Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20CE11T	**Semester**	I
Course Title	**CONSTRUCTION MATERIALS**	**Course Group**	Core
No. of Credits	4	**Type of Course**	Lecturing &Assignments
Course Category	Program Core Course	**Total Contact Hours**	4Hrs Per Week
			52Hrs Per Semester
Prerequisites	High school level science	**Teaching Scheme**	(L:T:P)= 4:0:0
CIE Marks	50	**SEE Marks**	50

RATIONAL

Materials for engineering play an important role as the vital tool for solving the problems of material selection and application in the civil Engineering construction field. Therefore, an engineering diploma student must be conversant with the properties, composition and behavior of materials from ***the point of view of reliability, sustainability and performance in civil engineering construction***. The study of basic concepts of materials will help the students understanding civil engineering subjects where the emphasis is laid on the application of thesematerials.

1. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

1) To learn about various construction materials, and understand their relevant characteristics.
2) To be able to identify suitability of various materials for different construction purposes.
3) To know about natural, artificial, and processed materials available for various purposes of construction activities.

2. COURSE OUT COMES

On successful completion of the course, the students will be able to demonstrate industry oriented Cos associated with the above mentioned competency:

CO1	Identify relevant natural construction materials.
CO2	Select relevant artificial construction materials
CO3	Identify and use of processed construction materials.
CO4	Select relevant special type of construction materials.

3. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for SEE on cognitive levels		TOTAL
					R	U	
CO1	Identify relevant natural construction materials.	1,4.7	R,U	15	30	30	60
CO2	Select relevant artificial construction materials.	1,4.7	R,U	21	40	40	80
CO3	Identify and use of processed construction materials.	1,4.7	R,U	10	20	20	40
CO4	Select relevant special type of construction materials.	1,4.7	R,U	06	10	10	20
		Total Hours of instruction		**52**	**Total marks**		**200**

4. DETAILS OF COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

UNIT NO	Unit skill set (In cognitive domain)	Topics/Sub topics		Hours L-T-P
UNIT-1 Natural Construction Materials **CO1**	1.Identify rocks based on geology of its origin 2.Explain the requirements and characteristics of stones 3.Explain the methods of Quarrying of stones 4.Explain the methods of deterioration of stones 5. Explain the methods of preservation of stones 6. Mention the properties of sand and its uses 7.Explain the classification of Coarse aggregate according to size 8. Explain the structure and properties of timber 9. apply the use of Bamboo in construction	1.1	Geological classification of Rocks	15-0-0
		1.2	Requirements of good building stone	
		1.3	General characteristics of stone	
		1.4	Quarrying of stones by wedging	
		1.5	Quarrying of stones by blasting	
		1.6	Deterioration of stones	
		1.7	Preservation of stones	
		1.8	Properties of sand and uses	
		1.9	Classification of coarse aggregate according to size	
		1.10	Structure of timber	
		1.11	General properties and uses of good timber	
		1.12	Different methods of seasoning for preservation of timber.	
		1.13	List various Defects in timber	
		1.14	Use of bamboo in construction	
		1.15	Asphalt-properties and uses	

