



## IIT Mandi

### Proposal for a New Course

**Course number** : CE203  
**Course Name** : Civil Engineering Materials  
**Credit** : 3  
**Credit Distribution** : 3-0-0-3  
**Intended for** : B.Tech. (CE)  
**Prerequisite** : None  
**Mutual Exclusion** : None

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#### 1. Preamble:

The ability to design efficient civil engineering structures relies on a thorough understanding of construction materials. This course introduces the processing techniques, properties and behaviour of materials commonly used in civil engineering projects. The contents cover the necessary fundamentals of material science and also the engineering aspects related to the selection of a material for a given job. The science of deterioration under service conditions, testing and evaluation techniques are also duly emphasized. The course will provide the basics needed for higher courses in mechanics and design.

#### 2. Course Modules with quantitative lecture hours:

##### Module 1: Fundamentals

**6 Hours**

Atomic bonding and molecular structure of materials; Organic, inorganic and metallic construction materials; Alloys and Phase diagrams; Mechanical, physical and thermal properties of materials; Preliminaries of viscoelasticity and rheology; Environmental impact indices for construction materials.

##### Module 2: Ferrous and Non-ferrous metals

**6 Hours**

Classification of ferrous alloys; Production process, microstructure and properties of steel; Effects of alloy elements, work hardening and heat treatment on mechanical properties and weldability of steel; Corrosion of steel and its prevention; Structural steel products; Aluminum, Copper and their alloys, production process, properties and uses; Quality and test standards; Sustainability of metals.

##### Module 3: Cement Concrete and Asphalt

**6 Hours**

Ingredients of cement concrete and their properties; Concrete mix design and production; Major types of concrete and their characteristics in fresh and hardened states; Durability issues; Cement mortar and its applications; Asphalt binders and their properties; Asphalt mixture formulations; Effects of moisture, temperature and aging on asphalt; Quality and test standards; Sustainability of cement concrete and asphalt.

**Module 4: Stones, Bricks, Blocks and Tiles**

**6 Hours**

Composition of good brick earth; Brick manufacturing; Classification of bricks; Classification of rocks: Rock forming minerals; Stone quarrying, seasoning and dressing; Qualities of good building stone and brick; Deterioration and preservation of masonry; Fly ash and concrete masonry units; Sustainability of bricks and blocks; Commonly used tiles for floor, wall and roof; Choosing a floor tile; Quality and test standards

**Module 5: Glass**

**4 Hours**

Composition of glass; Production and treatment processes; Physical and mechanical properties; Types and uses; Quality and test standards.

**Module 6: Wood and Wood products**

**4 Hours**

Structure of wood, defects and non-uniformities; Physical and mechanical properties; Durability and preservation; Wood-based composites; Quality and test standards; Sustainability of wood.

**Module 7: Polymers and Plastics**

**4 Hours**

Classification and properties of polymers; Fabrication methods, additives and fillers used for plastics; Common plastics and their uses; Environmental effects of plastics.

**Module 8: Paints**

**3 Hours**

Composition and classification of paints; Production process; Choosing a paint; Defects in painting; Effect of paints on indoor air quality.

**Module 9: Special topics**

**3 hours**

Soil as a construction material; Geosynthetics; Materials for sound and thermal insulation, waterproofing and fire protection; Bamboo; Smart materials; Preliminaries of 3D printing

**3. Text books:**

1. Duggal, S.K., "Building Materials", 4<sup>th</sup> edition, New Age International, India, 2012.
2. Varghese, P.C., "Building Materials", 2<sup>nd</sup> edition, PHI Learning, India, 2015.

**4. References:**

1. Young, J.F., Mindess, S., Gray, R.J. and Bentur, A., "The science and technology of civil engineering materials", Prentice Hall, USA, 1998.
2. Goncalves, M. C. and Margarido, F., "Materials for Construction and Civil

Engineering -- Science, Processing and Design". 1<sup>st</sup> edition, Springer Cham, Switzerland, 2015.

3. Subramanian, N., "Building Materials – Testing and Sustainability", 1<sup>st</sup> edition, Oxford University Press, India, 2019.

**5. Similarity with the existing courses:**

S. No.	Course Title	Course Code	Similarity Content	Approx. % of Content
1.	Materials Science for Engineers	IC 241	Overview of materials science, Structural application of materials	~29%

**6. Justification of new course proposal if cumulative similarity content is >30%: NA**