction information to determine quality requirements

Construction information:

Construction drawings

Specifications

Schedules

Building Information Modelling.

Statutory documents related to quality:

Building regulations

Health & safety regulations.

LO2 Prepare a report on defects and recommended remedial actions

Site visits and evaluation:

Patent defects

Latent defects

'Walking the site'

Identifying defects

Recording defects

Notifying defects.

On-site testing/off-site testing:

Prototypes

Mock-ups

Testing facilities

Quality certification systems.

Quality control responsibilities:

Architect Civil

engineer

Clerk of works

Contractors/sub-contractors

Site staff.

LO3 **Assess a pre-construction Health & Safety plan for a given construction project, in relation to local and national regulations**

Construction design management:

Client responsibilities

Professional responsibilities

Information recording and sharing.

Statutory health & safety requirements:

Site safety monitoring

Responsibilities

Notifications.

Risk assessment and management

LO4 **Discuss methods for evaluating and improving the performance of site staff**

Working relationships:

Effective communication

Motivation

Managing conflict

Equality and diversity.

Performance monitoring and evaluation:

Supervision and supervisors

Target setting

Review

Self-evaluation

Supervisor evaluation

Peer evaluation

Training and development needs.

Site manager responsibilities:

Leadership techniques

Identifying staff training needs

Training and development planning

Continuing Professional Development.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Evaluate construction information to determine quality requirements</td><td rowspan="5">LO1 and LO2

D1 Review construction information and schedules of defects to ascertain patent defects and the implication for defects liability</td></tr>
<tr><td>P1 Define quality requirements for a given project through the review of drawings, specifications and schedules

P2 Explore the relationship between project quality requirements with statutory requirements</td><td>M1 Evaluate the impact of potential changes in project quality requirements that are necessary to meet statutory requirements</td></tr>
<tr><td colspan="2">LO2 Prepare a report on defects and recommended remedial actions</td></tr>
<tr><td>P3 Identify defects for a given construction project and produce a schedule of defects

P4 Explore remedial actions necessary to address identified defects</td><td>M2 Discuss the difference between patent and latent defects and their associated implications for remedial actions</td></tr>
</table>

Pass	Merit	Distinction
LO3 Assess a pre-construction Health & Safety plan for a given construction project, in relation to local and national regulations		
P5 Discuss the importance of construction design management for ensuring site safety **P6** Discuss local and national requirements for Health & Safety in relation to construction projects	**M3** Evaluate the impact of Health & Safety violations on construction projects	**D2** Give examples of methods for promoting a positive approach to Health & Safety for a construction team
LO4 Discuss methods for evaluating and improving the performance of site staff		
P7 Describe the methods for evaluating the performance of team members **P8** Recommend training and development strategies to improve performance	**M4** Evaluate the relationship between equality and diversity and performance management in the construction industry	**D3** Analyse the relationship between performance management and Health & Safety legislation

Recommended resources

Textbooks

BARBER, J. and INSTITUTION OF CIVIL ENGINEERS (2002) *Health & Safety in Construction: Guidance for Construction Professionals*. London: Thomas Telford.

CHARTERED INSTITUTE OF BUILDING (2014) *Code of Practice for Project Management for Construction and Development*. 5th ed. Chichester, West Sussex Wiley-Blackwell.

COLES, D., BAILEY, G. and CALVERT, R.E. (2012) *Introduction to Building Management*. London: Routledge.

COOKE, B. and WILLIAMS, P. (2009) *Construction Planning, Programming and Control*. Chichester, West Sussex: Wiley-Blackwell.

DAINTY, A. and LOOSEMORE, M. (2012) *Human Resource Management in Construction: Critical Perspectives*. 2nd ed. London: Routledge.

FORSTER, G. (1986) *Building Organisations, and Procedure*. Harlow: Longman Scientific & Technical.

HARRIS, F., MCCAFFER, R. and EDUM-FOTWE, F. (2013). *Modern Construction Management*. Chichester, West Sussex: Wiley-Blackwell.

HUGHES, P., PHILLIP. W. and FERRETT, E. *Introduction to Health & Safety in Construction: for the NEBOSH National Certificate in Construction Health & Safety*. 5th ed. Abingdon: Routledge.

