



DETAILED SYLLABUS
FOR
BACHELOR OF ARCHITECTURE

Academic Year: 2022 - 23



BIJU PATNAIK UNIVERSITY OF TECHNOLOGY

Proposed Syllabus for Bachelor of Architecture (B. Arch),

Biju Patnaik University of Technology, Odisha.

The Biju Patnaik University of Technology (BPUT) is following the syllabus of Five-Year Full Time Bachelor of Architecture (B. Arch) degree programme, which was last revised during the year 2016. The Dean, Faculty of Architecture was advised to re-cast the syllabus and as such, with the assistance of the Pilo Mody College of Architecture (PMCA), Cuttack, the work was carried forward.

The new syllabus incorporates the National Education Policy 2020 recommendations and also the views of all the stakeholders viz., students, faculty, alumni, professionals/employers. The syllabus developed aims to encourage independent thinking, promote analytical approach to understand concepts in general and to minimize rote-learning in architectural education. The syllabus is framed so as to educate the students not only about the latest developments and innovations in the field, but also to make them sensitive to heritage, culture and tradition. The objective is to imbibe consciousness about sustainable and inclusionary development practice in the profession of architecture.

Some of the salient aspects of the syllabus:

The curriculum is envisaged as a Two-stage, Ten-semester program of five years duration.

The first six semesters comprise Stage 1: a period of Foundation and Exploration where basic competencies are developed and students are exposed to a breadth of knowledge in various subjects of Architecture.

The next four semesters comprise Stage 2: where students undergo a one-semester Practical Training and three semesters of in-depth Ideation and Synthesis. During the second stage students are encouraged to follow their interests and develop depth of understanding in any chosen field through electives and research-based study.

- All the subjects fit into four thematic streams: design, humanities, technology and practice. The credits and contact hours stipulated for each course is as per the guidelines of COA
- Restructuring of the syllabus with more vertical (across the semesters) and horizontal (in the same semester) correlation between the theory and non-theory courses

- Rationalization of the number of courses and credits. The total number of credits is 265 with scope for 12 additional courses under skill enhancement category (as per COA guidelines)
- The theory courses offered in the curriculum are organized systematically so as to serve as a strong input of conceptual knowledge and understanding for the subsequent studio and lab courses.
- To introduce new subjects and incorporate flexibility in the syllabus by introducing more electives
- Emphasis is laid on organizing seminars in both compulsory and elective courses so that students get opportunities in public speaking and become more articulate in direct presentation of their ideas.
- Rationalization in the marks awarded for progressive internal and final evaluation for studio-based subjects. The final evaluation to be conducted through external viva-voce.
- Technical skill-oriented courses are emphasized.
- Along with basic theoretical understanding it is felt that practical and case studies exercise is needed to be included to better comprehend the technical concepts.
- There is scope for introducing creative and alternative teaching pedagogy methods, as Module-5 is left as a flexible slot in the content of the syllabus in each subject.
- Architectural Design Studio in each semester
 - The Architectural Design course is envisaged to be the central discipline of the programme with highest credits. It retains its importance in the curriculum and includes continuity from the Basic Design Stage, in the first year, right up to the thesis work in the final year. Each design program in a semester maintains continuity and seeks to develop the ability of the students to become conversant with the design process.
 - In the new syllabus the Design Studios are carefully sequenced keeping in view the core theoretical learning and technical skills acquired prior to handling the respective design exercises. The studio sequence proceeds from a broad understanding of design to progressively complex exercises involving bigger spatial scales.
 - Structure and Services (relevant to the design topic) have been included as an important component in the deliverables with separate marking weightage

Guidelines

The current revision of the 5-year Bachelor of Architecture Syllabus, has been done to reorient the course structure to a robust practical approach along with a highly motivated

theoretical background. Each course is fore-warded with 'Course Objectives' and 'Anticipated Learning Outcomes', as per NAAC guidelines. This has deliberately been done, in order to allow colleges and faculty, with guidance and a certain degree of freedom to formulate their own 'Course Outcomes (COs)', assign weightage to the COs and map them with the 'Program Outcome (POs)'.

- The Course Outcome (COs) so formulated should be commensurate with the given 'Anticipated Learning Outcomes' and also with the levels of Bloom's Taxonomy. The 'correlation' levels of COs vis-a-vis POs should be worked out and CO-PO mapping worked out accordingly.
- For all sessional subjects, progressive submissions at each stage will be evaluated to complete internal evaluation of 60% of the total marks. Evaluation of rest 40% of the total marks will be done through external viva voce and presentations.
- Along with progressive evaluation of class works, tests to be conducted for all Sessional subjects, as part of the internal and external evaluation process.
- All Theory subjects are evaluated out of 150 marks out of which 50 marks are evaluated internally through two or more internal tests/ quiz/assignments.
- Architectural Design Studio to have one major problem, one minor problem and one time problem in the earlier semesters as noted in the semester design program.
- For the subject Building Materials and Construction, theoretical understanding about different aspects of the respective building materials used for different construction technologies taught in each module to be imparted in the beginning of the module before doing the technical drawings. First 1/2 hour of the 3-hour studio class to be dedicated to lectures where the theoretical aspects are discussed.
- The syllabus of History of Architecture is framed according to a timeline which will be covered in three semesters. Architecture principles, styles and settlement patterns of different geographical regions spanning a particular period will be taught in each semester. Different styles of different regions belonging to the same period can be studied in correlation, so that regional and periodic significance and relevance can be better understood and interpreted.
- Architecture has over the years developed a theoretical base which is well known now and is also clearly stated in present day design theory. The students, unless they are tutored about this logically and systematically, have a tendency to deal with their design work intuitively, leading to the production of work which cannot be supported by any sensible theoretical backup. In view of this, Theory of Architecture has been emphasised and included as a theory subject in two separate semesters. Theory of Design courses shall contribute liberally by providing design directions, readings and studies of design processes.
- Choice-based learning is introduced in the form of electives offered from Semester-VII to Semester-X. A choice-based studio for advanced technologies in Architecture

is also included in the VIII Sem. Core subjects are compulsory and account for 75% of the hours

- The location of the university in a region frequented by disasters requires the students to be familiar with Disaster Resilient Architecture and hence this subject is included. Besides, as Odisha has a large number of temples and heritage, the subject of Architectural Heritage Conservation is added. Finally, the rural setting of Orissa necessitates the study of Vernacular Architecture and Village Settlements, which is to be taught as a subject.

**COURSE STRUCTURE:
5 YEAR BACHELOR OF ARCHITECTURE PROGRAM**

COURSE STRUCTURE: FIRST YEAR B.ARCH. PROGRAMME

1st SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AS113	Structural Mechanics	3-0-0	3	50	100
2	22AR123	Introduction to Architecture.	3-0-0	3	50	100
3	22AR133	Technology in Architecture.	3-0-0	3	50	100
4	22AR143	Theory of Architecture-I	3-0-0	3	50	100
TOTAL			12	12	600	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
5	22AR154	Architectural Graphics-I	0-0-6	4	100	
6	22AR163	Surveying techniques	1-0-3	3	100	
7	22AR174	Basic Design-I	0-0-6	4	100	
8	22AR183	Building Materials & Construction-I	2-0-4	4	100	
TOTAL			22	15	400	
Total Contact Hours per week in the Semester			34			
Total Credits in the semester				27		
Total Marks in the semester					1000	

2nd SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AS213	Strength of Materials	3-0-0	3	50	100
2	22AR223	Climate Responsive Architecture	3-0-0	3	50	100
3	22AR233	History of Architecture-I	3-0-0	3	50	100
4	22AR243	Architecture & Society	3-0-0	3	50	100
TOTAL			12	12	600	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
5	22AR254	Architectural Graphics-II	0-0-6	4	100	
6	22AR266	Computer Applications in Architecture-I (2D Drafting)	0-0-3	2	100	
7	22AR274	Basic Design-II	0-0-6	4	100	
8	22AR283	Building Materials & Construction-II	2-0-4	4	100	
9	22AS293	Architectural Workshop	0-0-3	2	100	
TOTAL			24	16	500	
Total Contact Hours per week in the Semester			36			
Total Credits in the semester				28		
Total Marks in the semester					1100	

COURSE STRUCTURE: SECOND YEAR B.ARCH. PROGRAMME

3rd SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AR313	Structural Analysis	3-0-0	3	50	100
2	22AR323	History of Architecture-II	3-0-0	3	50	100
3	22AR333	Ecology & Environment	2-0-1	3	50	100
4	22AS343	Water Supply and Sanitation	3-0-0	3	50	100
TOTAL			12	12	600	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
5	22AR356	Architectural Design -I	0-0-9	6	100	
6	22AR364	Building Materials & Construction-III	2-0-4	4	100	
7	22AR373	Computer Applications in Architecture-II (3D Modelling)	0-0-3	2	100	
8	22AR383	Documentation & Measured Drawing (Buildings)	0-0-3	2	100	
TOTAL			21	14	400	
Total Contact Hours per week in the Semester			33			
Total Credits in the semester				26		
Total Marks in the semester					1000	

4th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AS413	Design of RCC Structures	3-0-0	3	50	100
2	22AR424	Landscape Design & Site Planning	2-0-2	4	50	100
3	22AR433	History of Architecture-III	3-0-0	3	50	100
4	22AR443	Vernacular Architecture & Village Settlements	3-0-0	3	50	100
5	22AE453	Lighting & Electrical Services	2-0-1	3	50	100
TOTAL			16	16	750	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
6	22AR466	Architectural Design -II	0-0-9	6	100	
7	22AR474	Building Materials & Construction-IV	2-0-4	4	100	
8	22AR483	Computer In Architecture -III (BIM)	0-0-3	2	100	
TOTAL			18	12	300	
Total Contact Hours per week in the Semester			34			
Total Credits in the semester				28		
Total Marks in the semester					1050	

COURSE STRUCTURE: THIRD YEAR B.ARCH. PROGRAMME

5th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AS513	Design of Steel Structures	3-0-0	3	50	100
2	22AR523	Responsive Built Environment	3-0-0	3	50	100
3	22AR533	Contemporary Architecture	3-0-0	3	50	100
4	22AR543	HVAC Systems	3-0-0	3	50	100
5	22AR553	Theory of Architecture-II.	3-0-0	3	50	100
TOTAL			15	15	750	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
6	22AR569	Architectural Design -III	0-0-12	9	100	
7	22AR574	Working Drawing-I (Load Bearing / Composite)	0-0-6	4	100	
8	22AR582	Design Communication	0-0-3	2	100	
TOTAL			21	15	300	
Total Contact Hours per week in the Semester			36			
Total Credits in the semester				30		
Total Marks in the semester					1050	

6th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AR613	Contract Documents & Specifications	3-0-0	3	50	100
2	22AR624	Advanced Building Systems & Services	2-0-1	3	50	100
3	22AR633	Advanced Building Materials	3-0-0	3	50	100
4	22AR643	Architectural Acoustics	3-0-0	3	50	100
TOTAL			12	12	600	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
5	22AR659	Architectural Design -IV	0-0-12	9	100	
6	22AR664	Working Drawing-II (Frame Structures)	0-0-6	4	100	
7	22AR673	Interior Design	1-0-3	3	100	
TOTAL			22	16	300	
Total Contact Hours per week in the Semester			34			
Total Credits in the semester				28		
Total Marks in the semester					900	

COURSE STRUCTURE: FOURTH YEAR B.ARCH. PROGRAMME

7 th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AR713	Estimation & Valuation	3-0-0	3	50	100
2	22AR723	Urban Design	3-0-0	3	50	100
3	22AR733	Sustainable Urban Habitats	3-0-0	3	50	100
4	Elective-I		3-0-0	3	50	100
	22EAR7413	i. Mathematics, Statistics & Operation Research				
	22EAR7423	ii. Appropriate Building Technology				
	22EAR7433	iii. Renewable Energy Systems				
	22EAR7443	iv. Architectural Heritage Conservation				
TOTAL			12	12	600	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
5	22AR759	Architectural Design -V	0-0-12	9	100	
6	22AR764	Architectural Details (Innovative Detailing)	0-0-6	4	100	
7	22AR772	Working Drawing -III (Municipal Approval & Statutory Drawings)	0-0-3	2	100	
TOTAL			21	15	300	
Total Contact Hours per week in the Semester			33			
Total Credits in the semester				27		
Total Marks in the semester					900	

8 th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AR813	Urban & Regional Planning	3-0-0	3	50	100
2	22AR823	Disaster Resilient Architecture	3-0-1	3	50	100
3	22AR833	Research Methods	3-0-0	3	50	100
TOTAL			10	9	450	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation (Progressive Evaluation-60 + Final Viva Voce-40)	
4	22AR849	Architectural Design -VI	0-0-12	9	100	
5	22AR854	Field Documentation (Larger Area)	1-0-5	4	100	
6	22AR862	Pre-Dissertation Studio	1-0-2	2	100	
7	Choice Based Studios		1-0-3	3	100	
	22EAR8713	i. Design of Tall Buildings				
	22EAR8723	ii. GIS & Remote Sensing				
	22EAR8733	iii. Art Appreciation in Architecture				

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	22EAR8743	iv. Parametric Architecture			
TOTAL			25	18	400
Total Contact Hours per week in the Semester			35		
Total Credits in the semester				27	
Total Marks in the semester					850

COURSE STRUCTURE: FIFTH YEAR B.ARCH. PROGRAMME

9th SEMESTER				
Sl. No.	Sub. Code	Sessionals/Practical	Credit	Internal Evaluation
1	22AR914	Office Training	4	100
2	22AR924	Site Supervision Work	4	100
3	22AR933	Critical Appraisal of Buildings	3	100
4	22AR943	Documentation of Architectural Details	3	100
5	22AR953	Study and documentation of Office communication with client, contractor and statutory authorities	3	100
Total Credits in the semester			17	500
Total Marks in the semester				500

10th SEMESTER						
Sl. No.	Sub. Code	Theory	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	University Marks
1	22AR013	Professional Practice (Manual of Architectural Practice of COA)	3-0-0	3	50	100
2	22AR023	Construction & Project Management	3-0-0	3	50	100
3	Elective -II		3-0-0	3	50	100
	22EAR0313	i. Green Architecture				
	22EAR03233	ii. Real Estate Management				
	22EAR0333	iii. Environmental Impact Assessment (EIA)				
	22EAR0343	iv. Entrepreneurship skill for Architects				
TOTAL			9	9	450	
Sl. No.	Sub. Code	Sessionals	Contact Hrs. (L-T-P)	Credit	Internal Evaluation	
4	22AR0418	Architectural Dissertation	0-0-21	15	100	
5	22AR053	Comprehensive Viva-Voce	0-0-0	3	100	
TOTAL			21	18	200	
Total Contact Hours per week in the Semester			30			
Total Credits in the semester				27		
Total Marks in the semester					650	

Total Credits in all the ten (10) semesters – 265

Total Marks in all the ten (10) semesters – 9000

Value added courses (4 X 3 = 12 credits) may be taken up by the colleges as deemed appropriate and a separate certificate issued to the students by the college and ratified by the university.

(Example of courses as suggested by COA: Technical Communication Skills, Entrepreneurship Skills for Architects, Product Design, etc.)

**DETAILED SYLLABUS:
5 YEAR BACHELOR OF ARCHITECTURE PROGRAM**

SEMESTER – I

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AS113	Structural Mechanics	3	0	0	3

Course Objective To introduce the concepts of behaviour of structural components and simple analytical techniques. The course aims at covering basic theorems of statics, the use and principles of composite sections, geometrical properties such as centroid, moment of inertia etc of sections for different shapes, analysis of perfect frames for vertical loads by analytical as well as graphical methods, concept of friction and its practical applications and also some elementary idea regarding special forces like wind and earthquake forces.

Anticipated Learning Outcomes: Understanding of concepts taught in the semester through simple numerical calculations and models.

Module 1
Brief introduction of history of structural design Trabeated construction, vaults, flying buttresses, tents, masted structures and bridges through ancient and medieval history, Post Industrial modular construction of large span and suspension structures in steel and concrete- examples of iconic projects.

Principle of statics, forces, resolution of forces, coplanar, non-coplanar, concurrent, non-concurrent, Equilibrium of concurrent forces in a plane, Triangle of forces, parallelogram of forces.

Module 2
Trusses & frames Plane trusses. Method of joints, Equilibrium of Ideal system, stable and unstable equilibrium. Examples related to building and other structures.

Module 3
Friction & virtual work Friction-definition, Types of friction, Laws of dry friction, Coefficients of friction, Angle of friction, Angle of repose, Friction in inclined plane, Numerical on dry friction, ladder and wedges.

Principle of Virtual work, Numerical on virtual work.

**Module 4
Forces &
geometrical
properties of
sections**

Centre of gravity, Centre of parallel forces in a plane, Centre of gravity, Centroids of curves, Distribution of forces in a plane.

Moment of inertia of plane figure with respect to an axis in its plane, with respect to perpendicular to the plane, parallel axis theorem, product of Inertia

Module 5

Introduction to special forces acting on structures, Wind force, Earthquake force, etc. Impact of these forces on structures.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Timoshenko, S., Young, D. H. and Rao, J. V., *Engineering Mechanics*. 4th Ed. New Delhi: Tata McGraw-Hill Education, 2007.
2. Khurmi R.S., *A textbook of Engineering Mechanics*, S. Chand and Co, New Delhi, 1999.
3. Rajashekharan, S. and Sankara Subhramanian, G., *Fundamentals of Engineering Mechanics*, 2nd Edition, Vikas Publishing House Pvt. Ltd.
4. Ferdinand, L. S., *Engineering Mechanics: Statics and Dynamics*. 3rd Ed. New York: Harper Collins Publishers, 1975.
5. Kumar, K. L., *Engineering Mechanics*. Delhi: Tata McGraw-Hill Education, 2003.
6. Ramamrutham, S., *Engineering Mechanics: A Textbook of Applied Mechanics*. New Delhi Dhanpat Rai Publishing Company, 2008.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR123	Introduction to Architecture.	3	0	0	3

Course Objective To acquaint students with the profession and the act of planning and designing buildings and structures

Anticipated Learning Outcomes: To equip students with an understanding of the role of an architect as a creative professional in society; gain an overview of professional duties and responsibilities

Module 1 Definition and concept of Architecture and Architects experienced through the ages.

Philosophy of architecture propagated by some leading architects

Factors influencing architecture such as climate, materials, socio cultural and technological influences

Module 2 Subjects to be learned by a student of architecture, such as the arts, the sciences, the soft sciences, the technologies and others.

Module 3 Role of an architect in society, scope of work of an architect, legal obligations and managerial roles during work execution. Architect as a 'Bridge' between client & contractor & parastatal agencies.

The types of projects that an architect deal with.

Good Design & its examples. Design thinking - definitions of creative thinking techniques - convergent, lateral thinking, interactive thinking, graphic thinking, etc. Blocks in creative thinking.

Module 4 A brief idea of mandatory professional codes and guidelines to be followed by an architect

Introduction to some old and new architecture projects in India and abroad.

Opportunities for architects to work after completion of the course.

Opportunities of Higher studies for architecture students;
 Personality requirement of a student in the field of architecture: Skills
 required by an architect. Brief idea of regulatory professional bodies
 like COA and learned societies like IIA

Module 5

Examples of Great Architecture over time

(Teachers to choose best examples of great architecture and
 discuss in class with respect to quality of space and context)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. James Snider Catmese, *Introduction to Architecture*.
2. V. S. Parmar, *Design Fundamentals in Architecture*, Somaiya Publications Private Limited, New Delhi.
3. Francis D.K.Ching, *Architecture-Form, Space and Order*, Van, Nostrand Reinhold company, New York.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR133	Technology in Architecture	3	0	0	3

Course Objective To give the student an initial grounding on the subject so that they have this basic information for use in the earlier semesters. This engineering knowledge will be elaborated upon in the subsequent advanced semesters.

Anticipated Learning Outcomes: To gain a basic knowledge of the technical skills/ knowledge expected from an architect in order to be able to lead a team of consultants; to understand that Engineering in its several forms is an inseparable part of Architecture; ability to explore multi-disciplinary facets of architecture.

**Module 1
Types of structures** A brief overview of six types of structures in Civil engineering, namely 1. Load bearing structure; 2. Framed structure; 3. Truss Structure; 4. Shell Structure; 5. Pre-engineered structure; and 6. Mass Structure.

Component of Building structures: Sub-structure & its types, materials used; Super-structure & its components, materials used, etc.; Roofing: Definition, types and materials.

**Module 2
Sanitation and water supply** A brief introduction of the five parts of water supply and sanitation system to include collection, transport, treatment, disposal or reuse.

**Module 3
Electrical services** A brief overview of internal electrification: including electrical wiring for lighting and power distribution, telephone, EPABX, Power points (wall outlets), Light fixtures and switches, Internet, Distributed audio, Security monitoring, Security CCTV, etc.

**Module 4
Mechanical services** A brief idea of air-conditioning for residential buildings; home lifts, etc.

IOT in architecture: home automation and smart technology in modern homes.

Module 5 Site visit to be organized to familiarize students with all the technologies.

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References

1. National Building Code of India. (2016).
2. Punmia, B. C., Jain, A. K. and Jain, A. K. (1995). *Water Supply Engineering*. New Delhi: Laxmi Publications.
3. Rangwala, S. C. (2005). *Water Supply and Sanitary Engineering*. Charoter Publishing.
4. *Handbook Water Supply and drainage with Special Emphasis on Plumbing*. Bureau of Indian Standards, New Delhi.
5. Bureau of Indian Standards. (2005). *Code of Practice for Electrical Wiring Installations IS-732*.
6. *Electrical Wiring and Contracting (Vol.1 to Vol.4)*.
7. *Handbook for Building Engineers in Metric Systems (1968)*, NBC, New Delhi.
8. William H. Severns and Julian R. Fellows. *Air conditioning and refrigeration*. John Wiley and sons, London
9. Khurmi, Gupta and Arora. *Refrigeration and Air Conditioning*, S Chand and Co.
10. Rangwala, S. C. (1963). *Building Construction: Materials and types of Construction*. 3rd Ed. New York: John Wiley and Sons.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR143	Theory of Architecture-I	3	0	0	3

Course Objective To emphasize on the theoretical framework for architecture; Introducing design elements in three-dimensional forms and space leading to classical methods of architectural form development, theory and application.

Anticipated Learning Outcomes: Ability to appreciate the beauty of form, space and order in Architecture to identify and analyse the elements, principles and vocabulary of three-dimensional design; Proficiency in understanding the language of architecture; ability to utilise the theoretical principles in architectural design to produce designs that are timeless; to grasp and develop unique thinking from the principles that govern architecture.

Module 1 Definition of architecture- elements of architecture - Concept of space, Articulation of form and space (Primary forms, properties of form, transformation of forms - dimensional transformation, subtractive, additive forms, organization of additive forms), Organisation of spaces, sense of enclosure, openings in space defining elements.

Module 2 Perception in Architecture: Visual, Audio, Olfactory, Tactile, and Taste. Visual and tactile understanding of inter-relationship of form, structure and materials.

Elements of composition- Point, Line, Plane and form, the development/ transformation of all these and their association with the physical entities we see in our daily living, in architecture and planning.

Principles of architectural composition eg unity, balance, proportion, scale, rhythm, contrast, harmony, accentuation, restraint, definition, repose, vitality, strength and their application to endow a quality to spaces and forms.

Understanding the various organizing principles of composition e.g., Axis, Symmetry, Rhythm, Harmony, Contrast, Balance, Datum, Hierarchy or Dominance, Transformation, etc.

Form and its attributes: Shape, size, colour, texture and lighting.

Platonic forms

Module 3

Parameters of design, anthropometrics, human activity and the use of space; Circulation and Flow Aspects of architecture (Bubble diagram or Relationship study)

Area and Space aspects of uses in architectural spaces; Making and Breaking of spaces.

Understanding different types of spatial organizations of masses e.g., linear, centralised, radial, clustered, grid organization through illustrations of buildings both historical and contemporary with respect to Building approach, building entrance, Configuration of path, Path space relationship, Form and Space, Space and Place.

Module 4

Introduction to Proportional Systems in Architecture e.g.

- The Greek and Roman proportion system; The renaissance proportions;
- The Golden Ratio in Art and Architecture; Le Corbusier's Modular System;
- The Indian Proportioning system- "Vastupurusha Mandala";
- The Japanese proportion system- "The Ken".

Module 5

Good Design & its examples. Architectural Theories - definitions and explanations; sources of architectural theories - historical & contemporary; examples of architectural projects based on theories.

Design thinking - definitions of creative thinking techniques - convergent, lateral thinking, interactive thinking, graphic thinking, etc.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Francis D. K. Ching, *Architecture - Form, Space and Order*, Van Nostrand Reinhold Company, 1979

2. Roger H. Clark, Michael Pause, *Precedents In Architecture*, Van Nostrand Reinhold Company, 1996
3. K. W. Smithies, *Principles of Design in Architecture*, Van Nostrand Reinhold Company, 1981.
4. Sam F. Miller, *Design Process - A Primer for Architectural and Interior Design*, Van Nostrand Reinhold Company, 1995
5. Ernest Burden, *Elements of Architectural Design – A Visual Resource*, Van Nostrand Reinhold Company, 1994
6. V. S. Parmar, *Design Fundamentals in Architecture*, Somaiya Publications, New Delhi, 1973. 7. Vitruvius, *Translation: Morris, H. M.* (1960).

SEMESTER – I

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR154	Architectural Graphics-I	0	0	6	4

Course Objective To train the students in the fundamentals of architectural drawing techniques and skills. Graphical presentation of objects through geometrical projection and visualization is taught in this course.

Anticipated Learning Outcomes: Understand conventions of architectural drawing, practice of line-types, line-weights symbols, lettering, scales & proportions, etc.; Ability to visually represent simple objects through hand-made 2D drawings - Orthographic projections and models; ability to express the fundamental geometry of basic shapes used in their day-to-day life through drawing; ability to prepare surface development of solids; measured and drawn to scale.

**Module 1
Introduction to plane geometry** Introduction to the basic principles of drawing: Scale conversion etc., conventions in lettering, drafting, and dimensioning.

**Module 2
Concept of orthographic projection** First- Angle Projection, Projections of Points, Projections of Straight Lines, Projections of Planes, Projections of Solids.

