

**Program Name: Civil Engineering Program Group**

**Program Code : CE/CR/CS**

**Semester : Third**

**Course Title : Building Construction**

**Course Code : 22304**

### 1. RATIONALE

Building Construction is a core subject in Civil Engineering, which deals with the construction processes of sub structure, super structure, Building Finishes and maintenance of buildings. This course essentially imparts the knowledge of construction technology along with the processes involved in it and various construction equipments used for effective execution of various construction activities. This knowledge shall be used for effective and efficient up keeping of building after construction. This will enable the students to undertake the activities in comparatively shorter period of time.

### 2. COMPETENCY

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

- **Implement safe building construction practices.**

### 3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select the relevant material for finishing works.
- Execute safe practices in building construction activities.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(\*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment 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, ESE - End Semester Examination; PA - Progressive Assessment

### 5. COURSE MAP (with sample COs, PrOs, UOs, AOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

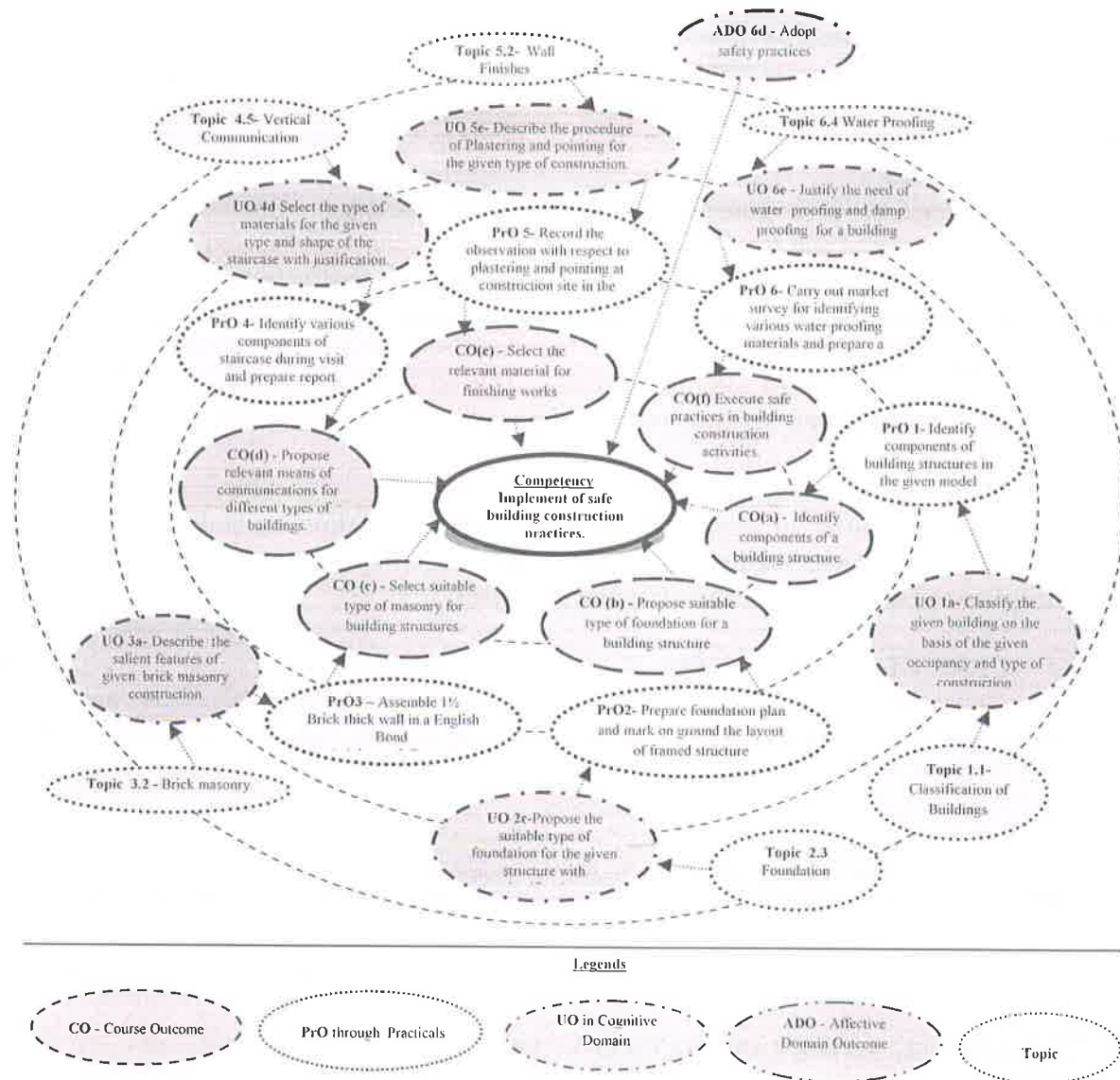


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS / EXERCISES**

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify components of building structures in the given model.	I	02*
2	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.(Part I)	II	02*
3	Prepare foundation plan to mark layout on the ground of the load bearing structure from the given building plan.( Part II)	II	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Prepare foundation plan to mark layout <b>on the ground</b> of the framed structure from the given building plan.(Part I)	II	02*
5	Prepare foundation plan to mark layout <b>on the ground</b> of the framed structure from the given building plan.( Part II)	II	02*
6	Assemble $1\frac{1}{2}$ Brick thick wall in a English Bond, (minimum 3 Course)	III	02*
7	Assemble $1\frac{1}{2}$ brick thick wall in a Flemish Bond. (minimum 3 Course)	III	02
8	Prepare a simple stone masonry construction work.	III	02
9	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part I)	III	02*
10	Prepare a report on visit to construction site with respect to scaffolding, formwork and centering work.(Part II)	III	02*
11	Identify various components of staircase in the given model.	IV	02*
12	Identify various components of doors and windows in the lab in the model to prepare the report with sketches.	IV	02
13	Identify various types of flooring and roofing materials in the lab to prepare report.(Part I)	V	02*
14	Identify various types of flooring and roofing materials in the lab to prepare report.( Part II)	V	02*
15	Record the observation of plastering and pointing work at construction site to prepare a report.	V	02*
16	Record the observation of painting in residential / public building work to prepare a report.	V	02
17	Carry out market survey for identifying various water proofing materials and prepare a report	VI	02
18	Prepare a sketch book consisting of all the sketches from experiment Number 1, 2, 4, 6, 7,11,12	I to IV	02*
	<b>Total</b>		<b>36</b>

**Note**

i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.

ii. Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10



