K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ARCHITECTURE & PLANNING (SOAP)

BACHELOR OF ARCHITECTURE

B. Arch

Programme Code: 16

2018–23

Approved in the 17th Meeting of Academic Council Held on 29 June 2018

Academic Council
Member Secretary
K.R. Mangalam University

Registrar
K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

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Preface

K.R. Mangalam University envisions all its programmes in the best interest of the students. It imbibes an outcome based curriculum for all its programmes to provide a focused, student-centric syllabus with an agenda to structure the teaching-learning experiences in a more outcome based manner.

The outcome based curriculum strengthens students' experiences and prepares the students for academia, employability and life-long learning.

Each programme reflects the promise to accomplish the learning outcomes by studying the courses. The graduate attributes encompass values related to the well-being, emotional stability, critical thinking, and social justice.

The redesigned curriculum focuses on the multi-disciplinary nature of the field of design with emphasis on core de

sign subjects with skills to represent the process of design graphically.

Another important part is the aspect of realizing the concept into graphical representation and a workable design. Students are exposed to research and hands on project-based education with active studio sessions. Visiting faculty and external examiners are professionals and academicians chosen from the field of design. Students develop their design with inputs from a highly driven team of faculty members and working professionals.

K.R. Mangalam University hopes that the outcome based curriculum will help students in realizing their careers as informed, sensitive and creative architects and designers.

Salient features of this model curriculum are:

1. Curriculum has been designed in such a way that it encourages innovation and research.
2. The revised curriculum has been designed where the students can understand the industry requirements and have hands-on experience.
3. The students will develop a problem-solving approach and will meet the challenges of future.
4. Emphasis on hands-on training has been promoted by including six-months Professional Training in eighth semester.
5. Bachelor of Architecture Department will ensure the revision of the curriculum to help students to achieve better employability, start-ups, and other avenues for higher studies.

ACKNOWLEDGEMENT

Programme : Bachelor of Architecture
Year/ Semester : 5 Years/ 10Semesters Session : 2018-23

The development of an outcome-based Model Curriculum for Undergraduate degree courses in the Department of Architecture is a result of thoughtful deliberations at various stages of dedicated and specialized experts. This model curriculum has been framed to meet the expectations of an academically challenging environment, develop problem-solving skills by students and align with current standards and to enrich the students to make them self-enablers and/or match job requirements on successful completion of their degrees.

We are greatly gratified Ms. Manvi Arora for her supervision contribution, guidance, and support throughout the development of this curriculum. Special thanks and gratitude to Prof. Aditya Malik, Vice Chancellor, K.R. Mangalam University and Prof. Pushplata Tripathi, Pro-Vice Chancellor and Registrar, K.R. Mangalam University who have been instrumental and encouraging throughout the process of developing this curriculum. Last, but not the least, we also sincerely thank to Ar. Hemani Singh and Ar. Pankaj Dhayal who have contributed for development of this curriculum.

We acknowledge by signing below that we have received and access to a copy of syllabus of the B.Arch Programme indicated above. We have redesigned the B.Arch syllabus in Outcome Based Format and understand the programme specific outcomes of the B.Arch Programme.

Furthermore, we acknowledge that the contents of the B.Arch syllabus have been explained and/or read to us. We understand the requirements concerning textbook(s), assignments, practicum and evaluation and how the final grades will be determined with respect to achieving Course Outcomes.

Prepared by:
Ar. Nisha Sharma
(Assistant Professor)

Verified by:
Prof. Hemani Singh
(Dean SOAD)

Approved by:

Registrar

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1. V.K. Jain, Building Services, Khanna Publishers. 60
2. S.K. Garg, Water Supply Engg. Khanna Publishers. 60
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- **Introduction to the study of acoustics, basic terminology, sound and distance – inverse square law; absorption of sound, sound absorption co-efficient. 77**
- **Reverberation time, Sabines' formula, various sound absorbing materials. Behavior of sound in enclosed spaces, Acoustical defects 77**
- **Noise and its types – outdoor and indoor noise, air born noise, structure borne noise, impact noise. 77**
- **Noise control at neighborhood and city level. 77**
- **Acoustical design for halls used for drama, music, speech, cinema theatres and open air theatres. 77**
- **Acoustical materials and constructional measures of noise control, insulation of machinery, sound insulation. 77**
- **Human Comfort conditions, Need for mechanical ventilation in buildings. Rate of ventilation for different occupancies, Methods and equipment employed for mechanical ventilation in buildings 78**

UNIT IV: 79

- **To understand design limitations due to regulations and byelaws and making drawing/ details necessary for final execution of a project. 80**

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1. Introduction

The K.R. Mangalam Group has made a name for itself in the field of education. Over a period of time, the various educational entities of the group have converged into a fully functional corporate academy. Resources at KRM have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly inter-disciplinary environment where in they develop integrative skills through interaction with students from engineering, social sciences, management and other study streams.

The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education the focus of the group was aimed at higher education. With the mushrooming of institutions of Higher Education in the National Capital Region, the university considered it very important that students take informed decisions and pursue career objectives in an institution, where the concept of education has evolved as a natural process.

K.R. Mangalam University is established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

K. R. Mangalam University Is Unique Because of Its

Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

2. Objectives

a) To impart undergraduate, post graduate and doctoral education in identified areas of higher education.

b) To undertake research programmes with industrial interface.

c) To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.

d) To act as a nodal center for transfer of technology to the industry.

e) To provide job oriented professional education to the Indian student community with particular focus on Haryana.

3. About School

SCHOOL OF ARCHITECTURE & PLANNING (SOAP) includes:

I. Department of Architecture
   i. Bachelor of Architecture (B.Arch): Council of Architecture (COA) approved five years Programme

3.1. School Vision

The School aspires to become a leading Architecture and Design school by empowering the students with knowledge, confidence and skillset required to navigate their professional path as innovative, creative, socially responsible professionals contributing to nation building through ethical design practices grounded in sustainability and multidisciplinary awareness.

3.2. School Mission

a) To establish a foundation for lifelong learning

b) To apply current educational theories that see learning as a process wherein the learner constructs or builds new concepts, focusing on learner-centric education vs. teacher-centric education.

c) To transform the role of teacher to that of facilitator, guide and mentor and not a transmitter of information

d) Enhance employability and entrepreneurship through interdisciplinary curriculum and progressive pedagogy with latest technology to produce graduates capable of critically synthesizing architecture, engineering systems, social sciences and entrepreneurial skills.

e) Developing active leadership skills as project leaders with understanding of various disciplines and collaboration with all stakeholders.

f) To encourage diverse learning styles, acknowledging Kolb's Experiential Learning Theory, which suggests that learning is cyclical and moving through this continuum over time every learner discovers the learning style best suitable to the person.

g) To enable students to learn to find meanings and connections by critical contemplation of available resources, strengthening the innate skills of reflection, evaluation, re-iteration and research.

h) To empower learning by doing. The Design studio is considered both a course and a place of study at the heart of an academic environment fostering design thinking that is simultaneously analytical and creative.

i) Develop ethical professional qualities among the students with understanding of environmental realities and context related design.

4. Department of Architecture

Department of Architecture offers undergraduate Bachelor of Architecture (B.Arch): Council of Architecture (COA) approved five years Programme.

4.1. Graduate Attributes

GA1: Creative, Sensitive and Adaptable architecture Professional

GA2: Equipped with Professional Ethics

GA3: Good at communication: Interpersonal and graphical.

GA4: Rational decision maker

GA5: Collaborative with multidisciplinary knowledge

GA6: Good at Modern Technology Usage.

5. The Programme B.Arch

Bachelor of Architecture (B. Arch.): Approved by Council of Architecture, India

Architecture is a challenging field that involves merging & intermingling to the skills of art and science. This programme is designed to attain a high level of contextual excellence in the arena of architectural design. Theory, Studio & Applied subjects are undertaken in the course structure of this programme; with crucial inputs by experts in the field of Art, Architecture, Planning, Engineering and Technology. At the end of the Programme, the students graduate with a strong foundation of multi-disciplinary skills related to environment friendly and sustainable design, construction techniques, space transformations and aesthetical features.

5.1. Eligibility Criteria

Only candidates who have the following credentials shall be eligible for admission to B.Arch. Course.

a) Qualified recognized aptitude test in Architecture (NATA or equivalent).

b) Have gone through any of the following curriculum with Marks as prescribed below:

10+2 or equivalent examination of central/State Govts. with 50% aggregate marks and with Physics, Chemistry and Mathematics as compulsory subjects of examination ; or

10+3 Diploma (any stream) recognized by Central /State Govts. with 50% aggregate marks with Mathematics as a compulsory subject of examination ;or

5.2. Career Options

Opportunities exist in both public & private sector, in the field of Architecture & Building construction industry. Independent professional practice is also an option in this field.

5.3. Programme Duration

The Minimum duration for the completion of B.Arch. Programme offered by the university is 5 years. i.e. 10 semesters.

As per COA directives & regulations this programme shall comprise of two stages: Stage-I (First 3 years) & Stage-II (Fourth & Fifth Year).

The candidates admitted to the programme shall have to complete the first stage within five years of admission to the programme. However, the maximum time allotted to complete both the Stages (I +II) is 8 years.

5.4. Class Timings

The classes will be held from Monday to Friday from 9.10 am to 4.10 pm.

5.5. Programme scheme

For B.Arch Programme Scheme is attached in Annexure I.

5.6. Syllabi

The syllabi of all courses for first year for B.Arch. program offered by SOAP are given in the following pages. These are arranged in numeric order of the last three digits of the course code. For each course, the first line contains; Course Code, Tittle and credits (C) of the course. This is followed by the course objectives, syllabus (Unit I to IV), Text book and reference books.

5.6.1. Two Year B.Arch Course at a Glance

	Courses	**Credits**
Semester I	7	32
Semester II	8	26
Semester III	9	28
Semester IV	7	27
Semester V	8	27
Semester VI	7	31
Semester VII	6	27
Semester VIII	1	18
Semester IX	4	22
Semester X	2	22
Total	**59**	**264**

5.6.2. Course Structure for B.Arch Programme

SEMESTER I			
S.no	Course Code	Course Title	Credits
1	APAR117	BASIC DESIGN & CREATIVE WORKSHOP	12
2	APAR119	INTRODUCTION TO BUILDING MATERIALS	2
3	APAR127	HISTORY OF CULTURE & CIVILISATION	2
4	APAR123	ARCHITECTURAL DRAWING-I	6
5	APAR125	ARTS & GRAPHICS-I	4
6	APCE113	STRUCTURAL DESIGN-I	3
7	APCH125	ENVIRONMENTAL STUDIES	3
		Total	**32**

SEMESTER II			
S.no	Course Code	Course Title	Credits
1	APAR118	ARCHITECTURAL DESIGN-I	6
2	APAR120	BUILDING CONSTRUCTION & MATERIALS-I	6
3	APAR128	THEORY OF DESIGN	2
4	APAR124	ARCHITECTURAL DRAWING-II	4
5	APAR126	WORKSHOP	2
6	APCE114	STRUCTURAL DESIGN-II	3
7	APEL101	COMMUNICATION SKILLS	4
8	APEL171	COMMUNICATION SKILLS LAB	1
		Total	**26**
SEMESTER III			
S.no.	Course Code	Course Title	Credits
1	APAR217	ARCHITECTURAL DESIGN-II	8
2	APAR219	BUILDING CONSTRUCTION & MATERIALS-II	6
3	APAR241	HISTORY OF ARCHITECTURE-I	2
4	APAR239	ENVIRONMENT & CLIMATE	2
5	APAR225	ARTS & GRAPHICS-II	3
6	APAR227	COMPUTER APPLICATION IN ARCHITECTURE-I	2
7	APCE237	STRUCTURAL DESIGN-III	3
8	APCE233	SURVEYING & LEVELLING	1
9	APCE235	SURVEYING & LEVELLING LAB	1
		Total	**28**

SEMESTER IV			
S.no.	Course Code	Course Title	Credits
1	APAR218	ARCHITECTURAL DESIGN-III	8
2	APAR220	BUILDING CONSTRUCTION & MATERIALS-III	6
3	APAR226	HISTORY OF ARCHITECTURE-II	2
4	APAR222	ARCHITECTURAL GRAPHICS	4
5	APAR224	COMPUTER APPLICATION IN ARCHITECTURE-II	2
6	APCE228	STRUCTURAL DESIGN-IV	3
7	APCE230	BUILDING SERVICES-I (WATER SUPPLY & SANITATION)	2
		Total	**27**

SEMESTER V			
1	APAR325	ARCHITECTURAL DESIGN -IV	10
2	APAR331	BUILDING CONSTRUCTION & MATERIALS-IV	6
3	APAR327	MODERN WORLD ARCHITECTURE	2
4	APAR329	HOUSING	2
5	APAR323	COMPUTER APPLICATION IN ARCHITECTURE-III	2
6	APCE315	STRUCTURAL DESIGN-V	3
7	APCE317	ESTIMATING, COSTING & SPECIFICATIONS	2
8	APEE321	BUILDING SERVICES-II (ELECTRICAL & LIGHTING)	2
		Total	**27**

SEMESTER VI			
S.no.	Course Code	Course Title	Credits
1	APAR318	ARCHITECTURAL DESIGN-V	10
2	APAR320	BUILDING CONSTRUCTION & MATERIALS-V	6
3	APAR336	TOWN PLANNING	2

4	APAR310	WORKING DRAWING & BUILDING BYELAWS	6
5	APCE332	STRUCTURAL DESIGN-VI	3
6	APAR328	BUILDING SERVICES-III (ACOUSTICS)	2
7	APAR334	AIR CONDITIONING & MECHANICAL SERVICES	2
		Total	**31**

SEMESTER VII			
S.no.	Course Code	Course Title	Credits
1	APAR419	ARCHITECTURAL DESIGN -VI	10
2	APAR421	BUILDING CONSTRUCTION & MATERIALS-VI	6
3	APAR431	PROFESSIONAL PRACTICE & OFFICE MANAGEMENT	2
4	APAR425	PROJECT CONSTRUCTION MANAGEMENT	3
5		ELECTIVE-I	3
6		ELECTIVE-II	3
		Total	**27**

SEMESTER VIII			
S.no.	Course Code	Course Title	Credits
1	APAR402	PROFESSIONAL TRAINING	18
		Total	**18**

SEMESTER IX			
S.no.	Course Code	Course Title	Credits
1	APAR519	DISSERTATION	6
2	APAR521	URBAN DESIGN	10
3		ELECTIVE-III	3
4		ELECTIVE-IV	3
		Total	**22**

SEMESTER X			
S.no.	Course Code	Course Title	Credits
1	APAR520	ARCHITECTURAL THESIS	18
2	APAR522	SEMINAR	4
		Total	**22**

LIST OF ELECTIVES			
S.no.	Course Code	Course Title	Credits
	For Elective I & II		
1	APAR411A	Art Movements & Architecture	3
2	APAR427A	Site Planning & Landscape Design	3
3	APAR415A	Intelligent Buildings	3
4	APAR509A	Water Resource Management	3
5	APAR511A	Integrated Waste Management & Technology	3
6	APAR513A	Interior Design	3
	For Elective III & IV		
7	APAR407A	Architectural Conservation	
8	APAR507A	Low Cost Construction Technology	3
9	APAR433A	Visual Arts	3
10	APAR413A	Sustainable Architecture	3
11	APAR515A	Vernacular Architecture	3
12	APAR517A	Structural Systems	3

6. DETAILED SYLLABUS

SEMESTER I

		L	T	S	P	C
APAR117	BASIC DESIGN & CREATIVE WORKSHOP	-	-	12	-	12

COURSE OBJECTIVE:

- Basic Design provides the framework for understanding design as a new language by sensitizing students to the conceptual, visual and perceptual issues involved in the design process.
- The Course sensitizes to the principles of design and design elements.
- Exercises complement the theories of design and ensure that the students learn to develop a series of compositions in two and three dimension.

UNIT I

Introduction to design:

- Meaning of design, Importance of design, Design in everyday life, Appreciation of Design in nature.
- Exercises in terms of sketching of objects available in nature and surroundings.

UNIT II

Elements of design:

- Fundamental elements of design and their definitions-point, line, shape, form, space, texture, value and colour.
- Forms (2D&3D) created through points (segments), lines (columns) and planes (volumes), and combination thereof; using various techniques & materials like Paper, Card board, Mount board, Thermocol, Styrofoam, Softwood, Acrylic sheets, wires etc.

UNIT III

Principles of Design:

- Introduction to the principles, of design-unity, balance, symmetry proportion, scale, hierarchy, rhythm, contrast, harmony, focus etc. use of grids, creating repetitive patterns.
- Theoretical inputs to be followed by exercises to develop the ability to translate abstract forms in 2D & 3D into compositions depicting various principles of design.
-

UNIT IV

Organic Designs:

- Appreciation of design through various organic forms in nature & various design principles they exhibit. Introduction to Biomimicry.
- To be followed by exercises to create organic forms using clay, Plaster of Paris, Metal scrap, Jute fiber etc.

Text Books:

1. Ching, Francis D. K., "Architecture: Form, Space, and Order", Wiley and Sons

Reference Books:

1. Wallschlaeger, C and Snyder, S.B., "Basic Visual Concepts and Principles for Artists, Architects and Designers", McGraw Hill.
2. Laseau, P, "Graphic Thinking For Architects and Designers", John Wiley and Sons

APAR119	INTRODUCTION TO BUILDING MATERIALS	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- To developed the understanding about elementary building materials & their applications.
- Properties of materials such as physical properties, structural strength, thermal & acoustical behavior - direct & indirect insulation, reflection and emission.

UNIT I

Stones:

- **C**lassification; sources, properties of constituent components; methods of quarrying stones; uses, test for stones & quality of good building stones.

