**GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)**

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

**Course Title: Building Construction**
(Course Code: 1036302)

| Diploma Programme in which this course is offered | Semester in which offered |
|---|---|
| Diploma in Architecture | Third |

## 1. RATIONALE

This course essentially imparts the knowledge of construction of buildings and its components; at an introductory level. This course further introduces the learners to interpret the drawings and get familiar with the functions and requirements of various building components. The learners will get an exposure to the general construction practices by undertaking site visits.

## 2. COMPETENCY

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

- **Apply building construction concepts and techniques for architectural design**

## 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 learner for the achievement of the following COs:

a) Comprehend basics of building components and explain various types of building foundations.
b) Describe general principles of masonry construction.
c) Select suitable type of openings and staircase for a given building as per the requirements.
d) Describe the R.C.C. construction.
e) Classify various sloping roofs as per 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 | - | 4 | 5 | 30* | 70 | 25 | 25 | 150 |

*(*): 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 the COs.*

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

## 5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *Some of the **PrOs** marked **'*'** (in approx. Hrs column) are compulsory, as they 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. Required |
|---|---|---|---|
| 1 | Sketches on building wall section | I | 02 |
| 2 | Sketches on types of Foundations | II | 08 |
| 3 | Sketches on Masonry Construction | III | 08 |
| 4 | Sketches on Openings | IV | 10 |
| 5 | Sketches on Staircase | V | 08 |
| 6 | Sketches of Scaffolding and Formwork | VI | 04 |
| 7 | Sketches of Sloping roofs | VII | 04 |
| 8 | Prepare one model of any of the given building components | -- | 04 |
| 9 | Carry out one site visit pertaining to the topics covered in curriculum | -- | 04 |
| 10 | Introduction to long-span structures:<br>Graphical representation of structures with spans larger than 20 meters. Draw neat sketches and explain in brief the following structures:<br>• folded plates<br>• shell structures<br>• tensile structures<br>• portal frames | -- | 04 |
| | | | **56 Hrs.** |

***Note***

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

*ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

| S. No. | Sample Performance Indicators for the PrOs | Weightage in % |
|---|---|---|
| 1 | Proper planning and layout of drawing sheet – overall composition (for optimum use of drawing sheet) | 10 |
| 2 | Completing given practice problems | 20 |
| 3 | Accuracy of drawing | 20 |
| 4 | Neatness of drawing | 10 |
| 5 | Timely submission of completed drawing sheet | 20 |
| 6 | Answering viva voce questions | 20 |
| **Total** | | **100** |

## 6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This 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. |
|---|---|---|
| 1 | Drawing Board with other drawing Instruments | 1 to 6 |
| 2 | Interactive board with LCD overhead projector | 1 to 6 |

## 7. AFFECTIVE DOMAIN OUTCOMES

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

a) Work as a leader/a team member.
b) Follow safety practices while using equipment.
c) Realize importance of green energy.

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

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

## 8. UNDERPINNING THEORY

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 higher level UOs could be included by the course teacher
to focus on attainment of COs and competency.

| Unit | Unit Outcomes (UOs)<br>(4 to 6 UOs at different levels) | Topics and Sub-topics |
|---|---|---|
| **Unit – I Introduction** | 1a. Explain types of building based on structure: Load bearing, Framed & Composite<br>1b. Describe concept of various types of components of building | 1.1 Principles of Load bearing, Framed & Composite structures; their merits and demerits<br>1.2 Components of Building: Section of a typical wall showing all major components of a building |
| **Unit – II Foundation** | 2a. Explain the concept and principle of foundation<br>2b. Compare Shallow Foundation and Deep foundation<br>2c. Prepare the sketches of different types of foundation | 2.1. Definition of foundation<br>2.2. Purpose of foundation<br>2.3. Bearing capacity of soil and its relevance to foundation<br>2.4. Types of foundation: Shallow, Deep<br>2.5. Various types of Shallow Foundation with sketches: Spread footing, stepped footing, Isolated and |