Websites

www.ciob.org	Chartered Institute of Building
www.pmi.org	Project Management Institute
www.cipd.co.uk	Chartered Institute of Personnel and Development
www.ice.org.uk	Institutions of Civil Engineers

Unit 38: Personal Professional Development

Unit code	**Y/615/1424**
Unit level	**5**
Credit value	**15**

Introduction

As a professional, learning is a continuous and lifelong process. Within the construction industry there are constant changes in technology, materials, processes, legislation and practice. In order to remain up-to-date, it is necessary to recognise the potential of both structured, classroom-based learning and the learning that is gained through professional activities 'on the job'.

This unit provides a framework in which students have the opportunity to reflect upon and contextualise the learning that they gain from working within the industry. In co-ordination with tutors and their employer, students will define the scope, duration and content of their expected work-based learning experience. Throughout the period of their work-based learning experience, students will be expected to record and reflect upon their own learning.

Learning Outcomes

By the end of this unit, students will be able to:

1 Assess personal learning needs and opportunities within the context of employment

2 Plan and manage own personal learning journey, through consultation with employer and tutor/instructor

3 Record personal progress and the feedback of others; responding as appropriate to own future development

4 Evaluate own learning, based on personal experience and comments from others, in order to plan for the future.

Essential content

LO1 **Assess personal learning needs and opportunities within the context of employment**

Learning styles:

Visual, aural, verbal, physical, logical, social, solitary

Identifying own learning style.

Continuous Professional Development (CPD):

Training vs development

Personal need vs employer need.

Identifying personal needs:

Skills audit

Future plans.

Employer needs:

Skills gaps

Company goals.

LO2 **Plan and manage own personal learning journey, through consultation with employer and tutor/instructor**

Setting goals:

SMART goals (specific, measurable, attainable, relevant, time-bound)

Learning goals vs employment goals.

Learning plan:

Goals

Actions

Resources.

LO3 **Record personal progress and the feedback of others; responding as appropriate to own future development**

Employer feedback

360-degree feedback

Performance management.

Learning/development record

LO4 **Evaluate own learning, based on personal experience and comments from others, in order to plan for the future**

Reflective practice:

Kolb: Learning Cycle

Gibbs: Reflective Model

Brookfield: '3 Lenses'.

Evaluating success:

Measurement

Learning from failure.

Future planning:

CPD and lifelong learning

Personal Development Planning (PDP)

Career goals, personal goals, company goals.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Assess personal learning needs and opportunities within the context of employment</td><td rowspan="5">LO1 and LO2

D1 Justify personal development plans in relation to employer needs, identifying resource requirements and time commitments of self and others</td></tr>
<tr><td>P1 Analyse prior learning to identify potential areas for development

P2 Review employer operations in order to identify training/ development opportunities

P3 Undertake a skills audit to define areas of personal development/training needs</td><td>M1 Discuss personal training/development needs with employer needs/goals</td></tr>
<tr><td colspan="2">LO2 Plan and manage own personal learning journey, through consultation with employer and tutor/instructor</td></tr>
<tr><td>P4 Develop a personal development plan

P5 Develop SMART goals to meet personal and employer needs

P6 Present a personal development plan to an employer and tutor</td><td>M2 Compare the expectations of self, employer and tutor to establish areas of commonality and divergence</td></tr>
</table>

Pass	Merit	Distinction
LO3 Record personal progress and the feedback of others; responding as appropriate to own future development		**LO3 and LO4** **D2** Critically assess own learning and development, in order to communicate examples of good practice and improvement for the future
P7 Manage own personal development through the course of the work-based learning experience **P8** Periodically review own progress and development	**M3** Reflect on instances of successful convergence of own goals and company goals, and instances of divergent goals	
LO4 Evaluate own learning, based on personal experience and comments from others, in order to plan for the future		
P9 Assess own learning and development through reflection and 360-degree feedback **P10** Prepare a plan for future development in relation to career goals	**M4** Evaluate career goals in relation to future learning and professional development needs	

Recommended resources

Textbooks

BOLTON, G. (2014) *Reflective Practice Writing and Professional Development*. London: Sage Publications Ltd.