UNIT II

Soil:

- formation – index property, specific gravity, grain size distribution, plasticity, characteristics & phase relationship, identification and local names; ISI classification; sources & uses of sand; fineness modulus.

Lime:

- Definitions, classification, properties, sources, constituents of lime stone, manufacturing, uses, test.

UNIT III

Clay and Clay Products:

- **Bricks:** classification of bricks; properties of constituent components, manufacturing process, quality test of bricks - Burnt Bricks, Brick Tiles, fly ash bricks, Brick Ballast and Surkhi.
- Terracotta-manufacturing, varieties, advantages, uses & products.

UNIT IV

Timber

- Difference between Wood & Timber, sources, classification, structure of a tree, processing, seasoning, conversion preservation & storage of timber
- Defects, qualities of good timber used in construction.

Text Books:

1. Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

Reference Books:

1. Farrelly, Lorraine, "Basic Architecture 02: Construction + Materiality", Ava Publishing
2. Agarwal, A., "Mud: The Potentials of Earth based Material for Third World Housing", IIED
3. HUDCO, "All you wanted to know about Soil Stabilized Mud Blocks", 4.Watson, Donald
4. "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill

APAR127	HISTORY OF CULTURE & CIVILIZATION	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVES:

- To generate an understanding about the development of civilizations and its impact on Habitat as a solution to the need or demands of the society.
- Understanding of the periods in terms of their context of location, climate as well as the socio-cultural, historical, economic and political influences of the time.
- Understanding the evolution of architecture from a basic need for shelter to the development of aesthetics and Order.

UNIT I

Primitive Beginnings and Birth of Civilizations

- Introduction to History and Architecture with special emphasis on Stone Age to Neolithic settlements in India, examples from Carnac, Bhibeteka & Stonehenge.
- In reference to the Asia-minor region with nascent cities like Jericho, Catalhayuk, and Hattasus etc.

Indus Valley Civilization

- Particularly in reference to the town planning principles exemplified with examples from Mohenjo-Daro and Harappa.

UNIT II

The Vedic / Aryan civilization

- With its emphasis on the Vedic town plan, its motifs and patterns.

Mesopotamian Civilization

- With special attention to cities of Mesopotamian like Ninveh, Khorsahbad, Marie, Babylon, and architectural constructs like Ziggurat.

UNIT III

Egyptian Civilization

- Particularly in reference to social & political context of Tomb Architecture and Temple Architecture with examples.

Aegean civilization

- Characteristic features of Aegean and Helladic architecture, with special reference to cities like Troy, Sparta and Mycenae, which formed the basis of Greek civilization.

UNIT IV

Greek & Roman civilization:

- Evolution of Greek and Roman architecture- factors affecting development
- Hellenic and Hellenistic periods; Etruscan architecture and the Roman period.

Greek Architecture

- Classical orders: mainly Ionic, Doric & Corinthian.
- Geometry and symmetry in their buildings; Geometry and symmetry of individual buildings and their relationship with others based on different organizing principles and conditions of site.
- Study of important acropolis, agora, temples, theatres, tombs and house forms.
- Brief introduction to Architecture, the classical orders & the advancements in construction techniques of the Romans (vaults & domes & stucco).

Roman Architecture:

- Invention of concrete and construction of walls vaults and domes.
- Social ,political & economic influence on the development of Roman architecture
- Study of structures like aqua ducts, bridges, roads, sewage system and fountains.

- Study of important buildings like forums, temples, basilicas, thermaes, theatres, amphitheaters, circuses, tombs, triumphal arches, palaces, houses and villas

Text Books:

1. Hiraskar, G.K., "The Great Ages of World Architecture (with Introduction to Landscape Architecture)", Dhanpat Rai Publications (P) Ltd.

Reference Books:

1. Maheshwari and Garg, "Ancient Indian Architecture", CBS,
2. Grover, S. K., "Buddhist and Hindu Architecture in India", CBS,
3. Thapar, B., "Introduction to Indian Architecture", Periplus Editions
4. Surendra S., "Indian Architecture: Hindu, Buddhist and Jain", Ajanta Offset and Packaging Ltd.
5. Risebero, Bill, " The Story of Western Architecture", MIT Press
6. Ching Francis D.K., Jarzombek, Mark M., Prakash, Vikramaditya, "A Global History of Architecture", Wiley
7. Cruickshank, D., Fletcher, B., Saint A., "Banister Fletcher's - A History of Architecture", Architectural Press.
8. Brown Percy, Indian Architecture- Volume I and II, Apt Books.

APAR123	ARCHITECTURAL DRAWING-I	L	T	S	P	C
		-	-	6	-	6

COURSE OBJECTIVE:

- Introduction and familiarization with drafting tools and accessories.
- To give basic knowledge of good drafting techniques.
- To develop comprehension and visualization of geometric forms.

UNIT I

- **Introduction:** Drawing Instruments and their uses.
- **Sheet layout** and sketching.
- **Lettering**: - Exercises in drafted and freehand architectural lettering.

UNIT II

- **Lines**: Concept and types of lines. Line thickness. Dimension lines.
- **Scales:** Engineers scale, Graphical scale and Representation factor (R.F.)
- **Scales on drawings**. Types of scales: Plain scale and Diagonal scale.
- Dimensioning of 2D objects

UNIT III

Orthographic Projections

- Definition, Meaning & concept, principles and Methods of projection.
- **Planes of projection:** Four Quadrants, First angle projection, Third angle projection, Projection of points, lines & planes.

Note: Studio exercises to be based on aptly & clearly communicating the relationship of plan elevation & section of objects & buildings to the students.

UNIT IV

- **Orthographic Projections**-II
- **Projections of solids**: Axis perpendicular to the H.P. and Axis perpendicular to the V.P. Axis parallel to both the H.P. & V.P. axis inclined to one reference.
- **Projection of solids-** simple sections of solids, complex solids, hollow object.

Suggestive Studio Exercise: Measured drawing of simple objects.

Text Books:

1. Bhatt, N.D., "Engineering Drawing: Plane and Solid Geometry", Charotar Publishing House.

Reference Books:

1. Gill, Robert W., "Basic Perspective", Thames and Hudson.
2. Leslie, Martin C., "Architectural Graphics", Macmillan Publications.
3. K.L.Narayana, P.Kannaiah, 'Text Book on Engineering Drawing' Scitech Publications.
4. Malik, Shankar, "Perspective and Sciography", Allied Publishers.

Web References

1. www.technologystudent.com
2. www.ider.herts.ac.uk/school/courseware

APAR125	ARTS & GRAPHICS-I	L	T	S	P	C
		-	-	4	-	4

COURSE OBJECTIVE:

- To understand the techniques of sketching & rendering in different mediums.

UNIT I

Indoor Sketching:

- To practice still life sketching of objects & figures with shades & shadows using pencil etc. (Black & White)

Outdoor Sketching:

- To practice still life sketching of objects & figures with shades & shadows using pencil etc. (Black & White)
- To understand principals of drawing shades & shadows with source of light being Sun.

UNIT II

- Color theory- color mixtures, colour systems, colour organization, application of colour schemes, national and international standards on colour.
- Use of colors and coloring techniques
  Brush control exercises in water, oil, poster, crayon and mixed media.

UNIT III

- Representation of scaled graphics of foliage-trees, plants & shrubs, human figures & furniture etc.

Architectural Presentation & Rendering of Landscape Elements:

- To practice presentation and rendering of Trees, herbs, shrubs, ground covers, contours & water bodies as a single entity, and in clusters / groups in association with built forms, both in plans & elevations, in Black & White and in color.

UNIT IV

Architectural presentation & rendering of inanimate objects in manmade environment:

- To practice presentation and rendering of both plans & elevations of cars, furniture, buildings, accessories such as telephone, desktops, etc., in Black & White and in Colour.

Architectural presentation & rendering of human figures:

- To practice presentation and rendering of both plans & elevations, in Black & White and in Colour.

Text Books:

1. Malik, Shankar, "Perspective and Sciography", Allied Publishers

Reference Books:

1. Robert W. Gill , "Rendering with pen and ink"
2. Leslie, Martin C., "Architectural Graphics", Macmillan Pub Co

APCE113	STRUCTURAL DESIGN-I	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

To understand the basic principles of structural mechanics so that it forms the basis for study of structural design.

UNIT I

Composition & Resolution of Forces:

- Force & its units
- Laws of forces
- Resultant of a force system – Analytical, Method of resolution, Triangle Law, Polygon law, Graphical (Vector) method
- Moment of force – Varignon's principle,
- Couple - Moment & Arm of a couple

Equilibrium of Forces:

- Principles of equilibrium
- Analytical & Graphical method for equilibrium of forces
- Free body diagram
- Conditions of equilibrium
- Types of equilibrium

UNIT II

Centroid & Centre of Gravity:

- Definition, Centroid and Centre of Gravity
- Relationship between C.G., Centre of Mass and Centroid.

- Centroid of a Line
- Methods of finding out C.G. & Centroid of plane figures; Symmetrical sections, unsymmetrical sections, solids by different methods – Geometrical, By moments, & Graphical method.

UNIT III

Moment of Inertia:

- Definition & important theorems – Parallel axis & perpendicular axis theorem.
- Section modulus
- Radius of Gyration
- MI of plane lamina
- MI of Composite sections.

UNIT IV

Support Reactions

- Types of loading – point load, uniformly distributed load, uniformly varying load.
- Methods for reaction of beams or frames and trusses i.e Analytical, Graphical, by Space diagram & Vector diagram
- Types of end supports of beams & frames – simple supported, Hinged, Overhanging beams
- Beams subjected to Moments
- Statically Determinate Structures

TEXT BOOK:

1. Applied Mechanics by R.S. Khurmi, S.chand Publications**.**

REFERENCE BOOKS:

1. Structure Mechanics for Architects by Prof. Harbhajan Singh, Abhishek Publications, Chandigarh.
2. Strength of Materials by S.Ramamrutham, Dhanpat Rai & Sons, New Delhi.
3. Mechanics of Materials by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd., New Delhi
4. Mechanics for Engineers, Statics, Ferdinand P. Beer & E. Russell Johnston, Jr. Mc.Graw Hill, International Student Edition.

APCH 125	Environmental Studies	L	T	S	P	C
		3	-	-	-	3

Course Objectives

This course in environmental studies will develop the:

- Basic understanding about the concept related to environment such as eco system and biodiversity.
- Understanding about pollution and its control.
- Insight about the various concerns regarding environment such as population and social issues.

UNIT I

Introduction of Environmental Studies: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
Natural Resources: Renewable and Non-renewable Resources.
Land resources: land use change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II

Ecosystems: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological Diversity: Levels of biological diversity; genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III

Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.
Environmental Policies and Practices: Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.
Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. International agreements: Montreal & Kyoto protocol and convention on biological diversity. Nature reserves, tribal population and rights, human wild life conflicts in Indian context.

UNIT IV

Human Communities and the Environment: Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Field Work:

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification.
Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books:

1. Anubha Kaushik and C. P. Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books:

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. P. H. Raven, D. M. Hassenzahl & L. R. Berg, Environment, John Wiley & Sons, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta, Ecology, Environmental Science and Conservation, S. Chand Publication, New Delhi.
4. Erach Bharucha, Textbook of Environmental Studies, Universities Press (P) Ltd., Hyderabad, India.

SEMESTER II

APAR118	ARCHITECTURAL DESIGN-I	L	T	S	P	C
		-	-	6	-	6

COURSE OBJECTIVE:

- Introduction to basic design and the basic understanding of form and space in architecture.
- Sensitizing students to be more observant to their surroundings and promoting it as a basic creative instinct in the students.

UNIT I

Study of Anthropometrics:

- Studies and introduction to human dimensions and functions, space-activity, relationships, measured drawings of simple living units.
- This can be best understood through one or two short exercises in anthropometrics. Presentations should be made through simple sketches and drawings.
- Short exercises in design and layout of personal space for living, eating, sleeping, cooking, toilets, laundry area, outdoor sitting spaces such as verandah, balcony etc.

UNIT II

Scale in Architecture:

- Exercises to increase perception and sensitivity of the students about space in terms of balance & proportions.
- Simple measurement exercises, with & without proper measuring instruments, so that before the students start doing building design proposals, they have to have a fair and almost accurate idea about sizes & measurements of some typical requirements of architecture & design in everyday life.
- Measuring drawing & dimensioning of simple building components.

UNIT III

Design of mono-cellular-units/structures on a level plane

- Design of simple single activity units such as milk booth, tea stall, shelter in park, bus stop or designing of student's own room (as a student of architecture).

UNIT IV

Design of multiple but simple activity spaces involving primarily horizontal circulation.

- Exercise to emphasize the significance of the user in the process of design.

The design of building unit to be completed in the following stages: Prototype study, Problem identification, Site analysis, Preliminary sketch etc. Models of the final design necessary for greater comprehension.

- Suggested exercises: Residence, Guest House, Dharamshala, etc.

Text Books:

1.Ching, Francis D. K., "Drawing: A Creative Process", Wiley and Sons

Reference Books:

1. Wallschlaeger, C and Snyder, S.B., "Basic Visual Concepts and Principles for Artists, Architects and Designers", McGraw Hill.
2. Laseau, P, "Graphic Thinking For Architects and Designers", John Wiley and Sons

APAR120	BUILDING CONSTRUCTION & MATERIALS-I	L	T	S	P	C
		-	-	6	-	6

COURSE OBJECTIVE:

- To acquaint the students to building materials such as wood, stone & brick; and with construction techniques for the use of these materials in building works.

UNIT I

MATERIALS:

BRICKS: Bricks for specific purposes like walls, flooring, cladding, tiling, etc. Their physical characteristics, specifications, manufacturing, testing, etc.

CONSTRUCTION:

Types of bricks, various brick bonds,

construction of arches

UNIT II

MATERIALS:

STONE: Stones for specific purposes like walls, flooring, cladding, tiling, etc. Their physical characteristics, types, specifications, uses etc.

CONSTRUCTION:

Various stone masonry, jointing and pointing, construction of arches

UNIT III

MATERIALS:

BINDING MATERIALS: Lime, Mud and Cement: availability, manufacturing, composition, physical and chemical properties, types, uses etc.

CONSTRUCTION:

Plastering, jointing and pointing

UNIT-IV

MATERIALS:

TIMBER: Structure, Classification, Characteristics, Seasoning, Storage, Defects, Preservation, Uses etc.

C O N S T R U C T I O N:

- Details of Ledged & Braced batten doors and windows

REFERENCE BOOKS:

1. Farrelly, Lorraine, "Basic Architecture 02: Construction + Materiality", Ava Publishing
2. Agarwal, A., "Mud: The Potentials of Earth based Material for Third World Housing", IIED,
3. HUDCO, "All you wanted to know about Soil Stabilized Mud Blocks",
4. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill,
5. Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

APAR 128	THEORY OF DESIGN	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- To generate and appreciate the background aspects of thinking & philosophizing required in architectural design.

UNIT I

Basis for Architectural Design

- Basic Design and Architectural Design-Elemental Differentiation
- Perception and Experience

- Tangible and Intangibles in Architecture
- Colour Aesthetics

UNIT II

Relation of Form & Function

- Function, Structure and Form
- Space, Space Usage and Interrelationship of spaces
  - Circulation within Spatial Units

Order in Architecture:

- Geometrical, structural, dimensional, material, spatial orders – through observation of surroundings as well as simple exercises in 2D and 3D.
- Exercises in order and transformations of form and space.

UNIT III

Connectivity of Spaces

- Horizontal Circulation
- Vertical Circulation
- Circulation and Spaces between Buildings

UNIT IV

Manifestation of Design for Interpretation

- Relationship of Plan, Section and Elevation
- Architectural Scale
- Programming in Architectural Design

Text Books:

1. Francis, D.K. Ching – Form Space & Order

Reference Books:

1. Snyder, J and Catanese, A, "Introduction to Architecture", McGraw-Hill.
2. Farrelly, Lorraine, "The Fundamentals of Architecture", Ava Publishing.
3. Voordt and Wegen, "Architecture in Use", Architectural Press.
4. Smithies, K.W., "Principles of Design in Architecture", Van Nostrand Reinhold Co.
5. Roger H. Clark and Michael Pause, "Precedents in Architecture", Van Nostrand Reinhold.

APAR124	ARCHITECTURAL DRAWING-II	L	T	S	P	C
		-	-	4	-	4

Course Objective:

- To develop the capability of understanding and drawing Three Dimensional Solids and their various complex sections as a basis of representing architectural design.

UNIT I

- To prepare drawings on Orthographic Projection of simple solids in simple positions.
- To prepare drawings on Orthographic Projection of group of solids in tilted positions.
- To prepare drawings on Orthographic projection of simple sections of solids, complex solids, hollow object and sections.

UNIT II

- To study the interpenetration of solids and development of surfaces & sections.
- To study the principles and techniques of axonometric, oblique and isometric views and construct three dimensional views of basic and complex geometrical shapes.

UNIT III

- To study the basic terms, principles, types and techniques of geometrical perspective drawing and to prepare perspective by measuring point method, angular and parallel perspective.
- To prepare drawings on the presentation of interior and exterior views in one point perspective and section perspectives.

UNIT IV

- To prepare drawings using two point perspectives for simple objects, inclined planes, cylindrical objects, arches and other circular forms etc.
- Introduction/ Meaning of Sciography, Projection of Sciography in plan and elevations.

Text Books:

1. Bhatt, N.D., “Engineering Drawing: Plane and Solid Geometry”, Charotar Publishing House.
2. K.L.Narayana, P.Kannaiah, ‘Text Book on Engineering Drawing’ Scitech Publications.
3. Malik, Shankar, “Perspective and Sciography”, Allied Publishers.

