GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester - II

Course Title: Advanced Building Materials
(Course Code: C4325003)

Diploma programme in which this course is offered	Semester in which offered
Architectural Assistantship	Second

1. RATIONALE

This course is in continuation with the "Building Materials" offered in their previous semester. It introduces the learners to various Advanced Building Materials used in the construction industry. In this course knowledge of various properties and uses of different building materials are imbibed in learners in such a way that this knowledge will enable them to take suitable material selection related decisions for architectural projects. In this course, the technology related to some of the important and widely used construction materials have been dealt with. This course will enrich architecture students in performing their task with required competency.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use relevant building materials for given architectural applications**

3. COURSE OUTCOMES(COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Understand the properties and uses of various materials used for building construction
b) Compare the different alternative materials suitable for the given requirement
c) Select suitable materials for building construction for the given requirement

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	0	0	3	30*	70	0	0	100

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of theCOs.

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** - End Semester Examination.*

5. SUGGESTED PRACTICAL/STUDIOEXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. T*hey are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. require
	Not Applicable		

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO.No.
	Not Applicable	

7. AFFECTIVE DOMAINOUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs. More could be added to fulfil the development of this course competency.

a) Work as a leader/a team member
b) Follow ethical practices
c) Practice environmental friendly methods and processes. (Environmentrelated)

The ADOs are best developed through the field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as explained below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNINGTHEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If

required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit– I **Finishes: Floor, Wall, Ceiling and Roofing**	**1.a**. Describe various factors affecting the selection of finishes **1.b**. Enlist various floor finishes and their uses with neat sketches **1.c**. Mention various types of flooring **1.d**. Explain various types of wall finishes and their uses **1.e**. Enlist various types of wall finishes **1.f**. Give requirements and uses of specified wall finishes **1.g.** Enlist various ceiling materials **1.h.** Explain various types of ceiling materials and its requirements	**1.1. Factors affecting the selection of finishes**: Base, room size and use, climatic conditions, maintenance, cost, appearance, safety and durability. **1.2. Types of flooring materials, their properties and their uses:** **1.2.1**. **Stone** – Natural stone like Marble, Granite, Kota, etc. and artificial stone **1.2.2. Wood** – Strip-flooring, block-flooring, Timber board, Timber Sheet, MDF/HDF (engineered wood), hardwood, bamboo **1.2.3. Tiles**–Vitrified, Mosaic, Ceramic, Thermoplastic, Flexible PVC, rubber, etc. **1.2.4. Glass**– Blocks, Toughened glass, Coloured glass, Textured glass, etc. **1.2.5.** Terrazzo, Marble finish, IPS, etc. **1.3. Requirements, properties and uses of the following types of wall finishes:** **1.3.1** Wall papers **1.3.2** Tiles **1.3.3** Wood **1.3.4** Cement mortar plaster **1.3.5** Gypsum plaster **1.3.6** Stucco plaster **1.3.7** Sprayed plaster **1.3.8** Special External Finishes for plaster surface • Roughcast • Smoothcast • Barium plaster **1.4 Requirements, properties and uses of ceiling materials:** **1.4.1** Plywood **1.4.2** Hardboard **1.4.3** Aluminium Composite Sheet **1.4.4** Fiberboard **1.4.5** Glassroof tiles **1.4.6** Thermocole sheets **1.4.7** Gypsum board **1.4.8** Fiber Glass **1.4.9** Plaster of Paris