S. No.	Performance Indicators	Weightage in %
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
<b>Total</b>		<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- a. Follow safety practices.
- b. Practice good housekeeping.
- c. Demonstrate working as a leader/a team member.
- d. Maintain tools and equipment.
- e. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> year.

#### 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Optical Square, Ranging rod, Pegs. Arrows, Line dori, Lime powder, Measuring Tape, Hammer of standard size and specification as per civil engineering application.	2-5
2	Bricks, Plumbs, Mason Square, Level tube, Line dori.	6,7
3	Models: a. Model of a civil engineering structure depicting various components. b. Cut section of building showing different components c. Types of Bonds in Brick masonry d. Types of Door and Windows e. Types of Stairs f. Types of Roofs g. Formwork for different RCC elements	9-12





## 8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Overview of Building components</b>	<p>1a. Classify the given building on the basis of the given occupancy and type of construction.</p> <p>1b. Categorize the component parts of the given type of building.</p> <p>1c. Explain the salient characteristics for the given building structure.</p> <p>1d. Compare the given parameters of given load bearing and framed structure.</p>	<p><b>1.1 Classification of Buildings</b> As per National Building Code- Part III (2005) Group A to I Latest code may be referred As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure.</p> <p><b>1.2 Building Components</b> a. Building Components and their function. b. Substructure – Foundation, Plinth and Plinth Filling. c. Superstructure – Walls, Partition wall, cavity wall, Sill, Lintel, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.</p>
<b>Unit – II Construction of Substructure</b>	<p>2a. Describe the procedure of line out of the given building for the given method</p> <p>2b. Explain the precautions required in excavation for the given type of foundation.</p> <p>2c. Propose the suitable type of foundation for the given structure with justification</p> <p>2d. Suggest the relevant pumping method of dewatering from given excavation pit with justification.</p>	<p><b>2.1 Job Layout :</b> Site Clearance, Preparing Job Layout, Layout For Load Bearing Structure and Framed Structure by Center Line And Face Line Method, Precautions</p> <p><b>2.2 Earthwork:</b> Excavation For Foundation, Timbering and Strutting, Earthwork for Embankment, Material For Plinth Filling. Tools and Plants Used for Earthwork</p> <p><b>2.3 Foundation:</b> Functions of Foundation, Types of Foundation –Shallow Foundation, Stepped Footing, Wall Footing, Column Footing, Isolated And Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation-Pile Foundation, classification based on materials and functions, Well foundation and Caissons. Pumping Methods of Dewatering. Deep wells, Well points, Cofferdams.</p>
<b>Unit- III Construction of Superstructure</b>	<p>3a. Describe the salient features of given type of brick masonry construction</p> <p>3b. Describe the major features of the given type of stone masonry construction</p> <p>3c. Describe the given type(s) of brick masonry bonds</p>	<p><b>3.1 Stone Masonry:</b> Terms used in stone masonry- facing, backing, hearting, through stone, corner stone, cornice. Type of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose and procedure. Selection of Stone Masonry, Precautions to be observed in Stone Masonry Construction</p>