Reference Books:

1. Gill, Robert W., “Basic Perspective”, Thames and Hudson.
2. Leslie, Martin C., “Architectural Graphics”, Macmillan Publications.

Web References

1. www.technologystudent.com
2. www.ider.herts.ac.uk/school/courseware

APAR126	WORKSHOP	L	T	S	P	C
		-	-	-	4	2

Course Objective:

- To introduce the carpentry tools, processes and wood working machines and learn about carpentry joints and their uses.

UNIT I

- To introduce carpentry tools, processes and wood working machines. To prepare three dimensional solids like cube, cuboids, pyramids, spheres, cone and cylinders and make a composition.

UNIT II

- Carpentry joints- Technical terms, classification of joints: lengthening, spliced or longitudinal joints; bearing joint, framing joint, angle/ corner joint, oblique/shouldered joint, widening or side joint
- Fastenings, Carpentry tools and various connecting devices
- To demonstrate the use of carpentry tools in making joints such as Dovetail Joint, Mortise and Tenon Joint, Lap joint, Butt Joint etc. to be used for making furniture.

UNIT III

- To prepare joints (Lap and Butt) by metal arc welding

UNIT IV

- To create complex three dimensional forms for models using carpentry methods.

Text Books:

1. . Raghuwanshi, B.S., "A Course in Workshop Technology – 'Vol. I and II', Dhanpat Rai and Co.

Reference Books:

1. Morris, M., "Architecture and the Miniature: Models", John Wiley and Sons
2. Mills, Criss B., "Designing with Models: A Studio Guide to Making and Using Architectural Models", Thomson and Wadsworth.
3 McKay, W. B., Building Construction (Metric) (vol. 1 to 4).

APCE114	STRUCTURAL DESIGN-II	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

- To understand the basic principles of structural mechanics that would be pertinent to simple design elements.
- To understand the structural behaviour of buildings.

UNIT I

Analysis of perfect frames

- Simple stresses in frames – Tensile & compressive
- Analysis of a perfect truss by method of joints, method of sections, graphical method & Link polygon
- Cantilever trusses
- Simply supported trusses

UNIT II

Overview of R.C.C. construction

- Cement, coarse aggregate, Water and reinforcement materials.
- Abram's water-cement ratio law
- Stress-strain curves and characteristic strengths of structural steel.
- Properties of Cement concrete & their impact on the structural strength,
- Introduction to Nominal mix concrete and Design Mix Concrete.
- Characteristic compressive strength of concrete and its determination,
- Workability of concrete, Slump test, compacting factor test;
- Compaction and Curing of concrete,
- Durability of concrete, Gain of strength of concrete with time, Age factor

UNIT III

Theory of R.C.C.

- Advantages of RCC
- Assumptions in the theory of RCC – Hooke's law
- Distribution of stress in Steel & concrete – Modulus of Elasticity
- Equivalent area of composite section
- Theory of bending of RCC beams – Elastic theory & Ultimate load theory
- Limit state method
- Stress Strain diagram & Neutral axis & its position
- Lever arm

Classification of RCC section

- Balanced or economical
- Over & under reinforced sections
- Moment of resistance

UNIT IV

Shear stresses in Beams

- Design for shear

Bond stress & development length
Design of Singly Reinforced Beams

TEXT BOOK:

- Reinforced Cement Concrete Design by Dr. B.C. Punmia , Ashok Kumar Jain, Arun Kumar Jain; Laxmi Publications (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. IS: 883–1984 (reaffirmed 2005), Code of Practice for Design of Structural Timber in Buildings.
2. IS: 1905–1987 (reaffirmed 2002), Code of Practice for Structural Use of Un-reinforced Masonry.
3. Design of Masonry and Timber Structures by Singh H. Abhishek Publications, Chandigarh.
4. Design and Construction of Wood Framed Buildings by Morton Newman, McGraw Hill Inc., New York.Design of Steel Structures by Dr. S.M.A. Kazimi, R.S. Jindal, Prentice Hall of India Private Ltd., New Delhi.
5. Concrete Technology by M. S Shetty.

APEL 101	COMMUNICATION SKILLS	L	T	P	C
		4	-	-	4

Course Objective: The purpose of this course is to

Understand the basics of Grammar to improve written and oral communication and to speak correct form of English with proficiency

Improve students' personality and enhance their self-confidence

UNIT I

Introduction to Communication: Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication; Literature: *A Bird Came Down the Walk* by Emily Dickinson

UNIT II

Essentials of Grammar: Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection; Using tenses; Articles; Types of sentences; Reported Speech; Punctuation; Literature: *Stopping by Woods on A Snowy Evening* by Robert Frost

UNIT III

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms &Synonyms, Phrasal Verbs, Idioms & Proverbs (25 each); Commonly used foreign words(15 in number); Literature: *The Gift of Magi* by O'Henry

UNIT IV

Personality Development: Etiquette & Manners; Leadership; Inter & intra personal skills; Attitude, Self-esteem & Self-reliance; Public Speaking; Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques; Literature: *My Prayer to Thee* by Rabindranath Tagore;

TEXT BOOK:

Kumar, Sanjay and Pushplata. *Communication Skills*. Oxford University Press.

REFERENCE BOOKS / SITES:

1. Tickoo, M.L, Subramanian A. E. and Subramaniam P.R. *Intermediate Grammar, Usage and Composition.* Orient Blackswan.
2. Mitra, Barun K. *Personality Development and Soft Skills*. Oxford University Press.
3. "Best Poems", http://100.best-poems.net/. 20 July 2016.
4. "Classic English Short Stories", http://www.eastoftheweb.com/short-stories/Collections/ClasEngl.shtml, 20 July 2016.

APEL 171	COMMUNICATION SKILLS LAB	L	T	P	C
		-	-	2	1

Objective:

The Communication Skills Lab focuses on communication activities in functional and situational contexts. It encourages students to speak with fluency and accuracy as well as to enhance the four language skills of reading, writing, listening and speaking through real life and professional situations.

In each practical class student should spend

- 5 to 10 minutes on effective browsing of online News paper
- 5 to 10 minutes on English Language software activities

Each student must actively complete the following ten activities in practical classes, and the Lab Record with the teacher's signature and the internal marks should be submitted to the External Expert during Viva.

Activity 1: Self- introduction: Informal introduction & formal introduction; A detailed write up on formal 'Self Introduction'; Formal Introduction of oneself in front of the group.

Activity 2: News Reading: Introduction to 'online News papers'; Browsing and selecting the preferred Newspaper; Browsing through the News Headlines; Selecting interested News items; Comprehending the content, writing down the essence and reading the News in front of the Group. Discuss 5 to 8 new words or terms, 4 to 5 important personalities of that day's news etc.

Activity 3: a. **JAM:** Introduction to 'Just A Minute speech' and the 'Extempore speech'; Preparation of speech on given topic (different topic for each student); delivery of the speech; Feedback(on content, time management, body language etc. highlighting the positive aspects first.)

b. **Listening Comprehension:** Listen to online / downloaded oration by renowned Orators; write down the content in a precise form and give an oral presentation of that write up following all the etiquettes of public speaking.

Activity 4: a. **Turn Coat**: Speaking for and against by the same person with time specification; assign topics from the immediate surroundings; write down the content either from the Net or from personal knowledge; prepare well and deliver; feedback & suggestions for improvement.

b. **News Discussions:** Selecting News of the day, Discussing among the group, prepare the news content and prepare the group opinion about the issue and present it in front of the class by the group involving each member; select 5 new words & new usages from the selected news item

Activity 5: Conversation ability: Characteristics of effective conversation; Listening to a few sample conversations; preparing conversation based on the given situation; enacting the situation through effective delivery of the script; feedback & suggestions for improvement.

Activity 6: Role Play: Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement.

Activity 7: Public Speaking: Characteristics of effective Public speaking; possible barriers; watching demo online; topic assignment, information gathering & recording; delivery in front of the class; feedback & suggestions for improvement. . (Different topic for each student)

Activity 8: Group Discussion: Importance and characteristics; Dos & Don'ts in GD; Demo display; assign topic for the group, Preparation & performance; feedback & suggestions for improvement.

Activity 9: Debate: Difference between Group Discussion & Debating; Watching demo of Debating; Topic for the group of 2 or 4; preparation and performance; feedback & suggestions for improvement.

Activity 10: .**Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.

TEXT BOOK:

Kumar, Sanjay and Pushplata. *Communication Skills*. Oxford University Press.

REFERENCE BOOKS:

1. Mitra, Barun K. *Personality Development and Soft Skills*. Oxford University Press.

2. Raman Meenakshi & Sharma, Sangeetha. *Technical Communication Principles and Practices,* 2nd Ed. Oxford University Press, New Delhi, 2011.

SEMESTER III

APAR217	ARCHITECTURAL DESIGN – II	L	T	S	P	C
		-	-	8	-	8

INTENT

- To foster understanding about land and landforms and the elements of built space.
- Experimentation with shapes forms and materials to increase sensitivity to built volumes.
- Introduction to vernacular architecture, use of local materials and appreciation of the s ocio-economic background of the users.

CONTENT

- The projects would address the study of built form and its relationship to the site, surr oundings and climatic setting.
- The study would induce students to experiment with built and open space.

Veranacular Traditions in Architecture :

- Study of the social and physical environment and methods of construction in vernacul ar architecture, evolving from the traditional ways of life of the people in a given place. This may be a village or part of a small town.
  (**Suggested exercises:** The students may be divided into groups, each group given to study one particular climatic zone of India in detail, and to make reports & graphical presentations on vernacular architecture evolving out of regional characteristics, in their respective zone of study.)

Major Design problem:

- Design of a simple building for public activity in a non-urban or semi-urban setting, or a situation without any bye-laws.
- Introduction to others role players in the architectural design process – the client and users.
- Design problem can be related to play school, healthcare center small shopping complex or similar projects set in a non-urban area.
- The students should be encouraged to endorse vernacular designs in their Design proposals.

REFERENCE BOOKS:

1. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill

2. Design Dialog: Dialectics of Design in Architecture, Prof. Shireesh A. Deshpande

3. The Discovery of Architecture: a contemporary treaties on ancient values and indigenous reality, M.N. Ashish ganju and Narendra Dengle

4. Agarwal, A., "Mud: The Potentials of Earth based Material for Third World Housing", IIED

5. Christopher Benninger , "Letters to a Young Architect"

APAR 219	BUILDING CONSTRUCTION & MATERIALS-II	L	T	S	P	C
		-	-	6	-	6

COURSE OBJECTIVE:

- To familiarize the student with the various aspects of building construction.

UNIT I

FOUNDATION: SHALLOW AND DEEP FOUNDATION

- Foundations: isolated, combined, eccentric footing and raft foundation. Pile foundations – details of pile, varieties of piles, pile caps.

CONSTRUCTION: Construction details of shallow and deep foundations

UNIT II

FLOORING

Mud, Brick & terracotta tiles flooring, Cement concrete, Stone slabs, Terrazzo, Ceramic & Vitrified tiles, Wooden flooring, PVC, etc.

ADHESIVES:

- Introduction
- Natural Adhesives – Animal, Casein, Bituminous.
  Thermoplastic Adhesives – Polyvinyl Acetate.
- Thermosetting Adhesives & Plastics - Urea Formaldehyde, Phenol Formaldehyde, Melamine Formaldehyde, Resorcinol Formaldehyde,
- Epoxide Resins, Rubber Adhesive.

CONSTRUCTION: Construction detail for laying the above floors on Ground and RCC slab.

UNIT III

MATERIALS:

ROOFING & ROOF COVERINGS: Clay Tiles (Country, Allahabad, Mangalore tiles etc.), Concrete Tiles, Asbestos Cement sheets (Plain & Corrugated), Aluminium Sheets (Plain & Corrugated), Galvanised Iron Sheets (Plain & Corrugated), Stone Slating, Shingles, Thatch.

CONSTRUCTION:
ROOFS AND TRUSSES: Timber roofs for small spans. Large timber trusses (12 meter span) . Simple flat, jack arch, Construction details of king-post trusses.

UNIT IV

TIMBER PRODUCTS:

- BOARDS: Decorative & Commercial Plywood and Boards – types and qualities, Ply board, block board, Particle board, Wood cement board, Fiber board, Compressed straw board, Cement fiber board etc.
- VENEERS & LAMINATES

C O N S T R U C T I O N:
WOODEN DOORS: Details of Flush, Panelled & Glazed doors, their fastenings, fittings & fixtures.
WOODEN WINDOWS: Details of panelled and glazed windows, their fastenings, fittings & fixtures.

Note:

- Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry.
- Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

TEXT BOOK:

1. Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

REFERENCE BOOKS:

1. Farrelly, Lorraine, "Basic Architecture 02: Construction + Materiality", Ava Publishing,
2. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill

WEB REFERENCES:

1. http://en.wikipedia.org/wiki/Building_material
2. www.bmtpc.org/pubs/book12.pdf
3. http://www.habitattechnologygroup.org/

APAR241	HISTORY OF ARCHITECTURE-I	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVES:

- Understanding Indian architecture as an amalgamation of ideas, building materials and techniques of different regions and religions.
- Understanding the built form as a culmination of belief system of different religions and influences of various regional dynasties that ruled different parts of India and the neighboring regions.
- Understanding of Buddhist, Hindu and Islamic periods in terms of their context of religious ideology, location, climate, socio-cultural, economic and political influences of the time.
- Study of the building 'types' in India and the development of architectural form and character based on the developments in construction and technology exemplified through specific building examples that identify the works of the period.

UNIT I

BUDDHIST ARCHITECTURE

- **Ashoka and the beginning of Buddhist Architecture:** Origin of Buddhism and its influence on the architecture, Ajivkyas and Cave Architecture, growth of Sanchi, toranas, symbolism and structural functions, chaitya halls, Amravati stupa.
- **Buddhist Rock Cut Architecture (Hinayana and Mahayana):** Includes Early Hinayana Phase and Buddhist Viharas and Monastries. Also includes caves in western ghats, Karli, Nalanda, Sarnath and Gaya. Also Ajanta Caves and the subsequent early Hindu shrines.

UNIT II

HINDU ARCHITECTURE

- **Nagara Style of temples:** With special attention to the evolution of the temple form, the shikhara in north India. Reference also to be made to the three schools of architecture the Gujarat, the Khajuraho, and the Orrisan styles.
- **Dravidian Style of temples:** Particularly in reference to the evolution of the vimana and the contributions of the Chalukyas, the Pallavas, the Pandyas and Cholas as well as the contributions of the Nayaks to the temple cities. Shld include Rathas and Shore Temple of Mahabalipuram
- **Vesara Style of temples:**
- **Forts & Palaces:** Morphology of forts- Amber fort Red fort, Chittorgarh fort, various havelis & various elements like stepwells, gates, baradaris etc.

UNIT III

INDO-ISLAMIC ARCHITECTURE:

- Rise of Islamic architecture & influence.
- Its architectural implications in various building types such as mosque, tomb, fort and their elements like domes, minarets, arches with reference to **the Slave, Khalji, Tughlaq, Sayyid, Lodhis and Shershah Suri** regimes and their architecture.

UNIT IV

- **Mughal Architecture**: Evolution of Mughal Architecture with emphasis on **Akbar**'s contribution (Fatehpur Sikri, Humayun's Tomb) and **Shah jahan's** architecture (Shahajahanabad, Red Fort, Jama Masjid and Taj Mahal).

TEXT BOOK:

1. Grover, Satish, "Buddhist and Hindu Architecture in India", CBS Publishers and Distributors.
2. Grover, Satish, "Islamic Architecture in India", Galgotia Publishing Company.

REFERENCE BOOKS:

1. Cruickshank, D., Fletcher, B., Saint A., "Banister Fletcher's - A History of Architecture", Architectural Press.
2. Brown, Percy, "Indian Architecture – Vol I and II", Apt Books.
3. Maheshwari and Garg, "Ancient Indian Architecture", CBS.
4. Grover, S. K., "Buddhist and Hindu Architecture in India", CBS.
5. Thapar, B., "Introduction to Indian Architecture", Periplus Editions
6. Surendra S., "Indian Architecture: Hindu, Buddhist and Jain", Ajanta Offset and Packaging Ltd.
7. Risebero, Bill, "The Story of Western Architecture", MIT Press.
8. Ching Francis D.K., Jarzombek, Mark M., Prakash, Vikramaditya, "A Global History of Architecture", Wiley.
9. Hiraskar, G.K., "The Great Ages of World Architecture (with Introduction to Landscape Architecture)", Dhanpat Rai Publications (P) Ltd.

WEB REFERENCES:

1. http://architecture.about.com/od/periodsstyles/Periods_and_Styles.htm
2. http://www.historyworld.net
3. http://www.nationalgeographic.com
4 .http://en.wikipedia.org/wiki/History_of_architecture
6. http://vlib.iue.it/history/topical/architecture.html

APAR239	ENVIRONMENT & CLIMATE	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- To familiarize the students with the Environment &climatological aspects associated with the Architectural Design, and in turn to the vernacular traditions of Architecture.

UNIT I

Introduction to Environment & Climate:

- Basic understanding about Environment & Climate
- Factors affecting Environment –effects on Land, Forest, Water & Energy
- Factors affecting climate,
- Elements of climate – Solar radiation, Temperature, Wind, Humidity & Precipitation, Sky condition, Night Radiation and their measurement.
- Classification of Climatic zones & their characteristics
- Characteristics of tropical climate,
- Macroclimate and Microclimate.
- Green House Effect, Global warming & its effects.

