B.ARCH
SYLLABUS 2014

DEPARTMENT OF ARCHITECTURE

BIT,MESRA.

AS PER B.O.S MEETING

1st SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 1301	Principles of Architecture	3	0	0	3	Dept Th
AR 1303	Primary Building Materials	3	0	0	3	Dept Th
AR 1305	History of Indian Architecture.*	3	0	0	3	Dept Th
AR 1307	*History of Indian and Middle East Architecture***					
MA 1105	Mathematics for Architects	3	0	0	3	Other Dept Th
HU 1101	Technical English [Breadth Subject – I]	3	0	0	3	BS 1
Note: Any one of AR 1305 / 1307 may be registered for [*: for students at Mesra/Patna, ** for students at RAK international centre]						
	SESSIONAL SUBJECTS					
AR 1302	Architectural Design – I	0	0	6	4	Dept L/S
AR 1304	Descriptive Geometry	0	0	6	4	Dept L/S
CS 1302	Fundamentals of Unix and C Programming	1	0	3	3	Other dept L/S
	NCC/ NSS/ CA/GAMES	0	0	3	1	Co-Curricular/BS
	TOTAL CREDIT				**27**	
Contact hours		**16**	**0**	**18**		**34**

FIRST SEMESTER

AR 1301 Principles of Architecture Credit 3 L-T-P: 3-0-0

COURSE OBJECTIVE:

- Identify different design elements and design principles used in visual communication and built environment.
- Critique the design elements, principles incorporated in the built environment.
- Incorporate different design elements and principles in Design exercises.
- Analyse the role of an architect.
- Define the domain and variety of the functions of an architect.
- Classify architectural styles through ages

Module 1: Architecture as a profession and role of an architect:

Contribution towards culture and the society, the building process and the Architect's role: How projects get built, need, site, financing, design and design approvals, Architectural services rendered by an architects and disciplines needed to learn by him/her

Module 2: **The structure of Architectural Education**

Curricular content, Design, The Design Studio, History and Theory, Technology, Structures, Materials and Methods of Construction, Environmental Controls, Computer-aided Design, Management, Electives.

Module 3: Design Elements

Understanding Architectural Aesthetics - Exercises to understand the visual properties of two dimensional forms of both geometric and non-geometric surfaces. Basic design elements and their incorporation in visual art and architecture such Line and Shape, Color and Texture, Form and Size, Value, Light.

Module 4: Design Principles

Principles such as Balance, Symmetrical, Asymmetrical, Proportion and Scale, Studies of Principles of Organization of Form & Space, Principles of three-dimensional Compositions.

Module 5: Module and its application in design

Types of Common Grids – Orthogonal and Radial, Brief Introduction to History of Modular Construction in Architecture, (Industrial Revolution and Pre-fabrication of Iron, Steel, Glass and Concrete units), "Building as Machine" concept of Corbusier and Le Modular.

Module 6: Factors influencing architecture of a region

Climate, material, technology and socio-cultural forces.

Module 7: Defining and Conceptualizing Architecture.

Different concept in the field through time, Concepts and philosophy of some leading architects. Introduction to few architectural projects (India and Global), Development of Architecture over ages.

Course Outcomes

After the completion of this course, students will be:

1.	Define the domain and variety of the functions of an architect.
2.	Analyze the design elements, principles incorporated in the built environment.
3.	Incorporating the above in Architectural Design.

References:

- Architect: A Candid Guide to the Profession, by Roger K. Lewis
- Understanding Architecture: Its Elements, History, and Meaning by Leland M. Roth, Westview Press Place publication.
- Francis D.K. Ching; – Architecture: Form Space and Order; Van Nostrand Reinhold Co., (Canaa), 1979.

FIRST SEMESTER

AR 1303 Primary Building Materials Credit 3 L-T-P: 3-0-0

COURSE OBJECTIVE:

The basic idea of the subject is to make aware of the primary building materials used in construction, their properties, types and common usage. This will enable students to equip themselves with the knowledge of materials and their judicial usage.

- To classify the different types of building materials used primarily in building construction work.
- To identify the types of materials and their compositions.
- To list, label and define the materials.
- To illustrate use of materials and ascertain their application..
- To identify the specific use and related technique for a required material.

Module 1. BRICK: Composition, Sizes, Properties and Classification of bricks, Tests for bricks. Introduction of Brickworks: masonry bonding & ornamental bonding, Substitutes for bricks.

Module 2. STONES: Classification of stones. Common building stones used in India. Characteristics and use of stones. Dressing of stone. Artificial stones. Introduction of Stonework: Rubble and Ashlars masonry.

Module 3. METALS: Pig iron, cast iron, wrought iron – types, properties, steel – properties, types, market form of steel and uses of steel in construction, properties of mild steel and hard steel, defects in steel.