| | | |
|---|---|---|
| | | Combined footing, Raft foundation, Grillage foundation<br>2.6. Pile foundation: Types of piles based on functions only<br>2.7. Causes of failure of foundation |
| **Unit – III**<br><br>**Masonry Construction** | 3a. Describe the main principles and features of Brick Masonry construction<br>3b. Describe the main principles & features of Stone Masonry construction<br>3c. Draw sketches of various types of bonds in brick masonry construction<br>3d. Prepare detail drawings of various types of joints in stone masonry construction<br>3e. Compare stone masonry & brick masonry in respect of their construction & use | 3.1. Definition of the terms related to Brick Masonry: Header, Stretcher, Bond, Closer, Frog, Quoins, Course, Face, Back, Hearting, Joint, Bat, etc.<br>3.2. General principles to be followed in construction of Brick Masonry<br>3.3. Different Types of Bonds: English Bond, Flemish Bond, Stretcher Bond, Header Bond, Racking Bond, Zigzag Bond, Garden Wall Bond<br>3.4. Plan and Elevation of above Bonds<br>3.5. Comparison between English bond and Flemish bond<br>3.6. Terms related to stone masonry: through stone, bonder, spell, natural bed, weathering, corbel<br>3.7. Types of Stone Masonry: Rubble masonry, Coursed rubble, Uncoursed rubble, Random rubble, Dry rubble, Ashlar masonry<br>3.8. General principles to be followed in construction of stone Masonry.<br>3.9. Joints in Stone Masonry: Butt joint, Rebated joint, Rusticated joint, Dowel joint, tonged & grooved joint, cramped joint, etc.<br>3.10. Comparison between Brick Masonry and Stone Masonry |
| **Unit– IV**<br><br>**Openings** | 4a. Give the functions of different types of openings: lintels, arches, doors, windows and ventilators<br>4b. Describe different types of openings with sketches | 4.1 Lintels & arches: Lintels – functions, types, construction.<br>4.2 Arches – technical terms, types – brick arches, rough, axed, stone arches, flat – semicircular.<br>4.3 Doors: Function and Types of Doors: Hinged Doors, Dutch Doors, Roller Doors, Sliding Doors, Pivot Doors, French Doors, Panel Doors, Flush Door, Battened & Ledged Doors, Glass Door, Louvered Doors, Swing Doors, Collapsible Doors, Rolling Shutters, Glazed/Slash Door, Revolving Doors |

| | | |
|---|---|---|
| | | 4.3 Windows: Functions and Types of Windows: Picture Windows, Casement Windows, Bay Windows, Single-Hung Windows, Double-Hung Windows, Awning Windows, Horizontal Sliding Windows, Casement Window<br>4.5 Ventilators: Functions and Types of Ventilators |
| **Unit– V**<br>**Staircase** | 5a. Identify the different components of stairs<br>5b. Enlist the various materials used in the construction of stairs<br>5c. Classify the different types of stairs. | 5.1 Definition of Staircase<br>5.2 Technical terms related to Stairs<br>5.3 Various materials used for Stairs<br>5.4 Classification of types of Stairs based on: shape, material etc. |
| **Unit– VI**<br>**R.C.C. Construction** | 6a. Describe the main principles and advantages of R.C.C. construction<br>6b. Draw basic sketches of Scaffolding<br>6c. Draw basic sketches of Formwork | 6.1 Definition of R.C.C.<br>6.2 Properties of R.C.C.<br>6.3 Advantages of R.C.C.<br>6.4 Causes of failure of R.C.C.<br>6.5 Basic sketches of Scaffolding<br>6.6 Basic sketches of Formwork for column, beam and slab |
| **Unit– VII**<br>**Sloping Roof** | 7a. Identify the various components of sloping roof<br>7b. Classify roof of different types<br>7c. Describe the features of steel sloping roof truss | 7.1 Technical terms related to sloping roof<br>7.2 Classification of roof<br>7.3 Composite roof truss<br>7.4 Steel sloping roof truss<br>7.5 Advantages of Steel truss over timber sloping roof |