Human Thermal Comfort:

- Concept of heat physics : Study of body's heat production and heat loss – heat balance (heat temperature, Thermal mass& capacity, Latent heat ,Conduction Convection, Radiation & Evaporation)
- Comfort zone, thermal comfort, heat stress, individual variation
- Bioclimatic chart and effective temperature

UNIT II

Solar Geometry:

- Relationship of Earth & Sun
- Direct and indirect insulation,
- Types of waves - infrared, visible light, ultraviolet, reflectivity and emissivity.
- Methods of recording sun's position in relation to earth, Solar Chart
- Radiation gains on various walls and roofs in various seasons.

Day light:

- Natural lighting, Glare, day light factor and day lighting in tropics.
- Colour, amount of light, sky as a source of light,
- Effect of size and shape of opening in different planes with & without obstructions,
- Intensity of light spread,penetration,
- Design and setting of buildings for day light.

Shading Devices:

- Shadow angle protractor and its application in designing of shading devices.
- Application of solar change in the design of sun control device.
- Sun machine and their uses.

UNIT III

Air temperatures:

- Factors that influence temperatures - sun latitude, season, land, water, wind, altitude, atmospheric impurities, green open areas, trees and urban areas.
- Inversion of temperature. Insulation, resistance insulation , capacity Insulation thermal diffusivity, thermal conductivity,
- Heat transmission through building components, time lag, i.e. value AIR heat transmittance co-efficient, scale , temperature.

UNIT IV

Wind:

- Study of diurnal and seasonal variations,
- Heating and cooling effect,
- Effect of topography,
- Effect of wind on location of industrial areas, airport & other land uses and road patterns.

Ventilation, Air-movement and Air change:

- Air patterns around buildings, & within buildings.
- Wind eddies, size and position of openings with & without overlays & other architectural elements.

Orientation:

- Orientation of buildings in relation to sun and wind.

TEXT BOOKS:

1. Manual of Tropical Housing and Building: Climatic design, by Otto H. Koenigsberger, Longman, – Architecture

REFERENCE BOOKS:

1. Krishnan, A. (ed.), Baker, N., Yannas, S., Szokolay, S., Climate Responsive Architecture – A

2. Givoni, B., Man, Climate and Architecture, Elsevier Publishing Company Limited.

APAR225	ARTS & GRAPHICS-II	L	T	S	P	C
		-	-	3	-	3

COURSE OBJECTIVE:

- To understand the application of colors & sculpting mediums in Design.
- To in hence Aesthetical & Design sense of students.

UNIT -I

- Practice various uses of line according to the value and its movement in basic shapes and forms and geometrical patterns and compositions with different mediums. Suggestive mediums: Pencil, ink pen and brush, charcoal and watercolor
- Sketching & Rendering of simple & complex geometrical objects in different color mediums.

UNIT II

- Sketching of Human figures in different postures & gesture in color medium.
- Free hand sketching of landscapes around us, compositions of buildings along with sky, trees, cars, human figures etc., with light and shadow, using ink pen brushes, pastels and water color.

Unit III

- To practice sketching single point perspective and two point perspective using ink pen brushes, and water color of any building interior along with sky, trees, cars, human figures etc., with light and shadow .
- Make 3 dimensional models using theory of bio mimicry in different sculpting mediums such as clay, P.O.P. Paper Mache, Wood, and Wire.

Unit IV

- Presentation on different Aesthetical approaches in Architecture.
- Make 3 dimensional models. (I.e. Furniture, Household item using different sculpting mediums.)

APAR 227	COMPUTER APPLICATION IN ARCHITECTURE– I	L	T	S	P	Credit
		-	-	-	4	2

Course Objectives:

- Introduction and Advanced learning of software's assisting in 2-Dimensional design available for architectural applications and their integration with the design studio project
- Introduction to the use and application of interest

Course Syllabus:

Unit 1

Introduction to engineering drawings , autocad, co-sys, drawing settings, Drawing tools- line, circle, rectangle, ellipse, arc, polygon, oops, donut Modify tools- erase, undo/redo, move ,copy, rotate, mirror, array, scale, stretch, trim, extend, break, join, chamfer, fillet, file management—new, qnew, open, save, save as, close, exit, quit,
Drawing tools—multiline, ray, xline
Mini project - orthographic views

Unit 2

Drawing tool pline, spline,, wipeout, revision, cloud, modify tools, grip editing, display control, zoom, pan, redraw, regen,clean screen, steering, wheel, layer management, object selection method, symbol & bom creation, block, base, insert, symbol & bom creation, project.

Unit 3

Dynamic block, parametric modelling, action recorder, design, centre, tool palette, isometric view drawing, perspective view drawing, one point and two point, project isometric view, annotation tools, text, style, mtext, scale text, spell, table, table style, hatching utilities, inquiry commands, fill fill mode, dimension, linear, aligned, radius, diameter, centre, mark, angle, are, length, baseline, space, dimension, leader.

Unit 4

M leader, multi leader style, add leader, leader lines, collect leader, dim, edit, dim tedit, dimension, associative, reass caate, dimension style, ole concepts, ole links oles cale, insert obj, hyperlink, copy, copy base, cop ylink, paste clip, paste block, external references, e-transmit, publish to web, introduction to plotting. Layout. Viewport, slide and 2d animation

Text book [TB]: Mastering AutoCAD ,
Author- George Omura / Brian C. Benton

Reference book(s) [RB]:

1. AutoCAD by Sham Tickoo , CADD CENTRE, Internet

APCE237	STRUCTURAL DESIGN-III	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

- To understand the analysis of indeterminate structures also, and their use in construction field.

UNIT I

Design of Lintels with sunshade

- Various cases of Load transfer on lintels

Design of Slabs spanning in one direction

- Cantilever Chhajja
- Reinforced Brick work
- Design steps of RBC

UNIT II

Determinate & Indeterminate structures

Theory & Design of Doubly Reinforced beams

- Notations
- Critical Neutral axis vs. Actual Neutral Axis
- Steel beam theory

Flanged beams & T Beams- their theory & design

- **N.A. of T beam**
- **Design of continuous T beams also**

UNIT III

Analysis & Design of Reinforcement for a section subjected to torsion also

- Shear & Torsion
- Longitudinal reinforcement
- Transverse reinforcement
- Side face reinforcement

UNIT IV

Design of two way slabs with

- Grashoff Rankine's theory
- IS Code 456-1978 method
- Simply supported
- Edges fixed & continuous & uniform loading
- Torsional reinforcement

TEXT BOOK:

1. Reinforced Cement Concrete Design by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. IS: 883–1984 (reaffirmed 2005), Code of Practice for Design of Structural Timber in Buildings.
2. IS: 1905–1987 (reaffirmed 2002), Code of Practice for Structural Use of Un-reinforced Masonry.
3. Design of Masonry and Timber Structures by Singh H. Abhishek Publications, Chandigarh.
4. Design and Construction of Wood Framed Buildings by Morton Newman, McGraw Hill Inc., New York.
5. Design of Steel Structures by Dr. S.M.A. Kazimi, R.S. Jindal, Prentice Hall of India Private Ltd., New Delhi.
6. R.C.C Design and Drawing by Neelam Sharma; S. K Kataria & Sons.

APCE233	SURVEYING AND LEVELLING	L	T	S	P	C
		1	-	-	-	1

INTENT

- To illustrate the role of Surveying and Leveling in Architecture
- Introduction to the Tools and equipment for Land Surveying.
-

CONTENT

UNIT I

Introduction:

- Introduction to surveying,
- Understanding land topography and its relevance in Architecture.

UNIT II

- Types of surveys in practice
- Introduction to survey equipments.
- Principles of survey, equipment require

UNIT III

- Types of compasses.
- The prismatic compass, its construction and uses,
- Different types of levels, their temporary and permanent adjustment, leveling staff

UNIT IV

- Characteristics of contour lines,
- Direct and indirect methods of contouring and interpolation of contours.
- Marking foundations, measuring buildings under construction.
- Tacheometric Surveying:
- General instruments,
- Different systems of tacheometric measurements -Stadia method &Subtense method.
- Photogrammatery:
- Definition, principles and application of photography in Surveying.

REFERENCE BOOKS:

1. Rangwala, Surveying &Levelling, Charotar Publishing House.
2. R.Subramanian, Surveying&Levelling, Oxford Higher Education.

APCE235	SURVEYING AND LEVELLING LAB	L	T	S	P	C
		-	-	-	2	1

INTENT

- Introduction to the Tools and equipment for Land Surveying.

CONTENT

UNIT I

Chain Surveying:

- Selection of station, methods of taking offsets, Booking the field notes,
- Obstacles in chaining, errors in chaining,
- Chaining on sloping ground & reciprocal ranging.

UNIT II

Compass Surveying:

- Reduced & whole circle bearing, magnetic declamation, effects of local attraction.
- Compass traverse and balancing the closing error.

Leveling:

- Book of the readings and reduction of levels.
- Errors in leveling.
- Curvature and refraction reciprocal leveling profile, leveling cross sections.

UNIT III

Plane Tabling:

- Equipment and methods.
- Two points and three points problems.

Contouring:

- Interpretation and preparation of contour maps.
- Site modeling with total station.
- Exercises in setting out of building works.

UNIT IV

Theodolite Surveying:

- Theodolite, its temporary and permanent adjustment,
- Measuring of magnetic bearings, horizontal & vertical angles.
- Theodolite traverse and balancing the closing error.

REFERENCE BOOKS:

1. Rangwala, Surveying &Levelling, Charotar Publishing House.
2. R.Subramanian, Surveying&Levelling, Oxford Higher Education.

SEMESTER IV

APAR218	ARCHITECTURAL DESIGN-III	L	T	S	P	C
		-	-	8	-	8

INTENT

- To foster understanding about land and landforms and the elements of environment of specific regions. Experimentation with shapes, forms & materials to increase sensitivity to built environment and regional characteristics.
- Introduction to Vernacular architecture, use of local materials and appreciation of the socio-economic background of the users.
- Focus on studying patterns in horizontal circulation in built areas.
- Introduction to Bye-laws.

CONTENTS

Design projects related to differing climatic conditions:

- The projects would address the study of built form and its relationship to the site, surroundings and climatic setting.
- The design problem should induce students to **experiment with built and open spaces**, such that the design proposals address the various issues of climate and physical setting sensibly and show sensitivity to the vernacular features of the site.
- Apart from the above mentioned, focus should also be on Functional, geometric and visual order of repetitive units.

Suggested studio exercises:

- Creative design of simple buildings such as Community halls, Restaurants, College Canteens, Libraries, Motels, way sides tourist arcades and kiosks, artist's studio
- Design of buildings having primarily horizontal circulation and repetitive units such as primary or middle school, post office nursing home, bank, police station etc.

Methodology:

Detailed site analysis to be done at the beginning of each design problem. This would develop sensitivity to existing site conditions and context and help students evolve design directives to guide the design process.

Other design issues that the Design proposals by the students must address are:

- Detailing of selected areas to introduce a working understanding of services.
- Integration of design ideas with structural feasibility.

- Evolving working solutions for human circulation patterns with emphasis on interrelationship of multiuse spaces.
- Proactive approach to vehicular circulation and parking areas.

REFERENCE BOOKS:

1. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill
2. Design Dialog: Dialectics of Design in Architecture, Prof. Shireesh A. Deshpande
3. The Discovery of Architecture: a contemporary treaties on ancient values and indigenous reality, M.N. Ashish ganju and Narendra Dengle
4. Agarwal, A., "Mud: The Potentials of Earth based Material for Third World Housing", IIED
5. Christopher Benninger , "Letters to a Young Architect"

APAR220	BUILDING CONSTRUCTION & MATERIALS-III	L	T	S	P	C
		-	-	6	-	6

COURSE OBJECTIVE:

- To familiarize the students with the various aspects of building construction.

UNIT I

MATERIALS:
METALS: Ferrous – Iron (Pig, Cast & Wrought).
CONSTRUCTION:

- Steel staircase, Metal stairs - types and construction details of steel stairs.
- Grillage Footing.

UNIT II

MATERIALS:
METALS: Nonferrous – Aluminum, zinc, Copper, and Alloys
CONSTRUCTION:
Doors, Windows & Partitions: Aluminum sections

UNIT III

MATERIALS: Glass and Plastic
CONSTRUCTION:
Curtain wall, Structure Glazing, UPVC windows, doors etc.

UNIT IV

MATERIALS: Gypsum, Paints and Varnishes

- Introduction - Gypsum Board, Ceiling Board & Tiles, Gypsum Plaster, Components and Accessories. Jointing and finishing
- Varnishes: Natural and synthetic clear varnishes, French polish.

CONSTRUCTION: False Ceiling and Partitions

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS:

1. Barry, R (1986) Construction of Buildings, London, vol. 1 to 5.
2. BIS (2011) National Building Code, SP 7, Bureau of Indian Standards.
3. Foster, Stroud (1963) Mitchell's Advanced Building Construction, Allied Publishers Private Limited, Bombay.
4. McKay, W. B. (1972) Building Construction (Metric), Longman, London, vol. 1 to 5.
5. Prabhu, Balagopal T. S. (1987) Building Drawing and Detailing, Spades Publishers Pvt. Ltd., Calicut.
6. Punmia, B. C. (2005) Building Construction, Firewell Media, Delhi.
7. Singh, Gurucharan (1981) Building Construction Engineering, Standard Book House, New Delhi.
8. Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

WEB REFERENCES:

1. http://en.wikipedia.org/wiki/Building_material
2. www.bmtpc.org/pubs/book12.pdf
3. http://www.habitattechnologygroup.org/

APAR226	HISTORY OF ARCHITECTURE-II	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- To study significant developments in Architecture in the medieval world till the advent of Renaissance.
- To understand the growth and development of architecture and appreciation of the role of the intangibles that brought this growth & development from the 18th & 19TH century to the advent of European & Indian development.

UNIT I

BYZANTINE ARCHITECTURE:

- Indistinct exterior of churches and the domed 'heavenly' interior.
- Types of domes & spanning of the space with the squinches.
- Construction of dome over polygonal compartments through the use of pendentives.
- Study of important churches in Constantinople.

ROMANESQUE ARCHITECTURE:

- New construction methods,
- Massiveness, verticality and ornamentation of medieval churches,
- Integration of centralized and longitudinal plans.
- Combination of the five towered structures and longitudinal basilica.
- Articulation of external wall like arcaded interiors resulting in dematerialization of exterior.
- Study of important cathedrals and churches from Italy and France.

UNIT II

GOTHIC:

- Continued integration of centralized and longitudinal plans,
- Flying buttress, ribbed vault,
- Sensitivity towards light, use of stained glass.
- Cathedrals and churches.
- Central Asia: cities of Bukhara, Samarkand etc.
- Gothic influence on Indian architecture (Mumbai, Kolkata& Shimla)

UNIT III

Renaissance Architecture (Classical Architecture):

- Break with medieval churches & Basilica form.
- Leaning on Greek & Roman Art & Architecture.

- Reintroduction of anthropomorphic Classical Orders.
- Use of elementary geometrical forms unified through symmetry and simple mathematical ratios.
- Study of palazzos & development of centralized church form through specific examples from Italy. Example: St.Peters Church.
- The classical era: Bridge between Medieval & Neoclassical era

Mannerism:

- Conflict and tension in Mannerism in place of harmony and order of Renaissance.
- Dynamic interplay of contrasting elements like fountain, landscape as against static addition of independent units of Renaissance church.
- Dynamism of urban spaces.
- Study of important villas, churches and urban spaces in Italy.

UNIT IV

BAROQUE:

- Dynamism and systemization of Baroque architecture.
- Vitality and spatial richness with underlying systematic organization.
- Sensitivity to effects of texture, color, light and water.(Optical illusion)
- Study of important urban spaces and churches in Italy and Germany.

Architecture in Europe – (late 18th to early 20th century):

- Industrial revolution and its architectural implications
- 19th century Neo Classicism
- Development of Architecture in Europe-Victorian England (Ex: Eiffel tower, Crystal palace)
- Technology of Iron and Steel
- Town planning trends in Europe
- Influence of Europe in India-Planning of Chandigarh city, India

TEXT BOOK:

1. Cruickshank, D., Fletcher, B., Saint A., "Banister Fletcher's - A History of Architecture", Architectural Press.

REFERENCE BOOKS:

1. Brown, Percy, "Indian Architecture – Vol I and II", Apt Books.
2. Maheshwari and Garg, "Ancient Indian Architecture", CBS.
3. Grover, S. K., "Buddhist and Hindu Architecture in India", CBS.
4. Thapar, B., "Introduction to Indian Architecture", Periplus Editions.
5. Risebero, Bill, "The Story of Western Architecture", MIT Press.
6. Ching Francis D.K., Jarzombek, Mark M., Prakash, Vikramaditya, "A Global History of Architecture", Wiley.

APAR222	ARCHITECTURAL GRAPHICS	L	T	S	P	C
		-	-	4	-	4

COURSE OBJECTIVE

- To augment and enhance the skill and techniques in architectural drawing rendering using different mediums.

UNIT I:

- Introduction to rendering of architectural drawing.
- Quick sketches of site plan, plan, elevation, section with professional markers

UNIT II:

- Techniques for rendering drawings in color pencil, water color and ink
- Rendering of plan, section and elevation, views in different mediums
- Rendering of plans, Elevations & views with Sciography.

UNIT III

- Rendering of two point perspective of a building in different mediums
- Rendering of one point perspective of an interior space in ink/color
- Internal spaces like bedroom, drawing room, kitchen, bathroom in markers.

UNIT IV

- Exercise of rendering of previous / current design drawings: Plans, Elevations, Sections, Views by using any one medium of choice.

REFERENCE BOOKS:

1. Robert W. Gill , “Rendering with pen and ink”
2. Malik, Shankar, “Perspective and Sciography”, Allied Publishers
3. Leslie, Martin C., “Architectural Graphics”, Macmillan Pub Co
4. Haft, P. S. (1991) Architectural Illustration in Water Colour, Whitney Library, NY.