**Module 3
Section of solid** Section of solids, True shapes of section.

**Module 4
Development of surfaces** Surface development of simple solid forms leading to complex forms.

**Module 5
Application** Measured drawing of a small simple built structure showing plan, elevations & sections.

Note: Along with progressive evaluation of class works, tests to be conducted for Descriptive Geometry as part of the internal and final evaluation process.

References

1. Bhatt, N.D. and Panchal, V. M., *Engineering Drawing*, Charotar Publishing House, Anand, India.
2. Agarwal, B. and Agarwal, C.M., *Engineering Drawing*, Tata McGraw-Hill.
3. Kumar, M. S., *Engineering Drawing*, D. D. Publications, Chennai.
4. Francis D. K. Ching and Steven P. Juroszek, *Design drawing*, John Wiley and Sons, USA, 1998.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR163	Surveying techniques	1	0	3	3

Course Objective To equip students with the basic principles and theories which underlie the systematic study of topographic features, through different methods of land surveying. Basic skills of landform analysis, execution of field survey for foundation layouting, contour survey, gradient plotting, surveying physical features, etc. are covered in the course. To train the students for preparation and interpretation of survey drawings, methods, tools and equipment necessary to carry out different survey procedures and recent advancements in the field of landforms survey and measurements.

Anticipated Learning Outcomes: Theoretical understanding about different surveying techniques taught in each module to be imparted in the beginning of the respective modules before doing the practical site surveys.

**Module 1
Introduction and linear measurements**

LECTURE: Reading of survey Maps, understanding of features and undulations of ground; Scales used in Plotting. Linear measurement and chain survey: use of various types of chains and tapes, setting-out and survey stations, measurement of correct length of line, direct and indirect ranging, open and closed traverse chaining along sloping ground, obstacles in chaining, errors, and their elimination.

Compass survey, bearings and angles, local attractions, errors in compass survey. Log-books, field boundaries, field area estimation.

PRACTICALS: Chaining station points, offsets, field-book entry, single- and double-line entry, Triangulation, Traversing, Plotting, Calculation of Areas. Compass Surveying, Traversing, balancing, closing errors, plotting, and calculating areas.

**Module 2
Levelling**

LECTURE: Profile levelling, Use of auto level and levelling staff; Temporary and Permanent adjustments of auto level; Reduction of levels by H.I and rise and fall method. Curvature and refraction error, sensitiveness of level tube, reciprocal levelling, levelling difficulties and common errors

PRACTICAL: Profile levelling using auto level and staff

**Module 3
Contours in
landforms**

LECTURE: Characteristics of contours, Contour interval and horizontal equivalent, methods of contouring- direct and indirect method, contour gradient, block contour surveys, longitudinal and transverse cross sections, gradients, contouring methods and equipment, plane-table, plotting contours and profiles, estimating areas and volumes.

PRACTICAL: Method of Plane Table Surveying, Two- and Three-Point Problems.

**Module 4
Theodolite survey
and measurement**

LECTURE: Theodolite Surveying, temporary adjustment, measuring horizontal and vertical angles, closing errors, theodolite traversing

PRACTICAL: Theodolite, measuring vertical and horizontal angles, Theodolite Plotting, balancing closing errors.

**Module 5
GIS & DGPS**

LECTURE: Introduction to GIS and Differential Global Positioning System (DGPS).

PRACTICAL: Site demarcation and setting out of a simple building on the site.

Reference

1. "A Text Book of Surveying-I", S.K.Duggal, TMH Publisher
2. Surveying- Vol-1, B.C. Punmia
3. Surveying and Levelling Vol-1, T. P. Kanetkar and S. V. Kulkarni
4. Surveying Vol-1 by R Agor

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR174	Basic Design – I	0	0	6	4

Course Objective The course aims at building up the vocabulary in visual and basic design principles. Introducing students to fundamental techniques of visual representation and to equip them with the basic principles of design. To enhance skills in developing a graphical language of architecture.

Anticipated Learning Outcomes: Ability to draw in various media and materials, to develop the power of drawing as a means of coordinating eye and hand in studio and field observation, to judge proportion, scale, and spatial relationships, understand principles of visual composition and experiment with them.

**Module 1
Sensory perception;
drawing, and
visual thinking** Perception is the awareness of the elements of environment through physical sensation; it is through the senses that this is achieved. Exposure to the sense of Visual, Audio, Smell, Tactile and Taste is the first step to the learning of design. Exercise to recognize these and understand its association to Architecture and design is fundamental.

Terminology, abbreviations and signage used in visual representation, Sheet layouts, art lettering, shading, symbols and scale;

Introduction to fundamentals of visual representation: Points, lines, planes, colour, texture, etc.

**Module 2
Composition** Making two dimensional and three-dimensional compositions involving various elements of design such as Line, Shape, Colour, Texture, Transparency, Mass, space etc., aimed at understanding the principles of design such as Axis, symmetry, Rhythm, Harmony, Contrast, balance, hierarchy and datum/ Dominance.

Transformation of points, lines, planes, volumes, and then form itself. The students are to be explained these aspects through exercises.

- Module 3**
Sculptural forms and spaces
- Making three dimensional sculptures involving the basic platonic solids and abstract sculptures: explore play of light and shade and application of colour.
- Introduction to external and internal forms, Concept of space, interrelationship between space, volume and order.
- Variations in forms with planar juxtapositions, Understanding the Elementary structural forms.
- Module 4**
Forms in nature
- Study of forms in nature and analysis with respect to their colour, form, texture and structure. Exercises involving these natural forms through the study, analysis and documentation of the shelter of birds, animals and insects.
- Module 5**
- The teacher may take up studies which seem appropriate for the course. Faculty to decide on explorative Basic Design assignments for students.

References

1. Charles Wallschlaeger and Synthia Busic Snyder, *Basic Visual Concepts and Principles for artists, architects and designers*, McGraw hill, USA, 1992.
2. Paul Zelanski and Mary Pat Fisher, *Design principles and Problems*, 2nd Ed, Thomson and Wadsworth, USA, 1996
3. Owen Cappleman and Michael Jack Kordan, *Foundations in Architecture: An Annotated Anthology of beginning design projects*, Van Nostrand Reinhold, New York.
4. Trewin Copplestone, *Arts in Society*, Prentice Hall Inc, Englewoods Cliffs, N. J. 1983. 4. H. Gardner, *Art through ages*.
5. Paul Laseau. (2001). *Graphic Thinking for Architects and Designers*, John Wiley and Sons, New York
6. Ching, F. D. K. (1997). *Design Drawing*. Hoboken: John Wiley and Sons.
7. Ching, F. D. K. (2012). *Architecture: Form, Space and Order*. 3rd Ed. Hoboken: John Wiley and Sons.
8. Broadbent, G. (1973). *Design in Architecture - Architecture and Human Science*. John Wiley and Sons, New York
9. Wiley and Sons, New York
10. Chauhan, P. (2005). *Learning Basic Design*. Mumbai: Rizvi College of Architecture.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
8.	22AR183	Building Materials and Construction – I	2	0	4	4

Course Objective To understand fundamental building material in the context of various construction methods.

BC-I would focus on Foundation as a building component and would be emphasised based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of traditional and modern construction methods and practices.

Anticipated Learning Outcomes: Ability to produce construction and detailed drawings of Foundations required for various types of buildings.

Module 1 LECTURE: Introduction to primary building elements (Nomenclature of various parts of Substructure and Superstructure) and evolution of building material (Natural and Manmade) and construction techniques.

Mud, Clay and Lime (Character, Property and Uses)

Cement: Types, Property and Cement Mortar.

SHEET WORK:

1. Different elements of a building

Module 2 LECTURE: Brick – Types, qualities and Uses; Brick masonry – Masonry tools & equipment.

Sub-structure: Introduction to Foundation, different types of foundation (Shallow and deep) using different material, soil bearing capacity, Soil testing etc.

SHEET WORK:

2. Different types of Brick.
3. Brick stepped, Strip foundation and Brick Pier.

Module 3

LECTURE: Concrete – Types (Lightweight concrete, and aerated concrete, cellular concrete and other types of cement concrete products), Grade and Uses, Reinforced cement concrete,

SHEET WORK: Types of R.C.C. foundation –

Isolated Footing

4. Stepped
5. Slopped
6. Eccentric

Combined

7. Slab (Rectangular and trapezoidal),
8. Slab and Beam,
9. Strap
10. Mat or raft foundation (Flat Plate Mat, Plate Thickened Under Columns, Tow Way Slab and Beam, Rigid Frame Mat, Piled Mat Foundation and Cellular Mat Foundation)

Deep foundation

11. Types of piles (Based on function and installation)
12. Raymond, Mac Arthur
13. Base Driven Piles
14. Swage piles
15. Button Bottom piles
16. Under reamed Piles

Module 4

LECTURE

Latest trends in foundation technology with different building typologies.

Example for larger buildings, earthquake resilient foundation etc.

Module 5

Any other topic as per present day need as decided by the teacher/ workshop on foundation.

NOTE:

- ***Frequent site visits to be arranged as a part of the curriculum. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.***
- ***Pedagogy should establish the linkage of the relevant material and construction techniques from past to present.***

- **Performing standards and Codes used for various Building Materials and Construction Techniques needs to be focused.**
- **Alternative construction techniques for respective topics need to be discussed in detail.**

References

1. Barry, R. (1999). *The Construction of Buildings Vol. 2. 5th Ed.* New Delhi: East-West Press.
2. Foster, J. and Mitchell, S. (1963). *Building Construction: Elementary and Advanced, 17th Ed.* London: B.T. Batsford Ltd.
3. McKay, W. B. (2005). *Building Construction Metric Vol., I–V. 4th Ed.* Mumbai: Orient Longman.
4. Hailey and Hancork, D. W. (1979). *Brick Work and Associated Studies Vol. II.* London: MacMillan.
5. Merritt, F.S. and Ricketts, J.T., *Building Design and Construction Handbook*, McGraw Hill.
6. Rangwala, S. C. (1963). *Building Construction: Materials and types of Construction. 3rd Ed.* New York: John Wiley and Sons.
7. Chudley, R. (2008). *Building Construction Handbook. 7th Ed.* London: Butterworth Heinemann.
8. Sushil-Kumar, T. B. (2003). *Building Construction. 19th Ed.* Delhi: Standard Publishers.
9. Ching, F. D.K – *Building Construction illustrated.* VNR, 1975
10. A. Agarwal – *Mud: The potentials of earth-based material for third world housing – IIED, London, 1981.*
11. HUDCO – *All you wanted to know about soil stabilized mud blocks, New Delhi, 1989.*

SEMESTER – II

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AS213	Strength of Materials	3	0	0	3

Course Objective To introduce the basic concepts of the stresses and strains for different materials and strength of structural elements; development of internal forces and resistance mechanisms for one dimensional and two-dimensional structural elements; and evaluate the behaviour of torsional members.

Anticipated Learning Outcomes: Ability to evaluate the strength of various structural elements along with their behaviour and suggest suitable material; understand the basic concept of analysis and design of members subjected to torsion.

**Module 1
Simple Stresses and Strains** Load, Stress, Principle of St. Venant, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Shear stress, Complementary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Safe stress values for materials, Relationship between elastic constants. Simple numerical on stress and strain and elastic constants. Composite bars in tension and compression - temperature stresses in composite rods.

**Module 2
Strain Energy & Impact Loading** Strain energy-elastic, plastic and rigid members, stresses due to different types of axial loading-Gradually applied loads, suddenly applied loads, impact loads, Simple numerical on strain energy calculation.

**Module 3
Biaxial State of Stress** Analysis of Biaxial Stress. Plane stress, Principal plane, Principal stress and Principal axes, Mohr's Circle for Biaxial Stress, Calculation of principal stresses from principal strains. Stresses in thin cylinders and thin spherical shells under internal pressure, wire winding of thin cylinders.

**Module 4
Bending of Beams** Theory of simple bending of initially straight beams, Neutral layer, Neutral axis, Bending stresses, Distribution of bending stresses in sections, moment of resistance, section modulus, Section moduli for

different shapes of sections, shear stresses in bending, Distribution of normal and shear stress, Composite beams. Simple numerical on bending stress and shear stress calculation.

Module 5
Torsion of Circular
Shafts

Pure torsion, theory of pure torsion, assumptions in the theory of pure torsion, torsional moment of resistance, polar modulus, power transmitted by a shaft, twisting moment, strength of solid and hollow circular shafts and strength of shafts in combined bending and twisting. Simple numerical on torsional moment calculation.

Text Books

1. Gere, J. M and Timoshenko, S. P., *Mechanics of Materials*, CBS Publishers and Distributors.
2. Kurmi, R. S. *Strength of Materials*. New Delhi: S. Chand and Company.

References

1. *Elements of Strength of Materials* by S. P. Timoshenko and D. H. Young, Affiliated East West Press
2. *Strength of Materials* by G. H. Ryder, Macmillan Press
3. *Strength of Materials* by R. Subramaniam, Oxford University Press

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR223	Climate Responsive Architecture	3	0	0	3

Course Objective To impart scientific understanding of processes by which building and entire habitats can be designed to respond to nature, with climate as the basic parameter of design. To study fundamental parameters for thermal comfort. Equip the students with fundamental scientific concepts required to design climate responsive buildings, by offering a clear understanding of the various climatic zones and its climate responsive considerations in architectural design of building and built-up areas.

Anticipated Learning Outcomes: Ability to interpret climatic data for design, understanding sun path diagrams, shadow angles, daylight factors, read wind charts and assess volume of natural ventilation.

**Module 1
Climate and thermal comfort** Effect of climate on habitat, shelter and environment. Study of world climatic zones, characteristics of tropical climate.

Human comfort conditions – Thermal balance of the human body, comfort chart, comfort zone, Thermal comfort indices- Effective temperature, CET, humidity, radiation, wind, precipitation and its considerations at Macroclimate and Microclimate, Psychrometric chart.

**Module 2
Solar geometry and design of sun shading devices** Apparent movement of the sun, sun path diagrams (solar chart) - Solar angles, Shadow angles, solar shading elements, etc.

Exercises on plotting isopleths, transfer of isopleths to solar chart, fitting a shading mask over the overheated period and design of sun shading devices for different orientations.

**Module 3
Principles of thermal design and ventilation in buildings** Thermal quantities – heat flow rate, surface conductance, transmittance – calculation of U- value, convection, radiation, concept of sol-air temperature and solar gain factor, conductivity (k- value), resistivity, thermal capacity and emissivity, conductance through a multi-layered body. Exercises in heat loss and heat gain under steady state conditions and its application in selection of appropriate materials for walls and roof.

Ventilation- The wind, the effects of topography on wind patterns, principles of natural ventilation, wind flow around buildings and air flow patterns inside buildings, air change, quality of air, use of fans, thermally induced air currents, Pressure losses: Stack effect, Venturi effect, Use of courtyard. Wind velocity – wind rose diagram.

Exercises on anemometer and its use. Wind tunnel experiment for wind movement around the buildings.

**Module 4
Design for climatic
types**

Building design and layout planning consideration for warm humid, hot dry and composite climates, tropical climate. Evaluating various built form and orientation of single building, Building material and construction for comfort conditions in the tropics. Effect of landscape elements on Climate and Architecture.

Exercises on climatic data sets, analysis, climate graph, the Mahoney tables and its recommended specification.

**Module 5
Daylight design**

Principles of day-lighting, architectural integration in different building types; daylight quality; sky view factor and daylight factor; daylight design software. Bioclimatic Design standards; Building bye laws related to day-lighting and natural ventilation

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. O.H. Koenigsberger, *Manual of Tropical housing and building – Climatic Design*, Orient Longman, Chennai, 1975.
2. M. Evans – *Housing, Climate and Comfort*, Architectural Press, London , 1980.
3. E. Schild and M. Finbow – *Environmental Physics in construction and its application in Architectural Design*, Granadar , London, 1981.
4. Olgyay, A. and Olgyay, V., *Solar Control and Shading Devices*. New Jersey: Princeton University Press, 1976.
5. Krishan, A. and Nick Baker, *Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings*, McGraw Hill Education Private Limited, India, 1999.
6. B. Givoni, *Man, Climate and Architecture*, Applied Science, Essex 1982.
7. Donald Watson and Kenneth labs – *Climatic Design – Mcgraw hill NewYork 1983*.
8. A. Konya- *Design Primer for Hot Climates*, Architectural Press, London, 1980.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR233	History of Architecture – I	3	0	0	3

Pre-Historic and Late Ancient (5000 BC – 1st Century AD)

Course Objective To provide an insight into the architecture of prehistoric period and late ancient civilizations, and the architecture of Classical antiquity of late ancient period. Social, religious and political character, construction methods, building materials and how they influenced their built form and settlement pattern shall be explained with suitable examples. Combined influence of geology, geography, climate, beliefs, religion and culture on the architecture must be highlighted so as to appreciate how architecture is embedded in a specific context.

Anticipated Learning Outcomes: Understanding of the socio-cultural and religious characteristics of civilizations to appreciate their architectural developments across a timeline; Ability to do a comparative evaluation of various civilizations, appreciate chronological developments along the timeline and across geographies.

Module 1 PREHISTORIC ARCHITECTURE AND SETTLEMENT: Introduction to human settlement: People, their shelter, settlement (*growth, factors influencing the development of a settlement*), burial systems, megaliths, memorials. (*Structures: Different types of graves, Stonehenge; and Settlements – World: Catal Hoyuk, Jericho; India: Mehrgarh etc.*)

INDUS VALLEY CIVILIZATION (IVC): Indus - People, their shelter and civic buildings (*typology, planning, construction and aesthetics*), settlement pattern and citadel (*Structures: Great Bath/Great Granary, simple Harappan house; and Settlements – Mohen-jodaro/ Harappa*)

VEDIC: People, their shelter and buildings (*typology, planning, construction and aesthetics*), settlement (*typical village, planning, shelter types, materials*) (*Structures – Vedic houses, Torana, railing around villages; and Settlements – Patliputra*)

- Module 2** NILE VALLEY CIVILIZATION: People, their shelter and buildings, settlement (*growth, factors influencing the development of architecture and character, settlements of NVC*) and religious (*cult temples*) and burial structures (*typology, planning, construction and aesthetics*) (*Structures: Mastabas, Pyramids: stepped, bent and Great Pyramids of Cheops; Temple of Abu-Simbel/Amun-Ra*)
- MESOPOTAMIAN (EUPHRATES and TIGRIS) CIVILIZATION: Sumerian, Babylonian and Persian people, their shelter and buildings, settlement (*growth, factors influencing the development of architecture and character, settlements*) and religious structures. (*Structures – Ziggurats, Persepolis; and Settlements – Planning of Ur and Babylon*)
- Module 3** CLASSICAL ARCHITECTURE OF ANCIENT GREECE (AEGEAN CULTURE): Evolution of city states, Hellenic and Hellenistic period, factors influencing Greek Architecture, orders in Greek Architecture, proportion, optical correction. (*Structures – Parthenon, Theatre, Agora, Stoas, and Settlements – Athens and Acropolis of Athens and Delphi*)
- Module 4** ROMAN ARCHITECTURE (ETRUSCAN CULTURE): Evolution of Republican States, Roman construction techniques (*masonry, vaults, domes, orders, use of concrete*), building typology (*Structures – Forum, Pantheon, Thermae, Basilica, Circus, Colosseum, etc.*)
- Module 5** Assignments on innovative interpretation of the periodic architectural styles. (*To be decided by the subject teacher*)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Fletcher, B. (1996). *A History of Architecture on the Comparative Method*. 20th Ed. London: B. T. Batsford Ltd.
2. Copplestone, T. and Lloyd, S. (1971). *World Architecture: An Illustrated History*. London: Verona Printed.
3. Brown, P. (2010). *Indian Architecture: Buddhist and Hindu period*. Mumbai: D.B. Taraporevala Sons and Co.
4. Dutt, B. B. (2009). *Town Planning in Ancient India*. Delhi: Isha Books.

5. Grover, S. (2003). *Buddhist and Hindu Architecture in India*. 2nd Ed. New Delhi: CBS Publishers.
6. Ingersoll, R. And Kostof, S. (2013). *World architecture: a cross-cultural history*. Oxford: Oxford University Press.
7. Singh, U. (2009). *A history of ancient and early medieval India: from the Stone age to the 12th century*. Delhi: Pearson India.
8. Hiraskar, G.K., *Great Ages of World Architecture*, Dhanpat Rai and Sons, Delhi.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR243	Architecture and Society	3	0	0	3

Course Objective Introduce the social dimension of architecture as an aspirational response to cultural and economic realities of a community.

Anticipated Learning Outcomes: Ability to understand basic sociological concepts and learn their applications in space planning and architectural design.

Module 1 Sociology, Economics and Culture-sociology and its uses in human settlement studies, socio cultural processes, socio economic parameters in community planning

Module 2 Society and Architecture: relationship of sociology with architecture, relation of house form and culture, socio-cultural transformation through ages and impacts on built environment; social identity and architectural relevance. Contribution of society, social structure and culture on the development of vernacular architecture, design approaches with social perspective

Module 3 Urbanization And Social Stratification- urbanization, rural urban continuum, urban growth, impact on society and urban area, social aspects of housing, territoriality and neighbourhood.

Module 4 Impact of socio-economic parameters on built form, slum and squatter settlements. Some case studies.

Module 5 Course teacher may add information for the student as deemed appropriate

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Rappaport, Amos, 1969. House Form and Culture. Prentice Hall Inc.
2. Brunskill, R.W., 1987. Illustrated Handbook on Vernacular Architecture.

3. Parmar, V.S,1989. *Haveli: Wooden Houses and Mansions of Gujarat*. Mapin Pub. Ahmedabad.
4. Jain, Kulbhushan 1992. *Mud Architecture of the Indian Desert*, Adi Centre, Ahmedabad.
5. Fathy, Hassan 2000. *Architecture for the Poor: An Experiment an Introduction to Sociology*. Vidya Bhushan, Kitab Mahal
6. King, Anthony D. 1980. *Building and Society*, Routledge.

SEMESTER – II

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR254	Architectural Graphics-II	0	0	6	4

Course Objective To train the students in the fundamentals of architectural drawing techniques and skills. Graphical presentation of objects through geometrical projection and visualization is taught in this course.

Anticipated Learning Outcomes: Develop ability to visualize 3-D of objects & spaces through the principles & techniques of 3D Projections - Isometric, Axonometric and Perspective. Ability to understand the effect of Light & Shade on objects & buildings. Learn techniques of rendering for effective presentation of drawings.

**Module 1
Isometric and axonometric views** Introduction to views, types and advantages. Isometric, Axonometric and Oblique view of objects, building components and Interior of the room.

**Module 2
Perspective views** Introduction to perspectives, difference between views and perspectives, Types of perspectives: one point, two point and three points, - Perspective Drawing of Three-Dimensional Objects, Interiors and Exteriors of Building, Sectional perspectives.

**Module 3
Sciography** Principles of Shade and Shadows- Sciography - Use, Definition, Direction of Light, Location of object, Method of finding shadows of a sphere, right circular cone, shade of double curve surface of revolution, Shadows of architectural elements, Shadows of circular solids, Shadows on buildings.

**Module 4
Rendering techniques** Representation technique of plan, elevation and section in architectural drawing; Monochromatic and different themes of rendering, architectural rendering techniques using pen and ink, colour, values, tones, and general approach to rendering. Architectural representation of trees, hedges, foliage, human figures, cars, symbols etc., exposure to various mediums of presentation, Rendering of buildings.

Note: Along with progressive evaluation of class works, tests to be conducted for Descriptive Geometry as part of the internal and final evaluation process.

References

1. Bhatt, N.D. and Panchal, V. M., *Engineering Drawing*, Charotar Publishing House, Anand, India.
2. Albert O'Halse, *Architectural Rendering: The Techniques of Contemporary Presentation*, McGraw Hill Book Company. New York, 1972.
3. Shankar Mulik, *Perspective and Sciography*, Allied Publishers
4. Shah, M.G. and Kale, K.M., *Perspective Principles*, Asia publication, Mumbai.
5. Francis D. K. Ching and Steven P. Juroszek, *Design drawing*, John Wiley and Sons, USA, 1998.
6. H. Morris, *Geometrical Drawing for Art Students*, Orient Longman, Chennai.
7. Narayana, K. L. and Kannaiyah, P., *Engineering Graphics*. New Delhi: Tata McGraw-Hill, 1988.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR266	Computer Applications in Architecture-I (2D Drafting)	0	0	3	2

Course Objective Introducing basic computer skills as relevant to the architectural profession and to bring all students from different backgrounds up to a common level of computer proficiency.

Anticipated Learning Outcomes: Ability to do word and image processing to make short reports and seminar presentations and make 2D orthographic projections in CAD.

Module 1 Introduction to Applications of MS Office in presentation: Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Adobe Page Maker.

Module 2 Introduction to computer aided design in architecture. Introduction to two-dimensional drafting in CAD. Understanding commands like Draw, Modify, Use of tools, layers, plotting system and its applications etc.

Module 3 Customization of Auto-CAD, Auto-CAD express tools, creation of architectural library elements and blocks, applying materials and rendering.

Google Sketch-up application in 3D architectural drawings, modelling, creation of entities, dimensioning, application of solids and surfaces

Module 4 Application of CAD in small Architectural projects done in the previous semester design class through site plan, floor plan, presentation plan, elevation and section using appropriate software.

Module 5 Seminar on another related software like ARCHICAD/INTELLICAD to understand basic differences between the two.

Reference

1. Gindis, E. (2014). *Up and running with AutoCAD 2015: 2D and 3D Drawing*

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR274	Basic Design-II	0	0	6	4

Course Objective To introduce design as a process and as a final product; to understand the several components of the process that leads to the creation of the “Architectural Design”. To enable the students to apply and internalise the theoretical knowledge learnt in the previous semester.

Anticipated Learning Outcomes: Ability to identify and analyse the elements, principles and vocabulary of three-dimensional design; ability to understand the importance of function and aesthetic in architecture and design.

Module 1 ANTHROPOMETRICS

Anthropometric study and ergonomics of human figure (including physically handicapped persons), dimensions of furniture - relationship with human anthropometrics (like in kitchens, toilets, bedrooms, staircases etc.)

Module 2 Area and space calculations for simple understandable spaces such as bed rooms, dining, living, kitchen, toilet, veranda, etc. using furniture and human activities as the basis.

Module 3 Preliminary ideas of circulation and flow aspects of simple habitations starting with a house, with the use of bubble diagrams.