Module 4. TIMBER: Qualities of timber for construction. Seasoning, Storage and Preservation of timber. Use of different types wood in various parts of building. Industrial timber: veneers, plywood, fibreboard, etc.

Module 5. LIME: Classification of lime. Fat and hydraulic lime – properties and use.
CEMENT: Composition of ordinary cement. Function of cement ingredients. Properties of cement – Fineness, Soundness, Setting times, etc. Grades of cement and different types of cements used in construction. Storage of cement in site.

Module 6. SAND: Sources of Sand, Classification, Test of Sand. Grades of sand and their uses
MORTAR: Types of mortar – lime mortar, mud mortar, lime-surkhi mortar, cement mortar. Different grades of mortar, their compositions and properties. Preparation of cement mortar. Use and selection of mortar for different construction work.

Module 7. CONCRETE: Compositions and grades of concrete. Various steps in concrete construction – batching, mixing, transporting, compacting, curing, shuttering, jointing. Tests and quality control of concrete. Design Mix of concrete.

Course Outcomes

After the completion of this course, students will be:

1.	Understand the different types of primary building materials used in building Industry.
2.	Choose proper building material and their application in building Industry
3.	Develop a sense of comparison between different building materials.

Recommended Books

1. B. C. Punmia; *Building Materials and Construction.*
2. Bindra & Arora; *Building Materials and Construction.*
W.B. Mckay, '*Building Construction'*, Vol. 1,2,3 Longmans, U.K. 1981.

FIRST SEMESTER

AR 1305 History of Indian Architecture Credit 3 L-T-P: 3-0-0

Course objectives:

Knowledge about Indian culture, building art and construction techniques helps an architecture student to develop designs that are rooted in this country. Appreciation of our heritage buildings should lead to the understanding that architecture is the product of a particular culture, time and place.

a) Acquire basic concepts regarding the historical and architectural development in ancient India.
b) Understand the diverse artistic and architectural expressions with regard to the historical context in which they are developed.
c) Utilise visual and verbal vocabularies of Indian Architecture
d) Develop a critical view towards development and expression of Indian architecture, and Value the different architectural developments in ancient India.
e) Analyse the diversity of imperial Indian Temple Architecture, Indian Mosques, Tombs, Forts, Cities, etc. including the buildings viewed as architectural masterpieces, and their urban settings.

Syllabus

Module 1.
- Indus Valley Civilization- the various towns, town planning principles, house construction, drainage systems; Vedic village settlement.
- Buddhist architecture – Evolution & golden age;
- Rock cut Architecture –Stupas, Chaitya, Vihara, Pillars, Ajanta, Ellora, Kailasanath, Rathas, etc.

Module 2.
- Hindu Architecture – Elements of Hindu Temple.
- Development of temple form from example like Ladh Khan, Temple at Deogarh, Bhittargaon Temple,
- North Indian Temple Architecture-
  - Architectural character of Gupta Temples
  - Architecture style of Orissan temple with examples.
  - Khajuraho group of Temples, and
  - Architectural character of Gujarat Temples

Module 3. South –Indian Temple Architecture- Pallava, Chola, Pandyas, Madura and Vijayanagar style with examples.

Module 4. Introduction – Rise of Indo-Islamic Architecture
- Special features of Mosque
- Special features of Tomb
- Influences of Indo-Islamic Architecture in India
- Use of arches, vaults, domes, squinches, pendentives, jaalis, minarets,etc.
- Special features – use of landscape, water bodies and gardens.
- Ornamentation in structures with interplay of materials – stones, mosaics, gildings.

Module 5.
- Sultanate Architecture - Slave Dynasty, Tughlaq Dynasty, Lodhi Dynasty.
- Provincial Styles of Sultanate Period – Punjab, Bengal, Jaunpur, Gujarat, Malwa, Bijapur and Golconda with examples.

Module 6. Mughal Style prevalent during the reign of
a) Babur; b) Humayun; c) Akbar; d) Jahangir; e) Shah Jahan.

Module 7. Revival of Indian Architecture under British patronage - Architecture in Colonial India - Monumental buildings of
- Early colonial period – Examples – St.Pauls Cathedral, Calcatta & Bombay Town hall.

- ° Architectural character of Indo-Saracenic and Classical revival –University of Madras Senate House & Victoria Memorial hall, Calcatta
- ° Later Colonial period – Contribution of Edwin Lutyens & Herbert Baker to the lay-out and Architecture of New Delhi – Rashtrapathi Bhavan & Parliament House

Emphasis should be on the use of structural techniques, stones, fine arts, special features, use of landscape, water bodies, and construction methods employed.

Students need to practice sketches and make an album and get it evaluated regularly.