COTTRELL, S. (2015) *Skills for Success: The Personal Development Planning Handbook*. London: Palgrave Macmillan.

HELYER, R. (2015) *The Work-based Learning Student Handbook*. London: Palgrave Macmillan.

MOON, J.A. (2006) *Learning Journals: A Handbook for Reflective Practice and Professional Development*. London: Routledge.

MEGGINSON, D., WHITAKER, V. and CHARTERED INSTITUTE OF PERSONNEL AND DEVELOPMENT (2007) *Continuing Professional Development*. London: Chartered Institute of Personnel and Development.

PRITCHARD, A. *Ways of Learning: Learning Theories and Learning Styles in the Classroom*. London: Routledge.

RAELIN, J.A. (2008) *Work-based Learning: Bridging Knowledge and Action in the Workplace*. London: Jossey-Bass.

SCHÖN, D.A. (1983) *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.

TARRANT, P. (2013) *Reflective Practice and Professional Development*. London: Sage.

THOMPSON, S. and THOMPSON, N. (2008) *The Critically Reflective Practitioner*. London: Palgrave Macmillan.

Unit 40: Alternative Energy Systems Design & Installation

Unit code	**D/615/1425**
Unit level	**5**
Credit value	**15**

Introduction

The demand for energy – to run electrical devices, heat and cool buildings, and maintain industry – continues to grow and places considerable strain on the natural environment. The pressures of supporting economic growth, while seeking to minimise our environmental impact, has driven the research and development of new sources of energy.

The objective of this unit is to provide students with the knowledge and skills necessary to implement suitable alternative energy technologies and understand their economic, social and environmental benefit within a broader context.

Topics covered in this unit will include: energy systems, solar power systems, energy conservation, passive solar heating, wind energy, ocean energy technologies, hydro and micro-hydro turbines, geothermal energy, air pollution abatement, carbon dioxide sequestration and carbon trading economics.

On successful completion of this unit students will be in a position to be able to assist senior colleagues with alternative energy system design and installation. In addition, students will have the advanced knowledge and skills to progress to a higher level of study.

Learning Outcomes

By the end of this unit students will be able to:

1 Calculate a load duration curve from given data relating to a supply situation

2 Evaluate the principles that underpin the design and installation of alternative methods of power generation and distribution

3 Discuss the social, political, environmental and economic factors related to alternative energy systems

4 Report on the selection of an alternative energy scheme for a given context.

Essential Content

LO1 **Calculate a load duration curve from given data relating to a supply situation**

Calculate the load factor and diversity factor from load curves

Determine a suitable cost of energy

Deduce the load duration curve from the load curve

LO2 **Evaluate the principles that underpin the design and installation of alternative methods of power generation and distribution**

Solar power

Passive solar heating

Wind energy technology

Ocean energy technology

Hydroelectric and micro-hydro turbine power

Geothermal energy

Combined heat and power (CHP)

District energy.

LO3 **Discuss the social, political, environmental and economic factors related to alternative energy systems**

Global warming:

Climatic and atmospheric changes

Air pollution abatement

Carbon dioxide sequestration and carbon trading economics

National policies

International agreement/targets.

LO4 **Report on the selection of an alternative energy scheme for a given context**

Building types and their needs

Technical aspects

Economical aspects

Social aspects

Environmental aspects.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Calculate a load duration curve from given data relating to a supply situation</td><td rowspan="5">LO1 and LO2

D1 Define a strategy for alternative power generation, based on optimal load duration</td></tr>
<tr><td>P1 Calculate and draw typical load and load duration curves from given data relating to a supply situation</td><td>M1 Illustrate changes in load, over time, for varying supply situations</td></tr>
<tr><td colspan="2">LO2 Evaluate the principles that underpin the design and installation of alternative methods of power generation and distribution</td></tr>
<tr><td>P2 Analyse a given energy generation system in order to define an installation strategy

P3 Discuss the installation requirements of a given alternative energy generation system</td><td>M2 Compare different systems of power generation in order to select a suitable system</td></tr>
</table>

