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WESTBENGAL

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5-Year Bachelor of Architecture (B.Arch.) Curriculum and Syllabus

Third Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	S	P	
Theory					
TIU## - 3##	Theory of Structure - I	4	0	0	3
TIUAR - 314	Water Supply and Plumbing Services	3	0	0	1
TIUAR- 311	History of Architecture - I	4	0	0	3
TIUAR- 312	Climatology	3	0	0	2
TIUAR- 313	Landscaping and Site Planning	2	0	0	2
Practical					
TIU## - 3##	Surveying & Levelling	2	0	2	2
TIUAR- 315	Computer Application - I : CAD 3D	0	0	2	2
TIUAR- 318	Educational Tour	0	0	0	2
Sessional					
TIUAR- 316	Architectural Design - II	0	6	0	6
TIUAR- 317	Details of Construction - II	2	4	0	4
Institute Programme					
TIUFY- 3##	Career Advancement & Skill Development	3	0	0	3
TIUFY- 3##	Entrepreneurship Skill Development	0	0	0	2
Total Credits					**32**

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THEORY OF STRUCTURE - I (TIU## - 3##) L – S – P (4 – 0 – 0)

Credits-3

MODULE I

Pure Bending:
Theory, assumptions and equation of bending. Concept of Sectional modulus, Distribution of bending stress in beam cross-section. Bending Stress Distribution in composite beam cross section, Concept of Modular Ratio.

MODULE II

Assumptions and equation of shear in beam section Shear stress in the Beam cross-section

MODULE III

Differential equation of the elastic curve – Deflection of beams (due to bending only) by double integration method – Area moment theorems – Applications to simply supported, cantilever and overhanging beams.

MODULE IV

Strain energy for axial load, bending Castigliano‘s First theorem. Applications to find beam deflection and deflection of Statically Determinate Truss.

MODULE V

Theory of Torsion, Equation of Torsion, Solid & Hollow shaft under pure torsion, percentage of savings, stresses due to combination of Torsion and bending Moment.

MODULE VI

Theory of Columns – Euler‘s theory for different support conditions –Rankin‘s Formula.

MODULE VII

Analysis of three hinged arches of parabolic and circular shape, Eddy‘s theorem. Bending moment, Normal thrust and radial shear.

Recommended books :

1. B.C. Purmia, Laxmi Publication; Strength of Material and Theory of Structures (Vol-I).
2. S. Timoshenko: Strength of Material, Tata McGraw Hill, New Delhi.
3. S.Ramamurtham, Strength of Material, Dhanpat Rai Publication.
4. Singer; Strength of Material.
5. Srinath ;Strength of Material.

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WATER SUPPLY & PLUMBING SERVICES (TIUAR - 314) L – S – P (3 – 0 – 0)

Credits-1

MODULE I

Water Supply: Sources and Requirements as per building types, Potable water-Norms, treatment processes, methods of supply, Water distribution and storage systems: Principles and general requirements

Domestic water piping systems: Water distribution networks. Cold and hot water distribution within the building. Specifications and sketches of various plumbing fittings for buildings. Uses of valves, taps, and their different types. House/service connection. Layout of water supply lines in a domestic house.

MODULE II

Sanitation and Drainage: Requirements and standards as per norms. Plumbing systems. Components of drainage and sanitation systems. Design considerations for drainage and sewerage systems for various building types. Details of a Septic tank and capacity calculation.

Sewer System: Quantity of sewage and storm water, infiltration, runoff calculation, Manning's
formulae, partial flow diagram. Design of Sewers, shapes of sewers, factors affecting the design
of sewers. Materials, bend, pipe joints used in sewer systems.

Sewer appurtenances: Manholes, Sub drains, culverts, ditches and gutters, drop inlets and catch basins roads and pavements, storm overflow/regulators. Intercepting chambers,inspection chambers and their proper location and ventilation of sewers. Laying and testing of sewer. Gradient used in laying of drains and sewers, and respective sizes.