	10. Mention the properties and uses of Asphalt.			
UNIT-II **Artificial Construction Materials** CO2	1.Explain the constituents and characteristics of Bricks 2. Perform Field tests on Bricks 3. With a neat diagram able to explain manufacturing process of bricks 4. Write the properties of Aerated Concrete Blocks 5.Identify different varieties of Floor tiles and wall tiles, Glazed tiles and vitrified tiles 6. With a neat diagram able to explain manufacturing process of cement. 7. Identify different types of cement and mention their uses. 8. Explain properties and uses of Precast hollow and solid concrete blocks and pavement blocks. 9. Explain and identify Plywood Particle board, veneers and laminated boards 10 Identify and explain uses of different types of glasses. 11. Explain the properties and uses of Ferrous, Non- ferrous and alloys.	2.1	Constituents of Good brick earth	21:0:0
		2.2	Modular and Standard bricks	
		2.3	Special bricks –fly ash bricks	
		2.4	Characteristics of good brick	
		2.5	Field tests on Bricks	
		2.6	Manufacturing process of burnt clay brick	
		2.7	Clamp burning of Bricks	
		2.8	Hoffmann's kiln	
		2.9	Aerated concrete blocks-Properties and uses	
		2.10	Flooring and wall tiles – Clay tiles,	
		2.11	Glazed tiles and vitrified tiles	
		2.12	Manufacturing process of Cement–only dry process	
		2.13	Types of cement and its uses.	
		2.14	Properties and uses of Pre-cast hollow and solid concrete blocks	
		2.15	Properties and uses of pavement blocks	
		2.16	Artificial or Industrial Timber -Plywood, Particle board, Veneers	
		2.17	Laminated board and their uses.	
		2.18	Types of glass: Soda lime glass, Lead glass and Borosilicate glass and their uses.	
		2.19	Ferrous Metals- Cast Iron and Steel- List Properties and Uses	
		2.20	Non-ferrous metals- Aluminium, Copper, Zinc, - Properties and uses	
		2.21	Alloys- Aluminium Alloys and Steel Alloys- Composition, and uses	
UNIT-III Processed Construction Materials CO3	1.Explain the constituents and Uses of POP 2.Explain properties and uses of Fiber reinforced plastics 3. Explain properties and uses of Paints, Distempers, oil paints and varnishes and able to apply for different types of surfaces, 4. Know the manufacturing process and uses of Manufactured Sand. 5. Identify different Cladding materials.	3.1 Constituents and uses of POP (Plaster of Paris),		10-0-0
		3.2 Plastics- Properties and uses of plastics		
		3.3 Fiber reinforced plastic (FRP) its properties and applications		
		3.4 Paints and Distempers, Ingredients and their uses. Properties of good paint.		
		3.5 Oil Paints and Varnishes with their uses. (Situations where used).		
		3.6 Varnishes with their uses. (Situations where used).		
		3.7 Special processed construction materials; Geo synthetic, Ferro Crete.		
		3.8 Manufactured sand (m sand): its manufacturing and their uses.		
		3.9 Cladding materials-Terracotta,		
		3.10 High Pressure Laminates (HPL) Aluminium Composite panels (ACP), Glass Reinforced Concrete (GRC), Pre painted Galvanized Iron sheets.		

UNIT-IV **Special Constructi on Materials** **CO4**	1.Explain the types of water proofing materials, Termite proofing materials, and sound insulating materials and suitability of its different types in construction 2.Explain the properties and applications of Geopolymer cement 3. Explain the applications of Epoxy Resins, Non-Shrink Grounts	4.1 Water proofing material- Types and its suitability in construction	
		4.2 Termite proofing- Types and its suitability in construction	
		4.3 Sound insulating materials- Types and its suitability in construction,	
		4.4Epoxy Resins ,Non-Shrink Grouts Shotcrete-Applications	
		4.5 Gypsum and its products :Types and its suitability in construction	
		4.6 Properties and uses of Geo polymer cement	

MAPPING OF CO WITH PO

CO	**Course Outcome**	PO Mapped	UNIT Linked	Cognitive Level **R/U/A**	Tutorial & Practical Sessions in Hrs
CO1	Identify relevant natural construction materials.	PO1,PO4, PO7	1-4	U/A	15
CO2	Select relevant artificial construction materials.	PO1,PO4 PO7	1-4	U/A	21
CO3	Identify and use of processed construction materials.	PO1,PO4 PO7	1-4	U/A	10
CO4	Select relevant special type of construction materials.	PO1,PO4 PO7	1-4	U/A	06
					52

Level of Mapping PO's with CO's

Course	**CO's**	**Programme Outcomes (PO's)**							**Programme Specific outcome (PSO's)**	
		1	2	3	4	5	6	7	1	2
Construction Matals		3	-	-	1	-	-	1	3	2
	CO2	3	-	-	1	-	-	1	3	2
	CO3	3	-	-	1	-	-	1	2	2
	CO4	3	-	-	1	-	-	1	2	2
	Average	**3**		**-**	**1**	**-**	**-**	**1**	**2.3**	**2**

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

Method is to relate the level of PO with the number of hours devoted to the CO's which maps the given PO.
If ≥50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3
If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2
If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1
If < 5% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not-mapped i.e.; Level 0

5. INSTRUCTIONAL STRATEGY

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes

1. Massive Open on line courses (MOOCS) may be used to teach various topics/sub topics.

2. Lecturer method(L) does not mean only traditional lecture method, but different type of teaching method and media that are employed to develop the outcomes

