



Pearson BTEC Level 4

Higher National Certificate in

Construction and Built Environment

Unit 3: Science & Materials

Level 4 – 15 Credit

Unit Code – L/618/8082

Assessment Type: Internal

Unit Leaders:

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www.edulibrary.co.uk

Academic Year: 2023/23

Please read this handbook in conjunction with departmental and unit pages on
Microsoft Office Teams (including the Programme Handbook)

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1 INTRODUCTION

1.1 Purpose of the Unit Handbook

This unit handbook aims to provide learners with guidance and support with the science and materials unit of the qualification.

1.2 Introduction to the Unit

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.

1.3 Unit 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 that inform the material choices for a given 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 (CIRIA).

LO3 Present material choices for a given project 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

Thermal

Heat loss

Heat gain

Thermal control (e.g., passive, active)

Illumination

Natural light

Artificial light

Heat gain through sunlight/exposure

Acoustics and vibration

Equipment noise/vibration (e.g., ventilation fans, air conditioning systems)

Road noise/vibration

2 TEACHING AND LEARNING METHODS

Delivery will be through lectures, group workshops and tutorials. It is expected that learners undertake problem solving, further reading and research to support the guidance provided during taught sessions. Reading materials will be provided via the virtual learning environment (VLE) to support teaching but learners are encouraged to familiarise themselves with college library and online databases. Prior to each assessment, there will be series of formative feedback tutorial sessions/revision. These sessions will provide the opportunity for learners to receive constructive feedback on work/tasks prior to assessment.

3. LECTURE PROGRAMME

Week	Date	Lecture Duration (Hours)	Learning Aim	Session Aim
1	15/09/2023	1.5	N/A	- Induction
2	22/09/2023	1.5	LO3	- Unit introduction - Material testing: Slump test
3	29/09/2023	1.5	LO3	- Material testing: Concrete compressive strength test
4	06/10/2023	1.5	LO3	- Material testing: brick compressive strength test
5	13/10/2023	1.5	LO3	- Material testing: tensile test of steel (1)
6	20/10/2023	1.5	LO3	- Material testing: tensile test of steel (2)
7	27/10/2023	1.5	LO3	- Structural behaviours: steel
	03/11/2023			- STUDY REVIEW WEEK
8	10/11/2023	1.5	LO3	- Structural behaviours: concrete
9	17/11/2023	1.5	LO3	- LO3 REVISION
10	24/11/2023	1.5	LO4	- Indoor environmental quality, calculation of u-values
11	01/12/2023	1.5	LO4	- Calculation of power loss; fabric and ventilation
12	08/12/2023	1.5	LO4	- Passive and active design strategies
13	15/12/2023	1.5	LO4	- LO4 REVISION

				- Issue Assignment 2
14	22/12/2023	1.5	L03&4	- Support/independent study
HOLIDAY	29/12/2023			
HOLIDAY	05/01/2024			
15	12/01/2024	1.5	L03&4	- Support/independent study
16	19/01/2024	1.5	L03&4	- Support/independent study - Submit Assignment 2



4. ASSESSMENT SCHEDULE

4.1 Detailed Description of Assessment Scheme

The unit will comprise of two summative assessments.

Summative assessment one 3.1 will cover learning outcomes 1 and 2 – James Jenkins

Summative assessment two 3.2 will cover learning outcomes 3 and 4 – Adewale Abimbola

NB: There will be ample opportunities for assessment resubmissions. Resubmission dates will be communicated in due course.

4.2 Learning Outcomes and Assessment Criteria

Learning outcome 1 [LO1]: Review health & safety regulations and legislation associated with the storage, handling and use of materials on a construction site

Pass	Merit	Distinction
P1 Discuss the regulations associated with the storage, handling and use of materials.	M1 Analyse how risk assessments are used to address hazards posed by selected materials or activities.	D1 Evaluate how multiple regulations and legislation may apply to a given site activity, highlighting how to plan and manage for safe handling and use of materials and processes.
P2 Describe strategies to safely manage the storage, handling and use of a selection of vocationally typical construction materials		

Learning outcome 2 [LO2]: Discuss the environmental and sustainability factors that inform the material choices for a given construction project

Pass	Merit	Distinction
P3 Explain material environmental profiling and lifecycle assessment, based on a material choice.	M2 Produce a waste management plan for a given project, considering a typical range of relevant waste materials	LO2 and LO3
P4 Discuss the benefits of product declaration and environmental certification.		D2 Illustrate how the use of sustainable practices and considerations for material choice can improve the environmental rating of the completed building

Learning outcome 3 [LO3] Present material choices for a given project using performance properties, experimental data, sustainability and environmental consideration		
P5 Select construction materials for a given project based on testing results and their performance properties in use.	M3 Assess the selection of structural materials, based on comparison of loading and performance and behaviour in alternative material choices.	
P6 Present the results of relevant testing procedures to identify performance characteristics of selected construction materials.		

Learning outcome 4 [LO4]: Evaluate the performance of a given building in respect of its human comfort requirements.

Pass	Merit	
P7 Define a material selection strategy with regard to human comfort requirements.	M4 Perform calculations (e.g., lux levels, u-values, acoustic performance, air changes) to support the provision of human comfort for a given project.	D3 Evaluate how the use of passive or active strategies can minimise energy, materials, water, and land use.
P8 Identify materials for a selected area within a project and explain how these contribute to human comfort.		

4.3 Marking Standards

The controlled assessments will be marked in accordance with the Pearson standards. It will also meet requirements set by the Regulated Qualifications Framework (RQF). Learners are expected to make reasonable attempts towards problem solving. A coherent, well-balanced and organised approach to tasks with clear notations and evidence will be rewarded.

5. LEARNING RESOURCES

The library offers services and resources needed for this unit. The following resources have been provided to assist your studies in this Unit:

- Access to specialist databases.
- Class notes and lecture slides.
- Library electronic services.
- Links to online journal articles.

- Open-access computers and printers.
- Reprographic services.
- Staff expertise and advice.
- Librarian and team of learning support staff.

If you have any queries about how to access any of these learning resources, please ask the Unit Leader.

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.

MCDONOUGH, W., BRAUNGART, M. (2010), Cradle to Cradle: Remaking the Way We Make Things, North Point Press

SOMAYAJI, S. (2001), Civil Engineering Materials, Pearson College Division

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