	1.i. Give sizes, uses and requirements of various roofing materials **1.j.** Explain various types of roofing materials with neat sketches	**1.5 Standard sizes, properties, uses and their requirements for roofing** **1.5.1** Profile Roofing Sheet and its types **1.5.2** Fibre sheets & Polycarbonate sheets **1.5.3** Mangalore tiles **1.5.4** Acrylic Sheet **1.5.5** PVC Sheet **1.5.6** A.C. Sheet
Unit– II **Building fixtures, Paints, Varnishes and Distempers**	**2.a**. Explain various types of building fixtures and hardware with neat sketches **2.b**. Describe the given fixture with neat sketches **2.c** Define Painting and give its objectives. **2.d** Give characteristics of an ideal paint **2.e** Give composition of an oil borne paint. **2.f** Enlist various types of paints. **2.g** Enlist various Types of Varnishes. **2.h** Give characteristics of an ideal varnish. **2.i** Explain uses and requirements of various types of Paints & Varnishes **2.j** Explain process of painting on different surfaces. **2.k** Describe defects in paint. **2.m** Write the ingredients of varnish. **2.n** Describe the process of varnishing. **2.o** Give the properties of distemper. **2.p** Explain the process of distempering. **2.q** Describe white-washing and colour-washing.	**2.1**. Types, sizes and uses of building fixtures and hardware as per ISI **2.1.1** Tower bolt **2.1.2** Hinges **2.1.3** Door handles **2.1.4** Door springs & Floor springs **2.1.5** Latches **2.1.6** Aldrop **2.1.7** Floor door stopper **2.1.8** Locks **2.1.9** Door closer **2.1.10** Patch Fittings (all fittings for glass) **2.1.11** Wire-mesh (mosquito & fly-proof) **2.1.12** Magic eye (eyehole) **2.2** Painting and Characteristics of an ideal paint 2.2.1 Ingredients of an oil borne paint **2.3** Types of paints - advantages and uses **2.3.1.** Aluminum Paint **2.3.2.** Anti-Corrosive Paint **2.3.3.** Cellulose Paint **2.3.4.** Cement Paint **2.3.5.** Emulsion paint **2.3.6.** Enamel Paint **2.3.7.** Graphite paint **2.3.8.** Inodorous paint **2.3.9.** Luminous paint **2.3.10.** Oil Paints **2.3.11.** Plastic paint **2.3.12.** Silicate paint **2.3.13.** Synthetic rubber paint **2.4.** Process of painting-painting on different surfaces **2.5.** Defects in Painting **2.6.** Varnishing &Characteristics of an ideal Varnish **2.7.** Ingredients of a varnish **2.8.** Types of varnishes, requirement & uses of different types of varnishes **2.9.** Process of varnishing, **2.10.** Distempering: properties, ingredients, process of distempering **2.11.** White-washing **2.12.** Colour-washing

Unit – III Clay and Cement Products	**3.a**. Explain various Types of Clay products **3.b.** Describe Stoneware and Porcelain products. **3.c.** Explain Types of glazing. **3.d.** Describe clay block with Sketch. **3.e.** Explain various types of cement products **3.f.** Describe Cement hollow blocks, cement grills and decorative posts for railings	3.1. Roofing Tiles: Mangalore Tiles 3.2. Earthenware Products 3.3. Stoneware Products and porcelain: uses and advantages 3.4. Terra-cotta: advantages, disadvantages, uses. 3.5. Porcelain 3.6. Glazing: purpose, types 3.7. Clay blocks 3.8. Cement hollow blocks, cement grills and decorative posts for railings
Unit – IV Ferrous and Non-ferrous Metals	**4.a.** Enlist various ferrous Metals **4.b.** Describe Different forms of M.S. Sections with neat sketches **4.c.** Give various categories of steel **4.d.** Explain properties of specified steel **4.e.** Give the advantages of Tor steel over Mild Steel **4.f.** Explain Properties & uses of Aluminum **4.g.** Describe Aluminum alloys **4.h.** Give the different market forms of Aluminum	4.1. Steel - Properties, uses of different types of Steel (1) C.I.(2) W.I.(3)M.S. (4) G.I 4.2. Different forms of M.S. Sections. 4.3. Various categories of steel. 4.4. Advantages of Tor Steel over Mild Steel (M.S) 4.5. Aluminum 4.6. Properties & uses of Aluminum 4.7. Aluminum alloys- Properties &uses 4.8. Different market forms of Aluminum
Unit – V Composite and Insulating Materials	**5.a**. Explain functions and advantages of composite materials **5.b.** Describe uses and disposal of fly-ash **5.c.** Give the types and properties of electrical insulators **5.d.** Explain uses of heat insulating materials	**5.1.** Composite Materials: Function, advantages **5.2.** Fly-ash: Disposal and Uses **5.3.** Electrical Insulators: Types, properties **5.4.** Heat insulating materials: Types and uses