Course Outcomes

After the completion of this course, students will be able:

1.	To define and understand the basic principles of elements of historic design elements, materials and patterns of construction and building techniques in each age befitting an application in contemporary times.
2.	To outline and employ critical thinking in the context of historical and architectural development in ancient India.
3.	To explain and utilise visual and verbal vocabularies of Indian Architecture
4.	To interpret and analyse the diversity of imperial Indian Temple Architecture, Indian Mosques, Tombs, Forts, Cities, etc
5.	To apply the materials and patterns of construction and building techniques in historic age befitting an application in contemporary times.

Recommended Books:

1. Asher Catherine, *Architecture of Mughal India*
2. Brown, P. *Indian Architecture (Buddhist Hindu)* Vol. 1: Taraporevala and Sons, Bombay 1983 & subsequent publications.
3. Brown Percy, *Indian Architecture (Islamic Period) Vol II*; Taraporevala and Sons, Bombay, 1983; and subsequent publications.
4. Fergusson, J.A. *A history of Indian and Eastern Architecture*, London 1876, revised 1891.
5. Grover, S. *The Architecture of India, Buddhist & Hindu*, Sahibabad, 1980.
6. Grover, S. *The Architecture of India (Islamic)* , Sahibabad, 1980.
7. Hillenbrand, Robert,; *Islamic Architecture, Form, Function and Meaning*, Edinburgh University Press, 1994.
8. Michell,George; *The Hindu Temple* , London
9. Michell, George; *Architecture of the Islamic World — (its history and social meaning*), Thames and Hudson, London, 1978.
10. Sterlin Henry , *Architecture of World , India*, Germany, ISBN-38228-9658-6.
11. Sterlin Henry, *Architecture of World, India (Islamic),* Germany ISBN– 38228-9658-6
12. Tadgell Christopher, *The History of Architecture in India*, London 1990
13. Tillotson, G.H.R. – *The tradition of Indian Architecture Continuity, Controversy – Change since 1850,* Oxford University Press, Delhi, 1989.

THEORY SUBJECTS

FIRST SEMESTER

MA 1105 Mathematics for Architects Credit 3 L-T-P: 3-0-0

Course Objectives

This course enables the students:

A.	Basics concepts of matrices, including rank, eigenvalues and eigenvectors of the matrix
B.	Determination of consistency and inconsistency of system of linear equations using rank of matrices
C.	Application of single variable derivatives and integrals in determining different properties of a curve
D.	Introduction to multi variable functions, partial derivatives and different properties associated with them their
E.	Applications of multi variable calculus in determining maxima – minima and double integrals for two variable functions
F.	Analysis of data using different statistical techniques

Syllabus

Module1. Matrix: Adjoin Transpose and Inverse of Matrices. Orthogonal Matrix, Rank of Matrix, Consistency and Inconsistency of a Equation.

Module2. Statistics &Probability: Measure of Central tendency and Measure of Dispersion. Kurtosis, Curve fitting, Method of Least Squares (Straight Line and Parabola),Correlation and Regression.

Module3. Differential Calculus: Successive differentiation. Leibnitz's Theorem Tangent and Normal Curvature (Cartesian and Parametric forms only), Telor's and Mclaurin's expansion.

Module4. Indeterminate forms, Maxima,Minima for a function of one variable, Point of Inflexture, Concavity and Convexity.

Module5. Partial differentiation, Euler's Theorem, Total Differential Coefficient, Change of variables.

Module6. Telor's and Mclaurin's expansion for two variables, Maxima, Minima for a function of two variables.

Module7. Integral Calculus: Reduction Formula, use of Double and Triple integrals, Calculation of areas in simple cases without the use of multiple integral.

Course Outcomes

After the completion of this course, students will be:

1.	To understand the basics of matrices, statistics, differential and integral calculus
2.	To apply the mathematical skills to specific problems arising in architecture
3.	To demonstrate the usage of calculus in determining shape, symmetry, pattern etc. of architectural designs
4.	To gain an understanding to establish connectivity between mathematics and architecture.

Recommended Books

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 1998.
2. P.Kandasamy, K. Thilagavathy, Enginering Mathematics Vol- I &II, S.Chandan Publishers-1998.
3. M.D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 12th edition, Pearson Educations, 2008.
4. E. Kreyszig, Advanced Engineering Mathematics, Wiley International, 9th edition, 2006.

FIRST SEMESTER *[BREADTH SUBJECT 1]*

HU 1101 Technical English Credit 3 L-T-P: 3-0-0

MODULE – I
Single word substitution, Idioms and phrases, Pairs of words, Common errors, Précis, Comprehension, Expansion.
MODULE – II
Official Correspondence - Memorandum, Notice, Agenda, Minutes, Circular letter, applying for a job, Resume, Demo-official letter.
MODULE – III
Business Correspondence-Types, sales letters; Social Correspondence- Invitation to speak, Congratulations; etc.
MODULE – IV
Report writing; general and technical report, Definition, Types, structure.
MODULE – V
Technical proposals, Definitions, types and format.
MODULE – VI
Research papers and articles.
MODULE – VII
Mechanics of manuscript preparation.