3. About 15 to 20% of the topics/sub topics which is relative simpler or descriptive in nature is tobe given to the students for self directed learning

4. Arrange visits to nearby Construction sites/ Manufacturing Industries/ Academic institution having research centre facility /Research labs for various understanding of tests on Building Materials

5. Show Video/animation films to explain functioning of various application of materials in Civil Engineering domain

6. Use different instructional strategies in class room teaching

6. SUGGESTED LEARNING RESOURCES:

A. List ofBooks

S. No.	Author	Title of Books	Publication/Year
1	Ghose, D. N.	Construction Materials	Tata McGraw Hill
2	S.K. Sharma	Civil Engineering Construction Materials	Khanna Publishing House
3	Varghese.P.C	Building Materials	PHI learning, NewDelhi.
4	Rangwala, S.C.,	Engineering Materials	Charatorpublisher,Ahemdabad.
6	Somayaji, Shan	Civil Engineering Materials	Pearson education, NewDelhi
7	Rajput,R.K	Engineering Materials	S. Chand and Co. New Delhi.
8	Sood H.,	Laboratory Manual on Testing of Engineering Materials	New Age Publishers New Delhi.
9	Sharma C. P	Engineering Materials	PHI Learning, NewDelhi
10	Duggal, S. K	Building Materials	New International, NewDelhi.
11	S.S.Bhavikatti	Building Materials	Vikas Publishing House Pvt.Ltd.

B. List of Materials required

MATERIAL LIST

The following are the specification of the specimens required for demonstration during the lecture hours of "constructions materials" and number of specimens required

SN	Name of the MATERIALS	Specification	Required Number
	STONES		
1	Granite	Size of 10×6×4 cm	2NOS EACH
	Trap	Size of 10×6×4 cm	2NOS EACH
	Basalt	Size of 10×6×4 cm	2NOS EACH
	Sandstone	Size of 10×6×4 cm	2NOS EACH
	Limestone	Size of 10×6×4 cm	2NOS EACH
	Gneiss	Size of 10×6×4 cm	2NOS EACH
	Laterite	Size of 10×6×4 cm	2NOS EACH
	Marble	Size of 10×6×4 cm	2NOS EACH
	Quartzite	Size of 10×6×4 cm	2NOS EACH
	Slate	Size of 10×6×4 cm	2NOS EACH
	BRICKS & BLOCKS		
2	Bricks Ground moulded		2NOS EACH
	Table moulded		2NOS EACH
	Machine moulded (Wire cut)		2NOS EACH
	Soil stabilized blocks		2NOS EACH
	Concrete blocks (solid-hallow)		2NOS EACH
	Fly ash brick		2NOS EACH
	Fire bricks		2NOS EACH
	Autoclave aerated concrete blocks		2NOS EACH
	BINDING MATERIALS		
3	Cement	50 kg bag	Consumable
	White cement	1 kg bag	1NOS EACH
	Lime	5 kg bag	Consumable
	Clay	1 kg bag	1NOS EACH
	Fly ash	50 kg bag	1NOS EACH
	Plaster of Paris	1 kg bag	1NOS EACH
	Lime putty	1 kg bag	1NOS EACH
	White cement based putty	1 kg bag	2NOS EACH
	TIMBER		
	Teak	Size of 15×10×6 cm	2NOS EACH
	Honne	Size of 15×10×6 cm	2NOS EACH
	Sal	Size of 15×10×6 cm	2NOS EACH
	Casuarina	Size of 15×10×6 cm	2NOS EACH
	Deodar	Size of 15×10×6 cm	2NOS EACH
	Jackfruit	Size of 15×10×6 cm	2NOS EACH
	Mahogan	Size of 15×10×6 cm	2NOS EACH
	Mango	Size of 15×10×6 cm	2NOS EACH
	Neem	Size of 15×10×6 cm	2NOS EACH
	Silver oak	Size of 15×10×6 cm	2NOS EACH