APAR 224	COMPUTER APPLICATION IN ARCHITECTURE– II	L	T	S	P	Credit
		-	-	-	4	2

Course Objectives:

BIM tools for architecture design
Revit BIM software helps architects and designers develop higher-quality, more accurate architectural designs. View architecture-specific features that help you capture and analyze concepts, and maintain your vision through design, documentation, and construction.

Course Syllabus:

UNIT-1

Introduction, About BIM, Introduction to Autodesk Revit Architecture, Revit File Types, Exploring User Interface, Building Elements , Starting a New Project, Drawing Plan as per Dimension, Drawing Aids, Project Units, Level, Grids, Walls, More in Depth- Wall, Modify Walls, Wall Layer wrapping, Stacked wall, Vertically compound wall, Wall shapes and openings, Wall sweeps and Reveals, Construction Modeling Tools, Parts, Assemblies, Modify Tools, Move, Copy, Create Similar, Rotate, Mirror, Array, Scale, Split Element, Trim, Align, Offset, Pin, Unpin, Doors, Windows, Keyboard Shortcuts, Floor, Adding Floor, Sloped Floor, Floor Slab Edge, Ceiling, Create Ceiling, Components, Working with Modern Medium Library, Roof, Creating Roof, Modifying Roof, Shape editing for Roofs and Floors, Roof Soffit, Roof Fascia, Roof Gutter, Openings, Opening on face and Vertical Opening, Wall opening, Shaft opening, Dormer opening

UNIT-2

Dimensions, Temporary Dimensions, Permanent Dimensions, Modifying Dimensions, Constraints, Creating views, Plan views, View range, Plan region, Elevation, Section, 3D Views, Lock 3D view, Background, Cropping view, Visibility or Graphics, View Templates, Duplicate views, Visual Styles, Filter, Graphic Display Options, Curtain wall, Adding Curtain Grids, Mullions, Reshaping Curtain wall Panels, Adding curtain Door to Panel, Embedded walls, Stair, Stair by component, Creating stair by sketching, Customizing stair documentation, Stair calculator, Modify stair railings, Ramp, Railings, Add railings, Add railings by sketching, Modify railing, Modifying continuous rail, Massing, In place Mass, Forms, Modify Forms, Rationalizing surface, Splitting Faces, Paint Tool, Placing Mass Instance from Mass Family, Face based Modeling, Conceptual Energy Analysis, Choosing Location , Energy settings, Enable energy model, Run energy simulation, Results and compare, Hands on, Customizing form rationalization, Display styles for analysis add in application, Controlling visibility of mass instances, Test, Adding text notes, Modify text notes, Model text, Tag, Tag tools, Applying tag by category, Tag all not tagged, Material Tag, Keynote, Types of Keynote, Placing Keynotes, Keynoting Settings, Custom Keynotes, Adding Keynote in 3D view

UNIT-3

Callout views, Types of Callouts, Detailing, Drafting views, Creating drafting views, Importing views from CAD program, Reusing drafting view, Inserting detail components,

Repeating detail, Creating schedules/quantities, Schedule properties, Custom parameters, Modify schedules, Material take off schedules, Annotation schedules or note blocks, Creating annotation schedule, Reusing schedule view Rooms, Creating rooms, Room boundaries, Room volume, Situations that can effect room volume computations, Room tag, Schedule Keys, Area, Area schemes, Area types, Area plans, Area tags, Color scheme, Legend, Sheets, Sheet list, Print, Light Materials, Sun settings, Rendering, Decals, Walkthrough, Solar Study, Site Design, Site Settings, Toposurface, Working in a team

UNIT-4

Working with linked models, Working with point clouds files, Import/Link CAD, Export, Design options, Phasing, Transferring project standards, Customizing project settings, Purge unused objects, Interference check, Groups, Family creation, Reference planes, Reference lines, Constraints and dimensions, Creating door family, Window family creation, Creating new furniture family, Table family, Lighting fixture, Chandelier, Face based family, Kitchen cabinet, Door handle, Custom staircase, Stair nosing, Custom handrail, Custom baluster, Working with adaptive components, Working with Adaptive components, Grill design, Railing on curved surface, Reporting parameter, Dividing paths by distribution algorithm, Component repetition, Adaptive curved railing, User interface and productivity enhancements, Displaced elements, Non rectangular viewports, Segmented elevation view, Schedules, Alternative dimension units, Change sort order of multiple items, Print option for regions, Materials, Stair by component enhancements, Import/Export, Energy analysis for Autodesk Revit, Modeling

Text book [TB]: Mastering Autodesk Revit Architecture (Eddy Krygien, James Vanduzande)

Reference book(s) [RB]:
Shyam Tickoo, CADD CENTRE, Internet

APCE228	STRUCTURAL DESIGN –IV	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

- To understand the analysis of indeterminate structures also, and their use in construction field.

UNIT I

Design of flat slabs

- Continuous frame method
- Empirical design method of flat slabs

UNIT II

Design of axially loaded RCC columns

- Long & short columns
- Lateral reinforcement for columns
- Permissible stresses in RCC columns
- Effective length
- Slenderness ratio
- Eccentricity
- Longitudinal & Transverse reinforcement
- Pitch & dia of ties
- Helical reinforcement
- Cover to reinforcement
- Permissible loads for compression member
- Composite columns, RCC walls

UNIT III

Direct & Bending stresses

- Columns subjected to tensile & compressive load & bending
- Design of columns subjected to combined bending & direct stresses
- ISI note on design of columns subjected to combined bending & direct stresses

UNIT IV

Isolated column footing & continuous footing for walls

- Square, rectangular, trapezoidal & circular footings
- Inclusive of one way and two shears
- Flexure & checks
- IS code for design of footing
- Design of continuous wall footing
- Design of isolated column footing

Design of combined footing

- Shapes of combined slab footing
- Design steps slab footing
- Design steps slab footing with centre beam
- Strap footing
- Mat or Raft foundation

RECOMMENDED BOOKS & REFERENCES:

1. IS: 883–1984 (reaffirmed 2005), Code of Practice for Design of Structural Timber in Buildings.

2. IS: 1905–1987 (reaffirmed 2002), Code of Practice for Structural Use of Un-reinforced Masonry.

3. Design of Masonry and Timber Structures by Singh H. Abhishek Publications, Chandigarh.

4. Design and Construction of Wood Framed Buildings by Morton Newman, McGraw Hill Inc., New York.

5. Design of Steel Structures by Dr. S.M.A. Kazimi, R.S. Jindal, Prentice Hall of India Private Ltd., New Delhi.

6. Comprehensive Design of Steel Structures by Dr. B.C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd., New Delhi.

APCE230	BUILDING SERVICES – I (WATER SUPPLY & SANITATION)	L	T	S	P	Credit
		2	-	-	-	2

INTENT

- Introduction to elementary building services of water supply, sanitation and roads.
- Exercises in layout of simple drainage systems for small buildings.
- Planning of bathrooms and lavatory blocks in domestic & multi-storied buildings. Exercises can also be clubbed with design studio project.
- To familiarize the student with plumbing bye laws as per ISI.

CONTENT

UNIT I

Water supply & its bye laws

- Need to protect water supply & requirements of water supply to different types of buildings
- Sources of water supply, Impurities of water and systems of water supply.
- Conveyance & distribution of water
- Various kinds of water meters, Water storage tanks, their capacity and location.
- Calculation of water consumption AND hot and cold water supply systems in low rise & high rise buildings, distribution system in campus.
- Size of pipes and their jointing details.
- Connections of different fittings like ferrule, stopcocks, bibcocks etc.

UNIT II

Sanitation & its bye laws

- Basic principles of sanitation.
- Dry and wet carriage systems.
- Sanitary fittings- washbasins, WC's, bathtubs, sink, urinals, bidets, flushing cistern, traps etc.
- Various types of joints, manholes and septic tanks (for non municipal areas)
- Proper location and ventilation of intercepting chambers and inspection chambers.
- Drainage systems- separate, combined and partially combined systems.
- Single stack system.
- One pipe and two pipe systems.
- Testing of house drains.
- Gradients used in laying drains and sewers.
- Self-cleaning and non-scouring velocities for drain pipes.
- Size of drainpipes and materials used.

UNIT III

Surface drainage & its bye laws

- Size of drainpipes and materials used.
- Drainage systems- separate, combined and partially combined systems.
- Gradients used in laying drains
- Drainage in non municipal area
- Rain water storage and water harvesting principles & methods

Solid Waste Management & its bye laws

- **Sources of solid waste**
- collection & conveyance of waste matter from buildings,
- Solid Waste Management - Quantity & quality of refuse.
- Sorting of solid waste
- Methods of disposal

UNIT IV

Roads

- Description and suitability of roads and comparative cost analysis.
- WBM (water bound macadam) road, tar, bitumen, asphalt and RCC roads.
- Soil stabilized, brick and stone paving.
- Design and construction of sewer's and sewer appurtenances

- Drainage sections for roads - sub drains, culverts, ditches, gutters, drop inlets & catch basins.

REFERENCE BOOKS:

1. V.K. Jain, Building Services, Khanna Publishers.
2. S.K. Garg, Water Supply Engg. Khanna Publishers.
3. S.K. Garg, Sewage disposal & Pollution, Khanna Publishers.
4. Punamia, Water supply Laxmi Publications.
5. Punamia, Waste water Engg. Laxmi Publications.

SEMESTER V

APAR325	ARCHITECTURAL DESIGN – IV	L	T	S	P	Credit
		-	-	10	-	10

INTENT

To understand basic structure forms in relation to space and materials & application of structural forms in design: The objectives of Arch. Design in the earlier semesters were concerned with 'space and form' and 'formal transformations'; 'space and activity'; 'space & regional setting" etc. The continuation of this leads to understanding of architecture as an outcome of 'space and structure'.
To inculcate the appreciation of the design process & an understanding of the design complexities and contradictions involved in resolving architectural design problems of Institutional nature.

CONTENT:

The following issues relating to institutional design will be addressed to:
Nature of contemporary institutions, correlation to urban structure.
Development control and urban infrastructure affecting design.
Various approaches to building in urban context.
Integration of function: movement, climate, acoustics, structure and services into the group of buildings.
Landscaping and site planning
Institutional character from abstract to detail.
User behavior and requirement pertaining to the physically handicapped.
Necessary theoretical inputs to be given highlighting the norms and design issues. The topics not covered as design problems may be covered by the studio faculty members through lecture/slide shows.

The topics to be covered as design problems may include:
Design of Institutional buildings: Schools, colleges with its various learning departments such as medical, engineering, law, business, music and dance colleges, vocational training institutions,
Socio-cultural Centres, Museums, Library, Art galleries, Cultural center, Performing Arts Centre, Industrial Buildings
Adaptive reuse of buildings of a documented building
All portfolio two drawings construction system and materials, services.

REFERENCE BOOKS:

1. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill

2. Design Dialog: Dialectics of Design in Architecture, Prof. Shireesh A. Deshpande

3. The Discovery of Architecture: a contemporary treaties on ancient values and indigenous reality, M.N. Ashish ganju and Narendra Dengle

4. Agarwal, A., "Mud: The Potentials of Earth based Material for Third World Housing", IIED

5. Christopher Benninger , "Letters to a Young Architect"

APAR 331	BUILDING CONSTRUCTION AND MATERIALS – IV	L	T	S	P	Credit
		-	-	6	-	6

COURSE OBJECTIVE:

- To introduce and familiarize the students with constituents, manufacturing process / availability, properties / characteristics, defects, classifications, treatments, preservation and uses of traditional building materials used in construction.
- To understand the use of the above said building materials in simple building works.

UNIT I

M A T E R I A L S :

METALS: Ferrous –Steel

Introduction to structural steel, types of steel used in buildings

- Joining details of various steel members
- Market survey of available steel sections

C O N S T R U C T I O N:

Steel beam and Column connections

Steel trusses- Lattice Girder and North-light truss, Tubular truss, Portal Frames, etc.

UNIT II

M A T E R I A L S: Timber and Steel

C O N S T R U C T I O N:

Scaffolding and Shuttering

UNIT III

M A T E R I A L S: Reinforced cement Concrete

C O N S T R U C T I O N: Various R.C.C. Columns and Beam details, Plinth Beam, One-way slab, Two-way Slab, Cantilever slab etc.

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS:

1. Barry, R (1986) Construction of Buildings, London, vol. 1 to 5.
2. BIS (2013) National Building Code, SP 7, Bureau of Indian Standards.

3. Foster, Stroud (1963) Mitchell's Advanced Building Construction, Allied Publishers Private Limited, Bombay.
4. McKay, W. B. (1972) Building Construction (Metric), Longman, London, vol. 1 to 5.
5. Prabhu, Balagopal T. S. (1987) Building Drawing and Detailing, Spades Publishers Pvt. Ltd., Calicut.
6. Punmia, B. C. (2005) Building Construction, Firewell Media, Delhi.
7. Singh, Gurucharan (1981) Building Construction Engineering, Standard Book House, New Delhi.
8. Relevant IS codes

WEB REFERENCES:

1. http://en.wikipedia.org/wiki/Building_material
2. www.bmtpc.org/pubs/book12.pdf
3. http://www.habitattechnologygroup.org/

APCE315	STRUCTURAL DESIGN-V	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

- To understand the analysis of intermediate structures & their use in field in greater depth.

UNIT I

Limit state method

- Concept of Limit state design
- characteristics strength of steel & concrete
- Design values,
- Loads & loading conditions
- Limit state of collapse & serviceability
- Limit state method Vs working stress method, Building code.

Theory & design by Limit state method, of

- singly reinforced,
- Doubly-reinforced
- L & T beams

UNIT II

Pre stressed concrete

- Elements, Principles and systems,

- loss of pre stress,
- analysis of pre stresses and
- design of beam, circular tanks & pipes

UNIT III

Design & detailing of Stairs

- With stair slab spanning horizontally
- With stair slab spanning vertically
- Distribution of loading on staircase
- Design of doglegged stairs
- Design of stairs with quarter space landing

UNIT IV

Domes, shells & folded plates

- Theory & design
- Stresses in spherical domes
- Stresses in domes due to Universally distributed load
- Stresses in domes due to concentrated load at crown, combined UDL & concentrated loads and wind loads

TEXT BOOK:

Punmia, B. C., Jain, A. K., and Jain, A. K. (1992) Reinforced concrete structures, Vol. I, Firewall Media, New Delhi.

REFERENCES:

1. BIS (2000) Indian Standard Code of Practice for Plain and Reinforced Concrete I.S: 456, Bureau of Indian Standards.
3. Singh, H. (2008) Design of Reinforced concrete structures for Architects, Abhishek Publications, Chandigarh.
4. Mallick, S. K. and Gupta, A. P. (1980) Reinforced Concrete, Oxford & IBH publishing company Pvt. Ltd. New Delhi.
5. Shetty, M. S. (2008) Concrete Technology, S. Chand Limited.
6. Neville A. M. (2012) Properties of Concrete, Prentice Hall
7. Mehta, P. K. and Moterio, P. J. M. (2005) Concrete: Microstructure and properties, McGraw-Hill Professional
8. Dayaratnam P. (1983) Reinforced Concrete Design, M. Primlani.

APAR 323	COMPUTER APPLICATION IN ARCHITECTURE– III	L	T	S	P	Credit
		-	-	-	4	2

INTENT

- Introduction and Advanced learning of softwares assisting in 2 –Dimensional and 3-Dimensional design available for architectural applications and their Integration with the design studio project.
- Introduction to the use and application of internet.

CONTENTS

UNIT I

Understanding Auctocad contd…..

Basic commands for 2-D AutoCAD

Understanding of Text, and dimension styles etc, supported with suitable exercise. Understanding
complex commands like Pline, spline, x-refs, Attributes, Model space & Paper space etc.
At least one working plan, elevation and section should be completed.

UNIT II

Understanding Auctocad contd…..

Basic commands for 3D

Introduction of basic 3D commands.
Different types of modeling in Auto CAD.
Exercise on wire mesh modeling.

UNIT III

Using 3-D MAX: 3-D Max and other related software for developing exterior and interior surfaces and spaces and creating walkthroughs using camera, light and assigning materials.

a) Introduction to animation.
b) Animation of still life.
c) Introduction to modeling
d) Introduction to materials and mapping.
    i. Assigning materials
    ii. Creating Transparencies.

iii. Mapping and mapping co-ordinates.

e) Introduction of lighting

i. Lighting effects.

ii. Shadow maps.

f) Rendering using active shades and depth of field.

UNIT IV

Setting up an INTERNET Connection:

a) Introduction to Internet Explorer and web Browsers like Netscape.

b) Finding Information on the Web

c) Browsing and Working Offline.

d) Security Aspects of Internet.

Printing and Saving Information

APAR329	HOUSING	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- To understand the housing fundamentals, policies programmes, housing process & design.
- To study & design of housing schemes with defined parameters.

UNIT I: Introduction to housing

- Concepts, definition & components of housing
- Role of housing in socio-economic development of nation
- Housing Process & sequence of development
- Housing need, demand and supply
- Housing problems and inadequacy
- Formal and informal housing
- Housing characteristics and situation

UNIT II: Policies & Programmes

- Housing in 5 year plans
- National Housing policies
- National housing schemes and programmes
- Elements of housing policy
- Housing surveys
- Housing agencies

UNIT III: Housing standards and design

- Housing typology
- Residential gross and net density
- Understanding of FAR, FSI, Ground coverage and other development controls
- Housing standards, and basic principles of formulating standards
- Desirable and minimum design standards
- Form and structure of housing as shaped by socio-economic & physical parameters: location, topography, development controls, climate etc.
- Community and neighbourhood factors
- Latest trends of Market

UNIT IV: Housing Finance

- Finance agencies
- Obstacles in financing
- Banking and non-banking institutions for financing

TEXT BOOK:

Rangwala, Town Planning, Charotar publishing House, Anand.