Sewage treatment: The process of self purification Disposal of sewage from isolated building (septic tank, imhoff tank), sewage breakdown. Plumbing definitions and related terms, plumbing systems (one pipe, two pipe; etc), House drainage system and sanitary appliances and traps.

Design considerations on drainage scheme: Preparation of plan, Planning of bathrooms, lavatory blocks and kitchen in domestic and multi-storeyed buildings. Indian standards for sanitary convenience. Model bye laws regarding sanitation of buildings

MODULE III

Materials, Fittings and Appliances for water supply, sanitation, drainage, and fire fighting.

Recommended books :

1. B. C. Punmia; Water Supply and Sanitation.
2. S.C. Rangwala, Water Supply and Sanitary Engineering, Charter Publishing House,
3. Anand 388 601, 1989.
4. C.S, Shah; Water supply and Sanitation Engineering.

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HISTORY OF ARCHITECTURE I (TIUAR - 311) L – S – P (4 – 0 – 0)

Credits-3

MODULE I

Evolution of Temple Architecture in India: Introduction - Earliest Temples of India**:** Influence of Vedic and Buddhist Architecture on temple design – basic functions and forms – nomenclature - Study of Gupta Temples - development of two main styles: South Indian (Dravida and Vesara Temples) and North Indian (Nagara Temples)

MODULE II

Temple Architecture of Southern India: Evolution of Dravidan Temples - basic principles of forms and functions – superstructure -iconography – relevant nomenclatures - temple development under Chalukya, Pallava, Chola, Pandya, Vijaynagar and Nayaka dynasties with examples\ Development of Vesara Temples – Hoysala Architecture

MODULE III

Temple Architecture of Northern India: Introduction to evolution of North Indian i.e. Nagara / Indo Aryan style – basic principles of forms and functions – superstructural uniqueness - iconography – temple development under Orissa, Khajuraho, Bengal and Gujarat group with examples Development of Jain Temple – principles of design – iconography - Study of the Dilwara Temple, Mount Abu

MODULE IV

Evolution of Islamic Architecture in India: Introduction – **Sultani Architecture:** Introduction to Islamic Architecture in India – Vocabulary and Principles – Religious and Secular Structures – Essential of a typical Indian mosque – Components of a typical tomb building – relevant nomenclatures like squinch, arch, domes, maqsurah, sahn, liwan, mihrab, qibla etc-

MODULE V

Development of Mosques and Tombs under Slave, Khilji, Tughlaq, Sayyid and Lodi dynasties – principles of design – scale – fusion elements – site planning – relevant nomenclatures - **Tomb of Sher Shah** – design principles – scale – iconography – site planning

MODULE VI

Introduction to the provincial styles of Islamic Architecture in India Islamic Architecture in Bengal – design principles – scale and proportion – fusion elements – drop arches, cross vault, bow-roof - examples

MODULE VII

Mughal Architecture: Earlier Sandstone Phase**:** Babar & Humayun: Beginning of garden tomb – ex. Humayun‘s Tomb — Akbar: assimilation of traditional Indian and Islamic style - red sandstone with insertion of marble – trabeated construction system with tudor arch – study of Fatehpur Sikri Later Marble Phase: Jahangir: Formal Mughal Gardens in Kashmir – marble structure – human scale – pietra dura and opus sectile work – ex. Tomb of Itmad-Ud-Daulla, Agra — Shahjahan: Age of marble – dome assuming Persian bulbous form constricted at neck – use of optical illusion – study of Taj Mahal, Agra and Red Fort, Delhi.