	Bamboo.	20 cm length	2NOS EACH
	Industrial timber- Veneers	6×4 feet	
	Plywood (diff thickness)		
	Fibre board		
	Hardboard		
	Block board		
	laminated sheets		
	FLOORING		
	Vitrified	2 × 2 feet	2NOS EACH
	Marble	1 × 1 feet	2NOS EACH
	Granite,	1 × 1 feet	2NOS EACH
	Pressed Clay tile	1 × 1 feet	2NOS EACH
	Interlocking pavers	60mm, 80mm thick	2NOS EACH
	Wooden flooring		2NOS EACH
	GLASS		
	Plain	6 × 4 inch	3NOS EACH
	Dark cool	6 × 4 inch	3NOS EACH
	Brown cool	6 × 4 inch	3NOS EACH
	printed	6 × 4 inch	3NOS EACH
	Mesh glass	6 × 4 inch	3NOS EACH
	Wired glass	6 × 4 inch	3NOS EACH
	Glass bricks	6 × 4 inch	3NOS EACH
	Structural glass	6 × 4 inch	3NOS EACH
	Ribbed glass	6 × 4 inch	3NOS EACH
	Perforated glass	6 × 4 inch	3NOS EACH
	Foam glass	6 × 4 inch	3NOS EACH
	Fibre glass	6 × 4 inch	3NOS EACH
	Float glass	6 × 4 inch	3NOS EACH
	Toughened glass	6 × 4 inch	3NOS EACH
	PAINTS		
6	Water based primer	1 litre	2NOS EACH
	Metal-wood & wall primer	1 litre	2NOS EACH
	Emulsion paint	1 litre	2NOS EACH
	Enamel paint	1 litre	2NOS EACH
	Cement paint (Snowcem)	1 litre	2NOS EACH
	Texture paints	1 litre	2NOS EACH
	French polish	1 litre	2NOS EACH
	Metallic paint	1 litre	2NOS EACH
	Distemper- Water based & weather proof exterior emulsion	1 litre	2NOS EACH
	ROOFING MATERIALS		
9	Mangalore tiles		2NOS EACH
	Country tiles		2NOS EACH
	A C sheet		2NOS EACH
	Plastic sheets		2NOS EACH
	Non asbestos Hi tech roofing sheet		2NOS EACH
	Meta colour sheets		2NOS EACH
	Alpha sheet		2NOS EACH

	Corrugated aluminium sheets		2NOS EACH
	Puff sandwiched roofing sheets.		2NOS EACH
	Steel bars ϕ5,6,8,10,12,16,20,22,25mm	Each bar 1m length	2NOS EACH
	Binding wire	1 bundle	1KG
DECORATIVE MATERIAL			
	Acoustic ceiling board		
	Gypsum ceiling board		
	Fibre board		
	Pulp board		
	Straw board		
	Polystyrene		
	Thermocol		
	Hair felt		
CHEMICAL CONSTRUCTION MATERIALS			
	Epoxy resin (base and hardener)	1 kg	2NOS EACH
	Plasticizer	5 litre	2NOS EACH
	Super plasticizer	5 litre	2NOS EACH
	Carboxylic admixtures	5 litre	2NOS EACH
	Silicon paste	1 kg	2NOS EACH
	Water proofing compound	1 litre	2NOS EACH
	Cement Grouts	25 kg	2NOS EACH
	Epoxy grouts	1 kg	2NOS EACH
	Adhesives	1 kg	2NOS EACH
	Sealants	250gms	2NOS EACH
	Asphalt	1 kg	2NOS EACH
	Geogrids	6 × 4 feet	2NOS EACH

SUGESTED ACTIVITY

1. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples.
2. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples.

SUGGESTED LIST OF PROPOSED STUDENT ACTIVITYS

Note: The following activities should be accompanied by at least 2 staff members from the department with prior approval from the industry. The visit should be recorded in the form of a hand written report and photo graphs. Each student should also submit the proof of their visit. A group of minimum 6 students should be assigned each activity. (Each group should select minimum one activity from each unit)