Module 4 Transformation of forms for better aesthetics and usability through additive and subtractive changes. Role of different forms in the aesthetics and beauty of the design to be explored through making and breaking spaces through combination of planes (vertical, horizontal, inclined and curvilinear)

Module 5 Design of a small structure having a single activity.

1. Assigning Utility to space. (Assigning of utility to space may be that of a memorial, bus shelter, park pavilion. Milk parlour / Snack kiosk / Garden pavilion / Entrance gate with a security booth)

2. Ranging the spaces according to aesthetics, anthropometrics, social and engineering aspects.
3. Feedback and design integration.
4. Producing a final design in the form of sketch plans, sections, perspective and Model.

References

1. Mike W. Lin, *Drawing and Designing with confidence – A Step by step guide*, John Wiley and sons, USA, 1998.
2. Criss B. Mills, *Designing with model: A Studio guide to making and using architectural models*, Thomson and Wadsworth, USA, 2000.
3. Bousmaha Baiche and Nicholas Walliman, *Neufert Architect's data*, Blackwell science Ltd.
4. Sam F Miller, *Design process– Van Nostrand Reinhold*
5. Ching, F. D. K. (2012). *Architecture: Form, Space and Order*, 3rd Ed. Hoboken: John Wiley and Sons.
6. Pandya, Y. (2007). *Elements of Space making*, Ahmedabad: Mapin.
7. Peter, V. M. (1998). *Elements of architecture – from form to place*, 1st Ed. New York: Routledge.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
8.	22AR283	Building Materials and Construction-II	2	0	4	4

Course Objective To understand fundamental building material in the context of various construction methods. BC-II would focus on Wall as a building component and would be emphasised based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of traditional and modern construction methods and practices.

Anticipated Learning Outcomes: Ability to produce construction and detailed drawings of Walls required for various types of buildings.

Module 1

LECTURE: Wall: Introduction to different types of walls (structural and Non-structural)

Structural walls with different materials (Stone, Brick, concrete and RCB)

Non-Structural walls with different materials (Stone, timber, Brick, glass, etc)

Different types of walls using alternative techniques (Different types of mud walls, Cob walls, Adobe blocks, wattle Daub,)

SHEET WORK:

1. Stone Masonry-Rubble masonry,
2. Ashlars masonry
3. Masonry Joints

Module 2

LECTURE: Brick Bonding & its principles (English Bond, Flemish bond and Rat trap Bond)

Non-structural bond (Brick jalis etc)

SHEET WORK:

4. Stop end, T, L & cross Junctions of English bond for up to two brick thick walls.
5. Rat Trap Bond and cavity walls

6. Corbelling, Cornices,
7. Types of coping, pointing & Threshold

Module 3 LECTURE: Reinforced Brick masonry

SHEET WORK:

8. Reinforced Brick wall and column

Module 4 LECTURE: Glass: Types of glass like plate, decorative, tinted, heat absorbing etc. structural glass bricks and glass Crete, fibreglass, wool etc.

SHEET WORK:

9. Curtain walls
10. Structural glazing

Module 5 LECTURE: Lift: Types, use, material and installation

Retaining wall: Types, use and material

SHEET WORK:

11. Lift
12. Retaining Wall

NOTE:

- **Frequent site visits to be arranged as a part of the curriculum. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.**
- **Pedagogy should establish the linkage of the relevant material and construction techniques from past to present.**
- **Performing standards and Codes used for various Building Materials and Construction Techniques needs to be focused.**
- **Alternative construction techniques for respective topics need to be discussed in detail.**

References

1. Barry, R. (1999). *The Construction of Buildings Vol. 2. 5th Ed.* New Delhi: East-West Press.
2. Foster, J. and Mitchell, S. (1963). *Building Construction: Elementary and Advanced, 17th Ed.* London: B.T. Batsford Ltd.
3. McKay, W. B. (2005). *Building Construction Metric Vol., I-V. 4th Ed.* Mumbai: Orient Longman.

4. Hailey and Hancork, D. W. (1979). *Brick Work and Associated Studies Vol. II*. London: MacMillan.
5. Merritt, F.S. and Ricketts, J.T., *Building Design and Construction Handbook*, McGraw Hill.
6. Rangwala, S. C. (1963). *Building Construction: Materials and types of Construction*. 3rd Ed. New York: John Wiley and Sons.
7. Chudley, R. (2008). *Building Construction Handbook*. 7th Ed. London: Butterworth Heinemann.
8. Sushil-Kumar, T. B. (2003). *Building Construction*. 19th Ed. Delhi: Standard Publishers.
9. Ching, F. D.K – *Building Construction illustrated*. VNR, 1975
10. A. Agarwal – *Mud: The potentials of earth-based material for third world housing* – IIED, London, 1981.
11. HUDCO – *All you wanted to know about soil stabilized mud blocks*, New Delhi, 1989.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
9.	22AS293	Architectural Workshop	0	0	3	2

Course Objective Introduce different techniques of model making in various materials and basic processes for fabrication and assembly of simple building components.

Anticipated Learning Outcomes: Ability to make true scale models of architectural designs, manually and mechanically and familiarity with carpentry, joinery, smithy and moulding with different materials and techniques.

**Module 1
Introduction to model making** Need for architectural models, Role of scale-models in design; General practices in model making; Types of models: block, detailed, construction and interior models. Introduction to concepts of model making and various materials used for model making

**Module 2
Detail modelling** Representing various surface finishes like brick/stone representation, stucco finish etc; Various site elements – Contour representation, Roads/Pavements, Trees/Shrubs, Lawn, Water bodies, Street furniture, Fencing etc.

**Module 3
Carpentry (Two joint job)** Carpentry tools like – saw, planer, chisels, hammers, pallet, marking gauge, vice, tee square, rule, etc., carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, type of woods, and carpentry hardware, safety precaution, demonstration of various operations by using hardware.

**Module 4
Fitting (One job)** Fitting tools like – files, vice, chisels, scriber, hammers, surface plate, try square, callipers, etc. Fitting operations such as filing, grinding, sawing, marking, drilling, tapping, safety precaution, demonstration of various operations, and preparation of male – female joints

**Module 5
Welding (One job)** Electric arc welding, welding machines, different types of electrodes, screen fixers, hand gloves, demonstration of welding operation.

Reference

1. *Work familiarization*: E. Wilkinson
2. *Workshop technology*: A.K. Hajrachaudhuri and S.K. Hajrachaudhuri
3. *ITB Handbook: Engineering Industry*, Training Board
4. *Workshop Technology. Vol. I and II*: Gupta and Kaushi
5. *BENN, the book of the house*, Ernest Benn limited London
6. *Janssen, Constructional Drawings and Architectural models*, Kari Kramer Verlag Stuttgart, 1973.
7. *Harry W. Smith, The art of making furniture in miniature*, E.P. Dutton Inc., New York, 1982.
8. *Thames and Hudson Manual of Rendering with Pen and Ink*-Robert W Gill.
9. *Ching, F. D. K. (2009). Architectural Graphics. 5th Ed. New Jersey: John Wiley and Sons.*
10. *Criss. B. M. (2011). Designing with models: A Studio guide to Architectural Process Models.3rd Ed. Hoboken: John Wiley and Sons.*
11. *Kieran, S. and Timberlake, J. (2008). Lobolly House: Elements of a New Architecture. New York: Princeton Architectural Press.*
12. *Morgan, C. L. and Nouvel, J. (2002). The Elements of Architecture. London: Thames and Hudson.*
13. *Werner, M. (2011). Model Making. New York: Princeton Architectural Press*

SEMESTER – III

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AR313	Structural Analysis	3	0	0	3

Course Objective To understand simple structural concepts and behaviour. With the acquired knowledge of statically equilibrium of forces the course aims at teaching methods to determine effect of loads on members of different determinate structures and give additional knowledge of deformation of structures to solve indeterminate structures. To familiarize the student with the effects of transverse forces such as shear force and bending moment in beams; determination of SF and BM in simple beams under different loading systems; and understanding of strength and forces in columns and arches

Anticipated Learning Outcomes: To demonstrate an understanding of concepts taught during the semester through simple calculations and models.

**Module 1
Beams: types and properties** Introduction to determinate and indeterminate structures, Different types of loads acting on a structure

Types of beams, its behaviour, types of supports and reactions, bending moment and shear forces; simply supported, cantilever and overhanging beams, relation between bending moment and shear force.

Explaining with Bending moment and Shear force diagram.

**Module 2
Bending and shear forces** Shear force and bending moment for fixed and continuous beams, application of Clapperayon's theorem of three moments. Moment distribution method.

Determination of members of forces in determinate trusses and simple frames.

**Module 3
Deflection** Relation between slope, deflection and curvature, double integration method, three moment theorems, deflection by

conjugate beam method. Application to simple cases including overhanging beams.

**Module 4
Columns**

Types of columns, columns and struts, buckling and crushing failure, Euler's theory, equivalent length and slenderness ratio, Rankine's formula.

**Module 5
Arches**

Determination of horizontal thrust, radial shear and normal force, axial thrust, bending moment and shear force for three-hinged arch. Structural concepts in post and lintel, arch, dome, and vault construction.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Junnarkar, S. B. (1991). *Mechanics of Structures. Vol. 1. 20th Ed. Delhi: Charotar.*
2. Kurmi, R. S. *Strength of Materials. New Delhi: S. Chand and Company.*
3. Mukherjee, S. *Elements of Engineering Mechanics. New Delhi: PHI Learning.*
4. Ramamrutham, S. (2008). *Engineering Mechanics: A Textbook of Applied Mechanics. Dhanpat Rai Publishing.*
5. Vazirani and Ratwani. (2008). *Analysis of Structures. Vol. I. New Delhi: Khanna Publishers.*
6. Gere, J. M and Timoshenko, S. P., *Mechanics of Materials, CBS Publishers and Distributors.*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR323	History of Architecture-II	3	0	0	3

Late Ancient and Early Medieval (1st Century AD – 1000 AD)

Course Objective Introduce the historic evolution of a temporal building typology through the exhaustive study of a specific type, viz. religious architecture from across the world.

Anticipated Learning Outcomes: Understanding of the factors that influence the evolution of early forms of the Hindu temple, Christian church and Islamic Mosque in India and abroad, and the architectural characteristics and features of each type.

Module 1 EARLY CHRISTIAN ARCHITECTURE: Evolution of church form from the Roman Basilica, architectural character and space planning, Schism of Roman Empire to Western and Eastern Provinces, Polymath architecture and Baptisteries, (*Structures – St. Peter's Basilica, St. Clemente*).

Module 2 CHURCH ARCHITECTURE OF BYZANTINE: Factors influencing Byzantine Architecture, development of Domes and Pendentives, (*Structures – Hagia Sophia at Constantinople*); Romanesque – evolution of religious orders in Christianity – Italy (*Pisa Cathedral complex*) and England (*Tower of London*).

Module 3 BUDDHIST AND JAIN ARCHITECTURE: Symbolism of Buddhist Architecture, rock-cut architecture, Ashokan School (*Hinayana and Mahayana Period*), development of Stupa, Buddhist schools – Mathura School and Takshashila School (*Greek influence*) (*Structures – Chaitya and Vihara, Monolithic Ashokan Pillars, Rock-edicts, Stupa of Sanchi / Amravati*)

Symbolism of Jain Architecture, rock-cut architecture, general planning, sitting and decorative treatments of Jain temples. (*Structures – Jain temples of Mt. Abu*)

Module 4 Columns	EARLY TEMPLE ARCHITECTURE: Evolution of Hindu temples, early shrines of Gupta (<i>Tigwa, Sirpur, Deogarh</i>) and Chalukya (<i>Ladh Khan, Durga Temple</i>), Development of Indo-Aryan style (<i>Papanatha, Virupaksha at Pattadakal</i>), Dravidian Style: Rock-cut of Pallavas (<i>Rathas and Mandapa</i>) and Structural (<i>Shore temple of Mahabalipuram</i>).
Module 5 Arches	Study on development of fortification, walled towns, settlement pattern, and the causative factors in India. (<i>Places to be decided by the subject teacher</i>)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Brown, P. (2010). *Indian Architecture: Buddhist and Hindu period*. Mumbai: D.B. Taraporevala Sons and Co.
2. Fletcher, B. (1996). *A History of Architecture on the Comparative Method*. 20th Ed. London: B.T.Batsford Ltd.
3. Copplestone, T. and Lloyd, S. (1971). *World Architecture: An Illustrated History*. London: Verona Printed.
4. Lloyd, S. and Muller, H.W., (1986), *History of World Architecture Series*, Faber and Faber Ltd., London.
5. Crouch, P. D. (1985). *History of Architecture: Stonehenge to Skyscrapers*. London: McGraw-Hill.
6. Dutt, B. B. (2009). *Town Planning in Ancient India*. Delhi: Isha Books.
7. Grover, S. (2003). *Buddhist and Hindu Architecture in India*. 2nd Ed. New Delhi: CBS Publishers.
8. Roth, M. L. (2006). *Understanding Architecture: Its Elements, History, and Meaning*. Columbia: West-view Press.
9. Harris, M. C. (1977). *Illustrated Dictionary of Historic Architecture*. New York: M. Courier Dover Publications.
10. Ingersoll, R. And Kostof, S. (2013). *World architecture: a cross-cultural history*. Oxford: Oxford University Press.
11. Singh, U. (2009). *A history of ancient and early medieval India: from the Stone age to the 12th century*. Delhi: Pearson India.
12. Hiraskar, G.K., *Great Ages of World Architecture*, Dhanpat Rai and Sons, Delhi.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR333	Ecology and Environment	2	0	1	3

Course Objective To bring about awareness of a variety of environmental concerns and to create a pro-environmental attitude and behavioural pattern in society based on sustainable lifestyles.

Anticipated Learning Outcomes: Ability to explain the fundamentals related to Ecosystem; To develop understanding of the Environment and Environmental issues, their causes and mitigation measures; ability to apply the ecological and environmental principles and guidelines learnt to their architecture/planning projects.

Module 1 Introduction Definition and origin of ecology, Basic concepts of ecology, Major divisions of ecology, Definition of environment, Interaction among ecological factors – light & temperature, precipitation, humidity, gases/wind, topography. Global warming & climate change, Loss of biodiversity, Desertification, Deforestation.

Module 2 Ecosystem Kinds of ecosystem, Structure, Function and energy flow of ecosystem. Ecological succession, Ecosystem development, Climax concept.

Module 3 Soil, Water & Air SOIL – EDAPHIC FACTORS: Definition of soil, Formation of soil, Soil profile, Classification, Soil complex, Soil depletion, degradation and conservation, relation of soil and built environment.

WATER REGIMES: Water in nature, Water balance problem, Surface / ground water, Sources of water pollution, Groundwater pollution, Marine pollution, Prevention control of pollution, Conservation & management, impact of human intervention on water.

AIR POLLUTION: Kinds of air pollution, Sources of air pollutants, Effects – Depletion of Ozone, Acid Rain, Prevention & control of air – pollution, Noise pollution, Effect of human habitat and human activity on atmosphere.

Module 4 Built Environment and Ecology Understanding the interrelationship between man, nature and built-form (in urban / rural area). Strategies to transform the built-environment to meet the risk of climate change.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Barucha, E., 2004. *Text Book Of Environmental Studies for Undergraduate Courses*. UGC Univ. Press
2. Joseph, Benny, 2005. *Environmental Studies*. Tata McGraw Hill
3. Kaushik, A. and Kaushik, C.P., 2010. *Basics of Environment and Ecology*. New Age Int. Publishers
4. Agarwal, K.C., 2001. *Environmental Biology*. Nidhi Publ. Ltd. Bikaner
5. Brunner, R.C., 1989. *Hazardous Waste Incineration*. McGraw Hill

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AS343	Water Supply and Sanitation	3	0	0	3

Course Objective To acquaint students with the principles of water supply and drainage, standards and codes, and design considerations for plumbing systems in buildings.

Anticipated Learning Outcomes: Ability to estimate water demand and draw plumbing layouts, drainage and sewage networks for simple residential buildings

**Module 1
Water supply** General idea of sources of water supply: qualitative and quantitative aspects, Water requirements for different types of buildings, water saving practices Water treatment and distribution systems- Domestic water supply systems, sump, overhead storage tank, pipe size, pipe fittings.

Special installation Cold water and Hot water supply in multi-storeyed buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower, types of valves etc. provision for firefighting and code requirements.

Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Site visits - Water treatment plant. Multi-storeyed apartments for studying water supply and submission of reports.

**Module 2
Sanitation** Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water overflow chambers, methods of laying and construction of drains and sewers

Traps: shapes, sizes, types, materials and function, Inspection chambers - sizes and construction, intercepting chamber, cast iron manholes

Ventilation of House drainage: Anti siphon pipe, system of plumbing - single stack, one pipe system, one pipe partially ventilating system and two pipe system, grey water recycling and dual plumbing

Types of fixtures and materials: Sinks, shower tray, shower temple, bath tub, Jacuzzi, water closets, flushing cisterns, urinals, sinks, wash basins, bidet, low flow fixtures, etc.

**Module 3
Sanitation**

Design of Septic tank, Oxidation Pond, Dispersion trench and soak pits.

Treatment system- Root zone treatment system, Decentralized Wastewater.

Treatment Systems (DEWATS), Soil Bio technology, packaged Bio-Reactor System.

**Module 4
Solid waste
disposal**

Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods, guidelines for municipal solid waste management, e-waste management.

Disposal of Wastes: Sanitary land filling, Composting, Vermicompost, Incineration, Pyrolysis.

Module 5

Application of above studies in building projects, preparation of layouts and details.

Site visits - Sewage treatment plant.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Birdie, B. S. (1996). *Water supply and Sanitary Engineering*. Dhanpat Rai and Sons.
2. *National Building Code of India*. (2005).
3. Punmia, B. C., Jain, A. K. and Jain, A. K. (1995). *Water Supply Engineering*. New Delhi: Laxmi Publications.
4. Rangwala, S. C. (2005). *Water Supply and Sanitary Engineering*. Charoter Publishing.
5. *Handbook on Water Supply and drainage with Special Emphasis on Plumbing*. Bureau of Indian Standards, New Delhi.

SEMESTER – III

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR356	Architectural Design -I	0	0	9	6

Course Objective Introduction of issues related to design of the human habitat, its components and space standard; To explore the interrelationship between human behaviour and space in a small residential environment, including, volume of space, shape, form, function, climate, materials and construction techniques.

Anticipated Learning Outcomes: Ability to identify user needs and translate them into a program and thereafter use the program to manifest them in a design in terms of space, materials and construction methodology that is appropriate in a particular context along with a preliminary idea of structure and services for effective utilisation of the building.

Guidelines In the third semester, the students will be given the design problem. The requirements (Function and Areas) and the site will be given by the teachers. The students may make some literature review and may see some cases for their information, but these will be tentative and will not be considered as essential. They will design the project keeping in mind the form, circulation, areas, engineering aspects, structure, water supply, electrification, site circulation and landscape aspects as directed and advised by the class teacher.

The exercises may be taken up as mentioned herein:

1. Small projects such as a small house, canteen, study centre, guest house, etc. may be given to the students as a design project.
The requirements and their areas are to be stipulated by the design teacher.
The students accompanied by the design teacher should visit at least two existing buildings as case studies.
Notes should be made on these in reference to its flow of operation. Climatic angles should be observed, particularly in case of a house design.
Materials used must also be observed.
2. A one-week workshop on the design of a bus stop, pavilion in a park or similar size small project should be done under the supervision of a teacher other than the subject teacher.

3. A two-day design examination should be conducted at the end of the semester

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

References

1. Chaira, J. D. and Crosbie, M. J. (2001). *Time Saver Standards for Building Types*. 4th Ed. New York: McGraw-Hill.
2. Bousmaha Baiche and Nicholas Walliman, *Neufert Architect's data*, Blackwell science ltd.
3. Hareguchi, H. (1988). *A Comparative analysis of 20th C. houses*. London: Academy Editions.
4. Miller, S. F. (1995). *Design Process: A Primer for Architectural and Interior Design*. New York: Van Nostrand Reinhold.
5. Robson, D. (2002). *Geoffrey Bawa: The Complete Works*. New York: Thames and Hudson.
6. Schulz, N. C. (1985). *The concept of dwelling*. New York: Rizzoli International Publications.
7. Unwin S. (2010). *Twenty Buildings every Architect should understand*. New York: Routledge.
8. Meiss, V. and Pierre, *Elements of Architecture: From Form to Place*.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR364	Building Materials and Construction-III	2	0	4	4

Course Objective To understand fundamental building material in the context of various construction methods.

BC-III would focus on Roofing systems as a building component and would be emphasised based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of traditional and modern construction methods and practices.

Anticipated Learning Outcomes: Ability to produce construction and detailed drawings of various kinds of Roofs required for various types of buildings.

Module 1 LECTURE: Different types of roofs- flat, pitch roof, shell roof & vault roof; Various types of Roof coverings for pitched roofs (Sheet, Tiles, etc).

SHEET WORK:

1. RCC slab/Roof
2. Timber Trusses: King Post, Queen Post; Lean to roof with roof covering

Module 2 LECTURE: Iron and Steel: cast iron, Steel and wrought iron with properties and sections, use of ironwork in buildings.

Introduction to tensile structures Space frame, Tensile structures, Pneumatic structures, cable structures, double layer Hyperbolic & parabolic structure.

SHEET WORK:

3. Different types of steel trusses
4. North light, Tubular, K-Type truss
5. Different types of girders,
6. Girder detail
7. Space frame- Single layer

Module 3 LECTURE: Precast & Prestressed concrete.

SHEET WORK:

- 8. Domes, Shells,
- 9. Folded plates

Module 4 LECTURE: Application of Ferro cement; non-conventional roofing techniques;

Innovative and cost-effective roofing technology. Waterproofing, terracing

Bamboo Construction techniques

SHEET WORK:

- 10. Filler Slab
- 11. Waterproofing, terracing
- 12. Bamboo Construction techniques

Module 5 LECTURE: Types of staircase and ramps

SHEET WORK:

- 13. Types of R.C.C. & M.S. staircase & ramps.
- 14. Simple MS & SS section gate design and details.

NOTE:

- ***Frequent site visits to be arranged as a part of the curriculum. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.***
- ***Pedagogy should establish the linkage of the relevant material and construction techniques from past to present.***
- ***Performing standards and Codes used for various Building Materials and Construction Techniques needs to be focused.***
- ***Alternative construction techniques for respective topics need to be discussed in detail.***

References

1. Barry, R. (1999). *The Construction of Buildings Vol. 2. 5th Ed.* New Delhi: East-West Press.
2. Foster, J. and Mitchell, S. (1963). *Building Construction: Elementary and Advanced, 17th Ed.* London: B.T. Batsford Ltd.

3. McKay, W. B. (2005). *Building Construction Metric Vol., I–V*. 4th Ed. Mumbai: Orient Longman.
4. Hailey and Hancork, D. W. (1979). *Brick Work and Associated Studies Vol. II*. London: MacMillan.
5. Merritt, F.S. and Ricketts, J.T., *Building Design and Construction Handbook*, McGraw Hill.
6. Rangwala, S. C. (1963). *Building Construction: Materials and types of Construction*. 3rd Ed. New York: John Wiley and Sons.
7. Chudley, R. (2008). *Building Construction Handbook*. 7th Ed. London: Butterworth Heinemann.
8. Sushil-Kumar, T. B. (2003). *Building Construction*. 19th Ed. Delhi: Standard Publishers.
9. Ching, F. D.K – *Building Construction illustrated*. VNR, 1975
- 10.A. Agarwal – *Mud: The potentials of earth-based material for third world housing* – IIED, London, 1981.
11. HUDCO – *All you wanted to know about soil stabilized mud blocks*, New Delhi, 1989.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR373	Computer Applications in Architecture – II (3D Modelling)	0	0	3	2

Course Objective To enable the students to understand the fundamentals of computer aided 3D Modelling (ACAD 3D/ Revit etc.) -presentation techniques.

Anticipated Learning Outcomes: Ability to visualize design concepts in-the-round and make simple and complex 3D objects in CAD/ Revit.

**Module 1
Introduction to 3d modelling** Project: Create 3D sculpture using 3D primitives (cubes, spheres etc.)
Tools: Slide facilities script attributes, V-port, editing session. Introduction to 3D-modelling technique and construction planes, drawing objects, 3D surfaces setting up elevation thickness and use of dynamic projections. Solid modelling with primitive command and Boolean operation. Surface development and exploration

**Module 2
3d rendering and setting** Project: Visualize a building. Explore the potential of lights and camera and use the same in the model created for the final submission. Tools: Rendering and scene setting to create a photo realistic picture, understanding material mapping, environment setting and image filling. Exercise to identify and visualize a building using the above said utilities.

Module 3 Seminar on another related software to understand basic differences between the two.

Reference

1. Gindis, E. (2014). *Up and Running with AutoCAD 2015: 2D and 3D Drawing and Modelling*, Oxford: Elsevier.
2. Seidler, D. R. (2007). *Digital Drawing for Designers: A Visual Guide to AutoCAD 2012*, London: Fairchild Publications.
3. Smith, B. L. (2007). *3ds Max 2008 Architectural Visualization Beginner to Intermediate*, Sarasota: 3DATS.
4. *3DS MAX – Advanced 3D Modelling and animation – C and M*, CADD Centre
5. *Tutorials: [http:// www.lynda.com/](http://www.lynda.com/)*

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
8.	22AR383	Documentation and Measured Drawing (Buildings)	0	0	3	2

Course Objective To expose the students to real world situations and to represent the observation and understanding through graphics, sketches and architectural technical drawings.

It is widely accepted that obtaining actual measurements is a very important part of observation.

Anticipated Learning Outcomes: Ability to observe and measure buildings of importance with accuracy to represent it in technical drawings; acknowledge and record building construction techniques and details through sketches and photographs; create a literary repository of information collected through field documentation and survey for further reference and information.

**Module 1
Methods of Documentation and Measured Drawing** For measured drawings, we are to document historically and architecturally significant buildings in the form of as-built drawings through the three documentation methods; measured drawings, written documentation and photographic documentation.

**Module 2
Written Documentation** Information collection from existing literature for the building and the area around. Verifying the information collected through a reconnaissance survey.

**Module 3
Measured Drawings** Understanding of different scales, measurement device and their uses in practice - Drawings to scale, geometrical representation techniques.

Produce a set of measured drawings of buildings or structures of specific given location by hands-on measurement exercise for documentation.

Documentation through sketches & photographs.