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Recommended Books:

1. Indian Architecture Vol. 1 (Buddhist & Hindu) / Percy Brown / D.B. Taraporevala Sons & Co. Pvt. Ltd.
2. Indian Architecture Vol. 2 (Islamic Period) / Percy Brown / D.B. Taraporevala Sons & Co. Pvt. Ltd.
3. Islamic Architecture in India / Satish Grover / Galgotia Publishing Company, New Delhi
4. Buddhist and Hindu Architecture in India / Satish Grover / CBS
5. A History of Architecture / Sir Banister Fletcher / Butterworth Heinemann (Hb), CBS (Pb)
6. The Great Ages of World Architecture / G. H. Hiraskar / Dhanpat Rai
7. A World History of Architecture / Marian Moffett, Michael Fazio & Lawrence Wodehouse / McGraw-Hill

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CLIMATOLOGY (TIUAR-312) **L – S – P (3 – 0 – 0)**

Credits-2

MODULE I

Introduction

- Climate and Weather
- Elements of Climate
- Classification of tropical climates
- Climate balanced Architecture

MODULE II

Comfortable Built Environment: Orientation of Buildings

- Basic climatic zones: hot & arid, hot / warm & humid, cold
- Climatic factors: solar radiation & temperature, clouds, relative humidity,
- prevailing wind; measuring instruments and si units
- Features of dwellings in tropics: aspects of day lighting, plantation of trees.

MODULE III

Comfort: The Desirable Conditions

- Requirement of ventilation
- Heat balance of body
- Sun path diagram — comfort zone & bio-climatic chart — comfort range
- Air change per hour — recommended values of air changes for different occupancies as per the NBC
- Methods of ventilation

MODULE IV

Principles of Thermal Design

- Thermal quantities – Heat flow, heat flow rate, density of heat flow rate —
- Sol-air temperature — Solar gain factor
- Heat Exchange Process: Conduction – Convection – Radiation through windows-Evaporation — Calculation of heat loss & heat gain — Cooling & heating by air — Transmittance of Composite Walls, Thermal Gradient

MODULE V

Means of Thermal Control: Natural Ventilation

Principle of nature ventilation in buildings- Cross-ventilation — position of openings – size of openings — control of openings: sashes, canopies, louvers wind shadow — humidity control: wind scoop

MODULE VI

Means of Thermal Control: Structural Controls

- **Solar control:** internal blinds & curtains – heat absorbing glasses
- **Sun's position:** effects of angle of incidence – stereographic projection – shadow angles
- **Shading devices:** vertical & horizontal – design of shading devices

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MODULE VII

Principles of Lighting

- Aims of good lighting and realization of the same
- Planning the brightness pattern considering the visual task, the immediate background of the task (central field & visual field) and the general
- Surroundings (peripheral field)
- Glare: direct, reflected & veiling
- Recommended values of illumination level for different occupancies as per the NBC.

MODULE VIII

Daylighting

Sources of light of a point inside a building: skylight, externally reflected light, internally reflected light, direct sunlight — working plane — Daylight factor — components of daylight factor: sc, erc, irc — daylight penetration

Recommended Books:

1. Narashimhan; An Introduction to Building Physics.
2. O.H. Koenigsberger and others, Manual of Tropical Housing and Building – Part I – Climatic Design, Longmans , 1980.
3. M.Evans- Houising Climate & Comfort – Architectural Press, Londan, 1980.
4. B. Givoni, Man, Climate and Architecture, Applied Science, Banking Essex, 1992.
5. Donald Watson and Kenneth Labs; Climatic Design – McGraw Hill Book Company – New Yark – 1983

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LANDSCAPING & SITE PLANNING (TIUAR-313) L – S – P (2 – 0 – 0)

Credits-2

MODULE I

Introduction:

- Definition of Landscaping — Appreciation of scale in terms of garden, landscape and nature.
- Role of landscaping and landscape architect in architecture — Evolution of Landscaping— Elements of landscaping: Natural & Man-made- An introduction to social and cultural dimensions of landscape.

MODULE II

Evolution of Garden Patterns:

- An outline of the chronology of development and evolution of landscape and garden design in relation to architecture and city planning from the earliest period to the present day.
- Development of landscape design and gardens till the early 19th century: Detailed study of selected examples from Eastern, Central and Western traditions.
- Influences and linkages across cultures and traditions, e.g Chinese tradition and the English Landscape style, influence of Persian traditions towards the West and East.
- Colonial landscape development in India
- Ancient Indian traditions; siting of structures, complexes and cities; traditional landscapes such as ghats, gardens, kunds, sacred groves etc. The comparative analysis of examples of landscape designs: siting, relationship to surroundings, use of landscape elements, function, scale, symbolism, etc. Illustrative range of examples from various geographic locations and periods, highlighting aspects of Form, Space and Order.

