

25HCET401	MODERN CONSTRUCTION MATERIALS	Category	L	T	P	R	Credit	Year of Introduction
		Honours	4	0	0	0	4	2025

Preamble: This course provides students a detailed insight into the various properties and testing of building materials, components of buildings and stages in construction of buildings.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the fundamental concepts of atomic bonding, crystal structure, and defects influencing material behaviour.	K2 (Understand)
CO2	Apply knowledge of material behaviour and mix design for developing durable and efficient special concretes.	K3 (Apply)
CO3	Describe the characteristics and civil engineering uses of composites, polymers, and non-structural materials.	K2 (Understand)
CO4	Explain concepts and applications of smart, intelligent, and nano materials in construction.	K2 (Understand)

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	-	-	2	-	-	-	-	2	3	3	2
CO3	3	2	2	-	-	2	-	-	-	-	2	3	2	2
CO4	3	2	2	-	-	2	-	-	-	-	3	2	2	3
Avg	3	2.25	1.75	-	-	2	-	-	-	-	2.25	2.75	2.33	2.33

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*			*	
CO2	*	*	*	*	*		*	*	
CO3	*	*	*	*	*		*	*	
CO4	*	*	*	*	*		*	*	

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*		*	*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment/Field study : 15 marks

SYLLABUS

Module 1 (15 hrs)

Review of atomic bonding, structure of solids and defects, movement of atoms, and development of microstructure- Review of surface properties, response of materials to stress, failure theories, fracture mechanics, rheology and thermal properties.

Module 2 (14 hrs)

Concrete: behavior of concrete - properties, mix design & advantages of High strength and High-performance concrete- properties & applications of Fibre reinforced concrete -Self-compacting concrete- Geo polymer concrete- alternative materials to concrete.

Types of steel- manufacturing process of steel,- advantages of new alloy steel- properties and advantages of aluminium and its products- types of coatings, coatings to reinforcement, applications of coatings.

Module 3 (14 hrs)

Composites :Types of plastics, properties and manufacturing process- advantages of reinforced polymers- types of FRP- FRP on different structural elements,-application of FRP, cellular cores, geo synthetic polymers, fibre reinforced plastics in sandwich panels- adhesives and sealants -structural elastomeric bearings, moisture barriers, applications in Civil Engineering.

Introduction of Non-Structural Materials and criteria for selection- Thermal insulation and acoustic absorption materials- recycled materials- water proofing compounds- non-weathering materials, flooring materials, surface preparation materials.

Module 4 (13 hrs)

Smart & Intelligent materials : Types and differences between smart and intelligent materials, special features- Case studies showing the application of smart and intelligent materials, Nano Concrete, Nano Technology in Construction.

Recommended Activity(Suggested topics)

1. Students review one emerging material (nano concrete, self-healing concrete, smart coatings, etc.) and present its composition, key properties, recent applications and future scope.
2. Mix design of a high strength concrete : Testing workability and strength in laboratory.
3. Students identify a real structure where advanced materials (FRC, SCC, FRP, geopolymer, smart materials, etc.) are used and prepare a short report

Text Books:

1. Callister, W. D. & Rethwisch, D. G. (2020). *Materials science and engineering: An introduction*(10th ed.) John Wiley & Sons.
2. Raghavan, V. (2015). *Materials science and engineering: A first course* (6th ed.). Prentice Hall of India.
3. Ashby, M. F., & Jones, D. R. H. (2019). *Engineering materials 1: An introduction to their properties and applications*. Butterworth-Heinemann.
4. Mehta, P. K., & Monteiro, P. J. M. (2014). *Concrete: Microstructure, properties, and materials*. McGraw-Hill Education.

Reference Books:

1. Claisse, P. A. (2015). *Civil engineering materials* (1st ed.). Elsevier.
2. Gonçalves, M. C., & Margarido, F. (Eds.). (2015). *Materials for construction and civil engineering: Science, processing, and design* (1st ed.). Springer.
3. Allen, E., & Iano, J. (2019). *Fundamentals of building construction: Materials and methods* (7th ed.). Wiley.
4. Liew, M. S., Nguyen-Tri, P., Nguyen, T. A., & Kakooei, S. (Eds.). (2019). *Smart nanoconcretes and cement-based materials: Properties, modelling and applications* (1st ed.). Elsevier.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25HCET401
Course Name	MODERN CONSTRUCTION MATERIALS
Max. Marks: 60	Duration: 2.5 Hours

Part A <i>(Answer all questions. Each question carries 3 marks)</i>				
Qn No.	Question	Marks	CO	BL
1	Explain the rheological behavior of materials.	3	1	L2
2	Describe the structure of crystalline solids.	3	1	L2
3	Explain the concept of Self-Compacting Concrete.	3	2	L2
4	Classify the different types of steel used in construction.	3	2	L2
5	Outline the advantages of reinforced polymers.	3	3	L2
6	Explain the function of structural elastomeric bearings.	3	3	L2
7	Differentiate between smart and intelligent materials.	3	4	L2
8	Explain intelligent infrastructure systems.	3	4	L2
Part B <i>(Answer any one full question from each Module. Each carry 9 marks)</i>				
Module I				
Qn No.	Question	Marks	CO	BL
9	Describe the principles of fracture mechanics and its applications in engineering	9	1	L2
OR				
10	Explain the different types of atomic bonding and their influence on material properties.	9	1	L2
Module II				
Qn No.	Question	Marks	CO	BL
11.a	Describe the properties and behavior of concrete and the importance of mix design.	6	2	L2
11.b	Explain High Performance Concrete.	3	2	L2
OR				
12.a	Explain the properties and applications of Self-Compacting Concrete and Geopolymer Concrete.	6	2	L2
12.b	Explain the properties of aluminium used in construction.	3	2	L2
Module III				
Qn No.	Question	Marks	CO	BL
13	Describe the different types of FRP and their applications in	9	3	L2

	structural elements.			
OR				
14	Explain the functions and applications of thermal insulation and acoustic absorption materials.	9	3	L2
Module IV				
Qn No.	Question	Marks	CO	BL
15	Explain the special features and engineering applications of smart materials.	9	4	L2
OR				
16	Explain the concept of Nano Concrete and its advantages over conventional concrete.	9	4	L2