Other than the measured drawing, the students have to draw sketches and take photographs/videos documenting the real-life situation/interaction of the building along with its vicinity.

Module 4
Preparation of the
Document.

(Report writing, measured drawing, sketches, photographs/videos of the given building)

The report will elaborate on the significance of the building being measured from various aspects such as architectural, historical and cultural. Captions to the photographs and sketches, annotating vital information should accompany each piece, about what is drawn based on the site given to them.

References

1. Ching, F. D. K. (2011). *A Visual Dictionary of Architecture*. 2nd Ed. Hoboken: John Wiley and Sons.
2. Lockard, W. K. (1992). *Drawing as a Means to Architecture*. 6th Ed. New York: Van Nostrand Reinhold Company.

SEMESTER – IV

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AS413	Design of RCC Structures	3	0	0	3

Course Objective To understand complex structural concepts and behaviour.

Anticipated Learning Outcomes: To demonstrate an understanding of concepts taught during the semester through simple calculations and models.

Module 1 Introduction to RCC design	<p>ISI CODE COMPLIANCE</p> <p>Characteristics of RCC, nominal mix, Design mix.</p> <p>Evolution of different design theory, principle of limit state analysis, load path in a building, creating building frames and selecting sizes of structural elements based on thumb rules with guidelines of relevant codes</p>
Module 2 Design of beam	Design of singly reinforced beams for flexure, shear, torsion and bond. Concept of doubly reinforced beams and design.
Module 3 Design of slab	Concepts and design of different types of slabs, behaviour and design of simply supported slabs spanning in one direction, two directions, continuous slab, cantilevered slab, flat slab, waffle slab, and inclined roof.
Module 4 Design of foundation and column	<p>Soil Mechanics: Soil formation and resulting soil deposits, different types of soils and their physical properties, classification as per Indian standard system.</p> <p>Foundations: Types of foundations for RCC structures, Design of isolated column footing, retaining wall. Design of short and long axially loaded RCC Columns, Principles of staircase design.</p>
Module 5 Practical	Laboratory: Soil testing, casting of cement concrete cubes, Compressive test of cement concrete cubes, and Tensile strength of steel. Visit construction sites for study of RCC structures.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Varghese, P. C. (2011). *Limit state Design of Reinforced Concrete*. PHI Learning.
2. Ramachandra, S. (2004). *Limit State Design of Concrete Structures*.
3. Scientific publishers.
4. Ramamrutham, S. (2000). *Design of RCC Structures*. New Delhi: Tata McGraw Hill Education.
5. Ramamrutham. S and Narayanan. R, (1997), *Reinforced Concrete Structures*, Dhanpat Kai Publication, New Delhi.
6. Punmia, B. C. (2005). *Soil Mechanics and Foundation Engineering*. Delhi: Laxmi publications.
7. Swamisaran. (2010). *Analysis and Design of Substructures*. 2nd Ed. (LSD).
8. Punmia, B. C. (2007). *Limit State Design of Reinforced Concrete*. Delhi: Laxmi Publications
9. IS 875- 1987
10. IS 800-2007
11. Explanatory Hand Book SP24 Design Aid SP 16,
12. Detailing of Reinforcement, SP 34

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR424	Landscape Design & Site Planning	2	0	2	4

Course Objective Introducing the relationship between the built and the un-built environment and principles of sustainable site planning; To enable the students to understand the principles of site planning, site analysis techniques and its application in design of different landscape types.

Anticipated Learning Outcomes: Ability to analyse ecological and geomorphological characteristics of a site; use site analysis information to propose appropriate site planning and landscape design.

Module 1 Principles Landscape design definition, Theories and principles, aesthetic value of landscape, site survey analysis and appraisal, Elements of Landscape design

Module 2 Landscape elements Contours Representation of Land form and Landform design, interpolation of contours, slope analysis, Grading

Design of water bodies, swimming pool, storm water drainage design, design to reduce surface runoff paving and surface treatments

Vegetation, planting design principles and practice, indoor landscaping, terrace gardening, industrial landscaping. An assignment to be given to identify native plant species, their availability

Module 3 Landscape design styles History of landscape design. Landscape design style and principles: Chinese, Japanese, English, French, Moghul

Module 4 Site planning and landscape design Site Zoning. Organization of vehicular and pedestrian circulation; parking; street widths; turning radii; street intersections; steps and ramps. Site planning considerations in relation to water systems, sewage disposal, outdoor electrical systems.

Landscaping of residential areas, parks, archaeological gardens, urban avenues, Roads and Highways and Parking design
Landscaping details.

An assignment to be prepared on designing and execution of a small landscape.

Module 5 Methods for multi-criteria landscape evaluation.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Appleton. (1996). *The Experience of Landscape*. Wiley.
2. Laurie. (1986). *An Introduction to Landscape Architecture*. Elsevier.
3. Lynch, K. (1962). *Site Planning*. Cambridge: The MIT Press.
4. Simonds, J. O. (2006). *Landscape Architecture: A Manual of Land Planning and Design*.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR433	History of Architecture-III	3	0	0	3

Medieval - Early Modern (10th Century - 19th Century AD)

Course Objective To impart understanding of the evolution in architecture and urbanism from the medieval to Early Modern times; social, religious and political character, building materials, construction methods, landscape and how they influenced their built form and settlement patterns shall be explained with examples. Knowledge of European Renaissance and Mughal architecture in India is provided; Combined influence of geology, geography, climate, beliefs, religion and culture on the architecture must be highlighted so as to appreciate how architecture is embedded in a place-specific context.

Anticipated Learning Outcomes: Ability to distinguish place- and period-specific architectural styles of religious architecture in India, Europe, West Asia and the Far East.

Module 1 GOTHIC AND RENAISSANCE ARCHITECTURE: Evolution of vaulting and development of structural systems (*flying buttress, pinnacles, spires, pointed arches*); Italian Gothic (*Vatican City and St Peter's Cathedral*), French Gothic (*Notre Dame at Paris*), English Gothic (*Westminster Abbey*). Renaissance architecture in Italy and France, Baroque Period.

Module 2 TEMPLE ARCHITECTURE: Indo-Aryan – salient features and development of Shikharas. Odishan – Early (*Vaithal Deula / Parshurameswar*), Middle (*Lingaraj / Konark Sun Temple*), Late (*Mukteswar / Raja Rani*); Gujarat (*Surya Temple, Modhera*); Central India (*Kandariya Mahadev, Khajuraho*); Dravidian – salient features and development of Vimanas and Gopuram. Chola style (*Brihadeswara, Tanjore*); Pandya Style (*Gopuram and temple complex, Meenakshi Temple*).

Module 3 ISLAMIC ARCHITECTURE: Evolution of Islamic architecture – features of a typical mosque, principles and influences; construction techniques – domes, arches, minarets, calligraphy, etc.

Imperial Style (*Delhi Sultanate*) and Provincial Islamic Styles – Development of mosques and tomb prototypes in India (*Structures – Qutub Complex at Delhi*), Bengal (*Adina Mosque*), Gujarat (*Jami Masjid*), Deccan (*Golgumbaz and Bijapur*), Hyderabad (*Charminar*), Lucknow (*Bara Imambara and Chhota Imambara*)

Module 4

MUGHAL ARCHITECTURE: Development of Mughal architecture under different rulers (*Fatehpur Sikri, Taj Mahal, Red Fort*)

INDO SARACENIC ARCHITECTURE: Synthesis with Indian architecture and climatic factors – Mysore (*Mysore Palace*) / Lucknow (*Char Bagh Railway Station/ La Martiniere, Lucknow*) / Baroda (*Laxmi Vilas Palace*).

Module 5

Study of heritage along waterfront in India.

Study of Palaces and Havelis. (Subject teacher to decide)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Brown, P. (1983). *Indian Architecture (Islamic Period)*. Bombay: Taraporevala and Sons.
2. Fletcher, B. (1996). *A History of Architecture on the Comparative Method*. 20th Ed. London: B.T. Batsford Ltd.
3. Catherine, A. (2001). *Architecture of Mughal India*. Cambridge University Press.
4. Faulkner, H. T. (1953). *Architecture through the Ages*. New York: Putnam Adult.
5. Grover, S. (2002). *Islamic Architecture in India*. New Delhi: CBS Publications.
6. Harris, M. C. (1977). *Illustrated Dictionary of Historic Architecture*. New York: M. Courier Dover Publications.
7. Hillenbrand, R. (1994). *Islamic architecture - form, function and meaning*. Edinburgh: Edinburgh University Press.
8. Ingersoll, R. And Kostof, S. (2013). *World architecture: a cross-cultural history*. Oxford: Oxford University Press.
9. Mitchell, G. (1978). *Architecture of the Islamic world - its history and social meaning*. London: Thames and Hudson.
10. Nath, R. (1985). *History of Mughal Architecture Vols I-III*. New Delhi: Abhinav Publications.
11. Tadjell, C. (1990). *The History of Architecture in India*. New Delhi: Penguin Books.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR443	Vernacular Architecture & Village Settlements	3	0	0	3

Course Objective The objective is to instil sensitivity towards the less explored field that is concerned with Architectural building traditions/practices that are cost effective, ecologically sensitive and culturally relevant. To introduce grass root principles of indigenous architecture that has evolved over time in response to environment, climate, culture, economy and basic human needs; The variations in built forms and their environmental performance across different climatic and geographical regions of India with more emphasis on Odisha.

Anticipated Learning Outcomes: Understanding of typology of settlement patterns with reference to physiographic features, site selection with appropriateness to respond to local climate and spatial organization of settlement to suit the functional need; Ability to understand the inherent sustainability of the Habitat; use the learnings from traditional settlements in their designs.

**Module 1
Introduction to vernacular architecture** Definitions and theories, Categories.
Contextual responsiveness: Climatic, Geographical, Anthropological and Cultural influences.

**Module 2
Environment and materials** Typical building materials, Built form and elements, Construction technique and Environmental performance.

**Module 3
Regional variations in built form** RURAL ARCHITECTURE: Settlement Pattern, Dwelling Typology, Symbolism, Typical features, Construction materials and techniques
EASTERN REGION: Odisha – Rural houses of the coastal and inland areas; Bengal –Rural house form- Aat Chala houses, Thakur Bari (Mansions in North Kolkata).
WESTERN REGION: Rajasthan- Rural Jat houses for farming caste and Bhungas (Circular Huts) and Havelis; Gujarat- Deserts of Kutch, Pol houses of Ahmedabad, Wooden Havelis;

SOUTHERN REGION: Kerala – Nalukettu, Houses of Nair and Namboothiri community, Koothambalam; Tamil Nādu – Toda Huts, Chettinad Houses (Chettiers); Andhra Pradesh –Rural Kaccha house

NORTHERN REGION: Kashmir – Typical Kutchha houses, Dhoongas (Boathouses), Ladakhi houses, bridges; Himachal Pradesh – Kinnaur houses

**Module 4
Village
settlements**

An in-depth analysis of the spatial organisation of our villages and the special and economic forces which influence these organisations.

An analysis of the public spaces in villages: A study of village housing and spaces for Animal habitation. Use of material and construction technology. Aesthetics of Rural Architecture

Rural Economy. Rural Social Structure.

**Module 5
Regional
variations in built
form**

TRIBAL ARCHITECTURE: Settlement Pattern, Dwelling Typology, Symbolism, Typical features, Construction materials and techniques of tribes of Andhra Pradesh, Madhya Pradesh, Odisha (Kondha and Santals)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Paul Oliver. *Encyclopaedia of Vernacular Architecture of the World*, Cambridge University Press, 1997.
2. Amos Rapoport. *House, Form and Culture*, Prentice Hall Inc. 1969.
3. R W Brunskill: *Illustrated Handbook on Vernacular Architecture*. 1987.
4. Ilay Cooper and Barry Dawson. *Traditional buildings of India*, Thames and Hudson Ltd., London. 1998.
5. Frampton, Kenneth. *Towards a Critical Regionalism: Six points for an architecture of resistance*, In *the Anti-Aesthetic: Essays on Postmodern Culture*. Edited by Hal Foster. Seattle, WA: Bay Press. 1983.
6. V.S. Parmar. *Haveli- Wooden Houses and Mansions of Gujarat*, Mapin Publishing Pvt. Ltd., Ahmedabad. 1989.

7. Kulbushanshan Jain and Minakshi Jain. *Mud Architecture of the Indian Desert*, Aadi Centre, Ahmedabad. 1992.
8. G.H.R. Tillotsum – *The tradition of Indian Architecture Continuity, Controversy – Change since 1850*, Oxford University Press, Delhi. 1989.
9. Carmen Kagal, *VISTARA – The Architecture of India*, Pub: The Festival of India, 1986.
10. *Traditions in Architecture / DARA planning*. Crouch and June. G. Johnson.
11. *Tribal Housing in Orissa* by N. Patnaik.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
5.	22AE453	Lighting & Electrical Services	2	0	1	3

Course Objective This course gives basic understanding about the science behind Lighting, and fundamental principles of lighting design and electrical services in buildings. By learning this course students can design for optimum lighting requirements for indoor and outdoor spaces. Power distribution network and fundamentals of electrification in buildings is covered to impart technical and practical knowledge.

Anticipated Learning Outcomes: Ability to work out electrical networks for a simple building, determine general lighting and acoustic requirements and performance for a space.

**Module 1
Introduction to daylighting** Physics of light, Transmission of light, coloured light, the Munsell system, Photometry (Law of illumination, illumination from point, line and surface sources), recommended illuminances, Glare, Luminance distribution.

**Module 2
Design for daylighting** Day lighting Design Principles, Design methods, Total flux method, Daylight factor method, Planning for daylight, day light utilization factor, Simple experiments to measure Lux levels under different sky conditions, Class room lux measurements, etc.

**Module 3
Artificial lighting** Classification of lighting, Artificial light sources, Spectral energy distribution, Luminous efficiency, Colour temperature, Colour rendering.

Types of luminaires, Power factor, reflector, type of lens, cove lighting, cornice lighting, track lighting, wall washer, down light, spotlight and stage lighting.

Exterior lighting –Flood, street, lighting for displays and signalling, Neon signs LED-LCD and lighting for surveillance.

General Illumination design and interior lighting: industrial, residential, office departmental store, indoor stadium, theatre, museum, hospital.

Module 4
Electrical services General distribution of electric power in towns and cities. Substation for small schemes and industrial units, supply undertaking, meter room, electrical installation in buildings, connection with the supply company, mains and meter board installation from the meter board to individual units.

Basics of electricity, Single and Three Phase Supply, Protective devices in electrical installation, Earthing for safety – Types of earthing, ISI Specifications.

Electrical installations in buildings – Types of wires, Wiring systems and their choice – planning electrical wiring for building – Main and distribution boards, Planning transformer and generator rooms, Standby Generators and Inverter Backup Systems; Electrical Load Calculation of Buildings. Electrical layout of a simple residential, school and commercial building

Module 5 Any topic on modern, energy saving and sustainable lighting and electrification techniques as decided by the teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Szokolay, S. V. (2008). *Introduction to architectural science*. Taylor and Francis.
2. Conceptnine, R. (2008). *The Architecture of Light: Architectural Lighting Design Concepts and Techniques*. Sage Publications.
3. Cox, T. J. and D'Antonio, P. (2009). *Acoustic Absorbers and Diffusers*. 2nd Ed. Taylor and Francis
4. Cuttle, C. *Lighting by Design*. 2nd Ed. Architectural Press.
4. Reinhart, C. (2014). *Day lighting Handbook*. Steffy, G. (2000). *Time-Saver Standards for Architectural Lighting*. McGraw-Hill.
5. Philips, D., *Lighting in Architectural Design*, McGraw Hills, New York.
6. Bovay, H. E. (1981). *Handbook of Mechanical and Electrical systems for Buildings*. McGraw-Hill Higher Education.
7. Bureau of Indian Standards. (2005). *Code of Practice for Electrical Wiring Installations IS-732*.
8. *Electrical Wiring and Contracting (Vol.1 to Vol.4)*.
9. *National Building Code, 2016, Bureau of Indian Standards*
10. Salvan, George S., *Architectural Utilities 3: Lighting & Acoustics*

SEMESTER – IV

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR466	Architectural Design -II	0	0	9	6

Course Objective Appreciation of the site and its socio-cultural context and their value as prime generators of design.

Anticipated Learning Outcomes: Ability to interpret site and contextual information as a decision-making aid for architectural choices, particularly in respect of groups of buildings.

Guidelines In the fourth semester, the students will be given the design problem, the requirements (Function and Areas) and the site by the teachers. The students may make some literature review and may see some cases for their information, but these will be tentative and will not be considered as essential. They will design the project keeping in mind the form, circulation, areas, engineering aspects, structure, water supply, electrification, site circulation and landscape aspects as directed and advised by the class teacher.

As in the previous semester, the ideas of basic design have to be kept in the mind, and some ideas of shared open space, clustering, community, aggregation and economy may be introduced.

The assignments may proceed as elaborated below:

1. Projects such as Primary Schools, Day Care Centres, Health Care Centres, Banks, Daily markets/Weekly Haats, Restaurant, Club, Residences etc. may be given to the students as a design project.

The requirements and their areas are to be stipulated by the design teacher.

The students accompanied by the design teacher should visit at least two existing buildings as case studies. Notes should be made on these in reference to its flow of operation. Climatic angles should be observed; particularly in case of a house design. Materials used must also be observed.

2. A one-week workshop on the design of a school, multipurpose hall, or health centre should be done under the supervision of an outside teacher.

3. A two-day design examination should be conducted at the end of the semester.

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

References

1. Chaira, J. D. and Crosbie, M. J. (2001). *Time Saver Standards for Building Types*. 4th Ed. New York: McGraw-Hill.
2. Bousmaha Baiche and Nicholas Walliman, *Neufert Architect's data*, Blackwell science ltd.
3. Hareguchi, H. (1988). *A Comparative analysis of 20th C. houses*. London: Academy Editions.
4. Frampton, Kenneth. *Towards a Critical Regionalism: Six points for an architecture of resistance*, In *the Anti-Aesthetic: Essays on Postmodern Culture*. Edited by Hal Foster. Seattle, WA: Bay Press. 1983.
5. V.S. Parmar. *Haveli- Wooden Houses and Mansions of Gujarat*, Mapin Publishing Pvt. Ltd., Ahmedabad. 1989.
6. Kulbushanshan Jain and Minakshi Jain. *Mud Architecture of the Indian Desert*, Aadi Centre, Ahmedabad. 1992.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR474	Building Materials and Construction-IV	2	0	4	4

Course Objective To understand fundamental building material in the context of various construction methods.

BC-IV would focus on Wall Openings (fenestrations) as a building component, temporary structure aiding towards construction and essential site utilities. These would be emphasised based on the performing standards and codes, wherein application of each material would be discussed in detail, both in the context of traditional and modern construction methods and practices.

Anticipated Learning Outcomes: Ability to produce construction and detailed drawings of Wall Openings (fenestrations) required for various types of buildings. Also students will be able to produce drawings for rainwater harvesting and allied site services.

Module 1 LECTURE: Wall Openings types and uses.

Lintels (Brick, timber, stone, steel and concrete),

Arches: Types and Uses

SHEET WORK:

1. Lintels (Brick, timber, stone, steel and concrete),
2. Different types Stone and brick Arches

Module 2 LECTURE: Timber: Uses and characteristics of timber. Types of Timber, defects in timber and preservation of timber.

Door and windows: Type, uses and materials used

SHEET WORK:

3. Panelled doors & windows
4. Flush doors

Module 3 LECTURE: Introduction of Glass, Fiberglass, GRC, Aluminium and Steel as building materials frameless door, fire retardant door, Anodised aluminium, steel.

SHEET WORK: Types of Advanced Doors and Windows –

5. FRP doors
6. Sliding door,
7. Folding door,
8. Revolving door,
9. Rolling shutter & collapsible gate,
10. UPVC window sections.

Module 4

LECTURE: Scaffolding & shoring, Introduction to single and multiple basements:

SHEET WORK:

11. Detailed section through basements
12. Scaffolding & shoring

Module 5

LECTURE: Rainwater harvesting & recharge pits, Site drainage, STP, Solar Water heating technology, Rooftop PV Technologies.

SHEET WORK:

13. Rainwater harvesting & recharge pits, STP
14. Site services

NOTE:

- **Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.**

References

1. Barry, R. (1999). *The Construction of Buildings Vol. 2. 5th Ed.* New Delhi: East-West Press.
2. Foster, J. and Mitchell, S. (1963). *Building Construction: Elementary and Advanced, 17th Ed.* London: B.T. Batsford Ltd.
3. McKay, W. B. (2005). *Building Construction Metric Vol., I-V. 4th Ed.* Mumbai: Orient Longman.
4. Rangwala, S. C. (1963). *Building Construction: Materials and types of Construction. 3rd Ed.* New York: John Wiley and Sons.
5. Chudley, R. (2008). *Building Construction Handbook. 7th Ed.* London: Butterworth Heinemann.
6. Eldridge, H. J. (1976). *Common Defects in Buildings.* London: HMSO.
7. Emmitt, S. and Gorse, C. A. (2006). *Barry's Advanced Construction of Buildings.* Blackwell Publications.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
8.	22AR483	Computer In Architecture –III (BIM)	0	0	3	2

Course Objective Basic proficiency in graphic information techniques across software platforms and devices to describe concepts holistically.

Anticipated Learning Outcomes: Understand difference between CAD and BIM. Know and understand the fundamentals of Building Information Modelling (BIM). Learn various workflows and procedures of the BIM work-environment. Develop basic skills in application of BIM tools and techniques in architecture and prepare 2D and 3D drawings using BIM software.

**Module 1
Introduction to BIM** Introduction to BIM, Concepts & Principles, User-Interface, Viewing the Model, Resources. Understanding terms, elements and properties. Creating a project in a BIM environment, creating levels and grids, creating conceptual design.

**Module 2
Basic Modelling** Modelling of walls, windows, doors, setting view range, components, columns, roof, ceiling, floors, openings, surfaces, stairs, ramps, railings, curtain elements. Understanding families and working with families, family editor, creating a component, in-place components, reference planes, voids, join/cut geometry. Rooms and areas.

**Module 3
Annotation and Visualization** Annotations; grids, dimensions, text, tags, rooms, schedules, sheets, symbols, creating views. Setting of colour schemes, legends, openings. Visualization; rendering, materials, lights, paint tool, decals. Project phasing, detailing and preparing construction documents.

**Module 4
Site and Solar Studies** Site, topo-surface, building pads, divided surface, creating topo-surface from CAD contours, massing studies. Setting up and creating solar studies. Applying and removing constraints.

References

1. *Mastering Autodesk REVIT Architecture 2015* by Eddy Krygiel and Jamnes Vandezende (Wiley India Pvt Ltd).
2. *Autodesk REVIT Architecture 2015 Essentials* by Ryan Duell and Tobias Hathom.

SEMESTER – V

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AS513	Design of Steel Structures	3	0	0	3

Course Objective To understand complex structural concepts and behaviour; to introduce the concepts of designing steel structure and its components; selection criteria for suitable steel roof truss for different spans of industrial buildings and large span structures. To demonstrate an understanding of concepts through simple calculations and models.

Anticipated Learning Outcomes: To enable students to analyse and design simple steel structural components. to select suitable steel roof truss for different spans of industrial buildings and large span structures.

Module 1 Introduction Introduction to Steel structures: Steel structural shapes, Introduction to IS 800; Rivets, welded connection, Steel structural members, tension, compression and bending Members. Design of riveted and welded connections like beam end connections (Limit Stress method).

Module 2 Structural elements Design of structural elements; Truss members under tension, a laterally restrained beam using rolled steel sections. Design of structural element under compression in a truss, a column using rolled steel sections, effective length buckling load.

(Practical case study of a steel section)

Module 3 Foundation Concept of type of foundation; Design of slab base and gusseted base; Introduction of plastic design.

Module 4 Design of a unit Visit to a construction site to study steel fabrication work. Design of shed in steel structure Foundations: Types of foundations for RCC structures, Design of isolated column footing, retaining wall. Design of short and long axially loaded RCC Columns, Principles of staircase design.

Module 5 Innovative designs in steel for space and box frames. (To be decided by the subject teacher)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Ramachandra. S, *Design of steel structures Vol. I, Standard publication, New Delhi, 1992.*
2. Vazirani. V.N, and Ratwani .M.M, *Steel structures, Khanna Publications, New Delhi, 1995.*
3. Arya. A.S, Ajamani. J.L, *Design of Steel Structures, Nem Chand and Bros, Roorkee, 1999.*
4. Subramanian, N. (2008). *Design of Steel Structures. Oxford University Press.*
5. Duggal, *Design of Steel structures, Tata McGraw Hill Company, New Delhi, 2000*
6. Lin. T.R, and Scalzi. J.B, *Design of Steel structures – Bressler Wiley Eastern Pvt. Ltd., New Delhi, 1960.*
7. Dayaratnam. P, *Design of Steel Structures, Wheelers Publishing Company Co. Ltd, 1990*
8. *Handbook of Typified Designs for Structures with steel roof trusses, SP 38 (SandT) – 1987, BIS, New Delhi, 1987.*
9. *Code of practice for Earthquake Resistant Design and Construction of Buildings IS4326-1976, BIS, New Delhi.*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR523	Responsive Built Environment	3	0	0	3

Course Objective To focus on the interplay between humans and their surroundings broadly encompassing natural environments, social settings, built environments, learning environments, and informational environments. To impart knowledge about psychological implications in designing a built environment. The focus is on understanding man-environment relationship, behavioural dynamics with respect to spatial pattern, and methods of conducting behavioural studies.

Anticipated Learning Outcomes: Ability to understand basic socio-psychological concepts and learn their applications in space planning and architectural design.

Module 1 Nature and scope of Environmental Psychology- What is it and its relation to Architecture and planning. Meaning of environment; Measurement of environmental stimuli from psychological aspect. Behavioural effects of Environmental conditions.

1. Physical - Noise, Temperature and air pollution
2. Social- Overcrowding and isolation.
3. Extra ordinary- Catastrophe.

Module 2 Environmental Perception and cognition. Perceptual factors of environment- perception of distance. Size and movement. Meaning of colour and form. Social and Cultural influences on environmental perception.

Module 3 Personal space - individual and situational as determinants of personal space. Consequences of too much or too little of Personal space. Personal space and environmental space as implications for design aspects.