MODULE III

Guidelines for Landscaping of Specific Areas:

- Residential: Individual and group of buildings; Commercial: Shopping Mall; Recreational: Parks and Play Areas; Public Spaces: Plaza, Precinct and Squares
- Natural Elements of Landscaping: Rock & Landform — Water — Plants:
- Different types of trees, shrubs, ground covers & climbers with their characteristics mentioning the basis of their selection for different purposes
- Manmade Elements of Landscaping: Materials, construction details and maintenance of the following manmade elements of landscaping —
    - ✓ Paving: Hard and soft – Layout for formal and informal paving – Different kinds of paving materials: soil, stabilized *murrum*, brick & stone etc.
    - ✓ Outdoor Furniture – Outdoor Light Fixtures – Signage & Signboard – Sculpture – Fences
    - ✓ Artificial Rock – Artificial Waterfall

MODULE IV

Site Planning:

- Site planning process and its significance; establishing relationship between site characteristics and design requirements. Inventory, documentation and site planning checklist.

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- Site Survey and Appraisal; topographic surveys and their methodology, visualising landforms. Understanding contours and their characteristics, graphical representation, deriving contours by interpolation.
- Earth form Grading; symbols and annotations, basic grading principles, grading terraces, grading of roads across/along contours, Basics of road alignment (horizontal and vertical).
- Surface Drainage: Site planning for efficient drainage; understanding drainage pattern and watershed area, calculation of surface runoff, determination of catchments area and discharge rate; types of drainage systems
- Earthworks cut and fill processes, volume computations.

Recommended Books:

1. Time-saver standards for LANDSCAPE ARCHITECTURE / Dines & Harris / mcgraw-Hill
2. Landscape Architect's Portable Handbook / N. Dines / mcgraw-Hill
3. Landscape Architecture / J. O. Simonds / Lliffee, London
4. Designs of the Landscape / Preece / CBS
5. Landscape Detailing Vol. I / M. Little wood / CBS
6. Landscape Detailing Vol. II / M. Little wood / CBS
7. Landscape for Living / G. Eckbe / F. W. Dodge Corporation, N.Y.
8. Kevin Lynch – Site Planning – MIT press, Cambridge
9. Sylvia Crowe Sheila Haywood, The Gardens of Mughal India, Vikas Publishing House
10. Testsuro Yoshida, Gardens of Japan, Jr. Marcus G. Sims, 1963
11. John O. Simonds – Earthscape, mcgraw Hill Book Co., New York

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SURVEY & LEVELLING (TIU##-3##) **L – S – P (2 – 0 – 2)**

Credits-2

MODULE I

Introduction: Types of Surveys, Chaining, Taping, Corrections, Angle and Direction Measurements,

MODULE II

Chain surveying: Principles, Methods of linear measurement; Instruments for Chaining; Chaining over uneven ground; Chaining tape corrections including sag corrections; Chain triangulation; Selection of stations, locating ground features; Plotting of chain survey' determination of area by chain survey, setting out of a building

MODULE III

Compass survey: Use of prismatic compass; Chain and Compass traversing, Plotting compass traverse

MODULE IV

Plane table survey: Introduction and method; Errors in plane tabling 3

MODULE V

Leveling: Adjustment of dumpy level; Reciprocal leveling and profile leveling; Countering and interpolation of contour maps

Recommended books :

1. B. C. Punmia; SURVEYING Volume I

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COMPUTER APPLICATION - I: CAD 3D (TIUAR - 314) L – S – P (0 – 0 – 2)