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPERDESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Finishes: Floor, Wall, Ceiling and Roofing	14	06	06	12	24
II	Building Fixtures, Paints, Varnishes and Distempers	14	06	06	12	24
III	Clay and Cement Products	04	02	02	02	06
IV	Ferrous and Non-ferrous Metals	06	04	02	04	10
V	Composite and Insulating Materials	04	02	02	02	06
Total		42	20	18	32	70

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

***Note**: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

10. SUGGESTED STUDENTACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Conduct Market survey for paint, varnishes and distempers.
b) Visit of construction sites to study the uses of advanced building materials and prepare a report.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide students on how to address issues on freehand sketching, model making etc. (not related to this course).
g) Guide students for using relevant ordering principle.
h) Arrange visit to nearby site for understanding various concepts related to Architectural Design.
i) Use video/animation films to explain various concepts/processes related to Architectural Design themes.
j) Use different instructional strategies in classroom teaching.
k) Display various technical brochures of recent Architectural Design processes

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar

presentation of it before submission. The duration of the micro-project should be about **14-16 (fourteen to sixteen) student engagement hours** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This must match with the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Conduct Market survey for the building materials.
b) Prepare a report on the market survey supported with the photographs.
c) Study of on-going constructions works and documentation of the same in the form of a report with photographs and sketches.

13. SUGGESTED LEARNINGRESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Engineering Materials (Material Science)	Rangwala	Charotar Publishing House Pvt. Ltd., Anand, ISBN: 9789385039171
2	Building Materials	S. K. Duggal	New Age International (P) Limited, Publishers ISBN (13):978-81-224-2975-6
3	Building Construction	S.C.Rangwala	Charotar Publishing House Pvt. Ltd., Anand, ISBN: 9788185594873
4	A text book of Building Construction	Dr. B. C. Punmia, Ashok KumarJain, ArunKumarJain	Laxmi Publications (P) Ltd., ISBN: 81-7008-053-3
5	The text book of Building Construction	S. P.Arora, S. P. Bindra	DhanpatRai Publications, ISBN 13: 9788189928803 ISBN: 978-1-84569-956-7 (online)
6	Material Architecture Paperback – Illustrated	John Fernandez	Routledge ISBN-10 : 0750664975 ISBN-13 : 978-0750664974

14. SOFTWARE/LEARNINGWEBSITES

- https://nptel.ac.in/courses/105/106/105106206/
- https://nptel.ac.in/courses/124/105/124105013/
- https://nptel.ac.in/courses/105/102/105102088/

15. PO-COMPETENCY-COMAPPING

Semester I	Building Materials (Course Code: C4315003)								
	POs and PSOs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ develop-ment of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO6 Project Manage-ment	PO 7 Life-long learning	PSO1 *	PSO2 #
Competency	Use relevant building materials for given architectural applications								
COa) Understand the properties and uses of various materials used for building construction.	3	-	-	-	2	-	1	1	1
CO b) Compare the different alternative materials suitable for the given requirement	3	2	-	-	2	-	1	1	1
CO c) Select suitable materials for building construction for the given requirement	3	2	-	-	2	-	1	1	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO/PSO.*

***PSO1: Planning & Design:** Prepare architectural designs and all types of drawings with appropriate material specifications and application techniques as per specific project requirements.

#PSO2: Execution: Work competently as assistants in architectural firms so as to contribute and coordinate both office work and execution on site.

16. COURSE CURRICULUM DEVELOPMENTCOMMITTEE

GTU ResourcePersons

Sr. No.	Name and Designation	Institute	Contact No.	Email
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