Crowding – Crowding, density and population, Influences on Crowding, High density, crowding, and human behaviour, Theories of crowding, Crowding and environmental design.

Module 4

Community environmental Psychology- Life in cities, what is neighbourhood, Anti-social behaviour in community environment, community environment design; territoriality, concept of defensible space.

Psychological aesthetics - Measurement of communication through art; determination of pleasantness and unpleasantness as psychological factors in environmental design.

Adaptation to environment - Behavioural aspects of adaptation to familiar and unfamiliar environment.

Module 5

Any other topic as per present day needs to be decided by the teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Burnette, C. (1971). *Architecture for human behaviour*. Philadelphia Chapter: AIA.
2. Canter, D. and Lee, T. (1974). *Psychology and the built environment*. New York: Halstead Press.
3. Christopher, A. et al. (1977). *A Pattern Language*. New York: Oxford University Press.
4. Clovis, H. (1977). *Behavioural Architecture*. McGraw Hill.
5. Lynch, K. (1973). *The image of a city*. Cambridge: MIT.
6. Sanoff, H. (1991). *Visual Research Methods in Design*. New York: John Wiley & Sons.
7. Zeisel, J. (1984). *Enquiry by design: Tools for Environment-Behaviour Research*. Cambridge: Cambridge University Press.
8. Zeisel, J. and Eberhard, J. P. (2006). *Inquiry by Design- Environment/ Behaviour/ Neuroscience in Architecture, Interiors, Landscape and Planning*. New York: W. Norton & Company.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR533	Contemporary Architecture	3	0	0	3

Modern (19th Century AD – Until Present)

Course Objective To impart an understanding of the evolution in architecture and urbanism from the advent of the modern era to present times. Understanding about the theories, principles and styles of architecture that emerged during the Industrial Revolution and its influence on the built form and settlement patterns. To introduce the initiation and development of Modern Architecture in the subcontinent and contemporary architecture in India and the world; Colonial mercantile capitalism and spread of Western influences in India, and synthesis of architectural styles as modes of political accommodation. To discuss the socio-economic and political context, scientific inventions, and technological improvements, and the exchange of styles and philosophies through notable works of leading architects.

Anticipated Learning Outcomes: Ability to understand the role of societal developments as a predictor of change in architectural paradigms through the study of Modern Architecture in the sub-continent and contemporary architecture of India and the world

Module 1 INDUSTRIAL REVOLUTION: Its impact, new materials and techniques, Exhibitions (*Great Exhibition 1851*), development of railways and change in settlement pattern, rapid urbanization and urban crisis. Art Nouveau, Art and Craft, Art Deco; Neo Classicism; Gothic Revival (*John Ruskin, works of Victor Horta, Antonio Gaudi*).

SELF CONSCIOUS MODERNITY: Chicago school (*Louis Sullivan*), Bauhaus Movement (*Peter Behrens, Walter Gropius*), Late Modern Styles; works of great masters (*Mies Van der Rohe, F. L. Wright, Le Corbusier, Louis Kahn, Alvar Aalto, Kenzo Tange, etc*).

Module 2 COLONIAL ARCHITECTURE IN INDIA: Spread of European mercantile capitalism and development of early colonial architecture, British, French and Portuguese influences; Inflow of new cultural practices

and construction technology, Stylistic transformations; Synthesis with Indian traditional motifs and climatic factor.

EARLY: Portuguese (*Basilica of Bom Jesus*), French (*Pondicherry- Old French Colony*) and British (*St. Andrew's Kirk*), Jewish settlement of Kerala.

LATE: Edwin Lutyens, Herbert Baker and planning of New Delhi, Indo-Deco architecture (*Rashtrapati Bhawan / Victoria Terminus / Umaid Bhawan Palace, Jodhpur*).

Module 3

WORLD ARCHITECTURE 1950 ONWARDS: Postmodernism and classical revivalism (*James Sterling, I. M. Pei, Robert Venturi*); Counter reaction, De-constructivism and industrial architecture (*Zaha Hadid, Renzo Piano, Norman Foster, Santiago Calatrava, Frank O. Gehry*) Alternative practices (*Hassan Fathy, Geoffrey Bawa, Tadao Andao*)

Module 4

ARCHITECTURE IN INDIA (POST INDEPENDENT ERA): Planning and Design of Post Independent Cities and Towns: *Chandigarh, Bhubaneswar, Amaravati, Auroville Experiments, Nehruvian nation Building Initiatives, Planning commission and industrialization*, Architecture by great Indian and International Masters: *A. Kanvinde, B. V. Doshi, Charles Correa, Raj Rewal, Joseph A. Stein*; Alternative practices (*Laurie Baker*), Award winning works of contemporary architects.

Module 5

Presentations and critical analysis of any other significant works of architects, as decided by the subject faculty.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Benevolo, L. (1977). *History of Modern Architecture*. 2 Vols., reprint, MIT Press.
2. Curtis, W. J. (1982). *Modern Architecture since 1900*. Phaidon Press.
3. Geidon, S., *Space, Time and Architecture: The Growth of New Tradition*, Harvard University Press.
4. Frampton, K. (1994). *Modern Architecture: A Critical History*. London: Thames and Hudson.
5. Jenks, C. (2007). *The Story of Post-Modernism*. London: Wiley and Sons.

6. Lang, J., Desai, M. and Desai, M. (2000). *Architecture and Independence: The search for Identity – India 1880 to 1980*. New Delhi: Oxford University Press.
7. Lang, J.T (2002). *A Concise History of Modern Architecture in India*
8. Mehrotra, R. (2011). *Architecture in India Since 1990*. Pictor.
9. Tadjell, C. (1990). *The History of Architecture in India*. New Delhi: Penguin Books (India) Ltd.
10. Johnson, P. and Wigley, M. (1988). *Deconstructivist Architecture*. New York: Museum of Modern Art.
11. Schulz, C. N. (1993). *Meaning in Western Architecture*. New York: Rizzoli International Publishers.
12. Singh, M. and Mukherjee, R. *New Delhi- Making of a Capital*. New Delhi: Roli Books.
13. Tafuri, M. (1980). *Modern Architecture*. Harry N. Abrams Inc.
14. Verma, P. (2010). *Becoming Indian – The Unfinished Revolution of Culture and Identity*. New Delhi: Penguin India.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR543	HVAC Systems	3	0	0	3

Course Objective This course aims to impart fundamental understanding about heating, ventilation and air-conditioning in buildings. Basic principles of thermodynamics and air-conditioning are covered with a specific orientation towards human comfort. The course enables the student to calculate and estimate the heating or cooling load of a building and design the air-conditioning system in an effective manner. Different types of air-conditioning systems and ducting systems are also taught in the course.

Anticipated Learning Outcomes: Ability to workout HVAC loads and space requirements for equipment; interpret and depict fire safety requirements in design & drawings, estimate lift numbers and lobby sizes, incorporate parking systems in project planning.

**Module 1
Definitions and laws** Definition and Units of Thermodynamic quantities - Heat (Specific heat and Latent heat), Pressure (Absolute, Gauge and Atmospheric Pressure), Absolute Temperature (Scales and measurement). PH diagram of water to understand Latent heat, Sensible heat, Superheat and Enthalpy, Degree of Superheat and Dryness Fraction.

Laws of Thermodynamics with respect to refrigerators and heat pumps, COP and EER of HVAC systems. Working principle of a Vapour Compression Refrigeration system with schematics and TS diagram. Application, Properties and Dupont Nomenclature of refrigerants.

**Module 2
Air conditioning principles** Heat Gains in Building Systems – Thermal Conductivity and U value of Building Materials. Conductive heat transfer through composite walls and pipes. Solar Heat Gain through Fenestration systems. Numerical.

Sensible and Latent Gains, Humidification and Dehumidification, Thermal comfort conditions and Comfort Chart.

Classification, Principle, construction and working of Summer and Winter Air-conditioning systems. Cooling load calculations. Numerical using Psychrometric chart.

Module 3
Heating systems

Space Heating: Conventional and Unconventional Heating systems, Radiant panel and Hydronic Heating systems. Passive heating and cooling techniques, green heating systems.

Module 4
Cooling systems

Air Distribution Systems – Natural and Mechanical ventilation systems, Supply, Return and Recirculation Ducts. Indoor air quality and Air Filters.

Thermostats and Humidistat. Centrifugal blowers and Exhausters.

Different types of air-conditioning systems. Window, split, ductable AC, etc.

Introduction to central air conditioning systems.

Understanding 2 pipe and 4 Pipe CV and VAV systems. Chilled Air and Water systems, Spatial requirement of HVAC plants and duct layout.

Module 5

Design of Air-conditioning system for a building as decided by the subject teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Bovay, H. E. (1981). *Handbook of Mechanical and Electrical systems for Buildings*. McGraw-Hill Higher Education.
2. Sawhney, G. S. (2006). *Fundamentals of Mechanical Engineering: Thermodynamics, Mechanics and Strength of Materials*. New Delhi: Prentice Hall of India.
3. Willim, J. McG. (1971). *Mechanical and Electrical Equipment for Buildings*.
4. Ambrose, E.R. (1968). *Heat pumps and Electric Heating*, John and Wiley and Sons Inc, New York.
5. *Handbook for Building Engineers in Metric systems (1968)*, NBC, New Delhi.
6. William H. Severns and Julian R. Fellows. *Air conditioning and refrigeration*. John Wiley and sons, London
7. Khurmi, Gupta and Arora. *Refrigeration and Air Conditioning*, S Chand and Co.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
5.	22AR553	Theory of Architecture-II.	3	0	0	3

Course Objective To create a deep understanding about Architecture and Design from a theoretical perspective. To help students to develop a strong design vocabulary to communicate their design and to understand the philosophy and the undercurrents of the design process. To impart knowledge of different aesthetic movements and philosophies that has influenced architectural principles and evolution of architectural style over time in the world.

Anticipated Learning Outcomes: Ability to comprehend some of the main theoretical moorings of 20th and 21st century in architecture, analyse built works and critically examine the ideas and view of practice they represent as a precursor to shaping one's own design approach and vocabulary.

Module 1 Theoretical Base in Architecture

Normatic, Thematic, Analogic, Proportional and Chronological.

Theories of perception and variability of perception, Phenomenology of perception - Merleau-Ponty; Themes that have informed 20th century architecture and urbanism: History and historicism, Type and typology, The nature of the site/The constructed site, Tectonic and Constructed object, Modernism (*Walter Gropius, Le Corbusier, Mies van der Rohe, Frank Lloyd Wright, Louis Sullivan*); Postmodernism (*Michael Graves, Robert Venturi, Philip Johnson*); Structuralism (*Charles Alexander Jencks, Aldo van Eyck, Herman Hertzberger, Kenzō Tange, Claude Lévi Strauss*); Post-structuralism/Deconstruction (*Bernard Tschumi, Peter Eisenman, Henri LeFebvre, Frank Gehry, Daniel Libeskind, Zaha Hadid*); Biomimicry/biomimetics (*Antoni Gaudi, Norman Foster*)

Module 2 General discussion on form; inanimate nature, biological nature and human environment. Understanding of the determinants of physical forms as known to architects and environmental planners-concepts of space, structure, organization, symbolism etc.; Case study methods; Concept theory.; Architectural Criticism.

- Module 3** Definition of design, Design process and thinking; goals and objectives, information gathering, checklists, analysis and synthesis, simulation, actionability and implementation of intentions; Value Judgments in Design; Design and Morality/Ethics, Socially Responsive Design Process, Inclusive Design, evaluation of design, Design Skills, Context for architectural design problems ; Proxemics, Kinesthetics; theories in relation to practice, writing and theory as design tools in professional practice, Theory as a basis of the student's personal philosophy as an architect.
- Module 4** Introduction to Ekistics; Post Occupancy Evaluation; Universal Design; Energy Audit; Nanotechnology and Materials; Space Syntax; Multi- criteria evaluation of site.
- Module 5** Introduction to the ideas, issues and concepts of sustainable development; principles of environmentally and ecologically sensitive architecture; Importance of water, energy, materials and community in architecture for sustainable development.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Geoffrey Broadbent - *Design in Architecture - Architecture and the human sciences* - John Wiley and Sons, New York, 1981
2. Nigel Cross - *Developments in Design Methodology*, John Wiley and Sons, 1984
3. Bryan Lauson - *How Designers Think*, Architectural Press Ltd., London, 1980.
4. Johnson, P, Wigley, M, (1988). "Deconstructivist Architecture" in *Deconstructivist Architecture*, New York: Museum of Modern Art, pp 10-20.
5. P. Eisenman, (1999). "Diagram Diaries". Universe, New York.
6. Merleau-Ponty, M., (1964). "The primacy of perception". In *The Primary Perception and other essays on phenomenological psychology, the philosophy of art, history, and politics*, (J. M. Edie Trans), North-western University Press.
7. Robert Venturi, (1966) "Complexity and Contradiction in Architecture. New York: The Museum of Modern Art.
8. Tschumi, B. (1994). "Architecture and disjunction. Cambridge", Mass: MIT.
9. 12. *Sustainable design manual, Vols. 1 and 2, The energy and resource institute, New Delhi.*

SEMESTER – V

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR569	Architectural Design -III	0	0	12	9

Course Objective To enable capability of designing buildings of specific categories for multiple user groups and understanding the allied structural and building services requirement.

Anticipated Learning Outcomes: To let the students, explore design possibilities of multifunctional environments with group of facilities supporting variety of user-groups; To expose the students to the challenges of site planning and designing buildings with varied functions, having an array of activities and services; To familiarize the students to the task of coordinating integration of structural design and specialized building services in the framework of architectural design.

FOCUS AREAS

- Considerations for planning of campuses/group of built-up spaces
- Zoning and orienting patterns
- Spatial integration
- Functional efficiency (utilitarian parameters, space optimisation, integration of structural systems and building services (HVAC, electrical, plumbing etc.)
- Man - Environment relationship

ALLIED KNOWLEDGE REQUIRED

- Site planning techniques
- Sustainable Design
- Barrier free environments
- Building services
- Landscaping Design

EXAMPLES OF STUDIO PROJECTS:

Design of buildings like Vocational training institute, School for special categories, Art and Craft Centre, Hospitality buildings (small resorts, motels, recreation clubs), multi-speciality clinic, Small commercial or office complex, old age home, SOS village, Community

centre, Rural Development Centre, Small auditorium, Large Guest House, Students' Hostel, etc. may be given to the students as a design project.

Information to be provided by the Course instructor:

1. The requirements and their areas are to be stipulated by the design teacher.
2. The students accompanied by the design teacher should visit at least two existing buildings as case studies. Notes should be made on these in reference to its flow of operation. Climatic angles should be observed.

Evaluation:

1. A one-week workshop on the design of a school, multipurpose hall, or health centre should be done under the supervision of an outside teacher.
2. A two-day design examination should be conducted at the end of the semester.

Guidelines for students:

In the fifth semester, again the students will be given the design problem, the requirements (Function and Areas) and the site by the teachers. Here the students will make literature review and examine case studies in a detailed way as per the enclosed guidelines for doing the same. However, the teacher shall provide the list of requirements (Function and Areas) and the site.

1. Literature review: Literature Review is a very important source of information for the students before starting a new project. Internet survey also provides a lot of information regarding the issue at hand. At this stage it must be pointed out that there is a chance of the student being overwhelmed with the excess information.

The teacher should take care that the student does not put the whole Time Savers Standard as his literature study. What is expected of the student is to discern between the core /fundamental information required for his/her project from the rest of the information available to him/her.

2. Case Studies: For architecture students "the Case Study Method" is a very suitable way of finding out information for their subsequent design work. However, just like a doctor seeing his patient for the first time, where he looks at the patients' heart beat with the stethoscope, his blood levels by looking at his years, pressing the patient's stomach looking for possible problems, so too does the Architect have to look at the case study in a methodological way. One such methodology is suggested below:

The case study building can be looked at under the following heads:

- a) Architectural aspects: In the architectural aspects matters such as form, roofing pattern, materials used, configuration of the building blocks over the land, the landscaping and other such matters can be looked into.
- b) Social aspects: Under social aspects the use of spaces by the people whether they are successful or not, How the designs have been made taking the needs of the local people and other such matter can be examined and recorded.
- c) Space and area Aspects: will record the sizes/areas of the spaces required for the various uses in the building under examination.
- d) Circulation aspects: In the Flow Aspects the circulation in the building, the connections required between the different parts may be documented.
- e) Engineering aspects: Lastly the Engineering Aspects which would deal with the structural design, the water supply, the sewer lines, electric power supply, air-conditioning and other may be examined.

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

References

1. Chaira, J. D. and Crosbie, M. J. (2001). *Time Saver Standards for Building Types*. 4th Ed. New York: McGraw-Hill.
2. Bousmaha Baiche and Nicholas Walliman, *Neufert Architect's data*, Blackwell science ltd.
3. Hareguchi, H. (1988). *A Comparative analysis of 20th C. houses*. London: Academy Editions.
4. Frampton, Kenneth. *Towards a Critical Regionalism: Six points for an architecture of resistance*, In *the Anti-Aesthetic: Essays on Postmodern Culture*. Edited by Hal Foster. Seattle, WA: Bay Press. 1983.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR574	Working Drawing-I (Load Bearing/Composite)	0	0	6	4

Course Objective To introduce Working drawings and their significance in the construction of buildings. To teach students the essential components of working drawings, notations, drawing standards, and strengthen students' knowledge about preparing working drawings for various stages of building construction and for details of building elements.

Anticipated Learning Outcomes: Ability to organize building design information in a working drawing format suitable for various purposes related to the execution of the project along with an ability to read building working drawings to extract specific information.

Module 1 Introduction The Course Objective is to acquaint students with preparation of drawings for construction of buildings using proper methods of labelling and dimensioning techniques. The drawings shall be based on buildings designed in previous semesters as a part of Architectural Design assignment and generally a load bearing, load bearing may be brick, rubble masonry, stone or any other structure.

Module 2 All drawings are to be in a readable scale and shall include grid and or centre lines of walls and columns, as per floor layout, indicated in all floor plans for ease of identifying areas of amendments when required. Following are the drawings that are to be prepared:

- Excavated Trench Plan including plan of required foundation up to plinth level along with proper sections at required locations, all considerably labelled and dimensioned.
- Ground Floor Plan, as a horizontal section at minimum three feet six inches above floor level, showing disposition of rooms, thresholds, any projection above floor level e.g. canopies, chajjas etc., position of doors and windows and marking their locations, indicating typical elements proposed in spaces like kitchen, toilet, wardrobes, staircases etc. all considerably labelled and dimensioned.

- Upper floor plans showing similar details as mentioned in Ground Floor Plan including all projection as that in elevations, all considerably labelled and dimensioned.
- Terrace or Roof Plan showing staircase / lifts along with extent of required parapet, proper roof drainage indicating ridges, valleys and slopes.
- Location of rain water outlet pipes with diameters of down pipes, all considerably labelled and dimensioned.
- A Site Plan / Layout Plan indicating shape and size of plot, dimensions of all sides, position of approach road, entries and exits, road layout if any, storm water drainage (surface or underground), location of septic tanks and sewage lines, underground water reservoirs and water supply lines, all considerably labelled and dimensioned.

Module 3

- Elevations of all sides - front, back and both the sides including stair head rooms and lift machine room, showing all features (solids and voids) and their surfaces marked with respect to a base level 0-0, floor levels as per heights starting from ground level to top of staircase / lift machine room.

Module 4

- As many transverse / longitudinal sections, required to explain vertical disposition of all elements proposed in the design and should preferably take critical areas like lifts, staircase, toilets, kitchen and walls with typical elevation features, all properly labelled/dimensioned.

Module 5

Any other topic as per the need of the present as felt by the teacher.

NOTE:

Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.

References

1. Building and Construction Authority. (2005). CONQUAS-21. Singapore: The BCA Construction Quality Assessment System.
2. Jefferis, A. and Madsen, D.A. (2005). Architectural Drafting and Design. 5th Ed. New York: Thomson Delmar Learning.

3. Joe, B. (Ed). (2002). *Details in Architecture: Vol. I-V*. Victoria: The Images Publishing group.
4. Osamu, A. W., Linde, R. M. and Bakhoun, N. R. (2011). *The professional practice of architectural working drawings*. 4th Ed. Hoboken: John Wiley and Sons.
5. Weston, R. (2004). *Plans Sections Elevations – Key buildings of the twentieth century*. London: Laurence King Publishing.
6. Hareguchi, H. (1988). *A Comparative analysis of 20th C. houses*. London: Academy Editions.
7. Frampton, Kenneth. *Towards a Critical Regionalism: Six points for an architecture of resistance*, In *the Anti-Aesthetic: Essays on Postmodern Culture*. Edited by Hal Foster. Seattle, WA: Bay Press. 1983.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
8.	22AR582	Design Communication	0	0	3	2

Course Objective To enhance writing skills and awareness about architectural journalism. To equip students with digital and 3D presentation techniques, fundamentals of photography, basic skills about architectural photography, and documentation.

Anticipated Learning Outcomes: To enable students to communicate their ideas/works through technical writing, and digital presentation using various media.

**Module 1
Architectural journalism** Introduction to Architectural journalism, Skill improvement in reporting, writing, editing, criticism of architecture, descriptive and analytical writing, book reviews, reporting, review and analysis of historical and contemporary architectural examples and news, Page composition.

**Module 2
Digital presentations** Introduction of various software available for Architectural presentation such as Photoshop & Coral. Basic Tools for Editing and Creating Graphics. Rendering AutoCAD drawings with appropriate materials. Compiling and arranging drawings on sheet for presentation or portfolio. Image doctoring and manipulation using computer software for graphics and animation (Photoshop and Flash).

**Module 3
Communication techniques** Advertising - Typography, artwork, Multimedia - digital graphic design techniques, surface decoration such as print, Printmaking – photo screen-printing and etching, scanning and laser printing.

**Module 4
3D digital presentations** Movie making Flash movies, animation graphics, and walkthroughs, 3D Printing.

**Module 5
Photography** Introduction to photography, types of Cameras, equipment-cameras & lenses, Principles of photo composition, properties & priorities: Exposure, Aperture, Speed, colour, black & white photography.

Architectural Photography- Exterior and Interior photography.

Practical exercises to understand composition, photo documentation of buildings, highlighting quality of architectural spaces.

References

1. Dinsmore, G. A. (1968). *Analytical Graphics*. Canada: D. Van Nostrand, Company Inc.
2. Freeman, S. (1978). *Written Communication*. New Delhi: Orient Longman.
3. Sounders, D. (1988). *Professional Advertising Photography*. London: Merchurst.
4. Edward, J. F. and Lee, J. (2000). *Feature Writing for Newspapers and Magazines*. 4th Ed. Longman.
5. Harris, M. (2002). *Professional Interior Photography*. Focal Press.
6. Heinrich, M. (2008). *Basics Architectural photography*. Birkhauser Verlag AG.

SEMESTER – VI

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AR613	Contract Documents & Specifications	3	0	0	3

Course Objective Introduce the concept of material and performance specifications for describing works for effective building contracts.

Anticipated Learning Outcomes: Ability to prepare general and detailed specifications and a contract for a small building project. To impart understanding in the mode of detailed clause by clause specification as complementary to the detailed drawings.

Module 1 What is a Contract? Indian Contract Act, 1872. Notice Inviting Tender, Form of tender, Instruction to tenderers, Article of F2 Agreement, Conditions of Contract, General & Special conditions and annexure.

Module 2 Introduction-Definition-Importance-Scope of the Subject, Specifications forming part of Building Contract, Drafting Specification, Correct form of writing, Avoiding duplication, Ambiguity and conflicting statements. Correct order of sequence. Specification of simple building materials i.e., Brick, Stone, Lime, Cement and Wood etc. Traditional building materials.

Module 3 Detail specification of Excavation in foundation, Plain Cement Concrete, Masonry in Brick and stone (Rubble and Ashlar) Reinforced Cement Concrete work detail specification of all the works related to all civil works.

Module 4 Material Quality and Standard, various Mixes, cutting, bending and fixing of M. S. Bars. Centring and shuttering and its removal. Curing of concrete, flooring, Paving and Tiling, Indian patent Stone, Terrazzo in situ. Flagstone flooring. Waterproofing of structure, Carpentry and Joinery.

Roof work in timber, Panelled door and Glazed window. Specification for Structural steel work, Materials Quality and setting

out. Cutting and welding. Specification of First-class building and Second-class building.

Building Boards. Plywood, Particle Boards, Block boards. Acoustic Boards. Flooring- Asphalt Rubber cork, Linoleum, Parquet etc. Glass – various types of glass used in buildings. Patent Glazing for Factories, Glass bricks, Partition, Pavements lights etc. Paints- Plastic Emulsion paint, metal paints, Cement paint, weather proof paint etc.

Module 5

Standard Specification for different Institutions like PWD, MES, CPWD, BIS etc. Abstract of quantities and writing Schedules, Rate and Material analysis. Bill of quantities.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Birdie, G. S. (2005). *Text Book of Estimating and Costing*. Dhanpat Rai Publishing.
2. Chakraborty, M. *Estimating, Costing, Specification and Valuation*
3. C.P.W.D. *Standard Schedule of Rates*.
4. Khanna, P. N., *Indian Practical Civil Engineers' Handbook*, Engineers' Publishers, Delhi.
5. Rosen, H.J., *Construction Specifications Writing*, John Wiley and Sons, N. York and London.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR624	Advanced Building Systems & Services	2	0	1	3

Course Objective To develop know-how and understanding of important advanced systems and services in buildings, their definitions and terms used, functioning and their applications in building.

Anticipated Learning Outcomes: By the end of the course students should be aware of the advanced systems and services, used in different kinds of projects with a fair idea of their Standards and Regulations.

**Module 1
Fire safety** Classification of Fires and Extinguishers, Dry Riser, Wet Riser and Down Comer systems, Sprinkler and Drencher systems, Fire detection systems, Fire Lifts and Fire Escape Plan, Fire prevention, safety and security measures and regulations.

Firefighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

**Module 2
Parking and circulation** Multi-Level Parking Systems, Semi-automatic and automatic parking systems, Elevator types and spatial requirements with respect to Passenger, Service and Fire lifts, Escalators and Travelators, Applications of Raised Floor systems.

**Module 3
Building utilities** Building Automation – Objectives and advantages, Smart devices used in Illumination, Climate control, Building Security systems etc., Laundry and Garbage chutes, Understanding Bio Medical Waste and their disposal, Chemical and Biological Toilets, Hot water systems for apartments and hotels, cooking gas distribution system for residences. Communication systems: space and connection facilities for LAN, computer server, PABX and telephone.