	<p>with sketches.</p> <p>3d. Describe the given type(s) of joints in stone masonry with sketches.</p> <p>3e. Compare stone masonry with brick masonry on the basis of given criteria.</p>	<p><b>3.2 Brick masonry:</b> Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry, Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone masonry and Brick Masonry. Tools and plants required for construction of stone masonry and brick masonry. Hollow concrete block masonry and composite masonry.</p> <p><b>3.3 Scaffolding:</b> Necessity, component parts and types of Scaffolding, platforms used for multi storeyed building.</p> <p><b>3.4 Scaffolding and Shoring:</b> Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork.</p>
<p><b>Unit– IV Building Communication and Ventilation</b></p>	<p>4a. Describe the type of opening for the given situation with sketches.</p> <p>4b. Select the relevant types of doors and windows for the given situation with justification.</p> <p>4c. Select the type of fixture and fastener for given type of door or window with justification.</p> <p>4d. Select the type of materials for the given type and shape of the staircase with justification.</p> <p>4e. Suggest the type of staircase for the given situation with justification.</p>	<p><b>4.1 Horizontal Communication: Doors –</b> Components of Doors, Fully Panelled Doors, Partly Paneled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS.</p> <p><b>4.2 Windows:</b> Component of windows, Types of Windows-Fully Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminum windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window. Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators, Cement Grills.</p> <p>4.3 Fixtures and fastenings for doors and windows.</p> <p>4.4 Material used and Functions of Window Sill and Lintels, Weather. Shed/Chajja.</p> <p><b>4.5 Vertical Communication:</b> Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators.</p>



		<p>Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, going, scotia, hand rails, newel post, landing, headroom, winder. Types of staircase-on the basis of shape: Straight, dog-legged, open well, Spiral, Quarter turn, Bifurcated, Three quarter turn, and Half turn, On the basis of Material: Stone, Brick, R.C.C., wooden and Metal.</p>
<p><b>Unit-V Building Finishes</b></p>	<p>5a. Choose the flooring material for the given type of building with justification.</p> <p>5b. Explain the procedure for laying and construction of given type of floor.</p> <p>5c. Describe the procedure of Plastering and pointing for the given type of construction.</p> <p>5d. Select the relevant type of paint material(s) to be used for the given type of building surface.</p>	<p><b>5.1 Floors and Roofs:</b> Types of Floor Finishes and its suitability- Shahabad , Kota, Marble, Granite, Kadappa, Ceramic Tiles, Vitrified, Chequered Tiles, Pavement Blocks, Concrete Floors, wooden Flooring, Skirting And Dado. Process of Laying- Process of laying And Construction, Finishing and Polishing of Floors, Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. and Painted Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss and Lean to Roof, terms used in roofs.</p> <p><b>5.2 Wall Finishes:</b> Plastering – Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, rough finish, Neeru Finishing and POP. Special Plasters- Stucco Plaster, sponge finish, pebble finish. Plaster Board And Wall Claddings. Precaution to be Taken While Plastering. Defects in Plaster. Pointing – Necessity, Types of pointing and Procedure of Pointing, Painting –Necessity, Surface Preparation for painting, Methods of Application, Selecting Suitable Painting Material.</p>
<p><b>Unit- VI Building Maintenance</b></p>	<p>6a. Suggest the techniques for repair of given type of cracks with justification.</p> <p>6b. Describe the causes and remedial measure for settlement of foundation of the given type of building structure.</p> <p>6c. Describe the safe procedure for demolition of the given structure.</p> <p>6d. Justify the need of water</p>	<p><b>6.1 Cracks :</b> Causes and Types of Cracks, Identification and Repair of Cracks. Grouting and Guniting.</p> <p><b>6.2 Settlement of Foundation:</b> Types, Causes and Remedial measures.</p> <p><b>6.3 Demolition:</b> Necessity, Method of Demolition- Hand Demolition, Machine Demolition, Controlled Blasting. Demolition Implosion, Precautions During Demolition.</p> <p><b>6.4 Water Proofing:</b> Necessity and importance, Material used for Water Proofing, Non</p>