Credits-2

- Creation of simple Architectural elements, Building Drawings in 2D
- Composition of Drawing Sheets
- Practice and preparation of 2D documentations based on class projects in the previous
- semester in Architectural Designs
- Details of task to be determined each semester by the individual Instructor
- Basic operations of 3-D
- Development of regions, polylines, Generation of surfaces and solids
- 3-D operation: Union, Subtraction and Intersection; 3-D operation: Rotate, Mirror and Array;
- Material Attachment and Rendering.
- Final rendering in Photoshop.
- Operations in 3-D
- Solids editing;
- UCS operation;
- Working with 3-D Viewports and 3-D Pan/Zoom to generate different views.
- Implications and advantage of 3-D wireframe, Hide, Shade etc. in generating 3-D views
- Making of perspective views, adjustment of Camera, window orbit etc.
- Material Attachment and Rendering.
- Exercise 1: Drawing of simple 3-D objects
- Exercise 2: Drawing 3-D of a building.
- Introduction to 3DS Max, Material attachment, Light focusing, Different views,
- Rendering with Background and Foreground. [Application to the previous exercise]

Recommended books:

1. AutoCAD Manual
2. AutoCAD Command Reference
3. Introduction to 3DS Max

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EDUCATIONAL TOUR (TIUAR-318) L – S – P (0 – 0 – 0)

Credits-2

1. Study of historic precincts/buildings, landscape and building interiors.
2. Documentation through mapping, hand-sketching, preparation of measured drawings and detailed-drawings, report writing and photography.
3. The Tour would be for 7-10 days.

The students are required to prepare a report based on the Educational Tour, which will develop the skills and methods of report writing. This will be supported by presentations in sheets, drawings, sketches, photographs and in electronic media.
Report should include the following:

1. The duration of the trip, the itinerary, the places visited, the number of pupil and teachers accompanying them.
2. The specific places, the important monuments, their description, historic background, architectural styles, present status, structural systems, special or notable features and an architectural unbiased criticism.
3. The people, societal framework, economical status, density, traditions and culture of the place/region.
4. Environment, natural flora and fauna, and manmade interventions- urban scape and its specific features, problems.
5. Summary: New things learnt questions that remained unsolved, conclusion.

The measured drawing conducted during the tour, will be presented as well drafted drawings by the students. It should be hand drafted and rendered and all the methods for proper documentation of the structure measured will be considered in the presentation.
This will follow a seminar, where the students will present their work verbally.

Viva voce
Final Viva-vice on all the design assignments to be conducted at the end of the semester

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ARCHITECTURAL DESIGN II (TIUAR - 316) L – S – P (0 – 6 – 0)

Credits-6

Objectives:

Design of Low-rise buildings using certain methods in the design process such as:

1. Analysis of space proximity studies with the help of Proximity charts
2. Use of Flow charts to analyse movements from space to space
3. Use of Bubble diagrams as ‗reduced drawings‘
4. Interpretation of climatic data to formulate design approaches

MODULE I

Small residential building / guest house

MODULE II

Clinic/ Dispensary/ Club/ Cyber Cafe

MODULE III

Restaurant (both outdoor and indoor)

MODULE IV

Memorial with landscaping/ Play school / Crèche

***Viva voce**

Final Viva-vice on all the design assignments to be conducted at the end of the semester

Recommended Books:

1. Ching, D.K; From, Space and Order.
2. A. Peter Fawcett; Architecture Design Notebook.
3. http://www.scribd.com/doc/45018090/Architecture-Design-Notebook
4. Robin Boyd; Puzzle of Architecture
5. National Building Code, BIS
6. Time Savers Standard

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DETAILS OF CONSTRUCTION II (TIUAR - 317) L – S – P (2 – 4 – 0)

Credits-4

Course Objective:

- Identify and understand the building construction principles (structures, materials, graphic conventions, technical standards of design).
- Identify the various elements of flooring
- Develop and understand the different types of foundation
- Understand the layout and construction details of different types of staircase
- Apply the special types of Door Window detailing in building application
- Site visits to be organized to make the students aware of various technical aspects, practical difficulties, onsite decisions which will strengthen the knowledge for handling and executing a project

MODULE I

FOUNDATION & BASEMENT:

LECTURE CLASSES

Purpose; Essential requirements; Settlement; Classification –Shallow (Wall footings, Inverted arch foundation, Isolated footings, Combined footing, Strip footing, Cantilever footing, Mat or raft foundation) Deep: (Pile foundation, Pier foundation).