REFERENCES BOOKS-

1. Chiara Joseph De et al (1995). Time saver standards for housing and residential development. McGraw Hill, New York
2. Correa, C. (1999) Housing and urbanization, Urban Design Research Institute, Mumbai.
3. Mehta, M. and Mehta, D. (1989) Metropolitan housing market. Sage Publications, New Delhi
4. Housing, Compilation of housing Related Topics for AITP examination, Instt of Town Planners.

APEE321	BUILDING SERVICES-II (ELECTRICAL & LIGHTING)	L	T	S	P	Credit
		2	-	-	-	2

INTENT:

To understand the electrical system in domestic and multistoreyed buildings including lighting, fixtures and fittings, and cabling.

CONTENT:

UNIT I:

Introduction to engineering services for buildings
Electrical Services: sources of electrical energy supplied to buildings
Electricity generation, transmission and distribution.
Instruments for measurement, metering
Electricity Authority, Act, rules and regulations

UNIT II:

Rules and regulations regarding electrification of buildings as appropriate with relevant standards
Types of electrical wiring system, earthing, scope and requirements
Requirements of electrical materials such as conductors, insulators
Types and requirements of electrical cables
Control equipments such as switch gear, safety devices to be used in electrical layouts

UNIT III:

Electrical lighting
Integration of Electrical lighting with day lighting, sensors
Instruments for measurement lux meters
Type of lamps and luminaries, lighting density and efficiency
Outdoor lighting, Specialized lighting like art galleries etc.

UNIT IV:

Graphical symbols electrical systems
Plug load calculation of a small building
Electrical drawing of a small building

REFERENCES BOOKS-

1. Raina K. B. & Bhattacharya S. K. (2007) Electrical Design, Estimating and Costing, New Age International Publishers, New Delhi.

2. Dagostino, F. R. (1978) Mechanical and Electrical Systems in Construction in Architecture, Reston Publishing Company, Prentice Hill Co., Virgenia.
3. Egan, D. M. (1983) Concepts in Architectural Lighting, McGraw Hill Book Company.
4. Flynn, J. E. et. al (1992) Architectural Interior Systems: Lighting, Acoustics and Air conditioning, Van Nostrand Reinhold
5. NBO (1966) Hand book for Building Engineers, National Buildings Organisation, New Delhi.
6. Grondzik, W. T., Kwok, A.G., Stein, B, Reynolds, J. S. (2009) Mechanical and Electrical Equipment for Buildings, Wiley.

APCE 317	ESTIMATING,COSTING & SPECIFICATIONS	L	T	S	P	Credit
		2	-	-	-	2

INTENT

Understanding of techniques and phraseology of written specifications of basic and composite materials, and various building works
To initiate students into theory and practice of calculating estimates and detailed costing for small to medium scale projects.

UNIT I

SPECIFICATIONS: Definition, Correct form of writing specifications –avoiding ambiguity and conflicting statements. Form and sequence of clauses, study and uses of standard specification viz; drafted by C.P.W.D etc.
Writing detailed specifications for various building materials e.g. bricks, sand, lime, timber, glass and paints etc. Writing detailed specifications for various building constructions works e.g. earthwork for foundations, concreting the trenches for foundations, superstructure in cement mortar, R.B. work, plastering and painting, lime punning, flooring, whitewashing, distempering and painting. Snowcem wash, stone masonry, mud phuska, terracing and others.

UNIT II

ESTIMATION: Preparation of project estimates, types of estimates-preliminary and detailed. Thumb rules used in estimating.
Exercise in estimating (with different methods) of small buildings, for interior schemes, plumbing work and electrical installations etc.

UNIT III

METHODS OF TAKING OUT QUANTITIES FOR BUILDING WORKS: Preparation of BOQ, mode of measurements of quantities, market rates of labour and building materials, labour turnouts and norms for consumption of basic materials.
SCHEDULE OF RATES: Principles of analysis of rates, rates of labour and materials, analysis of rates for common items of work like cement concrete, brick work, painting etc. factors affecting rates of an item.
Exercises in rate analysis of different building works, introduction to PWD accounts procedure, measurement books, daily labour, stocks indent form, mode of payment etc.

UNIT IV

TENDERS: Various forms of tender in building civil works, tender notices and tender documents, types of tendering in practices, process of tendering, price rise mechanism in tendering, award of tenders.

APPROACH:

- The course would be covered through lectures and tutorials.
- The students' seminars will help them in realizing the grasp on the subject matter.

REFERENCE BOOKS:

1. CPWD (1987) Schedule of Rates, Government of India Publications, New Delhi
2. Dutta, B. N. (2002) Estimating and Costing (ed.20), Sangam Books.
3. Rangawala, S.C. (1984) Estimating and Costing, Charotar Publishing Co
4. Relevant I.S. Codes for Material Specifications.
5. CPWD Specifications manual
6. HPWD Specifications

APAR327	MODERN WORLD ARCHITECTURE	L	T	S	P	C
		2		-	-	2

COURSE OBJECTIVE:

– To understand the growth and development of architecture and appreciation of the role of the intangibles that brought this growth & development from the 18^{th} to 21^{st} century to the advent of European & Indian development.

UNIT I

Colonial Architecture in India – (late 18^{th} to early 20^{th} century):

– Colonial culture reflecting in the architecture of India,

- Emphasis on the buildings of Kolkata, Goa, Delhi & Mumbai.
- Portuguese-Goa, Dutch-Coromandel, Malabar, French-Pondicherry

Early British Princely Indian Architecture

- Birth of Indo Saracenic Architecture
- Lutyen's Delhi

UNIT II

Modern architecture: Various modern movements in different parts of the Western world and their role in defining Modern architecture taking examples of Architects (Le Corbusier, FLW, Mies Vanderohe) /Artist and their works such as (Basically to learn the difference of Architecture style between all)

- Post Impressionism,
- Expressionism,
- Art Nouveau,
- Surrealism,
- Abstract Expressionism,
- Cubism
- In Indian Context: Public Works Department (PWD) and its role in the works of Indian Architects.
- Buildings of New Delhi

UNIT III

(Postmodern Architecture)

Architecture of early 19th and late 20th century): Architects Philosophies & their works

- American architecture
- Birth of American Skyscrapers
- Introduction to Chinese Architecture style.

(Brief Introduction to various styles)

- Constructivism
- DE –Constructivism (Examples of various Architects works)
- Biomimetic-Gherkin Building, London
- Parametricism

UNIT IV

Theory of Indian architecture:

- antiquity to modern times
- Impact of Architectural design theories and ideas on architects in India, pre-independence and post independent
- Claude Batley, Habib Rahman, Charles Correa, Achute P. Kanvinde, B. V. Doshi, Joseph Allen Stein, Anant Raje, Raj Rewal, Uttam C. Jain, Kulbhushan and Meenakshi Jain, Hasmukh Patel, Dulal Mukherjee, Chandavarkar and Thacker

- Search for appropriate architecture in the 21st century: Rahul Mehrotra, Vasant and Rewathi Kamath, Nimish Patel and Parul Jhaveri, Sanjay Mohe, Sanjay Prakash, Vinod Gupta, Karan Grover

TEXT BOOK

Cruickshank, D., Fletcher, B., Saint A., "Banister Fletcher's - A History of Architecture", Architectural Press.

REFERENCE BOOKS:

1. Snyder, J and Catanese, A, "Introduction to Architecture", McGraw-Hill,
2. Farrelly, Lorraine, "The Fundamentals of Architecture", Ava Publishing
3. Voordt and Wegen, "Architecture in Use", Architectural Press,
4. Smithies, K.W., "Principles of Design in Architecture", Van Nostrand Reinhold Co,
5. Roger H. Clark and Michael Pause, "Precedents in Architecture", Van Nostrand Reinhold Co.
6. Parmar, V. S., "Design Fundamentals in Architecture", Somaiya Publications Pvt. Ltd.

WEB REFERENCES:

1. http://en.wikipedia.org/wiki/Architectural_theory
2. http://www.britannica.com/EBchecked/topic/32876/architecture/31858/Theory-of-architecture
3. http://www.greatbuildings.com

SEMESTER VI

APAR318	ARCHITECTURAL DESIGN – V	L	T	S	P	Credit
		-	-	10	-	10

INTENT

- The objectives of Arch. Design in the earlier semesters were concerned with 'space and form' and 'formal transformations'; 'space and activity'; 'space & regional setting" etc.
- The continuation of this leads to understanding of architecture as an outcome of 'space and structure'---

– Understanding basic structure forms in relation to space and materials.
– Application of structure forms in design.
– Understanding of the design complexities and contradictions to resolve architectural design problems for Housing of different typologies and public buildings.

CONTENT

Design of Mid-rise apartments:

- Issues to be addressed for the design project pertaining to apartment design:
- Density, mixed land use, ground coverage, development controls.
- Type of occupancy, social strata, social status and prevalent social strata
- Urban systems, services and their integration with the project.
- User requirements (derived from surveys)
- Issues in appropriate technology and costs.
- Issues of hierarchy, identity of space, public and private scales of space. Integration of community institutions etc.
- Detailing for the disabled and the elderly.
- Indian / local architectural responses to climate, culture, traditional values, building elements, symbols motifs and special character.
- Details from the dwelling cell to immediate shared space to communal space shall be emphasized and worked out. Socio cultural layer of the occupants shall form a strong fabric in the ultimate weave of the design. Projects shall aim at developing a very sensitive attitude towards micro level human habitation and role of architecture in enhancing or curbing the quality of living.
- Examples of projects: Apartments for IT employees, Govt. servants, teaching faculty, Textile weavers, etc. luxury flats in the center of the city, group housing in the suburbs.

Design of public buildings:
The role of urban space as a public realm and the need to create such spaces as extension of private domain in a public building shall be investigated and shall become one of the architectural goals of the project. Some of the prerequisites of the project shall be;

1. Multiple functions,
2. Public access to majority of the spaces,
3. Large gathering areas which are open and extendable to the immediate urban context.

Examples of projects: Large scale exhibition spaces, Auditorium, Cinema halls, Sports stadium, etc., Detailing of architectural features of the major project like entrance lobby, skylights and staircases has to be attempted. All portfolios to include two drawings showing construction system and materials, services.

REFERENCE BOOKS:

1. Watson, Donald, "Time-saver Standards for Building Materials and Systems", Tata McGraw Hill
2. Alexander, C. Pattern language: Towns, Buildings, Construction. Oxford University Press, New York.
3. Chiara, De Joseph et al Timesavers standard for Housing and Residential development, McGraw Hill Inc, NY.

APAR 320	BUILDING CONSTRUCTION AND MATERIALS – V	L	T	S	P	Credit
		-	-	6	-	6

COURSE OBJECTIVE:

- To introduce and familiarize the students with constituents, manufacturing process / availability, properties / characteristics, defects, classifications, treatments, preservation and uses of traditional building materials used in construction.
- To understand the use of the above said building materials in simple building works

UNIT I

M A T E R I A L S: Nonferrous- Aluminum

CONSTRUCTION: Sandwichpanels, Aluminum Composite panel- Cladding, partitions, false ceiling

UNIT II

M A T E R I A L S: Glass

C O N S T R U C T I O N: Curtain Glazing, Structural Glazing

UNIT III

M A T E R I A L S: Stone

C O N S T R U C T I O N: Dry stone cladding

UNIT IV

C O N S T R U C T I O N:

Roofs & Trusses contd….:

– Construction of domes, vaults and shell roofs;

R.C.C. (Formwork & Laying):

– Beams, Columns, Lintel, column grid and frame construction. Slabs-simply supported & cantilevered, flat slab construction, etc.

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS:

1. Foster, Stroud Mitchell's Advanced Building Construction, Allied Publishers Private Limited, Bombay.
2. Singh, Gurucharan Building Construction Engineering, Standard Book House, New Delhi.
3. McKay, W. B. Building Construction (Metric), Longman, London, vol. 1 to 5.
4. Prabhu, Balagopal T. S. (1987) Building Drawing and Detailing, Spades Publishers Pvt. Ltd., Calicut.
5. Barry, R Construction of Buildings, London, vol. 1 to 5.
6. Punmia, B. C. Building Construction, Delhi.
7. BIS National Building Code, SP 7, Bureau of Indian Standards.
8. Relevant IS codes
9.Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

WEB REFERENCES:

1. http://en.wikipedia.org/wiki/Building_material
2. www.bmtpc.org/pubs/book12.pdf
3. http://www.habitattechnologygroup.org/

APCE332	STRUCTURAL DESIGN-VI	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE:

- To understand the principles and design of simple steel structures

UNIT I:

- Structural Properties of steel and use of steel as a structural material.
- Classification of rolled steel sections and their properties.

UNIT II:

- Riveted, Bolted & Pinned connection.
- Welded connections.

UNIT III:

- Design of Tension members.
- Design of compression members, lacing & bracing

UNIT IV:

- Analysis and Design of simple Beams & Plated Beams.

TEXT BOOK:

Punmia, B. C., Jain, A. K. & Jain, A. K., Comprehensive Design of Steel Structures, Laxmi Publications (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. BIS (1984) Indian Standard Code of Practice for General Construction in Steel IS : 800.
2. Duggal, S. K. Design of Steel Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Singh, H. Analysis & Design of Steel Structures for Architects, Abhishek Publications, Chandigarh.
4.. Arya, A. S. & Ajmani, J. L. Design of Steel Structures, Nem Chand & Bros., Roorkee.

APAR 328	Building Services – III (Acoustics)	L	T	S	P	Credit
		1	1	-	-	2

INTENT

To make students aware about Use of acoustic materials, Acoustic treatment etc. Fire Fighting & Fire Protection systems used in practice & norms related to it.

UNIT I

Acoustics

- Introduction to the study of acoustics, basic terminology, sound and distance – inverse square law; absorption of sound, sound absorption co-efficient.
- Reverberation time, Sabines' formula, various sound absorbing materials. Behavior of sound in enclosed spaces, Acoustical defects
- Noise and its types – outdoor and indoor noise, air born noise, structure borne noise, impact noise.
- Noise control at neighborhood and city level.

UNIT II

- Acoustical design for halls used for drama, music, speech, cinema theatres and open air theatres.
- Acoustical materials and constructional measures of noise control, insulation of machinery, sound insulation.

UNIT III

Fire Fighting & Fire Protection

- Causes of fire, reasons for loss of life due to fire, development of fire, fire load, fire hazards
- National Building Code: grading of structural elements due to fire, classification of building types, norms for fire-exit ways and building materials, concept of fire zoning, doorways, stairways, passages and corridors, fire escapes etc.
- Rules for fire protection and firefighting requirements for high-rise buildings in India
- Brief description of characteristics of combustible and noncombustible materials in case of fire

UNIT IV

- Fire resisting materials, fire resistant rating
- Concepts in passive fire protection and control – including design of escape routes, pressurization and compartmentation, etc.
- Active fire control using portable extinguishers. Basic concepts in fixed fire fighting installations.
- Automatic fire detection and alarm systems
- Fire preventive techniques, fire protection equipments

REFERENCE BOOKS:

1. Egan, D. Architectural Acoustics, McGraw Hill Book Co., NY.
2. Kinsleter, L. E. and Frey, A. R. Fundamentals of Acoustics (ed.2), Wiley Eastern Ltd., New Delhi.
3. Knudson, V. Acoustical Designing in Architecture, John Wiley, N.Y.
4. Narasimhan, V. Introduction to Building Physics, Central Building Research Institute.
5. Parich, P. Acoustics: Noise and Buildings, Faber and Faber, London.
6. Templeton and Saunders Acoustic Design, Architectural Press, London.

APAR 334	Air Conditioning & Mechanical Services	L	T	S	P	Credit
		1	1	-	-	2

INTENT

To appreciate how buildings can be made more comfortable by adding mechanical systems like artificial ventilation, air conditioning and conveyor systems.

CONTENT

UNIT I

- Human Comfort conditions, Need for mechanical ventilation in buildings. Rate of ventilation for different occupancies, Methods and equipment employed for mechanical ventilation in buildings.

Air Conditioning

- Principles of Air-conditioning, Indoor Air Quality, Carnot cycles, gas laws, refrigeration, cycles and refrigerants.
- Architectural considerations for air conditioned buildings
- Definition, advantages and disadvantages, brief introduction to psychrometric process, air-cycle and refrigeration cycle. Summer and winter air-conditioning, calculation of air-conditioning loads

- Zoning: purpose and advantages. Air-distribution systems: Ducts and duct systems. Air-outlets
- Compressors, condensers, evaporators, heat exchangers, etc.

UNIT II

Air-conditioning methods and equipment:

- Window units, split units, ductable air conditioners and package system.
- Central air-conditioning systems: AC plant and room, all air systems and chilled water systems, AHU and FC units, Building ducting, diffusers and grills.
- Location of air-conditioning equipment in buildings. Architectural requirement of various equipment, Residential and commercial air-conditioning, energy conservation techniques.
- Introduction to the concept of 'Clean Room' and their architectural requirements

UNIT III:

Elevators (Lifts) and escalators

- Brief history-types of Elevators like traction, hydraulic etc. Double-decker, sky lobby, lift lobby, lift interiors etc.,
- Definition and components
- Elevatoring a building: environmental considerations i.e., location in building, serving floors, grouping, size,
- shape of passenger car, door arrangement etc.
- Types of lifts, passenger, capsule, hospital lift; goods-lift etc.