BOOKS FOR REFERENCE:

1. Blickle, Margaret D., and K.W.Houp.
2. Reports for Science and Industry, Henry Holt & Co. N.Y.
3. Duddy, E.A. & M.J. Freeman Written Communication in Business, Amercian book Co.N.Y.
4. Berry, Thomas Elliot, The most Common Mistakes in English Usage; Tata McGraw Hill.
5. Stevensin, B.W., J.R. Spicer and E.C. Ames, English in Business and Engineering. Prentice Hall, Eaglewood
6. Cliffs, N.J.
7. Raul, Asha, Effective Business Communication, Prentice Hall of India.
8. Singh B. Business Correspondence including Bank letters.
9. Singh B. Theory and Practice of Business Correspondence, HPJ Kapoor Publications.
10. Report Writing and Business Correspondence Mohan and Sharma, Tata McGraw Hill Publications, India.
11. Best, W.D. The Students companion, Rupa & Co. Publications.

FIRST SEMESTER

AR 1302 Architectural Design-I Credit 4 L-T-P: 0-0-6

COURSE OBJECTIVES:

The students who complete our course on AD- I will acquire the knowledge and develop the skills listed below

To help the students grasp the fundamentals of design as a basic creative activity.

To help the students grasp the basics of Architectural aesthetics.

To help the students learn about the basic elements of visual aesthetics through exercises aimed at experimentation.

To make the students become familiar with visual and verbal vocabularies of architecture.

To develop analytical thinking and move toward spatial analyses of visual culture.

To encourage the students to enjoy looking at, talking about, and thinking about architecture and built spaces.

Syllabus

Module 1: Process of Architectural Design and its pre-requisites.

Module 2: By Graphical methods, comparison of designed and non-designed objects, appreciation of design criteria.
Explore the relationship between Attributes of Form and Space.

Module 3: Understanding Architectural Aesthetics - Exercises to understand the visual properties of two dimensional forms of both geometric and non-geometric surfaces.
and Forms in Nature (Animate and Inanimate).

Module 4: Exercises to demonstrate graphically the Visual Qualities of Point, Line, Size, Form, Pattern, Proportions, Repetition, Rhythm, Harmony, Contrast, Unity, Shape and Texture.

Module 5: Studies of Principles of Organization of Form & Space with exercises of Block Model; Principles of three-dimensional Compositions.

Module 6: Critically appraise and Design of an object in everyday use like Table, Chair, Stool, Drawing Board, T-Scale, etc.

Module 7: A critical study and ultimately Design of a space of a building by application of Principles of Aesthetic Appraisal. (The final exercise will culminate in application of all the knowledge and skills gained during the session.)

Importance should be given on sketching and communicating the design / study through effective two and three-dimensional drawings / sketches and models.

Course Outcome:

After the successful completion of the course, student will be able:

1.	To understand the basic principles of design and appreciate design criteria of objects in everyday use.
2.	To analyse, evaluate and make informed judgment on a wide range of visual and verbal vocabularies of architecture.
3.	To comprehend basic elements of visual aesthetics and relevance to design.
4.	To develop and employ critical and analytical thinking skills in the context of aesthetics and compositions.
5.	To apply the principles of design and design theory in architectural compositions.

Recommended Books:

1. C. D. Joseph and Callender John; *Time Saver Standards for Building Types*.
2. C. D. Joseph and Callender John; *Time Saver Standards for Architectural Design Data.*
3. Christopher Alexander; *A Pattern Language*
4. Francis D.K. Ching; – *Architecture: Form Space and Order*; Van Nostrand Reinhold Co., (Canaa), 1979.
5. Pearce Peter; *Structure in Nature – Strategy for Design.*
6. Pickering, Ernest; *Architectural Design*, John Wiley and Sons Inc., Canada, 1949.
7. Neufert's *Architect's Data.*
8. V.S. Paramar, *Design Fundamentals in Architecture*, Somaiya Publications Pvt. Ltd., New Delhi – 1973.
9. Von Meiss Pieree; *Elements of Architecture.*

All Books, journals and magazines on Architecture.

SESSIONAL SUBJECTS

FIRST SEMESTER

AR 1304 Descriptive Geometry Credit 4 L-T-P: 0-0-6

COURSE OBJECTIVES:

The students who complete our course on Descriptive Geometry I will acquire the knowledge and develop the skills listed below:

- To present the fundamental principles of architectural descriptive geometry and its application to architectural problems.
- To cultivate student's skills of geometric drawing, develop their capability of ideation and modeling with instrumental sketching.
- To enable the students to describe spatial relationship using sequential thinking.
- To analyze and solve basic problems involving graphics and spatial manipulations for architectural applications to represent the future forms of her/his projects.
- To use representation techniques and tools in the spatial concept.