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Introduction | 4 | 2 | 4 | 0 | 06 |
| II | Foundation | 6 | 2 | 4 | 8 | 12 |
| III | Masonry Construction | 10 | 2 | 4 | 8 | 14 |
| IV | Openings | 8 | 2 | 4 | 8 | 14 |
| V | Staircase | 6 | 2 | 4 | 6 | 12 |
| VI | R.C.C. Construction | 4 | 2 | 2 | 2 | 06 |
| VII | Sloping Roof | 4 | 2 | 2 | 2 | 06 |
| **Total** | | **42** | **14** | **22** | **34** | **70** |

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

***Note**: This specification table provides general guidelines to assist learner for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions 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 vary slightly from above table.*

## 10. SUGGESTED LEARNER ACTIVITIES

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

a) Visit of construction sites to observe the current construction practices and prepare a comprehensive report with photographs, sketches, descriptions, etc.
b) In a group of 4-5 learners prepare an internet/library-based presentation for each of above topics considering recent practices prevailing across the globe.

## 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 learner(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 learners 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 learners on how to address issues on environment and sustainability.
g) Guide learners for using data manuals.

## 12. SUGGESTED MICRO-PROJECTS

***Only one micro-project*** is planned to be undertaken by a learner that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of learners 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 learner 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 microproject should be about **14**-**16** ***(fourteen to sixteen) learner engagement hours*** during the course. The learners 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 has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Study of on-going constructions works and documentation of the same in the form of a report with photographs and sketches.

## 13. SUGGESTED LEARNING RESOURCES

| S. No. | Title of Book | Author | Publication with place, year and ISBN |
|---|---|---|---|
| 1 | The text book of Building Construction | S. P. Arora, S. P. Bindra | Dhanpat Rai Publications (P) Limited ISBN: 978-81-89928-80-3 |
| 2 | The Construction of Buildings (Vol. 1 to 5) | R. Barry | Wiley Publications, ISBN: 978-1-118-97721-7 |
| 3 | Building Construction | Dr. B. C. Punmia, Er. Ashok K. Jain, Dr. Arun K. Jain | Laxmi Publication (P) Limited, Eleventh Edition (2016), ISBN: 978-81-318-0428-5 |
| 4 | Building Construction (Vol. 1 to 4) | W. B. McKay | Orient Longman Limited |
| 5 | Building Construction | Rangwala | Charotar Publishing House (P) Limited ISBN: 978-93-85039-04-1 |
| 6 | Building Construction and Materials | Gurcharan Singh | Standard Book House, ISBN-13: 9788189401214 |

## 14. SOFTWARE/LEARNING WEBSITES

a) http://www.nptel.iitm.ac.in/

b) http://www.constructionknowledge.net/

c) http://houseconstructiontips.com/

## 15. PO-COMPETENCY-CO MAPPING

| Semester III | Building Construction (Course Code: 4335002) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | POs | | | | | | | | |
| Competency & Course Outcomes | PO 1 Basic & Discipline specific knowledge | PO 2 Problem Analysis | PO 3 Design/ development of solutions | PO 4 Engineering Tools, Experimentation &Testing | PO 5 Engineering practices for society, sustainability & environment | PO 6 Project Management | PO 7 Life-long learning | PSO1 * | PSO2 # |
| Competency | Apply building construction concepts and techniques for architectural design | | | | | | | | |

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Outcomes CO a) Comprehend basics of building components and explain various types of building foundations. | 2 | 1 | - | 1 | 1 | 1 | 2 | 2 | 2 |
| CO b) Describe general principle of masonry construction. | 2 | 2 | - | 1 | 1 | 1 | 2 | 2 | 2 |
| CO c) Select suitable type of openings and staircase for a given building as per the requirement. | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| CO d) Describe the R.C.C. construction. | 2 | 1 | - | 1 | 1 | 1 | 2 | 2 | 2 |
| CO e) Classify various sloping roofs as per requirement. | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |

***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 DEVELOPMENT COMMITTEE

### GTU Resource Persons

| S. No. | Name and Designation | Institute | Contact No. | Email |
|---|---|---|---|---|
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