UNIT IV:

- Working and operation of lifts, parts of lifts; industry standards and capacity calculations.
- Provision to be made in buildings for installation: location, systems, sizes, equipment, spatial requirement
- Introduction to working of escalator and design, escalators location, equipment

REFERENCE BOOKS:

1. Grondzik, WT, Kwok, AG, Stein, B, Reynolds, JS Mechanical and Electrical Equipment for Buildings, Wiley.

APAR 310	WORKING DRAWING AND BUILDING BYELAWS	L	T	S	P	Credit
		-	-	6	-	6

INTENT

- To acquaint the students with building legislation
- To understand design limitations due to regulations and byelaws and making drawing/ details necessary for final execution of a project.

CONTENT

UNIT I

Introduction to building codes and norms, bye laws and regulations, their need and relevance. Overview of basic terminologies, nature of building codes in special regions like heritage zones, air funnels, environmentally sensitive zones, disaster prone regions, coastal zones, hilly areas, etc.

UNIT II

- Study of building regulations, Study of Building bye laws, National Building Code etc,
- General building requirements, building classifications and permissible uses,
- Norms for exterior and interior open spaces, setbacks and margins, norms for building projections in open spaces, considerations in FAR, guidelines for open green areas.
- Definitions and guidelines for Plinth, habitable rooms, kitchen, wet areas, mezzanine, store rooms, elevated parts like chimneys, parapets etc., Means of access, norms for access widths for various types of buildings, requirements of parking spaces, Equivalent Car Space (ECS), standards for turning radius, access to service areas.

UNIT III

- Study of Building bye laws framed by local bodies of NCR
- Procedural method for use of bye laws for submission drawings, obtaining building permits, architectural control and provision of building services, regulations for super structures, building height regulations, regulations for multi-storied buildings etc.
- Making complete set of submission Drawings and Details for the residence presented earlier or any other small project designed in any of the previous semesters.

UNIT IV

Making complete set of working Drawings and Details for the residence presented earlier or any other small project designed in any of the previous semester. The drawings to also incorporate electrical and plumbing details complete with schedule and all specifications. The Working Drawings and details to include:

- Site plan
- Foundation layout with details of foundations.
- Ground floor Plan.
- First Floor Plan.
- Terrace Plan
- Sections
- Elevations.
- Doors and Windows
- Doors and Windows details
- Electrical Layout in at least one of the two Floors.
- Plumbing Layout in at least one of the two Floors.
- Toilet details complete with all fixtures and their specifications.
- Kitchen details complete with all fixtures and their specifications
- Flooring pattern on either of the two Floors.
- Staircase Details including railings.
- Details of Grills, Parapet or railings.
- Typical wall section showing foundation, DPC, skirting, sill, lintel, slab and terracing details.

REFERENCE BOOKS:

1. Durga Prasad, M. V. Law of Flats, Apartments and Buildings, Asia Law House, Hyderabad.
2. Scott, G. J. Architectural Building Codes, Van Nostrand Reinhold, NY.
3. National Building Code

APAR336	TOWN PLANNING	L	T	S	P	C
		2	-	-	-	2

COURSE OBJECTIVE:

- Introduction to elementary art and science of town planning including traffic and transportation planning.
- To expose the students to the history and development of planning, its relevance & application to modern day principles of town planning.

UNIT I: Introduction to Principles and Techniques

- Definition and vocabulary of Town Planning and Regional Planning
- Town planning and architecture, role of a town Planner, Elements and planning principal of city plan.
- Evolution of town planning in India: pre-independence and post-independence

UNIT II: Town planning Terminology, Planning Process & Standards:

- Land use, Concept of F.A.R. and Density, Zoning and Subdivision Regulations, Master Plan.
- Introduction about Professional Bodies in planning profession such as T.C.P.O. and I.T.P.I. etc. Various Planning authorities like D.D.A., CIDCO, HUDA/ HSVP ,etc. Introduction to Local and Self Government in urban as well as rural areas, introduction to 73rd and 74th amendment to the constitution.
- Planning Process & Standards Understanding of planning process. Relevance of standards in planning as per URDPFI guidelines prepared by TCPO.
- Introduction to Town Planning Schemes, Development Plan and Regional Plan.
- Town planning surveys (Physical, social and Economical, Aesthetic Surveys), Preparation of MASTER PLAN for old and new towns, Planning Standards.

UNIT III: Planning Concepts and Evolution:

- Planning concepts related to City beautiful movement (Chicago, Chandigarh), Urban Utopia (Broadacre), Garden city (Letchworth), Radburn Theory (Radburn) and Neighborhood planning.
- Planning Theories & Models – Theories by Le Corbusier, Sir Pattrick Geddes, Sir Ebenezer Howard, C. A.Doxiadis, Clarence Perry and Lewis Mumford. – their relevance to Indian conditions.

UNIT IV: Roads and traffic studies Modern Transportation systems:

- Awareness of concepts related to various traffic problems in India. Understanding of PCU, Traffic volume, Road capacities, Road types; their sections and intersections, Traffic calming as per IRC guidelines.
- Shapes of plan in accordance to road networks.
- New concepts in mass and rapid transportation systems e.g. BRT, LRT and Metro rail.

UNIT IV: Modern approach in Planning:

- Modern approach in Planning Introduction, Benefits and Planning components of Green City (e.g. Vancouver), Compact City (e.g. Sky city, China) and Smart City (e.g. Malta)

TEXT BOOK:

1. Rangwala, S. C. and Others Town Planning, Charotar Pub. House, Anand.
2. G.K.Hiraskar, Town Planning

REFERENCE BOOKS

1. Arthur B. Gallion and Simon Eisner, The Urban Pattern – City planning and Design, Van Nostrand Reinhold company.
2. John Ratcliffe, An Introduction to Town and Country Planning, Hutchinson 1981
3. Kevin Lynch -Image of City.
4. Sir Ebenezer Howard- Tomorrow – Peaceful Path To Social Reforms.
5. URDPFI Guidelines for Planning by TCPO.
6. IRC Guidelines
7. P.W.D. Handbook of Town Planning
8. Rame Gowda, Urban and Regional planning
9. Agarwal, M. K. Urban Transportation in India, Allied Publishers, Mumbai
10. J. G. Keskar -Basics of Town Planning.
11. Gowda, K. S. R. Urban and regional planning, Prasaranga, Mysore
12. Khosla, R. K Urban and Rural Development in India, Indian Publishers & Distributors, Delhi.

SEMESTER VII

APAR419	ARCHITECTURAL DESIGN – VI	L	T	S	P	Credit
		-	-	10	-	10

INTENT:

To develop design skills for complex service intensive buildings and structural systems.

CONTENT:

Projects shall be of urban scale with multiple functions and a need for imagery as one of the architectural goals.
Design issues should address the following:
Macro and micro climate
User behavior and requirements
Utility and space enhancement
Form and function
Circulation: horizontal and vertical.
Site Planning and Landscape detailing
Structural details such as beam framing, building services / HVAC etc.
Use of innovations in materials and techniques of construction.
Energy efficient design, water conservation and waste recycling
Energy Management systems
Lighting and acoustics
Communications and security systems
Design detailing considering the barrier free environment
Socio-economic profile of user group
Parking details and standards
Application of energy rating systems viz. LEED, GRIHA
Design of high rise buildings/services oriented buildings like Multiplexes; Shopping malls, commercial complexes, 5 star hotels, theme-based hotels, recreational buildings, hospitals, IT centres, etc.
Design of transport terminal like airports, bus terminals, railway station, etc.
All portfolio to include two drawings showing construction system and materials, services.
Architectural models of various structural forms and important historical buildings should be preserved in the Architecture museums of the college for the use in History of Architecture classes.

REFERENCE BOOKS:

1. Watson, Donald, “Time-saver Standards for Building Materials and Systems”, Tata McGraw Hill
2. Design Dialog: Dialectics of Design in Architecture, Prof. Shireesh A. Deshpande
3. The Discovery of Architecture: a contemporary treaties on ancient values and indigenous reality, M.N. Ashish ganju and Narendra Dengle
4. Christopher Benninger , “Letters to a Young Architect”

APAR421	BUILDING CONSTRUCTION AND MATERIALS – VI	L	T	S	P	Credit
		-	-	6	-	6

COURSE OBJECTIVE:

- To introduce and familiarize the students with advanced and speedy building techniques;
- The understanding for the system to be adopted for the construction of large span structures.

UNIT I

Prefabrication: Systems – open prefab system, large panel prefab system, joints, pre-casting methods, materials, on-site and off-site prefabrication, components, etc.

UNIT II

Pre-stressed Concrete: Introduction, methods of pre-stressing and their application to large space structures.

UNIT III

Speedy Construction: Mivan technology, Ciporex construction, Dry walling, Dry construction techniques

UNIT IV

Innovative and low cost construction techniques-

Techniques using recycled waste materials like PET bottles, glass bottles, wooden planks, cardboards, etc. Techniques using bamboo, coir, glass fibre, polymers, flyash etc.

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS:

1. Foster, Stroud Mitchell's Advanced Building Construction, Allied Publishers Private Limited, Bombay.
2. Singh, Gurucharan Building Construction Engineering, Standard Book House, New Delhi.
3. McKay, W. B. Building Construction (Metric), Longman, London, vol. 1 to 5.
4. Prabhu, Balagopal T. S. Building Drawing and Detailing, Spades Publishers Pvt. Ltd., Calicut.
5. Barry, R Construction of Buildings, London, vol. 1 to 5.
6. Punmia, B. C. Building Construction, Delhi.
7. BIS (2011) National Building Code, SP 7, Bureau of Indian Standards.
8. Relevant IS codes
9. Rangwala, S. C., "Engineering Materials (Material Science)", Charotar Publishing House.

APAR431	PROFESSIONAL PRACTICE AND OFFICE MANAGEMENT	L	T	S	P	Credit
		2	-	-	-	2

Role of Professional Bodies:

The Indian Institute of Architects, its working constitution and byelaws, categories of membership, election procedures.

Architects' Act 1972: Detail study of the Act, Council of Architecture; procedures of Membership.

Scale of charges: Conditions of engagement of an architect – Duties; Responsibilities and liabilities of a professional architect; Scale of charges, mode of payment etc.

Code of Professional conduct: Clauses governing conduct of professional architect.

Architectural Competition: Types of competitions; need and procedure for conducting competitions.

Tender and Contract: Type of building contracts, their demands. Preparation of tender documents, method of inviting tenders, opening of tenders, preparation of comparative statement, recommendation and award of projects, preparation of contract documents, general conditions of contract, interim certificates, defect liability period, retention amount and virtual completion.

Arbitration: Arbitration, Arbitrator, Umpire, Nature, of arbitration, Appointment, Conduct, Powers, and duties of arbitrators and umpires; Procedure of arbitration and preparation of awards.

Office management: Architectural office, architect, contractor, client relationships, Office correspondence, filing and record keeping, Human resource management.

APAR425	PROJECT CONSTRUCTION MANAGEMENT	L	T	S	P	C
		3	-	-	-	3

INTENT

- Introduction to the Construction Project management Tools and Technique. Method of effective management.

UNIT I

- Introduction & definition of Project construction management
- Project functions, Planning process.
- Project work breakdown, Modelling and analyzing networks and work scheduling process.

UNIT II

- Bar charts and Mile stone charts. Network analysis fundamentals, CPM Network analysis procedure. PERT - Network, Time estimates, Probability Distribution, Critical Path, Slack and Probability of achieving completion date.
- Project cost analysis - Cost versus time, Contracting the Network etc.

UNIT III

- Resource Allocation - Resource Smoothing and Resource Leveling. Updating the network based on the project progress.

UNIT IV

- Computer applications in construction management – using MS Projects software for project planning, scheduling and control.

REFERENCE BOOKS:

1. Srinath, L.S., "PERT and CPM - Principles and Applications", Affiliated East – West Press Pvt. Ltd., New Delhi, 1989.
2. Stevens, James. D., "Techniques for Construction Network Scheduling", McGraw - Hill Publishing Company, New York, 1990.
3. Mukhopadhyay,S.P., "Project Management for Architects and Civil Engineers", Firma KLM Pvt. Ltd., Calcutta, 1981.

GENERAL GUIDELINES FOR ELECTIVES:

These electives will enable students to initially suit their interests at the undergraduate level and later assist them pursue their specific interests at the postgraduate level. Students are expected to choose two electives from the entire list of the choices being offered by the institution. However the final list of elective subjects can **only** be finalized in the VII and X semesters in accordance with the availability of respective faculty at that time.

The outlines of each elective have been broadly outlined to suit the availability and interests of faculty in different institutions.The content & syllabus for each elective would be detailed out by the concerned teachers, at the time of commencement of teaching.

The syllabus of Elective subjects is to be made in such a way, that their implication and manifestation in the field of architecture is clearly defined & communicated to the students, during the course of study.

		L	T	S	P	Credit
APAR 407	**ARCHITECTURAL CONSERVATION**	**2**	**1**	**-**	**-**	**3**

To bring in an awareness of the value of natural and historical heritage and sensitise students to the issues of conservation. It is an initiation course for students who might wish to take up conservation as a specialization in future.

		L	T	S	P	Credit
APAR 427	**SITE PLANNING & LANDSCAPE DESIGN**	**2**	**1**	**-**	**-**	**3**

To develop a conceptual understanding of landscape design and site planning Principles.
To develop skills in integrating landscape design with built environments.

		L	T	S	P	Credit
APAR 411	**ART MOVEMENTS & ARCHITECTURE**	**2**	**1**	**-**	**-**	**3**

The course is considered as a medium of understanding architecture as one of the principal art in the pantheon of human creativity, the flowering of aesthetic sensibilities and a taste for the visual and sensory appeal of physical form. The emphasis is to make students into connoisseurs of art rather than consummate artists themselves.

		L	T	S	P	Credit
APAR 413	**SUSTAINABLE ARCHITECTURE**	**2**	**1**	**-**	**-**	**3**

To familiarize the students with the problems and methods of energy conservation through design of built forms.

APAR 415	INTELLIGENT BUILDINGS	L	T	S	P	Credit
		2	1	-	-	3

To familiarize the students about efficient use of energy and various intelligent systems applicable in buildings. study.

APAR 433	VISUAL ARTS	L	T	S	P	Credit
		2	1	-	-	3

APAR507	LOW COST CONSTRUCTION TECHNOLOGY	L	T	S	P	C
		2	1	-	-	3

To make the students aware of the use of conventional and non-conventional resources for low cost construction & technologies for the same.

APAR509	WATER RESOURCE MANAGEMENT	L	T	S	P	C
		2	1	-	-	3

To focus on concepts related to resource-oriented water conservancy that creates balance of environmental ecology as the system target.
Integrated water resources perspective for social, economic, environmental, and technical dimensions in the management and development of Water resources.

APAR511	INTEGRATED WASTE MANAGEMENT TECHNOLOGY	L	T	S	P	C
		2	1	-	-	3

To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes and the role resource efficiency plays in conserving resources and contributing to a low carbon economy, while focusing on key engineering and technical aspects involved.

APAR513	INTERIOR DESIGN	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE

- To initiate students into theory and practice of Interior Design by introducing them to principles of design and Vastu, along with various elements and materials of Interior Design.

UNIT I

INTRODUCTION AND BASIC PRINCIPLES OF DESIGN

- Principles of Interior Design and their application.
- Elements of Interior Design – Space, Light and Illumination, Colour, Texture, Furniture (movables & built-in), Fittings and Fixtures.
- Surface treatments in interiors, e.g. on walls, floors, ceilings etc.
- Different types of materials that are available and their uses in interiors

UNIT II

VASTU AND INTERIOR LANDSCAPE

- Introduction to Vastu Shastra in interior.
- Knowledge of indoor plants, indoor water elements like fountains and other landscape features.

UNIT III

UNDERSTANDING FURNITURE WORK

- Introduction to history of furniture & importance of styles related to furniture design.
- Understanding the furniture works of Great Masters.
- Furniture design exercises with types of furniture and their usage, construction materials and fabrics used in furniture designing

UNIT IV

MODERN TRENDS IN INTERIOR DESIGN

- Modern trends and contemporary attitudes to Interior Design e.g. Modular furniture, Modern materials.
- Application of colour, texture, pattern and their psychological effects in interior.

- Design of a small interior space e.g. Entrance Hall, Conference Room, Executive's Office, Study Room, Kitchen, Toilet etc.

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS

1. Kasu A Ahmed 2005,Inside Design ,6TH Edition, Om Publishers
2. Joseph Dechiara , Julius Panero , Martin Zelnik,Time-Saver Standards for Interior Design and Space Planning, II Edition, McGraw Hill Education
3. Francis D. K. Ching , Architectural Graphics 2009, 5th Edition ,Wiley
4. Premavathy Seethe & Raman Parveen Pannu ,Interior Design & Decoration CBS Publishers & Distributors Pvt. Ltd, 2005.
5. Francis D. K. Ching , Corky Binggeli, Interior Design Illustrated 2012 John Wiley & Sons; 3rd Revised edition edition

APAR515	VERNACULAR ARCHITECTURE	L	T	S	P	C
		2	1	-	-	3

INTENT

- To expose the students to traditional architecture of the various parts of the country.
- The students will have knowledge of the planning aspects, materials used in construction, constructional details and settlement planning of the settlements in various parts of the country.

UNIT I

- Introduction to vernacular architecture.
- Approaches and concepts to the study of Vernacular architecture – Introduction to Kutcha architecture and Pucca architecture

UNIT II

- SOUTH REGION Planning aspects, materials of construction, Constructional details & Settlement Planning of Kerala houses (Tarawads), (Mappilah houses), Temples, Palaces and theaters – Thattchushastra.
- TamilNadu – Toda Huts, Chettinad Houses (Chettiars) & Palaces
- Karnataka – Gutthu houses, Kodava ancestral home (Aynmane)
- Andhra Pradesh –Kaccha buildings Religious practices, beliefs, culture & climatic factors influencing the planning of the above.