	proofing and damp proofing for the given type of building construction. 6e. Describe safe practices to be used during the construction of the given type of building.	conventional method of waterproofing- Introduction of crystalline waterproofing, cement base polymer coatings. conventional waterproofing methods- brick bat coba waterproofing, Box type water proofing, Injection/grouting. Plinth Protection necessity and material used, Damp Proof Course.
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**Note:** To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

### 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	Overview of building components	6	2	2	4	08
II	Construction of Substructure	10	4	4	6	14
III	Construction of Superstructure	12	4	6	10	20
IV	Building Communication and Ventilation	8	2	4	6	12
V	Building Finishes	6	2	2	4	08
VI	Building Maintenance	6	2	2	4	08
<b>Total</b>		<b>48</b>	<b>18</b>	<b>20</b>	<b>34</b>	<b>70</b>

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

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

### 10. SUGGESTED STUDENT ACTIVITIES

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 conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Classify minimum three buildings near by your institute with reference to National Building Code- Part III (2005) and prepare a report.
- Identify the components of a building by inspecting the available model and prepare a report.
- Visit to construction site to observe brickwork, Sill, Lintel, Chajja, Slab, Parapet wall and prepare a report.
- Identify types of foundation by inspecting available models and prepare a report.
- Search software/freeware for the course content and write the report stating their applications.

### 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. '**L**' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Procure various materials required for practical exercises.
- g. Arrange visit to nearby industries and workshops for understanding various construction materials.
- h. Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
- i. Use different instructional strategies in classroom teaching.
- j. Demonstrate different samples of various construction materials like Stone, aggregate of different sizes, timber, lime, bitumen, Bricks, tiles, precast concrete products, Water proofing material, Termite proofing material, Thermal insulating material, plaster of Paris, paints, distemper, and varnishes.
- k. Display various technical brochures of recent building materials.

## 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. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a sketchbook consisting of components of building (for Sketches which are not included in Practical sketch book).
- b. Collect the relevant information of recent technologies in building construction and prepare a report on it.
- c. Identify the different types of cracks and remedial measures and submit a report on case study.
- d. Collect the relevant information of different techniques of demolition of existing structure and submit a report on it.
- e. Prepare a summary report with reference to content in any one part of National Building Code.



- f. Carryout market survey for identifying various water proofing materials and prepare a report.

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013, ISBN: 9788189928803
2.	Building construction illustrated	Francis D.K. Ching	Wiley India, USA, 2014, ISBN: 978-1-118-45834-1
3.	Building Construction	S. C. Rangawala	Charotar Publication, Dist-Anand ISBN-13: 978-8185594859
4.	Building Construction	B. C. Punmia and A.K. Jain	Firewall Media, 2005 ISBN 9788170080534
5.	Building Construction	S.K. Sharma	S. Chand and Co. Pvt. Ltd., New Delhi (ISBN:978-81-219-0479-7)
6.	Building Construction	Dr. Janardan Zha	Khanna Publication, New Delhi 2007, ISBN –8174091106
7.	Building Construction	S. S. Bhavikatti	Vikas Publication House Pvt. Ltd., New Delhi (ISBN: 978-93259-6079-4)
8.	A to Z Building Construction	Sandip Mantri	Satya Prakashan; New Delhi (2015) ISBN-13: 978-8176849692

#### HandBooks

S. No.	Title of Book	Author	Publication
1.	PWD Handbooks for Materials, Masonry, Building, Plastering and Pointing - Foundation	All India Council for Technical Education	All India Council for Technical Education (AICTE)
2.	Practical Civil Engineering Handbook	Khanna	Khanna Publication

#### BIS/ International Codes of Practice

S. No.	Title of Book	Author	Publication
1	National Building Code	BIS	Bureau of Indian Standard, New Delhi
2	BIS 962-1989 Code of Architectural and Building Drawing	BIS	
3	BIS 1038- 1983 Steel Doors, Windows and Ventilators	BIS	

### 14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://www.learningconstruction.com/>
- <http://www.understandconstruction.com/>
- <http://www.constructionknowledge.net/>