UNIT-I	
1	Visit to Geological Survey of India and study Rocks and Mineral samples available in the Museum
2	Visit to any nearby stone processing industry or Showroom
3	Visit to nearby timber depot and study different types of timber, Conversion of timber, Measurements, seasoning and storing pattern and various defects, quality of good timber.
UNIT-II	
4	Visit to nearby Brick manufacturing site and study size of bricks, mould and manufacturing

	process. Clamps and Kiln burning process of Bricks
5	Visit to nearby Hollow or solid concrete Block manufacturing site
6	Visit to nearby cement manufacturing plant and study manufacturing process
7	Visit to Plywood Retail Store and collect samples of Industrial timbers
8	Collect Market forms of Ferrous and Non ferrous metals
9	Collect different types of glass available in the market and explain its uses
10	Visit to nearby Tiles manufacturing industry or Visit to nearby Tiles show room and study different types of tiles available in the market its suitability and sizes and rates should be documented while visit.
UNIT-III	
10	Visit to nearby paint showroom or stores and study different types of paints available in the market.
11	Visit to nearby M sand manufacturing plant
12	Visit to nearby roofing and cladding materials sales showroom and study its different types and market rates and suitability of their use in construction
UNIT-IV	
14	Visit to a construction site where water proofing is under progress and study methodology adopted in water proofing.
15	Visit to a construction site where termite proofing and sound insulating is under progress and study methodology adopted in water proofing.

COURSE ASSESSMENT:

Sl. No	Assessment	Duration	Max marks	Conversion
1.	CIE Assessment 1 (Written Test -1) - At the end of 3 d week	80 minutes	30	Average of three written tests 30marks
2.	CIE Assessment 2 (Written Test -2) - At the end of 7 week	80 minutes		
3.	CIE Assessment 3 (Written Test -3) - At the end of 13 week	80 minutes		
4	CIE Assessment 4 (MCQ/Quiz) - At the end of 5 week	60 minutes	20	Average of three 20marks
5	CIE Assessment 5 (Open book Test) - At the end of 9 week	60 minutes		
6	CIE Assessment 6 (Student activity/Assignment)- At the end of 11 week	60 minutes		
7.	Total Continuous Internal Evaluation (CIE) Assessment			50marks
8.	Semester End Examination(SEE) Assessment (Written Test)	3 hrs	100	50marks
Total Marks				**100marks**

COURSE ASSESSMENT AND EVALUATION CHART

Assessment Method	Type of Assessment		Target	Assessment methods		Max Marks	Type of record	CO's for assessment
Direct Assessment	CIE Continuous Internal Evaluation	I A Testes	STUDENT	Three Tests (Average of Three Tests will be Computed)		30	Blue Books	CO1
								CO2, CO3
								CO4
		Assignment & Student activity		MCQ/QUIZ	20	20 **(Average)**	Log of record	Specified CO by the course coordinator
				Open Book Test	20			
				Student activity	20			
				Total CIE Marks		50		
	SEE	Semester End Exam		End of the Course		50	Answer Scripts by BTE	All CO's
				Total		100		
Indirect Assessment	Student feedback		STUDENT	Middle of the course		-NA-	Feedback forms	CO's which are covered
	End of Course survey			End of course			Question-naire	All CO's Effectiveness of delivery of instructions and assessment methods

RUBRICS FOR ACTIVITY (Example Only)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	4	**8**	**12**	**16**	**20**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	16
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	12

Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	16
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	16
					Average / Total Marks: (16+12+16+16)/4	**15 marks**

Note: Concerned	**faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity.**

Note: Dimension should be chosen related to activity and evaluated by the course faculty

Model Question Paper
I A Test (CIE)

Programme :	**Semester: I**
Course :	**Max Marks : 30**
Course Code :	**Duration : 1 Hr 20 minutes**
Name of the course coordinator:	**Test : I/II/III**

Note: Answer one full question from each section. One full question carries 10 marks.

Qn.No	Question	CL	CO	PO	Marks
	Section-1				
1.a)					
b)					
c)					
2.a)					
b)					
c)					
	Section-2				
3.a)					
b)					
c)					
4.a)					
b)					
c)					
	Section-3				
5.a)					

b)					
c)					
6.a)					
b)					
c)					

Model Question Paper
Semester End Examination

Programme:	**Semester: I**
Course :	**Max Marks: 100**
Course Code:	**Duration: 3 Hrs**

Instruction to the Candidate:

Answer one full question from each section. One full question carries 20 marks.

Qn.No	Question	CL	CO	Marks
	Section-1			
1.a)				
b)				
2.a)				
b)				
	Section-2			
3.a)				
b)				
4.a)				
b)				
	Section- 3			
5.a)				
b)				
6.a)				
b)				
	Section-4			
7.a)				
b)				
8.a)				
b)				
	Section-5			
9.a)				
b)				
10.a)				
b)				