UNIT III

- WESTERN REGION Planning aspects, Materials used, Constructional details, Climatic factors influencing the planning of
- WADA housing concept of Maharastra and Havelis(Pukka houses) of Rajasthan.
- Pol houses of Ahmedabad - Primitive forms, Symbolism, Colour, Folk art etc in the architecture of the deserts of Kutch & Gujarat state.
- Vernacular architecture of Goa.

UNIT IV

- NORTHERN AND EASTERN INDIA- Kashmir Typical Kutcha houses, mosque, Dhoongas (Boathouses), Ladakhi houses, bridges
- Himachal Pradesh -Kinnaur houses & Uttar Pradesh – Domestic housing of Uttar Pradesh
- Bengal – Bangla (Rural house form), Aat Chala houses – change from Bangla to Bungalow, Kutcha & Pucca architecture of Bengal.
- Nagaland – Naga houses & Naga village, Khasi houses Factors influencing the planning aspects, materials of construction & constructional details of the above.

REFERENCE BOOKS:

1. Traditional buildings of India, Ilay Cooper, Thames and Hudson Ltd., London

APAR517	STRUCTURAL SYSTEMS	L	T	S	P	C
		2	1	-	-	3

INTENT

- To study basic structural system in architecture.

UNIT I

- This course provides students with a basic knowledge of structural systems of the buildings.
- The course emphasizes the historical development of structural form and the evolution of structural design knowledge, from Gothic cathedrals to long span suspension bridges.

UNIT II

- Analysis and design for buildings, bridges and other structures.

- Students will investigate the behavior of structural systems and elements through design exercises, case studies, and load testing of models.

UNIT III

- Students will design structures using timber, masonry, steel, and concrete and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large scale construction.

UNIT IV

- Graphical analysis and design of structures; properties of construction materials; environmental assessment of materials; analysis,
- Design and behavior of beams, columns, trusses, frames, arches; and structural systems.
- The laboratory exercises include design exercises, materials testing, and model building.

REFERENCE BOOKS:

- 1. BIS (1984) Indian Standard Code of Practice for General Construction in Steel IS : 800.
- 2. Duggal, S. K. Design of Steel Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi.
- 3. Singh, H. Analysis & Design of Steel Structures for Architects, Abhishek Publications, Chandigarh.
- 4. Punmia, B. C., Jain, A. K. & Jain, A. K., Comprehensive Design of Steel Structures, Laxmi Publications (P) Ltd., New Delhi.
- 5. Arya, A. S. & Ajmani, J. L. Design of Steel Structures, Nem Chand & Bros., Roorkee.

SEMESTER VIII

APAR402	PROFESSIONAL TRAINING	L	T	S	P	Credit
		-	-	-	-	18

INTENT:

To offer students an opportunity to work in an architect's office and get acquainted with the demands of the profession

CONTENT:

The 22 week office training exposes students to the processes and challenges of designing in the real world. Students are expected to learn various aspects of the design process including design development, working drawings, presentation drawings, site visits, client and consultant meetings, and Project Management.
The Training Report shall consist of the various drawings, observations, technical graphic data, design, structure, construction methods, services, use of material etc. obtained during the process of training. The building study shall be a critical appraisal of one of the noted buildings designed and supervised by the firm in which the candidate has taken the training. The Building Material Study shall include pertinent data, characteristics and applications of a contemporary building material. The detailing study shall deal with the various aspects of an interesting detail done by the firm, where the candidate has done the training or any other project of interest

NOTE:

This entire semester will be used for Practical Training which is to be undertaken with an architect registered with the Council of Architecture and should have a minimum professional experience of ten years.

A Practical Training Examination will be conducted at the end of the training period, in which the work done by the trainee will be assessed through a viva voce
*The student trainees should take prior approval of the Architect's office they intend to join, from the concerned authority in the Department of Architecture.

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SEMESTER IX

APAR519	DISSERTATION	L	T	S	P	Credit
		-	-	6	-	6

INTENT

- To equip the students with the art of paper presentations and preparation of report.
- Independent study and documentation of architectural and allied topics by individual student along with oral & visual presentation with the help of guide.

CONTENT:

The dissertation shall entail the following:

• Identification of an appropriate and focused research topic reflecting social and technological needs of the day.

• Formulate synopsis including objectives, scope of work, methodology of work, case studies to be undertaken, site selection culminating in broad functional requirements.

• An investigation of the topic using an analysis of existing literature, case studies and other data sources.

• To develop understanding of the research topic.

• Conclusions from the research

The dissertation shall be based on empirical study, field work, and textual analysis in the field of urban and rural planning. It should demonstrate candidate's capacity for analysis and judgment as also her/his ability to carry out independent viewpoint in interpretation.

The dissertation shall present an orderly & critical exposition of existing knowledge of the subject or shall embody results of original interpretation and analysis & demonstrate the capacity of the candidate to do independent research work. While writing the dissertation, the candidate shall lay out clearly the work done by her/him independently and the sources from which she/he has obtained other information.

The dissertation shall be well structured document with clear objectives , well-argued and appropriate conclusions indicating an appropriate level of expertise. The submission format for all stages shall be print and digital. Seminars in related areas to the dissertation topic (conceptual, historical, analytical, and comparative or in any other area related to Architecture & habitat) are required to be presented at all stages during the entire semester.

APAR521	URBAN DESIGN	L	T	S	P	C
		-	-	10	-	10

COURSE OBJECTIVES

- To prepare the students to develop a holistic view of the city as a basis for designing the city/city components.
- To develop an understanding of cities, through documentation, research and urban design interventions.
- To address the various urban design and neighborhood issues faced by cities and places around, through studio exercises.
- To enable students to put together the various layers of Urban Design – visual, social, functional, environmental and economic – and come up with design proposals moving towards sustainable urban transformation.

URBAN DESIGN PROGRAMME:

- Understanding of the basic elements of urban design, different terminologies.
- Understanding of design with relation to the contextual environment, heritage, traffic, planning controls and impact analysis.
- The studio exercise should involve the design of a group of buildings in the urban context.
- This could include greenfield/ brownfield development, redevelopment, revitalization or transformation in the context of the city under study.
- An understanding of the architectural implications of design should also lead to insights in the formulation of urban design controls and policies.
- Preparation of the detail drawings showing all the layers of base plan like hierarchy of the roads, open green area, public amenities, low rise & high rise zone, services network etc. Preparation of the model to an appropriate scale.

Suggested studio exercises:

Study, documentation and analysis of urban area. Preparation of detailed site analysis, base map of the study area, figure ground map (nolli), road network etc. Understanding of urban issues through detailed site analysis and addressing them through urban design intervention.

OR

Green field project where students will study and analyze given site, its proximity, vicinity, socio economic structure, culture, weather, terrain end other element of urban design.

Preparation of the base plan of the neighborhood taking into account the building byelaws, zoning regulations, fire safety norms etc.

OR

Urban transformation, revitalization or redevelopment projects can be undertaken to understand processes governing the shaping of cities. The scale of prevailing urban transformation is unprecedented and the nature and direction of urban growth needs more awareness and understanding. Managing urban transformation, renewal or redevelopment has increased in both scope and complexity, and have become important challenges today.

REFERENCE BOOKS:

1. Image of city – Kevin Lynch; MIT Press
2. Site planning - Kevin Lynch; The MIT Press
3. Urban Design: The Architecture of Towns and Cities, Paul D. Spreiregen; Krieger Publishing Co.
4. Urban Space-Rob Krier; Rizzoli International
5. Pattern Language, Towns Buildings, Construction: Christopher Alexander; Oxford University Press
6. Emerging Concepts of Urban Space - G. Broadbent

GENERAL GUIDELINES FOR ELECTIVES:

These electives will enable students to initially suit their interests at the undergraduate level and later assist them pursue their specific interests at the postgraduate level. Students are expected to choose two electives from the entire list of the choices being offered by the institution. *However the final list of elective subjects can **only** be finalized in the VII and X semesters in accordance with the availability of respective faculty at that time.*
The outlines of each elective have been broadly outlined to suit the availability and interests of faculty in different institutions. The content & syllabus for each elective would be detailed out by the concerned teachers, at the time of commencement of teaching.
The syllabus of Elective subjects is to be made in such a way, that their implication and manifestation in the field of architecture is clearly defined & communicated to the students, during the course of study.

		L	T	S	P	C
APAR507	**LOW COST CONSTRUCTION TECHNOLOGY**	**2**	**1**	**-**	**-**	**3**

To make the students aware of the use of conventional and non-conventional resources for low cost construction & technologies for the same.

		L	T	S	P	C
APAR509	**WATER RESOURCE MANAGEMENT**	**2**	**1**	**-**	**-**	**3**

To focus on concepts related to resource-oriented water conservancy that creates balance of environmental ecology as the system target.
Integrated water resources perspective for social, economic, environmental, and technical dimensions in the management and development of Water resources.

APAR511	INTEGRATED WASTE MANAGEMENT TECHNOLOGY	L	T	S	P	C
		2	1	-	-	3

To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes and the role resource efficiency plays in conserving resources and contributing to a low carbon economy, while focusing on key engineering and technical aspects involved.

APAR513	INTERIOR DESIGN	L	T	S	P	C
		2	1	-	-	3

COURSE OBJECTIVE

- To initiate students into theory and practice of Interior Design by introducing them to principles of design and Vastu, along with various elements and materials of Interior Design.

UNIT I

INTRODUCTION AND BASIC PRINCIPLES OF DESIGN

- Principles of Interior Design and their application.
- Elements of Interior Design – Space, Light and Illumination, Colour, Texture, Furniture (movables & built-in), Fittings and Fixtures.
- Surface treatments in interiors, e.g. on walls, floors, ceilings etc.
- Different types of materials that are available and their uses in interiors

UNIT II

VASTU AND INTERIOR LANDSCAPE

- Introduction to Vastu Shastra in interior.
- Knowledge of indoor plants, indoor water elements like fountains and other landscape features.

UNIT III

UNDERSTANDING FURNITURE WORK

- Introduction to history of furniture & importance of styles related to furniture design.
- Understanding the furniture works of Great Masters.
- Furniture design exercises with types of furniture and their usage, construction materials and fabrics used in furniture designing

UNIT IV

MODERN TRENDS IN INTERIOR DESIGN

- Modern trends and contemporary attitudes to Interior Design e.g. Modular furniture, Modern materials.
- Application of colour, texture, pattern and their psychological effects in interior.
- Design of a small interior space e.g. Entrance Hall, Conference Room, Executive's Office, Study Room, Kitchen, Toilet etc.

Note: Assignments could be in the form of market surveys for building materials and study of latest building materials in the building construction industry. Students are also required to do case studies of architectural and interior projects where the above-mentioned materials have been innovatively used.

REFERENCE BOOKS

6. Kasu A Ahmed 2005,Inside Design ,6TH Edition, Om Publishers
7. Joseph Dechiara , Julius Panero , Martin Zelnik,Time-Saver Standards for Interior Design and Space Planning, II Edition, McGraw Hill Education
8. Francis D. K. Ching , Architectural Graphics 2009, 5th Edition ,Wiley
9. Premavathy Seethe & Raman Parveen Pannu ,Interior Design & Decoration CBS Publishers & Distributors Pvt. Ltd, 2005.
10. Francis D. K. Ching , Corky Binggeli, Interior Design Illustrated 2012 John Wiley & Sons; 3rd Revised edition edition

APAR515	VERNACULAR ARCHITECTURE	L	S/P	Tt	C
		2	1	-	3

INTENT

- To expose the students to traditional architecture of the various parts of the country.
- The students will have knowledge of the planning aspects, materials used in construction, constructional details and settlement planning of the settlements in various parts of the country.

UNIT I

- Introduction to vernacular architecture.
- Approaches and concepts to the study of Vernacular architecture – Introduction to Kutcha architecture and Pucca architecture

UNIT II

- SOUTH REGION Planning aspects, materials of construction, Constructional details & Settlement Planning of Kerala houses (Tarawads), (Mappilah houses), Temples, Palaces and theaters – Thattchushastra.
- TamilNadu – Toda Huts, Chettinad Houses (Chettiars) & Palaces
- Karnataka – Gutthu houses, Kodava ancestral home (Aynmane)
- Andhra Pradesh –Kaccha buildings Religious practices, beliefs, culture & climatic factors influencing the planning of the above.

UNIT III

- WESTERN REGION Planning aspects, Materials used, Constructional details, Climatic factors influencing the planning of
- WADA housing concept of Maharastra and Havelis(Pukka houses) of Rajasthan.
- Pol houses of Ahmedabad - Primitive forms, Symbolism, Colour, Folk art etc in the architecture of the deserts of Kutch & Gujarat state.
- Vernacular architecture of Goa.

UNIT IV

- NORTHERN AND EASTERN INDIA- Kashmir Typical Kutcha houses, mosque, Dhoongas (Boathouses), Ladakhi houses, bridges
- Himachal Pradesh -Kinnaur houses & Uttar Pradesh – Domestic housing of Uttar Pradesh
- Bengal – Bangla (Rural house form), Aat Chala houses – change from Bangla to Bungalow, Kutcha & Pucca architecture of Bengal.
- Nagaland – Naga houses & Naga village, Khasi houses Factors influencing the planning aspects, materials of construction & constructional details of the above.

REFERENCE BOOKS:

1. Traditional buildings of India, Ilay Cooper, Thames and Hudson Ltd., London

APAR517	STRUCTURAL SYSTEMS	L	T	S	P	C
		2	1	-	-	3

INTENT

- To study basic structural system in architecture.

UNIT I

- This course provides students with a basic knowledge of structural systems of the buildings.
- The course emphasizes the historical development of structural form and the evolution of structural design knowledge, from Gothic cathedrals to long span suspension bridges.
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UNIT II

- Analysis and design for buildings, bridges and other structures.
- Students will investigate the behavior of structural systems and elements through design exercises, case studies, and load testing of models.

UNIT III

- Students will design structures using timber, masonry, steel, and concrete and will gain an appreciation of the importance of structural design today, with an emphasis on environmental impact of large scale construction.

UNIT IV

- Graphical analysis and design of structures; properties of construction materials; environmental assessment of materials; analysis,
- Design and behavior of beams, columns, trusses, frames, arches; and structural systems.
- The laboratory exercises include design exercises, materials testing, and model building.

REFERENCE BOOKS:

- 1. BIS (1984) Indian Standard Code of Practice for General Construction in Steel IS : 800.
- 2. Duggal, S. K. Design of Steel Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi.
- 3. Singh, H. Analysis & Design of Steel Structures for Architects, Abhishek Publications, Chandigarh.
- 4. Punmia, B. C., Jain, A. K. & Jain, A. K., Comprehensive Design of Steel Structures, Laxmi Publications (P) Ltd., New Delhi.

SEMESTER X

APAR520	ARCHITECTURAL THESIS	L	T	S	P	Credit
		-	-	18	-	18

Intent:

- To prepare a student to independently handle and present all aspects of an architectural design from its evolution to final solution in totality;
- To understand the importance of the evolutionary stages of a design process and various techniques required for a successful presentation of an architectural design;
- To develop in students the ability to handle specific aspects of design relevant to the topic.

Thesis Programme:

The multiple challenges of 'built environment' offer unlimited scope for the choice of an architectural design thesis. The selection of the thesis subject may result either from issue/s involved, or from the challenges of design, or the inherent and acquired aptitude of a student, which he/she wishes to perfect and present. The variety of intentions give students the choice to select the topic of the thesis from a purely hypothetical to a 'live' programme, as long as the topic can result in tangible 'built environment' solution. Consequently, the size of the project has no relevance in the selection of the topic; the riding clause being the topic's relevance to serve the laid down specific objectives inherent in the philosophy of the institution.

For reasons of maintenance of uniformity in results and standards, the thesis presentation shall be in two distinct compartments: a report comprising of all the preliminary studies required for the thesis topic, and the final design solution.

The Thesis report shall consist of all relevant contextual studies: of user, place and time to enable the formulation of design criteria.

The design solution shall be in the form of sheets and models of the concept and design and shall further include the presentation of at least one specific aspect relevant to the selected topic in complete detail.

The report, in triplicate, shall be submitted in bound form together with prints/photographs of all the drawings and models.

APAR522	SEMINAR	L	T	S	P	C
		-	-	4	-	4

INTENT

- To study basic structural system in architecture.
- Modern architecture is the synthesis of a series of progressive movements since post-industrial period. It is necessary for students to understand these movements, styles, buildings, construction, and contribution of masters in a wider context.

UNIT I

- Introduction to Research Methodology.
- After consulting with subject teacher, Students should select topic of their interest for research & seminar. Topic should be related to Architecture/ Construction/ Green Building/ Energy saving/ contemporary techniques in architecture.
- The study includes the progressive developments of the requirements, architectural character and technological advancements of each period / style.

UNIT II

- **The analytical study**- must include examples and sketches with highlighting the relevant features.
- The study emphasizes to inculcate the research spirit and awareness of architectural heritage among the students.

UNIT III

- Socio political and other influences, Philosophies, approaches and purposes Architectural, constructional and other features Contribution of the pioneers.
- Revolutions related to selected topic, stage wise developments & importance in today's date.

UNIT IV

- The Sessional work shall comprise of individual work of the student completed under the guidance and supervision of the subject teacher as follows:
  1. Journal: Hand written/ printed journal with notes and sketches of relevant examples on the above mentioned syllabus contents
  2. Project work: Graphical representation or a model of any relevant topic from the above mentioned syllabus contents
- Individual students should present his work/Seminar on selected topic in front of whole class.

REFERENCE BOOKS:

1. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Sage Publications, New Delhi.
2. Fred N. Kerlinger, Foundations of Behavioral Research, Holt, Rinehart and Winston Inc, New York.