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| **Subject Code** | CSE19251 |
| **Subject Title** | Materials Science and Technology |
| **Credit Value** | 2 |
| **Level** | 1 |
| **Pre-requisite/ Co-requisite/ Exclusion** | Nil |
| **Objectives** | (1) To enable students to acquire basic knowledge of common materials of civil engineering constructions;<br>(2) To train students with basic laboratory techniques of material testing;<br>(3) To train students to logically analyze and interpret the test results. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br><br>a. understand the material properties of common materials of civil engineering construction;<br>b. appreciate the relationship between material properties and structural/mechanical performance;<br>c. conduct, analyze and interpret data in material testing experiments;<br>d. appreciate the significance of the characteristics of metal, and concrete in the design of structures;<br>e. communicate logically and lucidly through drawing, calculation, and writing;<br>f. work effectively with others in team work, and take responsibility for an agreed area of a shared activity;<br>g. acquire a recognition of the need for, and engage in life-long learning. |
| **Subject Synopsis/ Indicative Syllabus** | 1. Metals (6 weeks)<br><br>Structure of Metals<br>Atomic bonding, crystal structures and crystal geometry, solid solutions and intermediate compounds, equilibrium diagrams.<br><br>Deformation of Metals<br>Elastic deformation, plastic flow, ideal strength, mechanisms of slips, origin of dislocations.<br><br>Iron and Steel<br>Iron-carbon phase diagram, T-T-T diagrams, heat treatments of steels, types of steels and their uses; cast irons.<br><br>Behaviour in Service<br>Brittle and ductile fracture, creep, fatigue, corrosion and its prevention.<br><br>Mechanical Testing<br>Tensile test, hardness test, impact test, fatigue test, creep test.<br><br>Non-Ferrous Metals |

Aluminium and copper.

2. Concrete (7 weeks)

Constituent Materials
Cement, aggregates and admixtures.

Production of concrete
Batching and mixing concrete, transportation, placing, compaction and curing.

Properties of fresh concrete
Workability, factors affecting workability, stability.

Concrete Mix design
Methods of mix design - Department of the Environment method.

Properties of hardened concrete
Strength, factors affecting strength, modulus of elasticity, creep, shrinkage, durability.

Quality control
Quality compliance, statistical quality control, control charts

Tests on concrete
Workability - slump, compacting factor, V-B time.
Strength - cube strength, flexural strength, indirect tensile test.
Non-destructive tests - PUNDIT, Schmidt hammer, cover meter, others.

**Teaching/Learning Methodology**

Fundamental knowledge will be covered in lectures. Tutorials will provide opportunities for discussion of lecture materials and will also be conducted in the form of example class and problem-solving session to supplement understanding from lectures. Laboratory work will help students appreciate the basic principles and familiarize themselves with basic instruments.

**Assessment Methods in Alignment with Intended Learning Outcomes**

| Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f | g |
| 1. Assignments and Seminar Report | 9 | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| 2. Mid-term Test | 12 | ✓ | ✓ | | ✓ | ✓ | | |
| 3. Laboratory Reports | 9 | ✓ | | ✓ | | ✓ | ✓ | |
| 4. Final Examination | 70 | ✓ | ✓ | | ✓ | ✓ | | |
| Total | 100 | | | | | | | |

**Students must attain at least grade D in both coursework and final**

<table>
<tr><td></td><td colspan="2">examination (whenever applicable) in order to attain a passing grade in the overall result.<br><br>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:<br><br>The students will be assessed by four components, i.e. assignments, the mid-term test, the laboratory sessions and reports, and the final examination. Assignments need to be answered and submitted, in order to provide a timely assessment of lecture contents. The students will be required to attend laboratory sessions and submit laboratory reports. These laboratory sessions will enable students to acquire basic laboratory techniques of concrete and steel testing. The work in the laboratory sessions provides a supplement to the lectures. In particular, the assignments and the mid-term test will be designed to achieve the learning outcomes a), b), d) and e), and the laboratory reports will be designed to achieve the learning outcomes a), c), e) and f). The final examinations will provide a comprehensive assessment to students' learning in lectures, tutorials and laboratories, and it will examine all the learning outcomes except c) & f).</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td></td><td>Average hours per week</td></tr>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/ Tutorials/ Laboratory sessions</td><td>2 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and studying</td><td>2 Hrs.</td></tr>
<tr><td>▪ Completion of lab reports</td><td>2 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>6 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Jackson, N. and Dhir, R. K.(1996) "Civil Engineering Materials," 5th ed; (Macmillan)<br><br>Neville, A. M. (1996) "Properties of Concrete", 4th ed; (Longman)<br><br>Neville, A. M. and Brooks, J. J. (2010) "Concrete Technology", 2nd ed.; (Longman)<br><br>Taylor, G. D. (2002) "Materials in Construction: principles, practice and performance",2nd ed; (Longman)<br><br>Building Research Establishment "Design of normal concrete mixers," Revised ed.; 1997<br><br>Callister, William D.(2014) "Materials Science and Engineering: An Introduction", 9th ed; (John Wiley)</td></tr>
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