**Module 4
Standards and regulations** Study of building services with reference to NBC (National Building Code), ECBC (Energy Conservation and Building Code) and BIS regulations (Bureau of Indian Standards).

Module 5 Case studies and assignments for students on applications of building systems and services.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Stein Reynolds Mc Guinness – *Mechanical and Electrical equipment for buildings*, Vols 1 and 2, John Wiley and sons.
2. Francisco Asensio Cerver – *The architecture of Skyscrapers*, Hearst Book International, New York, 1997
3. Bennetts Ian and others – *Tall building structural systems*
4. William, J. McG. (1971). *Mechanical and Electrical Equipment for Buildings*
5. Bovay, H. E. (1981). *Handbook of Mechanical and Electrical systems for Buildings*. McGraw Hill Higher Education.
6. Bureau of Indian Standards. (2005). *Code of Practice for Electrical Wiring Installations IS-732*.
7. Kloft, E. and Johann, E. (2003). *High-rise Manual: Typology and Design, Construction and Technology*, 1st Ed. Basel: Birkhauser Verlag AG.
8. *National Building Code*
9. *Energy Conservation and Building Code*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR633	Advanced Building Materials	3	0	0	3

Course Objective The course intends to introduce different materials used in modern buildings, and innovative alternative materials that are being used to make the building more energy efficient and sustainable.

Anticipated Learning Outcomes: Students will be able to assess the property, application and performance of various advanced energy efficient and sustainable building materials in modern buildings.

**Module 1
Introduction &
Advanced
Concrete** Introduction to advanced building materials in the building industry. Role of advanced materials in building performance. Contemporary materials in super structure. Ultra-high-performance concrete, Ferrock, Liquid granite, Litracon etc. High-Ductility Concrete for Resilient Infrastructures: Engineered Cementitious Composite (ECC), Engineered stone, etc.

**Module 2
Glass** Speciality Glass as a contemporary building material. Types and categories of Glass and its application in building facades.

Laminated, curved and tempered glass, Kinetic glass, Smart glass and smart windows. Introduction to Digital building facades: Building kinetics and facade engineering, sensor glasses for interiors.

**Module 3
Wood &
Composites** Wood as an advanced material for buildings: Reconstructed wood, cross laminated timber, Plyboards, composite boards, Acoustics boards, and panelling materials, laminates and veneers, wood foam.

Advanced fibre composite materials: Bamboo, glass-reinforced plastic (GRP), Fibre-reinforced polymers (FRP), Shape memory polymer composites.

Vacuum insulation panel (VIP), stretched fabric wall systems External Thermal Insulation Cladding System (ETICS), Insulated Vinyl Siding.

Different types of stainless-steel applications, Polycarbonates.

Aluminium composite panels: application method in interior and exterior facades

Module 4
Introduction to
Different Building
Finishes

Paints and Varnishes: Properties and uses of ordinary paints, Varnishes and wood preservatives, method of distempering wall surfaces and painting of timber and metal work. Plastic paints, emulsion paints, cement paint and textured plaster. Enamel and epoxy paints.

Reflective indoor coatings and High reflectance and durable outdoor coatings.

Nano-materials for building construction and finishes.

Different types of flooring and wall cladding tiles, Anti-Static Vinyl surfaces.

Module 5

Site visits for practical exposure to different advanced materials and their application in the building industry.

Case studies to be conducted for further documentation of the knowledge explored, and report to be submitted.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Al-homound, M.S., *Performance Characteristics and Practical Applications of Common Building Thermal Insulation Materials, Building and Environment, Vol-40(3), 2005.*
2. Duggal, S.K., *Building Materials, New Age International Publishing Co., (3rd Ed.), 2008.*
3. Varghese, P.C., *Building Materials, PHI Learning Pvt. Ltd., 2005.*
4. www.in.saint-gobain-glass.com

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.	22AR643	Architectural Acoustics	3	0	0	3

Course Objective The course imparts fundamental understanding about architectural acoustics and environmental noise; physics of sound and acoustical design for built spaces.

Anticipated Learning Outcomes: Enables the student to provide appropriate acoustic solutions for both indoor and outdoor spaces.

**Module 1
Fundamentals of architectural acoustics** Fundamentals: Definitions, terms related to acoustics, sound waves, frequency, amplitude, intensity, wavelength, sound pressure, measurement of sound, decibels. Characteristics of speech, music and hearing.

**Module 2
Room acoustics concepts** Room Acoustics: resonance, reverberation, echo, reverberation time (Sabine's formula) Material property: Absorption, reflection, scattering, diffusion, transmission, absorption coefficient, Noise Reduction Coefficient (NRC),

Absorbing materials used and their choices for different acoustic treatment, Sound insulation Simple exercises involving reverberation time and absorption

**Module 3
Acoustics treatment in building design** Basic room acoustics concepts and design: shape, volume, defects, treatment for interior surface, basic principles in designing, cinemas, recording studios, classrooms, conference halls, Auditorium.

**Module 4
Environmental noise** Noise and its control- Air and structure borne, sound transmission, vibration isolation, damping.

Noise source within buildings and its control (Fans, chillers, boilers, HVAC noise sources). External noise source and its control: Open air acoustics, Free field propagation of sound, absorption from air and natural elements, Site planning, Design of open-air theatres, Types and design of Noise barrier, effects of landscape elements

Module 5

Acoustic design of small spaces using innovative techniques and materials by applying manual or simulation software methods, as decided by the subject teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Szokolay, S. V. (2008). *Introduction to architectural science*. Taylor and Francis.
2. Vigran, T. E. (2008). *Building Acoustics*. 1st Ed. Taylor and Francis.
3. Barron. M. (2009). *Auditorium acoustics and architectural design*. 2nd Ed. Taylor and Francis.
4. Eagan, D. *Concepts in Architectural Acoustics*.
5. Kang, J. (2006). *Urban Sound Environment*. 1st Ed. CRC Press.
6. Meyer, H. B. and Goodfriend, L. *Acoustics for Architects*. Reinhold.
7. Smith, B. J., Peters, R. J., and Stephanie, O. (1982). *Acoustics and Noise Control*. New York: Longman.

SEMESTER – VI

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR659	Architectural Design -IV	0	0	12	9

Course Objective The objective of this studio is to expose the students to the complexities of providing shelter for people from different socio-economic backgrounds in an urban setting. To expose the students to the challenges of bigger scale site planning involving a group of buildings, space programming, complexities of providing building services and infrastructure facilities and economic feasibility. To enable the students to understand how to design in compliance with building regulations and space standards.

Anticipated Learning Outcomes: To generate an understanding within the students about the various past and future concepts of neighbourhood design, and deal with the complexities of mixing various user groups (economic and socio-cultural) in living environments. While designing socio-economic determinants and technological alternatives shall be studied in detail. Special emphasis is put on structural aspects of high-rise buildings, utilitarian parameters, space optimisation, conformance with regulatory requirements, integration of structural systems and building services. They are also expected to be conscious about the need for climate sensitive passive design techniques. Application of concepts of project phasing, financing and construction planning are to be applied. Design and standards for different physical infrastructure such as, roads/streets, pedestrian pathways, parking provision (basement parking, other covered and open parking), site drainage, solid waste management facilities, water conservation systems.

FOCUS AREAS

- The concept of neighbourhood/sense of belonging
- Housing Density
- Typologies of residential units based on their economic occupancy (unit typology, floor plate typology and building group typology)
- Economic and environmental sustainability
- Structural criteria

- Alternative construction techniques for affordable housing/ Innovative techniques for high rise and modern housing

**ALLIED
KNOWLEDGE
REQUIRED**

- Building regulations and codes
- Building and site services (technical)
- Sustainable architecture

EXAMPLES OF STUDIO PROJECTS:

Design problems dealing with: Housing types based on height of buildings, and occupancy densities, housing types based on affordability, Office Complex, Recreation Centres, Star-rated Hotels, etc. may be given to the students as a design project.

Information to be provided by the Course instructor:

1. The requirements and their areas are to be stipulated by the design teacher.
2. The students accompanied by the design teacher should visit at least two existing buildings as case studies. Notes should be made on these in reference to its flow of operation. Climatic angles should be observed.

Evaluation:

1. A one-week workshop on the design of a school, multipurpose hall, or health centre should be done under the supervision of an outside teacher.
2. A two-day design examination should be conducted at the end of the semester.

Guidelines for students:

In the fifth semester, again the students will be given the design problem, the requirements (Function and Areas) and the site by the teachers. Here the students will make literature review and examine case studies in a detailed way as per the enclosed guidelines for doing the same. However, the teacher shall provide the list of requirements (Function and Areas) and the site.

1. Literature review: Literature Review is a very important source of information for the students before starting a new project. Internet survey also provides a lot of information regarding the issue at hand. At this stage it must be pointed out that there is a chance of the student being overwhelmed with the excess information.

The teacher should take care that the student does not put the whole Time Savers Standard as his literature study. What is expected of the student is to discern

between the core /fundamental information required for his/her project from the rest of the information available to him/her.

2. Case Studies: For architecture students “the Case Study Method” is a very suitable way of finding out information for their subsequent design work. However, just like a doctor seeing his patient for the first time, where he looks at the patients’ heart beat with the stethoscope, his blood levels by looking at his years, pressing the patient’s stomach looking for possible problems, so too does the Architect have to look at the case study in a methodological way. One such methodology is suggested below:

The case study building can be looked at under the following heads:

- a) Architectural aspects: In the architectural aspects matters such as form, roofing pattern, materials used, configuration of the building blocks over the land, the landscaping and other such matters can be looked into.
- b) Social aspects: Under social aspects the use of spaces by the people whether they are successful or not, How the designs have been made taking the needs of the local people and other such matter can be examined and recorded.
- c) Space and area Aspects: will record the sizes/areas of the spaces required for the various uses in the building under examination.
- d) Circulation aspects: In the Flow Aspects the circulation in the building, the connections required between the different parts may be documented.
- e) Engineering aspects: Lastly the Engineering Aspects which would deal with the structural design, the water supply, the sewer lines, electric power supply, air-conditioning and other may be examined.

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

References

1. Chaira, J. D. and Crosbie, M. J. (2001). *Time Saver Standards for Building Types*. 4th Ed. New York: McGraw-Hill.
2. Bousmaha Baiche and Nicholas Walliman, *Neufert Architect’s data*, Blackwell science ltd.
3. Hareguchi, H. (1988). *A Comparative analysis of 20th C. houses*. London: Academy Editions.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR664	Working Drawing-II (Frame Structures)	0	0	6	4

Course Objective To produce a complete set of working drawings for a mid-rise/high-rise building showing an understanding of framed structural systems and building engineering services including electrical, PHE, HVAC, Lifts and escalators, Fire Safety Etc., Interior and Exterior finishes etc.

Anticipated Learning Outcomes: Ability to organize building design information in a working drawing format suitable for various purposes related to the execution of the project along with an ability to read building working drawings to extract specific information.

Module 1 Introduction The Course Objective is to acquaint students with preparation of drawings for construction of buildings as a part of "Contract Documents", required for entering into an agreement with the Contractor, using proper methods of labelling and dimensioning techniques. The drawings shall be based on buildings designed in the previous semester as a part of Architectural Design assignment and generally a frame structure.

Module 2 All drawings to be in a readable scale and shall include grid and or centre lines of walls and columns, as per floor layout, indicated in all floor plans for ease of identifying areas of amendments when required. Following are the drawings that are to be prepared:

- Excavated Trench Plan including plan of required foundation up to plinth / parking level showing all structural members (columns and other R.C.C. elements) along with proper sections at all places, as necessary, all considerably labelled and dimensioned.
- Drawings should indicate the type of foundations adopted in a scheduled manner.
- Ground / Stilt Floor Plan, as a horizontal section at minimum three feet six inches above floor level, showing parking layouts, disposition of rooms, thresholds, any projection above floor level e.g. canopies, chajjas etc., position of doors and windows and marking their types (as per door and window schedule) and locations, indicating internal finishes (as per

schedule of finishes), typical elements proposed in spaces like kitchens, toilets, wardrobes, staircases etc. all considerably labelled and dimensioned.

- Upper floor plans showing similar details as mentioned in Ground Floor Plan including all projection as that in elevations, all considerably labelled and dimensioned.
- Drawings should also include, in typical formats, Schedules of Doors and Windows with their Hardware fixtures and also a Schedule of Finishes.
- Separate floor plans, at all levels, indicating electrical fixture layouts in respective areas.
- Detailed layout plans for toilets, kitchens, staircases indicating type of fixtures.
- Terrace or Roof Plan showing staircase / lifts along with extent of required parapet, proper roof drainage plan considering catchment area of roof indicating ridges, valleys and slopes, location of rain water outlet pipes with diameters of down pipes, location of lightning arrestors, all considerably labelled and dimensioned.

Module 3

- Elevations of all sides - front, back and both the sides including stair head rooms and lift machine room, showing all features (solids and voids) and their surface levels marked with respect to a base level 0-0, floor levels as per heights starting from ground level to top of staircase / lift machine room, all considerably labelled and dimensioned.
- A probable indication of colour scheme, on all surfaces, is to be prepared referring to materials available in the market for external coating.
- As many transverse / longitudinal sections, required to explain vertical disposition of all elements proposed in the design and should preferably take critical areas like lifts, staircase, toilets, kitchen and walls with typical elevation features, all properly labelled/dimensioned.

Module 4

- A Site Plan indicating shape and size of plot dimensions of all sides, position of approach road, entries and exits. It should include, within the premises, road layout if any, storm water drainage system (surface or underground) with discharge

details, location of septic tanks and underground sewage lines, underground water reservoirs both for fire and domestic use, firefighting system and Water Supply network, all considerably labelled and dimensioned.

- Additionally, the drawing shall also have reference to the water harvesting system in the form of recharge pits and or zero disposal technique.
- In case of large plots with multiple building units, the project might need a Sewage Treatment Plant (STP) - open or closed type where it becomes mandatory to show the system of treatment. Detailed drawings of the system may have to be included as per respective area norms.

Module 5 Any other topic as per the need of the present as felt by the teacher.

NOTE:

Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.

References

1. Building and Construction Authority. (2005). CONQUAS-21. Singapore: The BCA Construction Quality Assessment System.
2. Jefferis, A. and Madsen, D.A. (2005). Architectural Drafting and Design. 5th Ed. New York: Thomson Delmar Learning.
3. Joe, B. (Ed). (2002). Details in Architecture: Vol. I-V. Victoria: The Images Publishing group.
4. Osamu, A. W., Linde, R. M. and Bakhoun, N. R. (2011). The professional practice of architectural working drawings. 4th Ed. Hoboken: John Wiley and Sons.
5. Weston, R. (2004). Plans Sections Elevations – Key buildings of the twentieth century. London: Laurence King Publishing.
6. Hareguchi, H. (1988). A Comparative analysis of 20th C. houses. London: Academy Editions.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR673	Interior Design	1	0	3	3

Course Objective To familiarize students about the need of interior design; its principles and theories with specific reference to colour, texture, light and their effects.

Anticipated Learning Outcomes: Students will explore their creativity and innovative design options with the basic knowledge of anthropometrics, building materials and finishes and construction details.

Module 1 Style of Interior: Period style, Country style, High-tech style, etc.
 Interior space programming, Introduction to basic physical factors/elements of interior design i.e., walls, floors, ceiling, doors, windows etc.
 Usage of modern, traditional as well as cost effective materials.
An assignment to be submitted on a market survey of various interior materials.

Module 2 Study of the relationship between furniture and spaces, human movements and furniture design as related to human comfort. Function, materials and methods of construction, changing trends and lifestyles, innovations and design ideas. Study on furniture for specific types of interiors like office furniture, children's furniture, residential furniture, display systems, etc.
Assignment on different furniture types and product design.

Module 3 Study of interior lighting, different types of lighting and their effects; types of lighting fixtures. Other elements of interiors like accessories used for enhancement of interiors, paintings, objects-de-art, etc. Interior landscaping elements like rocks, plants, water, flowers, fountains, paving, artefacts, etc. their physical properties, effects on spaces and design values.

Assignment on two interior schemes of different functional types: residential/commercial /Public buildings at different scales will form the major design assignment and include Concept development and furniture layout.

Module 4 Details like false ceiling, partition, flooring, wall panelling/cladding. Use of daylight and artificial lighting for specific functions, electrical layout, colour scheme, furnishings, interior landscape to be included in each design portfolio.

Module 5 One time problem of 3 hours (one week) to be conducted.

NOTE:

Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.

References

1. Ching, F. D. K. (1987). *Interior Design Illustrated*. New York: V.N.R. Publications.
2. Doshi, S. (Ed.) (1982). *The Impulse to adorn Studies in traditional Indian Architecture*, Marg Publication
3. Kathryn, B. H. and Marcus, G. H. (1993). *Landmarks of twentieth Century Design* Abbey Ville press
4. PENERO, J. and ZELNIK, M. (1979). *Human Dimension and Interior space: A Source book of Design Reference Standards*, New York: Whitney Library of Design.
5. Slesin, S. and Ceiff, S. (1990). *Indian Style* New York: Clarkson N. Potter.
6. Dorothy, S D., Kness, D. M., Logan, K. C. and Laura, S. (1983). *Introduction to Interior Design*. Design Michigan Macmillan Publishing.

SEMESTER – VII

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AR713	Estimation & Valuation	3	0	0	3

Course Objective The course intends to provide knowledge of methods of estimation and valuation for the building industry.

Anticipated Learning Outcomes: Students get equipped with practical and working knowledge in areas of building construction and specification, quantifying materials and rate analysis.

Module 1 Estimation Introduction to the subject, definition, aim and objective. Scope and importance of the subject, principles of and methods of estimating. Different types of estimation. Approximate and detailed estimation

Module 2 Methods of approximate estimating- Built in or Carpet area method, Cubic content method and numerous systems. Rates of materials, Rate analysis, Pricing of bill of quantities, Abstract and detailed estimate. Taking out quantities of various items. Common abbreviations. Cost estimates, standards modes of measurements, writing schedules, elements of cost accountancy and bookkeeping.

Module 3 Valuation Principles of valuation of real properties for the purpose of sale and purchase, mortgage, lease, Freehold and leasehold, interest, forms of rents, seller's values, fair value, mortgage values, distress sale values, buyer's value, fancy value, annual value, year's purchase, depreciation value.

Methods of valuation- Valuation of land, methods of belting, methods of front land, land building methods of valuation, shop premises properties.

Module 4 Valuation of residential offices, commercial, industrial, leasehold agricultural properties, valuation of municipal rate, and compulsory acquisition valuation of industries as going concern factories, mills, easement rights and valuation thereof, development of properties. Arbitration- litigation laws

Module 5 Complete estimation of a small-scale building as decided by the faculty.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Birdie, G. S. (2005). *Text Book of Estimating and Costing*. Dhanpat Rai Publishing. Chakraborty, M. *Estimating, Costing, Specification and Valuation*
2. C.P.W.D. *Standard Schedule of Rates*.
3. Dutta, B. N. (1998). *Estimating and Costing in Civil Engineering*. 24th Ed. UBS Publishers Distributors Ltd.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR723	Urban Design	3	0	0	3

Course Objective Introduce basic concepts of urban design, reading the city, understanding urban issues with the intent of resolving the interface of buildings with each other and with the urban space they help to define between them.

Anticipated Learning Outcomes: Ability to comprehend architecture at the urban scale, understand the problematic issues in a given urban area after a methodical analysis and contemplate possible urban design solutions that will guide built-form and open-space morphology.

Module 1 Definition of urban design
Components of a city and their interdependent role; determinants of urban form, Evolution of historic urban form.
Urban form and cities.

Module 2 Urban design principles and criteria, imageability; developing an understanding of factors affecting built and open spaces at urban scale and methods to perceive, record and analyse them.

Module 3 Urban design theories, visual survey techniques:
Techniques to understand movement systems, activity patterns, visual and physical linkages.
Studying land use, building uses, social, physical and perceptual context and behaviour. User patterns, perceptions and behaviour.

Module 4 Social aspect of urban design, urban design review process, Comprehensive role of urban design in planning

Module 5 The teacher may teach any appropriate material which she/he may find important.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Design of cities / Bacon, En / 711.4 BAC/D*
2. *The Architecture of towns and cities / Spreiregen Paul D / 711.4 SPR/U*
3. *The Image of the city, Kevin Lynch*
4. *Urban Pattern/ Gallion, Arthur B. / 711.4 gal/u*
5. *Urban Design Method in techniques- C. Moughtin*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR733	Sustainable Urban Habitats	3	0	0	3

Course Objective Introduce urban housing problems, their causes and discover solutions thereof.

Anticipated Learning Outcomes: Ability to comprehend housing as a key component of urban habitat, closely linked to urban infrastructure and urban economy, to connect emerging concepts in environmental studies with human needs towards more sustainable paradigms for mass housing.

Module 1 Shelter, housing form, Census of India definitions.
Housing policies, demand and supply, housing shortage, income and affordability, poverty and slums.

Green housing, green rating.

Module 2 Social and Economic Dimensions- social security, role of housing in family and community well-being, status and prestige, safety, crime and insecurity, deprivation and social vulnerability, ghetto-ism, gender issues, housing and the elderly.

Module 3 Neighbourhood as a major constituent of the City Plan.

Traditional and modern approaches to neighbourhood planning, planning and design standards for area distribution, density, development controls and building byelaws.

UDPFI guidelines, NBC provisions.

Module 4 Sustainable Infrastructure for neighbourhoods, Transit-oriented development, Mass Solar Energy generation, Smart Energy and water conservation, Recycling of Waste.

Net-Zero communities.

Module 5 The teacher may teach any appropriate material which she/he may find important.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Charles Abrams. *Man's struggle for shelters in an urbanizing world*, Vikas Fetter and Simons Pvt. Ltd, Mumbai
2. Babur Mumtaz and Patweikly. *Urban housing strategies*, Pitman publishing, London
3. Geoffrev K. Paul, *Low-income housing in the developing world*, John Wiley and sons.
4. John F.C Turner, *Housing by people*, Marison Boveros, London, 1976
5. Martin Evans, *Housing, Climate and comfort*.
6. Lewis Davidson Gottlieb, *Environment and design in housing*. The McMillan Corp, New York.
7. *Housing and building in hot-humid and hot dry climate/ 721.06 Brab/H*
8. *Low-cost housing in developing countries/ Mathur, GC/363. 509/72Mat/LN93.*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.1	22EAR7413	Elective 1. Mathematics, Statistics and Operation Research	3	0	0	3

Course Objective The course is aimed to develop basic mathematical techniques required to support architectural and engineering concepts, and is also oriented to understand and analyse practical engineering problems. To introduce Operation Research as a tool for multi-criteria decision making for projects.

Anticipated Learning Outcomes: The course modules cover statistics and operation research, which will enable the students to analyse field study data and formulate mathematical models.

**Module 1
Geometry and measurements** Proportion, Golden ratio, Euclidean geometry, Methods to calculate areas, surface areas of solids and volumes for various geometrical shapes (types of curves) and volumes (cube, sphere, cone, cylinder)

**Module 2
Calculus and applications** Methods of differentiation. Calculus of one variable

Fundamentals of Integral calculus, Maxima and Minima for a function of one variable, Reduction Formulae, Calculation of areas using integrals: Area bounded by curve – Arc length of curve.

**Module 3
Matrices** Elementary rows and column transformation, Gauss elimination and solution of System of equations, Inverse matrix. Eigen Value.

**Module 4
Statistics** Introduction to various types of Distributions, Measures of central tendency, Mean/ Median mode, measures of dispersion (Mean deviation/Standard Deviation, Variance), Correlation and Regression. Hypothesis formulation & Testing; Statistical tests: Parametric & Non-parametric.

**Module 5
Basics of Operation Research** Introduction to Operations research; linear programming, integer programming, transportation problem, introduction to nonlinear programming.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Kreyszig, E., *Advanced Engineering Mathematics*. Hoboken: John Wiley and Sons, 2007.
2. Grewal B.S., *Higher Engineering Mathematics*, 35th edition, Khanna Publishers, 2000.
3. Kapoor, V. K. and Gupta, S. C., *Fundamentals of Mathematical Statistics*, Sultan and Sons
4. Kalavathy, S., *Operation Research*, Vikas Publishing House Pvt. Ltd., 2009
5. Boucher, J. S., 1857, *Mensuration, Plane and Solid*, Longman, Brown, Green, Longmans and Robert, London.
6. Vohra, N. D., 2010, *Quantitative Techniques in Management*. McGraw Hill Publications, New Delhi.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.2	22EAR7423	Elective 2. Appropriate Building Technology	3	0	0	3

Course Objective To highlight the different cost reduction techniques and to make them familiar with non-conventional building materials and construction practices.

Anticipated Learning Outcomes: Students shall be able to identify and apply appropriate non-conventional building materials and construction technologies as per site and project context.

Module 1 Basic shelter issues in India. National building Organization-Recommendations of Housing & Urban Development Corporation.

Module 2 Traditional materials and techniques- pressed soil blocks, soil cement blocks and other alternate building materials- fly ash brick, by-product gypsum, bamboo, jute stalk, etc.

Module 3 Building process- Different types of walling, Roofing, foundation, Pre-cast blocks.

Laurie Baker's experiments in low – cost housing. Modular construction.

Experiments conducted by CBRI, Roorkee.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Low-cost housing Technology*; L. J Goodman & R. P. Pama
2. *Houses; How to reduce building cost*; Laurie Baker
3. *Cost reduction for Primary school*, Laurie Baker

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.3	22EAR7433	Elective 3. Prefabrication & Modular Coordination	3	0	0	3

Course Objective The course aims to focus on the study of basics of modular coordination and applications of prefabrication systems in buildings primarily in the Indian context.

Anticipated Learning Outcomes: Ability to understand, assess and implement prefabrication and modular coordination techniques in design projects.

Module 1 Introduction Introduction to conventional modular principles and practices in the West in different periods, Post Industrial modular construction of large span and suspension structures in steel and concrete, Introduction to system building, mechanization of production of system.

Module 2 Principles of modular systems Means and methods of various structural systems (Form - active systems like cables and arches; surface active systems like folded plates, vector- active like trusses, bulk active like trabeated members and complex structures).

Modular number pattern introduction, basic modular components and concepts of modular planning, advanced and contemporary themes of modular principles- new theories of pattern, space systems and group organisation and centring processes.

