

MATERIALS, TESTING AND EVALUATION

IV Semester: CE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACEB08	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
COURSE OBJECTIVES:								
I. The properties and importance of various constituent materials of concrete used in construction.								
II. The mechanical behavior of engineering materials under compressive and tensile loads.								
III. The fundamentals of fracture mechanics and identify initiation and propagation of crack around stress-strain fields.								
IV. The standard testing procedures and assess engineering properties of construction materials.								
COURSE OUTCOMES:								
After successful completion of the course, students will be able to:								
CO 1 Explain various physical and mechanical properties of engineering materials used in construction for assessing their strength and durability.								
CO 2 Classify the construction materials based on their behaviour for using in various construction fields.								
CO 3 Explain the mechanical behaviour of steel and concrete by standard testing procedures for identifying their performance.								
CO 4 Explain fundamentals of fracture mechanics to describe the pattern of fracture developed due to fatigue.								
CO 5 Identify the modes of failures in concrete caused by fracture to avoid the failure of concrete structures.								
CO 6 Recall different types of metals based on their composition for finding their suitability in various construction activities.								
CO 7 Explain testing procedures of construction materials for estimating their engineering properties.								
CO 8 Explain special materials like polymers, composites used in construction for satisfying the future needs of industry.								
CO 9 Select suitable Cementitious materials to substantiate cement in concrete structures for producing ecofriendly green concrete.								
MODULE - I	INTRODUCTION TO ENGINEERING MATERIALS						Classes: 09	
Cements, Sand, Concrete (plain, reinforced and steel fiber / glass fiber reinforced, light weight concrete, high Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical Material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses.								

MODULE -II	INTRODUCTION TO MATERIAL TESTING	Classes: 09
Introduction to material Engineering; Mechanical behavior and mechanical characteristics; Elasticity principle and characteristics; plastic deformation of metals; tensile test-standards for different material (brittle, quasi-brittle, elastic) True stress-strain interpretation of tensile test; hardness tests; bending and torsion test; strength of ceramic; Internal friction, creep fundamentals and characteristics; Brittle fracture of steel-temperature transition approach; Background of fracture mechanics; fracture toughness testing for different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics.		
MODULE-III	STANDARD TESTING & EVALUATION PROCEDURES	Classes: 09
Mechanical testing of various metals; naming systems for various irons, steels and nonferrous metals; elastic deformation; plastic deformation.		
Impact test and transition temperatures; fracture mechanics background; fracture toughness-different materials; Fatigue of material; Creep.		
MODULE-IV	STANDARD TESTING PROCEDURES	Classes: 09
Tests & testing of bricks, Tests & testing of sand, Tests & testing of concrete, Tests & testing of soils, Tests & testing of bitumen & bituminous mixes.		
MODULE-V	TESTING PROCEDURES OF SPECIAL MATERIALS	Classes: 09
Testing of polymers and polymer based materials, tests and testing of metals, special materials, composites and cementitious materials. Explanation of mechanical behavior of these materials.		
Text Books:		
<ol style="list-style-type: none"> 1. Chudley, R., Greeno, “building construction handbook”, R. Butterorth Heinemann, 6th edition, 2006. 2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, “Highway Materials and Pavement Testing”, Nem Chand & Bros, 5th Edition. 3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications. 		
Reference Books:		
<ol style="list-style-type: none"> 1. KyriakosK omvopoulos, “Mechanical Testing of Engineering Materials”, Cognella, 2011. 2. E.N. Dowling, “Mechanical Behaviour of Materials”, Prentice Hall International, 1993. 3. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000) 		