To be able to express her/his ideas by drawing.

Topics	No. of Sheet
Free hand drawing and lettering for titles, line work with the use of Drawing Instruments	1
Dimensioning of different 2D objects	1
Scale drawing of simple shapes, reduction and enlargement of drawings on different scales	1
Building up of simple 3D forms (cones, cylinders etc.)	1
Projection of planes and solids	2
Analysis of forms such as cylinders, vaults etc. at different intersections	1
Study of interpenetrated solids to include representation of such groups in these projections	1
Study of development of surfaces, drawing of unfolded surfaces of 3d objects	1
Techniques of drawing Isometric and Axonometric views of solids	2
Techniques of drawing 1 point, 2 point and multi-point perspective views of blocks and buildings	3
Concept of shade and shadow of objects	1

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the various aspects of preparing architectural drawings
2.	Understand the different methods of representing the same object, with the help of suitable drawing instruments
3	Exposure to technical understanding of preparing views, along with shades and shadows, which will be applied in all architectural projects.

Recommended Books

1. B. Gupta; *A Textbook of Engineering Drawing*
2. N.D. Bhatt; *Engineering Drawing*
3. Hiram. E. Grant; *Engg Drawing, , Mc.Graw Hill Book Company*
4. Sherkey W, MORGAN; *Architectural Drawing, Mc Graw Hill*
5. Arthur L. Guptill, Watson; Rendering in Pen and Ink,- Guptill Publications, New York.

FIRST SEMESTER

CS 1302 Fundamentals of Unix and C Programming Credit 3 L-T-P: 1-0-3

MODULE – I

Fundamentals of Unix Operating System, Login & Password, Different Commands, Unix directory, Structure and working with directories, Vi-editor, History and Importance of C, Sample programming, Basic Structure and execution of C programmes, Constants, Variables, and Data Types and various type of declarations, Different type operators and Expressions, Evaluation of Expressions, Operator Precedence and Associability, Mathematical Functions.

MODULE –II

Managing Input and Output operations, Decision Making and Branching Decision Making and Looping.

MODULE – III

One – dimensional Arrays and their declaration and Initialisations, Two-dimensional Arrays and their initialisations, Multidimensional Arrays, Dynamic Arrays, String Variables, Reading and Writing Strings, Arithmetic Operations on characters, Putting Strings together, Comparison of Two Strings, String – handling functions, Table and other features of Strings.

MODULE –IV

Need and Elements for user –defined Functions, Definition of Functions, Return values and their types, Function calls and Declaration, Arguments and corresponding return values, Functions that return multiple values, Nesting of functions, Recursion, Passing arrays and strings to functions, The Scope, Visibility and Life time of variables.

MODULE –V

Defining Structure, Declaring Structure Variable and Accessing Structure Members, Initialisation of Structure, Comparing Structure Variables, Operation on Individual Members, Arrays of Structures, Structures within structures, Structures and Functions, Unions, Size of Structures, Bit Fields.

MODULE – VI & VII

Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialisation of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Arrays, Pointers and Character Strings, Arrays of Pointers, Pointers and Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures, File Management in C.

Text Book :

1. E. Balagurusamy – Programming in ANSI C, 3rd Edn. , TMH, New Delhi ; 2004

Reference:

1. A. N. Kanthane – Programming with ANSI and TURBO C, Pearson Education, New Delhi; 2004
2. Y. Kanetkar – Let us C, 4th Edition, BPB Publication , New Delhi; 2002

FIRST SEMESTER

NCC/NSS/CA/GAMES **Credit 1** **L-T-P: 0-0-3**

2nd SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 2301	Theory of Design	3	0	0	3	Dept Th
AR 2303	Secondary Building Materials	3	0	0	3	Dept Th
AR 2405	History of Architecture- Western	3	0	0	3	Dept Th
AR 2407	Statics & Strength of Materials	3	0	0	3	Other Dept Th
CH 2203	Environmental Science [Breadth Subject – II]	3	0	0	3	BS 2
	SESSIONAL SUBJECTS					
AR 2402	Creative Workshop	0	0	3	2	Dept L/S
AR 2304	Architectural Design – II	0	0	6	4	Dept L/S
AR 2306	Building Construction – I*	0	0			
AR 2408	*Building Technology – I** (RAK CENTRE)*	6			4	Dept L/S
	NCC/ NSS/ CA/GAMES	0	0	3	1	Co-Curricular/BS
	TOTAL CREDIT				**26**	
Contact hours		**15**	**0**	**18**		**33**

SECOND SEMESTER

AR 2301 Theory of Design Credit 3 L-T-P: 3-0-0

COURSE OBJECTIVE:

On completion of this course students will be able to

- Define Designing as a process; evaluate historical progress of designing.
- Review different design principles and methods, historical and contemporary, and critically incorporate these methods in their design exercises.
- Choose and adopt different Design Methods for given set of situation and design problems.