Pass	Merit	Distinction
LO3 Discuss the social, political, environmental and economic factors related to alternative energy systems		**LO3 and LO4** **D2** Justify the selection of an alternative energy system, for a given context, which recognises the social, political and economic factors that influence the selection process
P4 Discuss the ways in which social, political and economic factors influence the discourse around the environment and alternative energy	**M3** Evaluate the ways in which global warming and carbon emissions impact on the adoption of alternative energies	
LO4 Report on the selection of an alternative energy scheme for a given context		
P5 Specify an alternative energy generation scheme for a given context **P6** Illustrate an alternative energy scheme for a given context, highlighting the key factors informing the selection	**M4** Present a comparison of different alternative energy systems in support of the decision for a selected system	

Recommended resources

Textbooks

GEKIVORKIAN, P. (2010) *Alternative Energy Systems in Building Design*. London: McGraw-Hill.

GREENSOURCE (2008) *The Magazine of Sustainable Design Emerald Architecture: Case Studies in Green Building*. London: McGraw-Hill.

HASELBACH, L. (2010) *The Engineering Guide to LEED – New Construction: Sustainable Construction for Engineers*. London: McGraw-Hill.

LUCKETT, K. (2009) *Green Roof Construction and Maintenance*. London: McGraw-Hill.

MELAVER, M. and MUELLER, P. (2009) *The Green Building Bottom Line: The Real Cost of Sustainable Building*. London: McGraw-Hill.

NICHOLS, A. and LAROS, J. (2009) *Inside the Civano Project: A Case Study of Large-Scale Sustainable Neighborhood Development*. London: McGraw-Hill.

TWIDELL, J. and WEIR, T. (2005) *Renewable Energy Resources*. 2nd ed. London: Routledge.

YUDELSON, J. (2008) *Green Building Through Integrated Design*. London: McGraw-Hill.

YUDELSON, J. (2009) *Greening Existing Buildings*. London: McGraw-Hill.

Unit 46: Advanced Materials

Unit code	**M/615/1431**
Unit level	**5**
Credit value	**15**

Introduction

Technological advancements have allowed us to develop material composites with optimum strength performance. Advanced composites allow lightweight materials to perform like metal components, with the necessary strength and stability. 'Smart' materials, that can alter their properties in response to external stimuli, are increasingly being found in ever more innovative design solutions. This progress in material technology and processing techniques is essential for the efficient delivery of contemporary buildings and infrastructure.

The aim of this unit is to enable students to make decisions based on the application of knowledge and concepts related to advanced materials. As ever more innovative structural solutions are sought, so the need for greater understanding of material performance and behaviour is required. This encapsulates an understanding of the relationship between material microstructure, composition and mechanical properties in use, and also a knowledge of 'smart' materials that are at the heart of innovative material technology development.

Upon successful completion of this unit students will be able to make decisions based on an analytical approach to understanding material performance. They will also be able to make an appraisal about the feasibility of innovative and smart materials in construction projects.

Learning Outcomes

By the end of this unit, students will be able to:

1 Evaluate the characteristic properties which contribute to the mechanical functionality of materials

2 Examine failure mechanisms of different materials through intrinsic and extrinsic methods

3 Present a case study exploring innovative and smart materials and their role in sustainable construction

4 Analyse material selection and design strategies in either a structural or civil engineering environment.

Essential Content

LO1 **Evaluate the characteristic properties which contribute to the mechanical functionality of materials**

Properties of materials:

Drivers for material characterisation and testing

Relationship of microstructure and manufacture/processing to the properties

Mechanical properties and deformation of materials.

Underpinning principles of materials characterisation:

Destructive and non-destructive testing

Characterisation testing techniques, equipment, and practices of material characterisation methods; microscopy, chemical, physical and structural analysis, and thermal techniques

Competencies and limitations of testing methods in determining functional properties of materials.

Material processing techniques:

Processing techniques: heat treatment, coating processes, surface treatments

Manufacturing techniques.

LO2 **Examine failure mechanisms of different materials through intrinsic and extrinsic methods**

Modes of failure:

Deflection, fatigue, creep, distortion, corrosion, fracture, impact, thermal cycling etc., including combinations.

Extrinsic failure (environmental):

Environmental interactions and factors leading to the failure of materials.

