SCIE C1503: Material Science and Soil Mechanics

Module Title:	Material Science and Soil Mechanics
Language of Instruction:	English

Credits:	10

NFQ Level:	6

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	Lectures Laboratory Practice & reports Project Private study

Module Aim:	The aims of the Material Science portion of this module are: (1) to prepare students for participation in the quality control of materials used in the construction of civil engineering projects; (2) to give students a basis for further study of materials. The aims of the Soil Mechanics portion of this module are: (1) to provide students with a sound knowledge of the fundamentals of soil mechanics laboratory testing, as a basis for further studies in the area of geotechnical engineering; (2) to provide students with the technical ability to participate in quality control in earthworks and other associated areas.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	describe & examine the: - (a) source and origin of various engineering materials including aggregates, timber, metals and cement; (b) physical properties associated with aggregates, cement, timber, metals and fresh and hardened concrete; (c) principles of sustainability; (d) impact that sustainability, carbon footprint and circular economy has on our choice of materials;
LO2	demonstrate an awareness of: - (a) manufacturing technologies associated with aggregates, cement, concrete, timber and metals; (b) various engineering products available including admixtures etc.
LO3	demonstrate a knowledge of quality assurance of materials.
LO4	demonstrate the skills developed in: - (a) taking and preparation of laboratory samples; (b) laboratory analysis for engineering properties of materials in accordance with codes of practice including the use of specifically designed engineering testing apparatus; (c) analysing laboratory data in accordance with codes of practice and checking conformity of laboratory results with specifications; (d) understanding the significance of accurate sampling and testing and its relevance to the overall performance of materials in construction; (e) the preparation of laboratory reports; (f) taking a soil classification tests and have a basic knowledge of technical report writing;
LO5	Evaluate exacvated soil to improve project sustainability in accordance with the BS/Eurocode 7 Classification Systems, having a basic knowledge of technical report writing and appreciation of the the importance of moisture content
LO6	Undertake Hazard Identification and Risk Assessment for a variety of design and construction activities so as comply with the competencies required by the QQI Manual Handling and Ergonomic Certificate and demonstrate a knowledge of the requirements, duties, responsibilities and competencies associated with SAFE PASS

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

SCIE C1503: Material Science and Soil Mechanics

Module Content & Assessment

Indicative Content
(1) Sustainability (a) Principles of Sustainability (b) Carbon Footprint, CO2 emissions, Kyoto Protocol, embodied carbon (c) Life Cycle/Circular Economy, Construction Waste
(2) Aggregates (a) Origin and geological classification of rock. (b) Sources of aggregates. (c) Sampling of aggregates. (i) Sampling (ii) Riffling (iii) Quartering (d) Physical properties and classification of aggregates. (i) Particle size analysis (ii) Fines Content (iii) Flakiness Index Test (iv) Moisture Content (e) Typical Laboratory Experiments Aggregates (i) Sampling (ii) Quartering & Riffling (iii) Particle size analysis (iv) Fines Content Test (v) Flakiness Index Test (vi) Moisture Content
(3) Cement (a) Composition, types and manufacturing process (b) Setting times (c) Soundness (d) Strength
(4) Concrete (a) Constituents and mix design (b) Basic Properties of fresh concrete (c) Basic Properties of hardened concrete (d) Typical Laboratory Experiments Concrete (i) Workability – Slump Test (ii) Making Cubes (iii) Curing Cubes (iv) Demoulding Cubes (v) Measuring Cubes (vi) Crushing Cubes
(5) Timber (a) Growth and structure of trees (b) Classification of wood (c) Moisture content and seasoning (d) Natural and handling defects (e) Insect and fungal attack (f) Preservation (g) Stress grading (h) Timber products (i) Typical Laboratory Experiments Timber (i) Physical identification and examination of natural wood samples (ii) Physical identification and examination of manufactured board samples (iii) Microscopic examination of hardwood and softwood (slides) structure that is radial, tangential and longitudinal sawn cuts (iv) Moisture content measurement by both Oven and Meter testing (v) Physical examination of defects and deterioration in timber samples (vi) Physical examination and measurement of Knot / Area ratio on timber samples (vii) Physical examination of both Pressure and Brush applied preservative treatments to timber samples
(6) Metals (a) Ferrous/non–ferrous (b) Processes, treatments (c) Properties and use (d) Typical Laboratory Experiments (i) Physical identification and examination of various metal samples (ii) Microscopic examination of structure of various metal samples (iii) Metals material testing for Stress and Strain and Hardness tests
(7) Introduction To Soils Technology (a) Geological formation of soil and rock - Rock cycle. (b) Clay and silt minerals.
(8) Site Investigation (a) Aims and objectives (b) Desk study (c) Site reconnaissance (d) Ground investigation
(9) Classification Of Soils (a) Moisture content (b) Atterberg limits (c) Particle size analysis - wet sieve analysis (d) Particle size analysis - sedimentation (e) Particle density
(10) Strength Of Soil (a) Shear strength theory (b) Direct shear test - shear box (c) Field testing - vane test (d) California Bearing Ratio
(11) Compaction Of Soil (a) Optimum Moisture Content (b) Dry density / moisture content test (c) Measurement of in-situ density
(5) Sustainability and Re-use of Soil Optimum Moisture Content (b) Dry density / moisture content test (c) Measurement of in-situ density (D) Converting waste soil and rock into engineered material to increase project sustainability
Typical Soil Mechanics Laboratory Experiments (a) Soil sampling & sub-sampling (b) Classification of a soil (c) Measurement of Optimum Moisture Content (d) Measurement of California Bearing Ratio (e) Measurement of shear strength parameters using shear box (f) Measurement of shear strength parameters using triaxial apparatus.
Self-Assessment Students assess their own H&S analysis

Assessment Breakdown	%
Continuous Assessment	80.00%
End of Module Formal Examination	20.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Other	In class exams, practicals	1,2,3,4,5,6	80.00	n/a

No Project

No Practical

End of Module Formal Examination				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	n/a	5,6	20.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

SCIE C1503: Material Science and Soil Mechanics

Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	4.00
Laboratory	12 Weeks per Stage	6.00
Estimated Learner Hours	12 Weeks per Stage	13.00
	Total Hours	276.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_CMHCE_B	Bachelor of Engineering (Honours) in Civil Engineering	1	Mandatory