Module 1: Design Process

Designing today, Design as a process, various thoughts and definition, Design methodology, Philosophies and approaches to design process , KISS principles by Kelly Johnson, Use-centered design by John Flach and Cynthia Dominguez
Challenges of designer, User-centered design.

Module 2: Brief History of Design

The era of Craft evolution, era of Design by drawing, era of System Designers The era of "Technological Change (or Socio-technical Innovation)", Designers as Black Boxes, Designers as Glass Boxes, Designers as Self Organizing Systems , Criteria for Design Project Control

Module 3: Different Design Methods

Different design methods, Prefabricated strategies, Methods of exploring design situation.

Module 4: Stages of Design

Designing as a three stage process, Divergence, Transformation, Convergence.

Module 5: Systematic Search

Decision Theory Approach**,** Logical certainty

Module 6: Collaborative strategy for adaptive architecture

Enabling everyone concerned with the designing of a building influencing decisions that affect both the adaptability of the building and the compatibility of its components.

Module 7: Selection of Strategies and Design Methods.

Criteria for choosing design method, input out put chart for selecting design methods, Design strategies, Linear strategies, Cyclic Strategies, Branching strategies, adaptive strategies.

Course Outcomes

After the completion of this course, students will be:

1.	Critically incorporate the various design methods taught in their design exercises.
2.	Choose and adopt different Design Methods for given set of situation and design problems, depending on design situation and design context.

Reference Books:

1. *Design Methods* by John Chris
2. *Experiencing Architecture* by Steen Eliel Rasmussen
3. *Urban Experience* by Raymond J. Curran

SECOND SEMESTER

AR 2303 Secondary Building Materials Credit 3 L-T-P: 3-0-0

COURSE OBJECTIVES:

- To list the various properties of non-ferrous alloys used as building material
- To classify the types of corrosion of ferrous and non-ferrous metals and respective preventive measures.
- To outline the use of various admixtures in concrete
- To compare the use of traditional concrete and RMC
- To analyze and prepare the specification of various clay and ceramic tiles for building application.
- To outline the application of different painting system in building exterior and interior

Module 1. **Non Ferrous Metal**: Aluminium, Copper, & important alloys like brass, bronze, etc – brief description of uses. Corrosion of both ferrous and non-ferrous metals – types and preventive measures.

Module 2. **Clay Products**: Tiles, their properties and use - terra-cotta, earthenware, stoneware, porcelain, vitreous.

Module 3. **Special Concrete**: Water repellent, Waterproofing compounds, Accelerators, Air entraining agents. Hardeners, plasticizer, Fly ash. Their availability and uses. Light weight concrete, ready-mix concrete, and precast concrete

Module 4. **Wall & Floor Tiles**: General character and construction process of traditional flooring like: IPS flooring, Terrazzo flooring. Sizes, Classification & Properties of tiles used in wall and flooring. Selection criteria & Methods of fixing various types of tiles.

Module 5. **Varnishes, Paints Distempers**: Characteristics and process of varnishing, Type and Compositions of Paints, Types of painting system: aluminum paints. Cement-based paints, oil emulsion paints, enamel paints. Their selection criteria.

Module 6: **Plastics and Polymers:** Types and Use of Plastic in building construction. Properties of Plastic. Use of various Polymer Materials in building industry, Use of Nano-paints.

Module 7: **Miscellaneous Materials:** Glass, Fibre glass. Cork, rubber, Gypsum, sealants, Asbestos, heat and sound insulative materials. Their trade name and uses.

Course Outcomes

After the completion of this course, students will be:

1.	Understand the different types of Advanced building materials used in building Industry.
2.	Choose proper alternative of building material and their application in building Industry
3.	Develop a sense of organization of appropriate building material

Recommended Books:

1. B. C. Punmia; *Building Materials and Construction* .Laxmi Publications Pvt Ltd, New Delhi,1993
2. Bindra & Arora; *Building Materials and Construction.*

3. W.B. Mckay, '*Building Construction'*, Vol. 1,2,3 Longmans, U.K. 1981.
4. Arthur Lyons; Materials for Architects and Builders- An Introduction; Arnold, London 1997

AR 2405 History of Architecture (Western) Credit 3 L-T-P: 3-0-0

COURSE OBJECTIVE

Grossly divided, architecture of the World are of two type – Oriental (eastern) and Occidental(western). Students of Architecture in this course have been exposed to the former in the previous semester, where they have studied the more spiritual approach towards buildings and their design – the I-Thou concept. In this subject, they would be taught about the more materialistic and philosophical approach of the occidental school of thought – the I-It concept. The basic objectives of the course are:

- To teach the development of occidental, henceforth mentioned as Western architecture along time scale, with the help of chronological development of civilizations across the globe
- To introduce students to different styles of Western architecture of different prominent civilisations of west till the advent of Industrial Revolution
- To explain the relationship of architecture and its stylistic elements with materials and methods of construction of a space and time
- To teach the student the analysis of social, political, religious, climatologic and financial factors and how they have influenced architecture

All the following Modules will be studied with the following sub-heads: 1. Geography and Building Materials / Resources 2. Methods of Construction 3. Sociological Background – Degree of Dominance of Ecclesiastical / Political / Economical class		
Module **1**	**Mesopotamian and Egyptian Architecture**	1. Salient building types : (Mesopotamian) • Ziggurats and their development – White Temple, Ziggurat of Ur, Urnammu and Khorsabad • Generic Temple Layout - Temple Oval and Khafaje • Palace Complex/Citadel of Khorsabad, Nebuchadnezzar's Babylon, Persepolis 2. Salient building types: (Egyptian) • Temples & temple complexes m- Cult Temple and Mortuary Temple • Mastabas – development and typical components • Pyramids – Complex of Zoser, Pyramid of Cheops and Cephren, Standard mortuary complex layout of pyramids 3. Special Building Elements / Features & their organic origin
Module **2**	**Greek Architecture**	1. Classical Order – Doric, Ionic, Corinthian 2. Salient building types: • Temple types on basis of column layout – case example of Acropolis, Athens • Public Buildings and Square – Agora, Stoa, Prytaneum, Bouleuterion, Tholos, Gymnasium, Theatre
Module **3**	**Roman Architecture**	1. Contribution in new materials and new construction/structural systems, eg, Pozzolana, Cementae, Stone Blocks, Stone Masonry, Arch, Vault, Dome 2. Salient buildings: • Pantheon

		• Aqueduct • Colosseum • Bath of Caracalla • Basilica of Trajan • Forums of Rome
Module **4**	**Early Christian & Romanesque Architecture**	Early Christian Architecture 1. Development of Early Christian Church from Roman Basilica 2. Example – St. Peter's Basilica Romanesque Architecture 1. Development of Romanesque architecture from Early Christian architecture
Module **5**	**Byzantine Architecture**	1. Contribution of Byzantine architecture in the development of structural system – dome construction over square plan, 2. Adoption of Greek cross in church layout 3. Use of mosaic and mural in interior 4. Case example – Santa Sophia, Istanbul; St. Mark's Cathedral, Venice
Module **6**	**Gothic Architecture**	1. Development of Gothic church and its new elements: • Pointed Arch window • Different arch types – lancet, equilateral, depressed • Trefoil arch • Cluster column and intersecting vault roof • Clerestorey window and triforium • Flying burtress • Glazed window, stone and metal trellis, flamboyant window, rose window • Entrance of church 2. Case example – cathedrals of Chartres, St. Dennis, Notre Dame (Paris), Reims
Module **7**	**Renaissance Architecture**	1. Division of Rennaissance architecture into Early, Mature and Late periods. 2. Contribution in structural system, eg, ribbed dome, lantern dome 3. Revival of classical orders an principles – Neo-Classicism 4. Baroque and Rococo Architecture

Course Outcomes

After the completion of this course, students will be able to:

1.	Develop an appreciation of varied cultures and the resulting architectural productions which are unique in time and place.
2.	Improve their knowledge about place and culture by studying the planning, construction, and aesthetics of important historical buildings ie. Western Architecture.
3.	Build basic concepts for subjects like Principles of Human Settlements, Model Making Workshop, Contemporary Architecture etc.
4.	Improve their knowledge about the historical context and explore their contemporary design implications.

Recommended books:

1. Sir Banister Fletcher, A History of Architecture, University of London, the Antholone Press, 1986.
2. Kenneth Frampton, *Modern Architecture*: *A Critical History;* Thames and Hudson, London, 1994.
3. Sigfried Gideon, *Space Time and Architecture: The growth of a New Tradition*, Hazard University Press, 1978.
4. S. Lloyd and H.W. Muller, History of World Architecture – Series, Faber and Faber Ltd. London, 1986.

AR 2407 Statics and Strength of Materials Credit 3 L-T-P: 3-0-0

Course Objectives

This course enables the students:

A.	To understand the equilibrium conditions of different force systems in two-dimensional plane
B	To understand stress-strain behaviour of ductile and brittle materials in their elastic limit.
C	To draw shear force and bending moment diagram of statically determinate beams subjected to different types of loads.