Module 3 Prefabrication systems Modular systems for building components– Classification of prefabrication systems (Example- developed by CBRI Roorkee; Skeletal system, Brick panel system, R. C. Planks, non-structural elements); off-site and on-site prefabrication elements and construction joints.

Manufacturing of building components – Technology requirements for industrial building system Equipment used – manufacturing processes – transportation of components – assembly and finishing – structural aspect.

**Module 4
Application of
modular systems**

Prefabrication - Advantages, limitations and relevance in Indian context; Feasibility of using industrial building systems in Residential and Non-Residential buildings. Social and economic issues related to the industrial building system.

Development of planning Module and structural Modules for various types of buildings in India (Application of dimensional and functional coordination of modular systems in modern buildings), use of Industrial building system as an option for disaster mitigation. (Examples - Hindustan housing factory. Tapsia system and other such contemporary systems in India).

Module 5 Case studies and construction site visits as decided by the faculty.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Industrial Building and Modular Design* Henrik Missen – C and CK, UK 1972.
2. Albert G. H. Dietz, Laurence Secotter – “*Industrialized Building Systems for Housing*” – MIT, special summer session, 1970 USA.
3. *Industrialized Building Construction – Proceedings of National Seminar, Nov-17- 18, 2000, Indian Concrete Institute, Mumbai.*
4. *Innovative Construction Materials – Proceedings of Seminar, Jan 20-21,2001, Veermata Jeejabai Technical Institute, Mumbai.*
5. R.M.E Diamant, *Industrialized buildings*, 1968.
6. *Building Digest notes of CBRI, Roorkee*
7. R. Nagarajan, *Standards in building*, Pitman Publishing, 1976
8. Le Corbusier, *Le Modular-1 and 2*
9. Garry Stevens, *Reasoning Architect: Mathematics and Science in Design*, McGraw-Hill Education, 1990.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
4.4	22EAR7443	Elective 4. Green Architecture	3	0	0	3

Course Objective To understand global environmental concerns and how these can be addressed through building design and active systems integration for sustainability.

Anticipated Learning Outcomes: Ability to apply relevant codes for energy and environment, ascertain approximate renewable energy feasibility on projects, and configure systems integration for energy conservation.

Module 1 Sustainable Principles and Practices Introduction to the ideas, issues and concepts of sustainable development; principles of environmentally and ecologically sensitive architecture; Importance of water, energy, materials and community in architecture for sustainable development.

Brief introduction to green rating systems and criteria for evaluation of different categories of built development - IGBC, GRIHA and LEED rating systems.

Module 2 Green Building Design Sustainable site planning and landscape design; Building form and orientation for sun and Wind.

Building envelope design- Fenestration design, shading devices, facade treatment, efficient use of daylighting.

Integrated Use of Landscape: Vertical Landscape, Green Wall, Green Roof.

Module 3 Solar Passive Techniques Passive Heating techniques: General principles – Direct gain systems - Glazed walls, Bay windows, Attached sun spaces etc.

Indirect gain systems – Trombe wall and Solar Chimney.

Passive Cooling techniques: General principles – Evaporative cooling, Nocturnal radiation cooling, Passive Desiccant cooling, induced ventilation, earth sheltering, Wind Towers, Earth-Air tunnels, Air Vents.

Case studies on buildings designed with passive heating and cooling techniques.

**Module 4
Green Practices
and Technologies**

Energy utilization in buildings, Renewable and Non-Renewable energy sources. Integration of non-conventional energy systems from renewable source of energy-solar (photovoltaic), wind and biomass.

Water conservation practices- Rainwater Harvesting systems; Recycling of waste water: Physical, Chemical and Biological treatment methods, Rootzone treatment, Use of recycled water. Environment friendly materials (paints, light sensitive glass, etc), Embodied energy of materials, Biodegradable materials, Recycling and Reuse of materials.

Module 5

Introduction to building performance simulation software (as decided by the faculty) Example- Autodesk Ecotect, IES (Integrated Environmental solutions), Radiance.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Sustainable design manual, Vols. 1 & 2, The Energy and Resource Institute, New Delhi. Krishan, A. and Nick Baker, Climate Responsive Architecture: A Design Handbook for Energy*
2. *Efficient Buildings, McGraw Hill Education Private Limited, India, 2001.*
3. *Energy Conservation Building Code (ECBC), USAID-INDIA.*
4. *Szokolay, S.V., Introduction to Architectural Science - The Basis of Sustainable Design, Architectural Press.*
5. *Ralph Lebens M., Passive Solar Architecture in Europe – 2, Architecture Press, London 1983.*

SEMESTER – VII

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR759	Architectural Design -V	0	0	12	9

Course Objective The objective of the course is to focus on energy efficiency as an important design consideration.

Anticipated Learning Outcomes: Students should be able to demonstrate through their design their understanding of energy efficient systems, structural systems, services and construction systems in the design of a modern medium to high-rise building in the urban context; understanding of developmental regulations and their application in the design studio work.

FOCUS AREAS

- Spatial organisation
- Structural innovations
- Sustainable design

ALLIED KNOWLEDGE REQUIRED

- Advanced concepts of structures
- Advanced building services
- Building automation and intelligent buildings

EXAMPLES OF STUDIO PROJECTS:

Recommended building types are 5-star hotels, country clubs, complexes for places of worship, city centre, Management development Centre, shopping mall, multiplexes, Service Apartments, information centre, entertainment centre, museums and art gallery. Housing of different economic groups. Stadiums, convention centres, exhibition pavilions, museum complex, educational campus design, multi-speciality hospitals, mercantile buildings like shopping malls, office complex, hospitality buildings.

Information to be provided by the Course instructor:

1. The design teacher should prepare the design brief for the problem. The students have to work out the detailed requirements.

Evaluation:

1. A one-week workshop on the design of a school, multipurpose hall, or health centre should be done under the supervision of an outside teacher.
2. A three-day design examination should be conducted at the end of the semester.

Guidelines for students:

In the seventh semester, the students will be given the design problem and the site by the teacher. The students will prepare the literature review, case study and formulate the requirements and areas in a group study. They will then submit a report with appropriate inferences. The students shall also submit a report on site analysis separately.

This will be followed in the process of laying out the design on the site as per the written inferences of the literature review/case studies and the findings from the site analysis.

1. Literature review: Literature Review is a very important source of information for the students before starting a new project. Internet survey also provides a lot of information regarding the issue at hand. At this stage it must be pointed out that there is a chance of the student being overwhelmed with the excess information.

The teacher should take care that the student does not put the whole Time Savers Standard as his literature study. What is expected of the student is to discern between the core /fundamental information required for his/her project from the rest of the information available to him/her.

2. Case Studies: For architecture students "the Case Study Method" is a very suitable way of finding out information for their subsequent design work. However, just like a doctor seeing his patient for the first time, where he looks at the patients' heart beat with the stethoscope, his blood levels by looking at his years, pressing the patient's stomach looking for possible problems, so too does the Architect have to look at the case study in a methodological way. One such methodology is suggested below:

The case study building can be looked at under the following heads:

- a) Architectural aspects: In the architectural aspects matters such as form, roofing pattern, materials used, configuration of the building blocks over the land, the landscaping and other such matters can be looked into.
- b) Social aspects: Under social aspects the use of spaces by the people whether they are successful or not, How the designs have been made taking

the needs of the local people and other such matter can be examined and recorded.

- c) Space and area Aspects: will record the sizes/areas of the spaces required for the various uses in the building under examination.
 - d) Circulation aspects: In the Flow Aspects the circulation in the building, the connections required between the different parts may be documented.
 - e) Engineering aspects: Lastly the Engineering Aspects which would deal with the structural design, the water supply, the sewer lines, electric power supply, air-conditioning and other may be examined.
3. Inferences: Inferences are the important directives written down in a language format which has to be incorporated into the new design being worked upon. Examples of inferences for a college building could be as follows:
- a) Area should be provided near the entrance to the property for parking.
 - b) The whole area inside should be pedestrian.
 - c) Spaces should be created for gathering informal groups of students.
 - d) Classrooms should be well lit.
 - e) Group of shops for stationery, photo copying, and food stuff should be provided.
 - f) There should be courts for basketball, tennis, badminton along with a swimming pool.
 - g) The whole area should be well landscaped.....and so on.

The inferences will be drawn up from both the literature review and the case studies.

- 4. Concept: Concept formation is a subject of separate study by itself. But for architecture students it should mean the lead Idea on which you start organizing the layout and design of the architectural project. It may also be referred to as the super organizing Idea for a project. This is the starting point from which the plans and designs are made while at the same time incorporating the inference we have already derived.
- 5. Breaking into Design: Having gone through the earlier four stages of literature review, case studies, inferences and concept development which may all be referred to as the analysis stages, we have now reached the crucial point of coming up with a design.

It is at this stage that the student needs tremendous hand holding from the design teachers. Maximum attention must be given at this stage for a good outcome.

If this is successfully carried forward, the student will, from here on, make the presentation drawing, the plans, the elevations, sections, views, walk through etc. and be on the way to complete the architectural designs.

6. Conclusions: Students and the design teachers have to work in close coordination to have a successful design program. Each teacher is gifted with his own special abilities to design but it requires more than his personal abilities as a designer to teach design to a student. These format/guidelines are prepared to keep the teaching of the subject to a predetermined structure so that every teacher and student knows where and how he is to proceed.

The Teacher shall develop his References From various Sources.

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR764	Architectural Details (Innovative Detailing)	0	0	6	4

Course Objective This course focuses on creative architectural detailing of building components and use of different materials and technologies involved for implementation. It intends to equip the students with knowledge and skill for handling modern building exteriors/interiors works.

Anticipated Learning Outcomes: Develop ability to create and implement innovative architectural detailing; improved understanding of construction and structural details.

Module 1 Latest trend in external finishing materials, it's implementing technology and hardware i.e., stone, metal, glass, tiles,

1. Entrance doors/special doors and windows (sliding, folding, revolving)

Module 2 Latest trend in internal finishing materials, its implementing technology and hardware i.e., gypsum, plywood, metal, glass, stone, tiles etc.

2. Staircase and balcony details with finishing and railing designs,
3. Parapet design, coping, cornices,
4. Kitchen and wardrobe details.

Module 3 Worked out/creative details of walls, partitions, floorings, suspended ceilings of different materials with electrical wiring lighting, ventilation and air conditioning, Acoustic design and finishing for interiors.

Module 4 Structural layout, detailing and schedule of a RCC framed building.

Module 5 Innovative and sustainable Architectural detailing as decided by the faculty.

NOTE:

Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.

References

1. Barry, R. (1999). *The Construction of Buildings Vol. 1 - 5. 5th Ed.* New Delhi: East-West Press.
2. McKay, W. B. (2005). *Building Construction Metric Vol. 1-IV, 4th Ed.* Mumbai: Orient Longman.
3. Allen, E. and Rand, P., *Architectural Detailing.* 4. Emmitt, S., *Principles of Architectural Detailing.*
4. Joe, B. (Ed). (2002). *Details in Architecture: Vol. I-V.* Victoria: The Images Publishing group.
5. Osamu, A. W., Linde, R. M. and Bakhoun, N. R. (2011). *The professional practice of architectural working drawings. 4th Ed.* Hoboken: John Wiley and Sons.
6. Rangwala, S. (2004). *Building Construction. 22nd Ed.* Anand.: Charotar Pub. House.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.	22AR772	Working Drawing –III (Municipal Approval & Statutory Drawings)	0	0	3	2

Course Objective To produce a complete set of drawings to communicate the technical details of a project vis a vis the statutory requirements stipulated by the local authorities.

Anticipated Learning Outcomes: Ability to organize building design information in an approval drawing format suitable for the statutory requirements stipulated by the local authorities, following building bye-laws.

Module 1 Introduction to Approval Drawing, related definition like barsati, FAR, carpet area, built-up area, LIG, MIG, EWS, habitable room, ledge, mezzanine floor etc., Guidelines for preparation of Drawing, certificate or Clearance from authority, colouring notion of plan, the responsibility of architect, applicant and authority, constitution of the committee.

Module 2 Zoning Regulation, Land-use, required information for approval-plot size, access, set back, parking details, open space, base FAR, lifts, staircase and ramps, basement, distance from electric post, ventilation shaft, and provision for RWP.

Module 3 Water requirements and calculation, Fire safety and requirements, standards for sanitation requirements, Calculation of STP.

Module 4 Implementation of the above data based on a sketch design prepared in the earlier semester. And submission of approval drawings consisting of site plan, detailed floor plan elevation and sections including required services appropriate for submission to the local statutory body.

NOTE:

Frequent site visits to be arranged as a part of the curriculum and contact hours. Site visits should be in line with the present studio work. It is mandatory for students to submit a site observation report, either periodically or at the end of the semester.

References

1. *Building and Construction Authority. (2005). CONQUAS-21. Singapore: The BCA Construction Quality Assessment System.*
2. *Jefferis, A. and Madsen, D.A. (2005). Architectural Drafting and Design. 5th Ed. New York: Thomson Delmar Learning.*
3. *Joe, B. (Ed). (2002). Details in Architecture: Vol. I-V. Victoria: The Images Publishing group.*
4. *Osamu, A. W., Linde, R. M. and Bakhoun, N. R. (2011). The professional practice of architectural working drawings. 4th Ed. Hoboken: John Wiley and Sons.*
5. *Weston, R. (2004). Plans Sections Elevations – Key buildings of the twentieth century. London: Laurence King Publishing.*

SEMESTER – VIII

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AR813	Urban Planning	3	0	0	3

Course Objective The course aims to impart a comprehensive knowledge of urban planning.

Anticipated Learning Outcomes: The students are exposed to Planning concepts, settlement planning, different levels of urban planning, familiarize with the implementation processes through various statutory and non-statutory guidelines.

Module 1 General decisive factors for any settlement; Early Indian town planning and Industrial era and its impact on human settlement system.

Definition of a town. Planning philosophies of pioneers such as Geddes, Howard, Aber Crombie, Le Corbusier, and other eminent planners. Planning concept related to Garden city, Satellite town, Radburn development and neighbourhood planning.

Module 2 Level of planning and steps for preparation of a town plan, Concepts, function, components and preparation of a development plan, master plan, structure plan and perspective plan.

Module 3 Introduction to analytical technique in town planning; land subdivision regulation and zoning.

Module 4 New approaches and concepts in town planning: smart city, ecological city, healthy city, resilient city, liveable city, etc.

Module 5 Any other topics deemed relevant by the teacher.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Urban pattern*-Gallion
2. *Town planning* –G. K. Hiraskar
3. *City planning* – Bandyopadhyay.
4. *Ekistics: An introduction to the science of human settlements* / Doxiadis. C.A/720
Doxie
5. *Town and country planning in India Town planning in ancient India/ DUTT, Binode Behari / 711.40934 DUTT*
6. Joseph De Chiarra and Lee Copleman, "Planning Design Criteria", Van Nostrand Reinhold Co., New York, 1968
7. *Town Planning*, A. Bandyopadhyay, Books and Allied, Calcutta 2000.
8. Babur Mumtaz and Patweikly, *Urban Housing Strategies*, Pitman Publishing, London, 1976.
9. Geoffrey K. Payne, *Low Income Housing in the Development World*, John Wiley and Sons, Chichester, 1984.
10. John F. C. Turner, *Housing by people*, Marison Boyars, London, 1976.
11. Martin Evans, *Housing, Climate and Comfort*, Architectural Press, London, 1980.
12. Forbes Davidson and Geoff Payne, *Urban Projects Manual*, Liverpool University Press, Liverpool, 1983.
13. Rangwala, *Town Planning*, Charotar publishing house.
14. G. K. Hiraskar, *Town Planning*.
15. Rame Gowda, *Urban and Regional planning*.
16. N. V. Modak, V. N. Ambedkar, *Town and country planning and Housing*, Orient Longman, 1971.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR823	Disaster Resilient Architecture	3	0	1	3

Course Objective The course is framed to provide an overview of the occurrence, causes and consequences of disaster and understanding of fundamental concepts and application of disaster resilient design.

Anticipated Learning Outcomes: Ability to understand and formulate management plans and disaster mitigation strategies in buildings.

Module 1 Introduction Overview of disaster, major natural disasters - flood, tropical cyclone, droughts, landslides, heat waves, earthquakes, fire hazards etc; Hazard (earthquake and cyclone) map of the world and India

Module 2 Design for Cyclone Climate change and its impact on tropical cyclones; Nature of cyclonic wind; Behaviour of structures in past cyclones and wind storms, case studies.

Cyclonic retrofitting– strengthening of structures and adaptive sustainable reconstruction; Life-line structures such as temporary cyclone shelter.

General planning/design considerations, Norms and Standards for wind storms and cyclones; Coastal zoning regulation for construction and reconstruction phase in the coastal areas; innovative construction materials and techniques; traditional construction techniques in coastal areas.

Module 3 Design for Earthquake Causes of earthquake; Past effects of earthquake on ground and building - Behaviour of various types of buildings, structures, and collapse patterns;

Seismic retrofitting - Weakness in existing buildings, concepts in repair, restoration and seismic strengthening.

General Planning and design consideration, Norms and Standards; Various types and construction details - Foundations, retaining walls, plinth fill, flooring, walls, openings, roofs and boundary walls.

Innovative construction materials and techniques, traditional regional practices

**Module 4
Disaster
Management** Strategies for disaster prevention and mitigation; Disaster management plan; National crisis management committee; state management group.

Module 5 Exercises on design and construction techniques for disaster resilient buildings.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Aga Khan Award for Architecture. Ed. Shelter. (1996). *The Access to Hope*. AKDN, Istanbul and Geneva.
2. Agarwal, P. and Shrikhande, M. (2009). *Earthquake Resistant Design of Structures*. New Delhi: PHI Learning.
3. Singh, P. P. and Sharma, S. (2006). *Modern dictionary of natural disaster*. Deep and Deep Publications.
4. Simiu E. and Scanlan R. H. (1996). *Wind Effects on Structures-Fundamentals and Applications to Design*. 3rd Edn., John Wiley.
5. Sinha, P. C. (2006). *Disaster Mitigation, preparedness, recovery and Response*. New Delhi: SBS Publishers.
6. Talwar, A. K. and Juneja, S. (2009). *Cyclone Disaster Management*. Commonwealth Publishers.
7. Taranath, B. S. (2004). *Wind and Earthquake Resistant Buildings: Structural Analysis and Design*. CRC Press.
8. U.N.D.P. (2004). *Reducing Disaster Risk: A Challenge for Development*. New York: UNDP.
9. World Bank. (2009). *Handbook for Reconstructing after Natural Disasters*.
10. *Seismic Design hand book for Buildings*
11. *Earthquake Architecture: New construction techniques for quake disaster Prevention*.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.	22AR833	Research Methods	3	0	0	3

Course Objective The subject exposes the students to a general understanding of research and different research methodologies. To emphasize on the development of critical and technical writing and composing skills by inculcating an attitude towards analytical reading.

Anticipated Learning Outcomes: Ability to source information on a chosen topic, clearly understand, collate, analyse, reflect upon it by means of a strategic discussion. Enable students to understand how research projects/topics can be converted to design projects/ proposals and writing research papers.

Module 1 Introduction to research. Meaning of Research, research process. Types of research. Research Process. Introduction to research Methodology. Identification of area of interest, Types of dissertations, Appropriate Methodology for respective thesis (Time factor) Pre – thesis studies.

Module 2 Research Design.
Building upon a hypothesis, formulating synopsis, Identifying the research component in thesis.
Sample Design. Types of sample design.

Module 3 Measurement and scaling. Types of data. Types of scale.
Data Collection. Collection of Primary and Secondary data. Various methods of data collection: Questionnaire surveys, Case study method, etc.

Module 4 Orient the students towards research applications in Architecture by making them familiar with various research methods available for design programming, behavioural studies and environmental mapping.

Report writing. Steps in report writing. Citation and bibliography.

Module 5

Course teacher may take up any other topic as seen relevant.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Sanoff, H. (1991). *Visual Research Methods in Design*. New York: John Wiley and Sons.
2. Kothari, C.R. and Garg, G., *Research Methodology: Methods and Techniques*, New Age International Publishers.
3. Anderson, J. and Poole, M. (1998). *Thesis and assignment writing*. Brisbane: John Wiley.
4. Borden, I. and Ray, K. R. (2006). *The dissertation: an architecture student's handbook*. 2nd Ed. Oxford: Architectural Press.
5. Fink, A. (1998). *Conducting research literature reviews: from paper to the Internet*. Thousand Oaks: Sage.
6. Murray, R. (2005). *Writing for academic journals*. Berkshire: Maidenhead, Open University Press.

SEMESTER – VIII

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
4.	22AR849	Architectural Design -VI	0	0	12	9

Course Objective To facilitate understanding and conceptualising design in spaces involving groups of buildings in a public realm and having multiple stakeholders. To impart knowledge on all aspects of the external environment, understand the interface between public and private realm and explore the multitude of activities and the spaces they define in the urban environment. These observations are expected to be applied to design interventions within the context of the given urban setting. The students are expected to carry out field study, documentation of the built fabric and area analysis of a given area within a city.

Anticipated Learning Outcomes: Promote understanding of students related to spaces and activities in urban spaces in the public domain; equip students to develop architectural design by contextualising and harmonizing with the built fabric and the urban environment and apply this understanding to create physical environments through skilful integration of movement networks, open spaces, suggestive built form, infrastructure network in compliance with planning norms.

FOCUS AREAS

- Density and Land use optimization
- Contextualisation of architectural intervention
- Vehicular and pedestrian movement
- Urban aesthetics
- Socio-economic and cultural characteristics
- Heritage, development controls and impact analysis.

ALLIED KNOWLEDGE REQUIRED

- Urban planning and urban design principles
- City level services
- Social anthropology
- Sustainable development
- Urban design controls and urban planning policy

EXAMPLES OF STUDIO PROJECTS:

Recommended building types are Transportation nodes like intercity and interstate bus terminus and railway stations, metro stations, waterfront developments, development in heritage zones/context of urban conservation, city centre, administrative and legislative areas, streetscape, urban markets, greenfield/ brownfield development, redevelopment or revitalization project in the context of the city under study, greenfield/ brownfield development, redevelopment or revitalization project in the context of the city under study, etc.

Information to be provided by the Course instructor:

1. The student will operate at an advanced stage of design formulation and design preparation.
2. Exposure to case studies, literature reviews, interviews, should be insisted upon.
3. The growing problems of urban areas in third world countries and their future development shall be explored. An understanding of the architectural implications of such a development scheme should lead to insights in the formulation of urban design controls and urban planning policy.
4. The studio exercise could involve the design of a group of buildings in the urban context.
5. The study is required to consider its context, physical features, views, orientation, volumetric analysis and figure ground characteristics, visual imageries, streetscape and skyline analysis, pedestrian and vehicular circulation pattern, and utility networks.

Guidelines for students:

In the eighth semester, the students will be given the design problem and the site by the teacher. The students will prepare the literature review, case study and formulate the requirements and areas in a group study. They will then submit a report with appropriate inferences. The students shall also submit a report on site analysis separately. This will be followed in the process of laying out the design on the site as per the written inferences of the literature review/case studies and the findings from the site analysis.

1. Literature review: Literature Review is a very important source of information for the students before starting a new project. Internet survey also provides a lot of information regarding the issue at hand. At this stage it must be pointed out that there is a chance of the student being overwhelmed with the excess information.

The teacher should take care that the student does not put the whole Time Savers Standard as his literature study. What is expected of the student is to discern between the core /fundamental information required for his/her project from the rest of the information available to him/her.

2. Case Studies: For architecture students "the Case Study Method" is a very suitable way of finding out information for their subsequent design work. However, just like a doctor seeing his patient for the first time, where he looks at the patients' heart beat with the stethoscope, his blood levels by looking at his years, pressing the patient's stomach looking for possible problems, so too does the Architect have to look at the case study in a methodological way. One such methodology is suggested below:

The case study building can be looked at under the following heads:

- a) Architectural aspects: In the architectural aspects matters such as form, roofing pattern, materials used, configuration of the building blocks over the land, the landscaping and other such matters can be looked into.
 - b) Social aspects: Under social aspects the use of spaces by the people whether they are successful or not, How the designs have been made taking the needs of the local people and other such matter can be examined and recorded.
 - c) Space and area Aspects: will record the sizes/areas of the spaces required for the various uses in the building under examination.
 - d) Circulation aspects: In the Flow Aspects the circulation in the building, the connections required between the different parts may be documented.
 - e) Engineering aspects: Lastly the Engineering Aspects which would deal with the structural design, the water supply, the sewer lines, electric power supply, air-conditioning and other may be examined.
3. Inferences: Inferences are the important directives written down in a language format which has to be incorporated into the new design being worked upon. Examples of inferences for a college building could be as follows:
 - a) Area should be provided near the entrance to the property for parking.
 - b) The whole area inside should be pedestrian.
 - c) Spaces should be created for gathering informal groups of students.
 - d) Classrooms should be well lit.
 - e) Group of shops for stationery, photo copying, and food stuff should be provided.
 - f) There should be courts for basketball, tennis, badminton along with a swimming pool.

g) The whole area should be well landscaped.....and so on.

The inferences will be drawn up from both the literature review and the case studies.

4. Concept: Concept formation is a subject of separate study by itself. But for architecture students it should mean the lead Idea on which you start organizing the layout and design of the architectural project. It may also be referred to as the super organizing Idea for a project. This is the starting point from which the plans and designs are made while at the same time incorporating the inference we have already derived.
5. Breaking into Design: Having gone through the earlier four stages of literature review, case studies, inferences and concept development which may all be referred to as the analysis stages, we have now reached the crucial point of coming up with a design.

It is at this stage that the student needs tremendous hand holding from the design teachers. Maximum attention must be given at this stage for a good outcome.

If this is successfully carried forward, the student will, from here on, make the presentation drawing, the plans, the elevations, sections, views, walk through etc. and be on the way to complete the architectural designs.

6. Conclusions: Students and the design teachers have to work in close coordination to have a successful design program. Each teacher is gifted with his own special abilities to design but it requires more than his personal abilities as a designer to teach design to a student. These format/guidelines are prepared to keep the teaching of the subject to a predetermined structure so that every teacher and student knows where and how he is to proceed.

The Teacher shall develop his References From various Sources.