SHEETS

- Wall foundation, isolated and combined foundation in RCC.
- Raft foundation. Parts of pile foundation and its type, Grillage Foundation.
- Construction detail of basement wall, Retaining wall, floor and foundation with particular emphasis to their damp proofing protection against rain water and provision for natural lighting and ventilation.

MODULE II

FLOORING: STUDIO EXERCISES

- Types of flooring, methods of laying, furnishing of floors with different floor finishes like cement, colored cement, mosaic, terrazzo, tiles etc.
- Special consideration for rubber, Linoleum and PVC flooring, Flag Stone Flooring, parquet flooring.
- Different types of resilient and vibration resistive floor.

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MODULE III

DAMP PREVENTION AND WATER PROOFING: LECTURE CLASSES

- Causes and effects of dampness in buildings; Methods of damp prevention - Membrane damp proofing, Integral damp proofing, Surface treatment, Guniting; Damp Proofing of Basement, Foundation & Plinth, Cavity walls, Projections, Expansion/Seismic Joints;
- Water proofing treatment - Flat Roofs & Terraces, Parapet Wall (Details of Coping and Drip course), Window Sill & Chajja (Detail of Drip course)

MODULE IV

ROOFING: STUDIO EXERCISES

- Types of roof, Parts of roof and Types of Roof trusses.
- Flat roof with wood and RCC, simple jack arch, Waterproofing, Rainwater gutter details.
- Inclined Roof - Common roof covering and its arrangement: tiles, asbestos and metal sheets etc. with fixing and rainwater gutter

MODULE V

SPANNING OF OPENINGS: LECTURE CLASSES

Corbels, Lintels and Arches; Typical detail of a masonry window opening showing sill, lintel & chajja projection; Lintel types by construction methods: Brick lintel, RCC lintel (precast and cast-in-situ);Typical details of an arch opening with nomenclature; Types of Arches - Semi- circular, Segmental, Flat, Relieving arch etc.

MODULE VI

SPECIAL DOOR & WINDOW: STUDIO EXERCISES

- Special doors and windows: One way and both way-swinging door, sliding door (manual and automatic), folding, revolving, collapsible and rolling door with hardware details.
- Window and Ventilator with Aluminum frame.

MODULE VII

STAIRS: LECTURE CLASSES

Components and requirements; Classification based on form, structural systems, materials; Typical construction details such as balustrade fixing, nosing, etc.

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MODULE VIII

UPPER FLOORS: LECTURE CLASSES

Timber Floor; Jack arch floor; RCC Floor - Slab (one-way, two-way & cantilever), Beam & slab, Flat Slab, Ribbed floor; Pre-cast concrete floors; Steel Floor with joist and deck-plate.

MODULE IX

STAIRCASE: STUDIO EXERCISES

- Different elements of staircase, Relation between Tread and Riser, Types of staircase,
- Construction Details of a concrete staircase, balustrade and handrail detail

***SITE VISIT:**

At least one visit to be paid to the construction site covering various sequences of construction and a report to be submitted by individual students as a part of the sessional work.

Recommended Books:

1. Building Construction - W.B. Mc. Kay Vol. 1- 4
2. The Construction of Building 2 - Barry
3. Building Construction Illustrated - Francis D.K. Ching Van Nostrand Reinhold
4. Construction Technology - R. Chudly Vol. 1- 4
5. Materials - Mitchell`s Building Construction – Alan Everett - B.T. Batsford Ltd
6. Components and Finishing - Mitchell`s Building Construction - Alan Everett - B.T. Batsford Ltd
7. Construction for Interior Designers - Roland Ashcroft
8. Building Construction Dictionary
9. B. C. Punmia; Building Materials and Construction .Laxmi Publications Pvt Ltd, New Delhi,1993.
10. Bindra & Arora; Building Materials and Construction
11. Francis D. K. Ching, Building Construction Illustrated VNR, 1975