Intrinsic failure (material):

Crystallography and fracture mechanics

Design faults, assembly error, material defects.

Failure prevention mechanisms:

Practices and techniques used to prevent or impede environmentally induced failure of materials; materials selection, engineering design and materials monitoring and inspection strategies.

LO3 **Present a case study exploring innovative and smart materials and their role in sustainable construction**

Innovative and smart materials:

Composite materials: matrix composition, glass reinforced plastic (GRP), fibre-reinforced polymers (FRP), concretes, metals

Innovative materials: aerogels, smart concrete, aluminium oxynitride glass (AlON)

Nanotechnology: photocatalytic concrete, nano-silica, carbon nanofibers, nano-calcite particles

Reversible energy exchanging, energy exchanging, property changing materials

Smart materials and sustainability.

Use of innovation and smart materials:

Creation of energy efficient structures

Adaptive and intelligent behaviours as characterisation properties.

LO4 **Analyse material selection and design strategies in either a structural or civil engineering environment**

Design intent:

Design for strength

Design for failure avoidance

Design for energy efficiency.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Evaluate the characteristic properties which contribute to the mechanical functionality of materials</td><td rowspan="5">LO1 and LO2

D1 Evaluate data from material characterisation techniques and discuss how this information may inform material selection choices</td></tr>
<tr><td>P1 Discuss material characterisation methods for a selection of vocationally relevant materials

P2 Determine the properties and characteristics of materials based on data from testing

P3 Evaluate how material characteristics are influenced by the forms in which materials are commonly available</td><td>M1 Describe the effects of different manufacturing methods in relation to material properties</td></tr>
<tr><td colspan="2">LO2 Examine failure mechanisms of different materials through intrinsic and extrinsic methods</td></tr>
<tr><td>P4 Explore cause and effect of intrinsic and extrinsic modes of failure

P5 Select materials and processing methods for a given structural element</td><td>M2 Discuss methods of remedial or preventative action to enhance service life of a range of materials</td></tr>
</table>

Pass	Merit	Distinction
LO3 Present a case study exploring innovative and smart materials and their role in sustainable construction		**D2** Using a given structural element or characteristic of traditional manufacture, analyse how a smart or innovative material could replace it
P6 Evaluate key performance features of smart materials **P7** Produce a case study discussing the use of innovative materials currently available or in use in the construction industry	**M3** Describe typical applications of smart materials with reference to their characteristics and properties	
LO4 Analyse material selection and design strategies in either a structural or civil engineering environment		**D3** Assess the use of advanced materials or techniques to prevent structural failure and create energy efficient structures
P8 Analyse a selection of suitable materials for a given design problem or structural element	**M4** Justify the selection of construction materials by exploring the benefits gained from specific production processes or techniques for their intended end use	

Recommended resources

Textbooks

AHMED, A. and STURGES, J. (2014) *Materials Science in Construction: An Introduction*. Abingdon: Routledge.

ASHCROFT, N. and DAVID, M. (2003) *Solid State Physics*. Faridabad: Thomson Press Ltd.

BORESI, A. and SCHMIDT, R. (2002) *Advanced Mechanics of Materials*. 6th ed. John Wiley & Sons.

CASINI, M. (2016) *Smart Buildings: Advanced Materials and Nanotechnology to Improve Energy-Efficiency and Environmental Performance*. Kidlington: Woodhead Publishing Ltd.

CLAISSE, P.A. (2015) *Civil Engineering Materials*. Kidlington: Butterworth-Heinemann.

COOK, R. and YOUNG, W. (1994) *Advanced Mechanics of Materials*. 2nd ed. Pearson Education.

DOMONE, P. and ILLSTON, J. (2010) *Construction Materials*. Abingdon: Routledge.

IBACH, H. (2009) *Solid-State Physics: An Introduction to Principles of Materials Science*. Berlin: Springer.

MOSKOWITZ, S. (2016) *Advanced Materials Innovation: Managing Global Technology in the 21st Century*. Chichester, West Sussex: Wiley-Blackwell.

SJOSTROM, C. (2006) *Durability of Building Materials and Components 7: Proceedings of the Seventh International Conference*. Abingdon: Taylor & Francis.