Note: Structure and Services considerations in the design have to be evaluated after the design development stage with separate marking weightage. This is to be conducted as a panel viva.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR854	Field Documentation (Larger Area)	1	0	5	4

Course Objective This studio aims to inculcate amongst the students the research methods for exploring into different aspects of the built environment, from architectural elements to spatial environment. Their characteristics are to be studied in view of their creation being the outcome of a phenomena that occurred in the past or present, and their social, cultural and environmental impact while considering people in interface with their built habitats.

Anticipated Learning Outcomes: To expose students to extensive field documentation methods, so as to enable them to undertake such studies in future for research and projects.

Process

1. Choosing an area for investigation
2. Identifying the elements of research
3. Studying the phenomenon in live cases through personal visits
4. Drawing inferences about the cause-effect of the phenomenon
5. Different field observation techniques

Allied knowledge required

1. Architectural research methodology
2. Environment behaviour

Information to be provided by the Course instructor

1. The Studio Coordinators will select a theme for the semester relating to issues in architecture and planning.
2. Students will conduct research in groups on the topic of their choice within the larger theme. The research may involve both secondary and primary data from field studies.
3. The research will be presented in the form of a seminar presentation, followed by a paper of publishable quality. Overall supervision will be provided by the Studio Coordinators and each group will be guided for the research work by internal faculty/ external experts.

References

1. Ching, F. D. K. (2011). *A Visual Dictionary of Architecture*. 2nd Ed. Hoboken: John Wiley and Sons.
2. Lockard, W. K. (1992). *Drawing as a Means to Architecture*. 6th Ed. New York: Van Nostrand Reinhold Company.
3. Sanoff, H. (1991). *Visual Research Methods in Design*. New York: John Wiley and Sons.
4. Kothari, C.R. and Garg, G., *Research Methodology: Methods and Techniques*, New Age International Publishers.
5. Anderson, J. and Poole, M. (1998). *Thesis and assignment writing*. Brisbane: John Wiley.
6. Borden, I. and Ray, K. R. (2006). *The dissertation: an architecture student's handbook*. 2nd Ed. Oxford: Architectural Press.
7. Fink, A. (1998). *Conducting research literature reviews: from paper to the Internet*. Thousand Oaks: Sage.
8. Murray, R. (2005). *Writing for academic journals*. Berkshire: Maidenhead, Open University Press.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
6.	22AR862	Pre-Dissertation Studio	1	0	2	2

Course Objective At this stage the student is on the verge of preparing a final dissertation in the coming 10th semester, as such, this course will give the student a head starts by initiating him/her into the selection of an appropriate Dissertation topic.

Anticipated Learning Outcomes: To enable students to undertake extensive literature study and then review to arrive on a topic. To enable students to prepare a synopsis document for their thesis.

Area of studies on which the dissertation work could be based.

The Pre-Thesis Research shall be a research paper of a subject of theoretical/philosophy/current issues related to any aspect of Architecture, Urban design, Landscape Architecture, Sustainable Architecture, Architectural Conservation, which the student shall subsequently take up as Thesis topic. This course is a mandatory prerequisite to do the Design Thesis. The selected topic of each student shall be considered as the first module of the Design Thesis where the students will finalise their broad area of interest for the design thesis and the subsequent research will act as the primary literature review for the design thesis. Individual guidance can be provided by respective subject experts within the faculty of the institution, in special cases outside subject experts may be invited for guest lectures. By the end of the semester along with the research paper the students are required to prepare their preliminary proposal for the design thesis, further, more specific research and case studies can be done on their respective topics during the professional training semester.

Broad Course Structure:

1. Introduction, overview of subject, Research Methodology, critical reading, writing, referencing etc.
2. Lectures/seminars to clarify/discuss common mistakes/doubts among the students, and to discuss the common topics students would be dealing with.
3. Research Proposal, including the Research Problem, Background, Aim, Objectives and Research questions, Panel review to finalise the research topics.
4. Critical Reading/Literature Review, continuous assessment and assignments.
5. Writing, Referencing and Citations with review of stage wise submissions.
6. Submission of a final report

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.1	22CAR8713	Choice Based Studio 1. Design of Tall Buildings	1	0	3	3

Course Objective To introduce the design of high-rise buildings in the context of Urban areas.

Anticipated Learning Outcomes: Understand and design tall high-rise buildings, taking into consideration structural design, multi-use planning, fire and safety, vertical transportation, etc.

Module 1 Introduction to High-rise in the context of Urban Densification and social change.

Module 2 Concepts of structural design through use of geometry. Introduction to concepts of horizontal & vertical structural systems.

Module 3 Design considerations for tall buildings: Wind loads, Earthquake resistance, Foundations, etc.

Multi-use planning. Vertical transportation, environmental systems, vertical landscaping. Fire and safety considerations. Construction management & Modular Coordination.

Module 4 Design of a Tall building.

Note: Teacher to prepare her/his own references. References

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.2	22CAR8723	Choice Based Studio 2. GIS & Remote Sensing	1	0	3	3

Course Objective To introduce GIS and Remote sensing to the students as it is a very important tool for architects and planners in their effort to do their professional work.

Anticipated Learning Outcomes: Understand and interpret various types of satellite imagery, use GIS tools for planning and research works.

**Module 1
Fundamentals of Remote Sensing** Concept of satellite remote sensing: Types of satellites: Sun-synchronous and geostationary satellites; Platforms and sensors; Stages of remote sensing; Electromagnetic radiation (EMR); Electromagnetic Spectrum; Interaction with atmosphere; interaction with the earth surface; Remote sensing sensors and their characteristics; Spectral signature; Types of resolutions; Satellite data types and their uses; IRS satellites series, LANDSAT series, IKONOS, Quick bird and WV; Remote sensing data acquisition.

**Module 2
Fundamentals of GIS** Basic concepts of Geographic Information System; Concept of geo-informatics; Components of GIS; GIS data formats; Types of Data structure; spatial and non-spatial; Vector and raster data structure; Data models; tabular, hierarchical, network, relational, object oriented; Errors and accuracies in GIS.

**Module 3
Spatial Data Input and Analysis** Methods of data capture and input; Geo-referencing; Projection and datum; Coordinate transformation and re-sampling; Digitization of maps and satellite images; Generation spatial database; Attribute generation; Linking spatial and non-spatial data; Generation of thematic maps.

**Module 4
Manipulation, Analysis and Output** Data manipulation techniques; Spatial data analysis; overlay operations and proximity analysis; Data interpolation; point and line data; Network analysis and suitability analysis; Creation of database; contours, spot heights; 3D modelling; digital elevation models (DEM), slope and aspect; Query in GIS; Data output and presentation.

Note: Teacher to prepare her/his own references. References

References

1. Burrough PA and Rachael A. McDonnell, *Principles of Geographic Information Systems*, 2nd Ed.
2. Lo CP and Yeung AKW, 2004, *Concepts and Techniques of GIS*, Prentice-Hall of India, New Delhi
3. Heywood I, Cornelius S, Carver S, 2000, *Introduction to GIS*, Addison Wesley Longman, New York
4. Lilies and T M and Keller R W 2000. *Remote Sensing and Image Interpretation*, John Wiley and Sons, New York
5. George Joseph 2003, *Fundamentals of Remote Sensing*, University Press, Hyderabad
6. Sabinss, F. F., 1986, *Remote Sensing; Principles and Interpretation*, Freeman, New York
7. Rashid S M and Mazhar A. K., 1993 *Dictionary of remote sensing*, Manak Publishing House, Delhi
8. Fazal S and Rahman A, 2007, *GIS Terminology*, New Age International Publishers, New Delhi
9. Wolf, P.R., *Elements of Photogrammetry*, 2nd ed., McGraw Hill, New York, 1983.
10. Jeneson J R, *Introductory Digital Image Processing A Remote Sensing Perspective*, 2nd Eds. Printice Hall, New Jersey
11. American Society of Photogrammetry, *Manual of Remote Sensing*, 2nd ed., Falls Church, Va., 1983.
12. Rampal K.K., 1996, *Handbook of Aerial photography and interpretation*, Concept publishing company, New Delhi

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.3	22CAR8733	Choice Based Studio 3. Art Appreciation in Architecture	1	0	3	3

Course Objective To acquaint the student with the aesthetic principles, its appreciation and its association with architecture. The course is designed to create a deeper appreciation of the creative processes involved in visual arts. This course reviews two and three-dimensional art forms, examines the visual elements and principles of design, and briefly surveys art styles.

Anticipated Learning Outcomes: Ability to appreciate the broad spectrum of sensory arts, architecture being one of them; enable flowering of aesthetic sensibilities and a realization of the sensual appeal of physical form.

Module 1 Role and meaning of Art, various types of art – fine arts, performing arts, commercial arts, industrial art, folk art, abstract art, visual arts, special arts, temporal art, pop art, etc.

Relationship of architecture with other arts like painting and sculpture and the difference between them

Some arts are only seen from outside like sculpture, painting etc. Architecture, pottery, furniture, is seen from outside and used inside extensively.

Module 2 Aesthetic components of design/Art: Theories of Art- Abstraction, expressionism, formalism, mimesis, minimalism, naturalism, romanticism and symbolism

The elements of art - the visual components of colour, form, line, shape, space, texture, and value

Exploration of the basic principles of design (both Art and Architecture) such as Proportion, scale, balance, rhythm, contrast, harmony axis, symmetry, hierarchy, datum; Golden proportion,

Module 3 Use and need of ornamentation in architectural design- different types of ornamentation in buildings. Decoration in form of paintings, sculpture, and art in architecture. Painting, sculpture and other art

works in interior design. Murals in buildings. Information, signage and hoardings. Use of different materials like brick, timber, stone, concrete, glass, concrete, for aesthetic purpose in buildings.

Module 4

Art in Public Spaces: Public art can include murals, sculpture, memorials, signage, integrated architectural or landscape architectural work, community art, digital new media, and even performances and festivals.

Module 5

The teacher may take up studies which seem appropriate for the course.

Notes: Students will be familiarized with all forms of arts through continual exposure to creative works through presentations, film shows, seminars, discussion-debates, workshops, symposia, exhibitions etc., in which students can participate in interest-based groups

References

1. Francis D. K. Ching, *Architecture - Form, Space and Order*, Van Nostrand Reinhold Company, 1979
2. Roger H. Clark, Michael Pause, *Precedents In Architecture*, Van Nostrand Reinhold Company, 1996
3. K. W. Smithies, *Principles of Design in Architecture*, Van Nostrand Reinhold Company, 1981
4. Sam F. Miller, *Design Process - A Primer for Architectural and Interior Design*, Van Nostrand Reinhold Company, 1995
5. Ernest Burden, *Elements of Architectural Design – A Visual Resource*, Van Nostrand Reinhold Company, 1994
6. V. S. Parmar, *Design Fundamentals in Architecture*, Somaiya Publications, New Delhi, 1973.
7. Vitruvius, *Translation: Morris, H. M. (1960)*.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
7.4	22CAR8743	Choice Based Studio 4. Parametric Design	1	0	3	3

Course Objective Introduction to Parametric Design, Generative modelling, application to product design, architecture, landscape, digital fabrication, creation of physical and digital parametric models.

Anticipated Learning Outcomes: Ability to develop basic skills in using parametric tools.

**Module 1
Elements of
Parametric Design
and Design
Patterns** Introduction to Parametric design, Historical development of parametric design, The structure of parametric design processes, their characteristics and reusable parametric design approaches

**Module 2
Fundamental
Concepts of
Geometric
Modelling** Spatial coordinates, Projections, Boolean operations, Formal transformations, Freeform surface creation, Surface development and deformations aimed at architecture applications, Discretization and meshing, Digital prototyping and geometry reconstruction. Concepts in computational geometry applied to parametric architectural geometry modelling.

**Module 3
Parametric
Modelling
Techniques and
Tools** Introduction of tools for model design parametrically to illustrate the construction of geometrical relationships among complex shapes. Focus on hands-on techniques that can be applied to the design process, to extend the efficiency and productivity of work during the process. Use of various available software relevant to parametric design.

**Module 4
Digital Fabrication** Using 3D digital modelling to efficiently produce components without the need for 2D representation

**Module 5
Parametric Design
& Environment** Use of relevant plugins for simulation.

References

1. Gips, James. "Computer implementation of shape grammars." In *NSF/MIT workshop on shape computation*, vol. 55, p. 56. Cambridge, MA: Massachusetts Institute of Technology, 1999.
2. Piker, Daniel. "Kangaroo: form finding with computational physics." *Architectural Design* 83, no. 2 (2013): 136- 137.
3. Ingels, Bjarke. *Hot to cold: an odyssey of architectural adaptation*. No. 72: 504 72: Medio Ambiente. BIG Bjarke Ingels Group., 2015.
4. Schumacher, Patrik. "Parametricism: A new global style for architecture and urban design." *Architectural Design* 79, no. 4 (2009): 14-23.
5. Sakamoto, Tomoko, ed. *From control to design: parametric/algorithmic architecture*. Actar-D, 2008.

SEMESTER – IX

This semester would comprise compulsory practical professional training for the entire academic session.

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
1.	22AR914	Office Training	-	-	-	4

Students are required to be involved in all aspects of office works-conceptual design; presentation drawings and detailed working drawings; 3 D modelling; estimation and specification of small buildings; interaction with clients, structural consultant and other building services consultants.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
2.	22AR924	Site Supervision Work	-	-	-	4

The aim of this training is to give exposure to the students on different stages of construction on the site and to learn how drawings are executed at the construction site. The student is required to prepare and submit a report comprising a set of working drawings, sketches, photographs etc. to supplement his/her observation.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
3.	22AR933	Critical Appraisal of Buildings	-	-	-	3

A student may select any small project and trace down its development from early conceptual design stage to procedure adopted in decision making at inception level to series of changes in the process of approval with due consideration to constraints such as financial, human and building bye-laws. Design changes during the execution and changes done by the client after occupation also need to be identified along with reasons thereof. Users 'reaction to different physical planning aspects also need to be critically evaluated with respect to their performance, usefulness etc.

The study is to be presented in the form of a report comprising a series of sketches, photographs supported by brief analysis and observation etc.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
4.	22AR943	Documentation of Architectural Details	-	-	-	3

Documentation of at least 20 details of innovative construction practices from personal observation, office record or field studies. These may include historical as well as contemporary details. The selection of details should be based on their special nature due to a practical need/situation.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR953	Study and documentation of Office communication with client, contractor and statutory authorities	-	-	-	3

Documentation of office communication with clients, contractors and statutory authorities; Study the letters critically, make corrections professionally and place them in a document file.

SEMESTER – X

THEORY SUBJECTS

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
1.	22AR013	Professional Practice (Manual of Architectural Practice of COA)	3	0	0	3

Course Objective

To enable the students to understand the logistics of state & central govt. in enhancing better living conditions to all without losing the interest of self. It lays down the criteria for constructing built up spaces in cities & sub-urban; good PH & Sanitation; safety & security, etc. and familiarize the students about current professional practice guidelines, codes, ethics as well as norms of professional fees & charges. It will expose them to skills and techniques for organizing a particular project, its preparation and execution etc. The same course will also contribute in getting acquainted with project management, contractual implication as well as legal formalities.

Anticipated Learning Outcomes:

To familiarize students with legislations applicable to architects, procedures for engagement in architectural services, aspects of setting up and being part of an architectural office. Familiarity with the procedures for tendering, arbitration, valuation of works and real estate and aspects of international practice. Proficiency in preparation of projects proposals and presentations for procuring projects.

Module 1 Practicing Architecture

Introduction to Architects duties and liabilities, salient features of architect's act 1972, the Council of Architecture, New Delhi.

Understanding office management and project awarding; organization structure, responsibility towards employees, consultants & associates; maintenance of accounts; filing of records; balance sheet, Income tax; Service tax; Professional tax.

Various architectural services, additional services and scale of professional fees.

Building regulations related to submission of approval drawings to concerned public bodies.

Refer: Volume ONE, FOUR & FIVE: Guidelines for Architectural Practice (Manual of Architectural Practice)

**Module 2
Architectural
Competitions &
Legislations**

Regulations governing the conduct of competitions, open & closed competitions.

Role of development authorities & urban arts commissions, Environmental acts & laws, special rules governing hill area development & coastal area management, heritage act of India etc. Prerequisite for Indians to work in other countries & vice versa, emerging trends in architectural collaborations.

Refer: Volume Two: Guidelines for Engagement of Architects and Code for Competitions (Manual of Architectural Practice)

**Module 3
Tender & Contract**

Types of tenders, invitation of tender and conditions of tender documents, submission, scrutiny, recommendations & award of contract.

Definitions and general principles of Indian Contract Act 1872 and building, contract documents, conditions of contract, Execution of contract, various certifications, defects liability.

Refer: Volume THREE: Guidelines for Architectural Contracts (Manual of Architectural Practice)

**Module 4
Arbitration**

Need for Arbitration, Principles of Indian Arbitration Act-1974, role of arbitrators, umpire etc, excepted matters, arbitral award.

Municipal Acts, Fire prevention, safety and security measures in buildings.

Module 5

The Practicing Architect's responsibility and commitment to Internships - which form an integral part of the CoA's endeavour to link graduating students with the realities of actual professional practice.

Refer: Volume FIVE: General Advisory (Manual of Architectural Practice)

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. COA. (2022) *Manual of Architectural Practice*
2. COA. (1989). *Architects (Professional conduct) Regulations, Architectural Competition guidelines*. Council of Architecture Publications.
3. COA. (2005). *Handbook of Professional Documents*. Council of Architecture.
4. R H. Namavati, *Professional practice*, 7th ed, Lakshmi Book Depot, Mumbai, 1997.
5. *Environmental Acts of the Ministry of Environment and forests*, Govt. of India
6. *Architects Practice*, J.J.Scott.
7. *Handbook of Professional Practice*, Madhav Deobhakta.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
2.	22AR023	Construction & Project Management	3	0	0	3

Course Objective To equip students with a practical approach to implement building projects, basic knowledge about construction industry, project management techniques needed for managing and coordinating building projects in a professional manner.

Anticipated Learning Outcomes: Ability to use project management techniques and quantitative methods in project definition, administration of contracts, billing and verification, monitoring quality at site and participating in preparation of Detailed Project Report.

Module 1 Introduction Introduction to Construction Industry- Significance, objectives and functions, stakeholders, roles, responsibilities and functional relationships;

Construction projects – objectives and lifecycle, existing construction practices and project management systems; Project scale.

Project Team, organization, roles, responsibilities, Management Ethics (human aspects) in construction projects, Labour welfare, applicable labour legislations.

Module 2 Project Planning Concepts of project planning, scheduling and controlling.

Management Techniques-Planning for Construction Projects: Principles, objectives, advantages of planning, stages of planning;

Scheduling: Definition, advantages, methods of scheduling: Bar chart, Milestone chart; Controlling, Work Break-down Structure (WBS)

Module 3 Project Scheduling & Resources Management Project Management through Networks-Introduction, objectives, advantages, terms and definitions, types of networks, rules for drawing a network;

Introduction to PERT, CPM, difference between PERT and CPM, Network analysis – forward and backward passes, finding critical path;

Methods of material/resource management- Project time reduction and optimization, resource levelling and resource allocation.

**Module 4
Project Monitoring
& Control**

Construction equipment types, characteristics and applications, Quality tests for construction material and processes, Quality control inspections.

Site organization, Project progress tracking.

Finance and Risk management - Financial analysis of projects, Project direct and indirect costs. Crashing Project Schedules, its impact on time, cost and quality. Safety in Construction Projects.

Module 5

To be decided by the Subject teacher and may include: Assignments/ exercises on preparing a project schedule; writing site inspection reports; sample correspondence for notices to contractors, work-orders, presentations for review meetings etc.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. Punmia, B. C., and Khandelwal, K. K. (2006). *Project planning and control with PERT and CPM*. New Delhi: Laxmi Publications.
2. Wiest, J. D., and Levy, F. K. (1982). *A Management Guide to PERT/CPM*. New Delhi: Prentice Hall of India.
3. Chandra, P., *Projects: Planning, Analysis, Selection, Financing, Implementation and Review*, McGraw Hill Education (India) Private Limited.
4. Mukhopadhyay, S.P., (1974), *Project Management for Architect's and Civil Engineers*, IIT, Kharagpur.
5. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E. (1992). *Construction Project Scheduling*. McGraw-Hill.
6. Chitkara, K. K. (2004). *Construction Project Management: Planning, Scheduling and Controlling*. Tata McGraw-Hill Education.
7. O'Brien, J. J., and Plotnick, F. L. (2009). *CPM in Construction Management*. Mc Graw Hill Professional.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.1	22EAR0313	Elective 1. Architectural Heritage Conservation	3	0	0	3

Course Objective This course intends to develop an understanding in Architectural conservation.

Anticipated Learning Outcomes: Ability to appreciate both tangible and intangible heritage and apply methodologies for conservation management.

Module 1 Meaning of Architectural Conservation, need and degrees of conservation.

Module 2 History of conservation in India and West, conservation charters, role of Archaeological survey of India in conservation of India's cultural heritage.

Listing and documentation, its importance and methods.

Module 3 Urban conservation, methodologies to be adopted for conservation management.

Module 4 Case studies in conservation related to Adaptive reuse, Building in context, preservation, Urban conservation.

Module 5 Case studies as suggested by the faculty.

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Handbook on Architectural Conservation by Sir Bernard Fielden. INTACH, New Delhi.*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.2	22EAR0323	Elective 2. Real Estate Management	3	0	0	3

Course Objective To acquaint the students with the issues, regulations and functioning of Real Estate market, economic concepts, land acquisition, legal matters concerning land and property.

Anticipated Learning Outcomes: Exposure and awareness to different concepts of real estate development in the Indian context.

Module 1 Type of land and property; Land use planning and Urban Land Management; Land as a resource of Urban Development (supply and demand of land);

Basic components of Urban Land Policy; Land assembly; Land Pooling techniques; Land Holding (Freehold and Leasehold).

Module 2 Land and building related regulations; Building Bye laws, Real Estate laws; Apartments Act, Land registration and Society Registration Act.

Module 3 Comparison of Housing policies and Real Estate development in India;

Master Plan guidelines in relation to real estate growth; Real Estate management concepts.

Module 4 Concepts of mixed-use development; condominium;

Gated Community and serviced apartments.

Module 5 Case studies as suggested by the faculty

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Gelbtuch, H.C., Mackmin, D. and Milgrim, M.R., Real Estate Valuation in Global Markets, Amazon Books*
2. *Rangwal, S. C., Valuation of Real Properties, Charotar Publishing House, 2003*
3. *Chapin, S., and Keeble, L., Urban Land Use Planning*
4. *Urban Development management I.T.P.I. Journal*

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.3	22EAR0333	Elective 3. Environmental Impact Assessment (EIA)	3	0	0	3

Course Objective To familiarize students with social, economic and environmental impacts of buildings as well as large scale developments.

Anticipated Learning Outcomes: Ability to understand sustainable systems and utilities and their integration and management at building and site levels

Module 1 Introduction to EIA. Role of EIA in the Planning and decision-making process, definition and need, evolution and objectives, tasks and scope, methods of EIA; advantages and limitations.

Module 2 Environmental consequences of building projects, sensitive projects and large developments.

Module 3 Impact areas and assessments, prediction and mitigation of negative impacts, administrative procedures and clearances.

Module 4 Environmental impact of traffic; Energy issues in transportation, Transportation policies and safety standards.

Module 5 Case studies as suggested by the faculty

Text Books

1. Kulkarni, V., and Ramachandra, T.V., *Environmental Management*, Capital Publishers, New Delhi, 2006.
2. Mary, K. T., *Introduction to Environmental Management*, Taylor & Francis, 2009.

References

1. Barrow, C.J., *Environmental Management: Principles and Practice*, Routledge, 1999.
2. Kanholm, J., *EMS Manual, 21 Procedures and Forms*, AQA Press, USA, 2000.
3. Holling, C.S., *Adaptive Environmental Assessment and Management*, John Willey & Sons, New York, 1987.
4. Meadows, D.H., Meadows, D.L., and Randers, J., *Beyond the Limits – Global Collapse or Sustainable Future*, Earth Scan Publications Limited, London, 1992.

Sl. No.	Sub. Code	Theory	Contact Hours			Credit
			L	T	P/S	
3.4	22EAR0343	Elective 4. Building System Integration & Management	3	0	0	3

Course Objective To familiarize students to advanced building systems and their integration to achieve effective functioning.

Anticipated Learning Outcomes: Awareness about integrated building management systems. optimization of various systems, and home automation technology.

Module 1 System and Sub-systems in buildings, relationship and analysis of subsystems.

Module 2 Building systems for different building typologies, Optimization and sub-system;

Module 3 Control systems for various buildings services, Types of controllers. Preparation of necessary drawings for installing control systems.

Module 4 Integrated building management system, remote monitoring and management, Home automation, Developments in service control systems.

Module 5 Case studies as suggested by the faculty

Note: Most Architectural subjects do not have Textbooks. The Reference books mentioned below are for reference only and University question paper should be prepared from the Syllabus descriptions.

References

1. *Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs)* by Reinhold A. Carlson, Robert A. Di Gian Domenico.
2. *Building Control Systems, Applications Guide (CIBSE Guide)* by The CIBSE (2000).
3. Sinopoli J. (2010). *Smart Building Systems for Architects, Owners and Builders*. Elsevier Inc. USA.

SEMESTER – X

SESSIONAL SUBJECTS

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
4.	22AR0415	Architectural Dissertation	0	0	21	15

Each student is expected to prepare a design thesis under a department approved guide/ advisor. The thesis should be a design-oriented project but could have a research component and approved by the department. The thesis should reflect the knowledge gained from the entire course taken by the student in all the previous semesters.

The topic should be related to the student's Pre-Dissertation selected topic. The particular schedule, content presentation, format etc. As decided by the department, from time to time, shall be strictly followed.

At the end of the semester each student is expected to submit all original drawings prepared as per the department's specification, 3 copies of thesis report in the specified format and a model to the department after obtaining approval of the respective guide/ advisor.

The department shall schedule the final Viva Voce, which is to be conducted by an external jury/panel after the Thesis submission.

Sl. No.	Sub. Code	Sessional	Contact Hours			Credit
			L	T	P/S	
5.	22AR053	Comprehensive Viva-Voce	-	-	-	3

A viva voce would be conducted by a panel of teachers of the department. The viva would cover the topics related to the various subjects taught to the students throughout their five-years of B. Arch and would also contain topics of general nature related to Architecture.