Syllabus:

Module: 1
Principles of Statics, co-planar and concurrent force systems, free body diagrams, various force systems in a plane and conditions for equilibriums.

Module: 2
Analysis of simple plane truss using method of sections and method of joints. Graphical solutions for force analysis of trusses. Equilibrium of parabolic curves.

Module: 3
Determination of centroid of plane, curve areas. Centroid and center of gravity of solid objects, Moment of Inertia of plane figures, Polar moment of inertia, parallel axes theorem. Radius of gyration.

Module: 4
Theory of elasticity, concept of stress and strain, normal and shear stress, Hook's Law, Poisson's Ratio, Elastic properties of materials and their relationships, stress-strain curve for structural steel and concrete. Fundamental difference between ductile and brittle materials.

Module: 5
Bi-axial state of stress at a point, Complimentary shear, Principal stresses, Graphical representation of stresses (Mohr's Circle). Two-dimensional state of strains at a point, principal strains, Strain Gauge.

Module: 6 & 7
Different types of supports, redundancy and degree of freedom, Statically determinacy and indeterminacy of beams, Equilibrium of a beam, Beam supports reaction, Bending moment and shear force diagram of statically Determinate structures. Cantilever and simply supported beams with concentrated distributed and moment loads. Relations between shear force and bending moment.

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the basic principle of statics and strength of materials theorems and to apply the concept in structural problems.
2.	Analyse force applied to the truss members in simple and plane truss.
3.	Evaluate centre of gravity and centroid of solid objects and plane figures, respectively

4.	Analyse elastic behaviour of ductile and brittle materials
5.	Evaluate shear force and bending moment of the beams subjected to different types of loads

Recommended Books:

Johnson and Beer; *'Engineering Mechanics'*
Merium and Kraig; *'Engineering Mechanic'*
Timoshenko, S. P. & Young, D. H.; *'Elements of Strength of Materials'*; 5th edition, East West Press, 1993
Timoshenko, S.; *'Strength of Material'*; Tata McGraw Hill, New Delhi

Reference Books:

I.B. Prasad; *'Engineering Mechanics'*
I. H. Shames; *'Engineering Mechanics'*
Rajashekharan; *'Engineering Mechanics'*
S. Ramamurtham; *'Strength of Materials'*; Dhanpat Rai Publications
Srinath; *'Strength of Materials'*
B.C. Punmia; '*Strength of Materials and Theory of Structures'*; Laxmi Publications
Singer; *'Strength of Materials'*
R.K. Rajput; *'Strength of Materials'*; S. Chand Publications

CH 2203 Environmental Science Credit 3 L-T-P: 3-0-0

Course Objectives

This course enables the students:

A.	To impart basic knowledge of ecological principles and their applications in environment
B.	To help the students get exposed to the structure composition of the spheres of the earth, the only planet sustaining life
C.	To make students competent to analyse, how the environment is getting contaminated and probable control mechanisms for them
D.	To train students to generate awareness and become a sensitive citizen towards the changing environment

MODULE– I
Environmental Awareness: Multidisciplinary nature of environmental Science, Definition, scope, importance and need for public awareness(2)

MODULE– II
Ecology and Environment: Concept of an ecosystem, structure and function of an ecosystem, producer ,consumer and decomposer, energy and nutrient flow biogeochemical cycles, food chain ,food web, ecological pyramid(3)

MODULE– III
Environmental Pollution **:** Segments of environment, sources, pathways and fate of environmental pollutants, causes of environmental pollution , physical ,chemical and biological transformation of pollutants , population explosion, environment and human health, human rights, value education ,women and child welfare(5)

MODULE– IV
Air Pollution: various segments of atmosphere and their significance, classification of air pollutants, toxic effects, sampling and analysis, stationary and mobile emission, sources and their control, photochemical smog ,sulphurous smog, green house effect, global warming, ozone depletion, Air (prevention and control of pollution) Act(10)

MODULE– V
Water Pollution: Water resources ,sources of water pollution ,various pollutants, their toxic effect, potability of water , municipal water supply , disinfection, characteristics of waste water, primary and secondary waste water treatment, BOD and COD measurement and their significance ,rain water harvesting ,water shed management, Water (pollution and control) Act.(12)

MODULE– VI
Natural Resources and Biodiversity: Renewable and non renewable resources, Forest resource, consequences of deforestation, floods and draughts, equitable use of resources for sustainable development, Dams benefits and problems, Biodiversity: ecosystem diversity , threats to biodiversity, conservation of biodiversity**.** (4)

MODULE– VII

A brief introduction to Noise Pollution, Soil Pollution, Solid Waste Management.
(4)

Course Outcomes

After completing this course, a student:

1	Would get introduced to the structure and function of ecosystems and their importance in the holistic environment
2	Would be able to know the sources, causes, impacts and control of air pollution
3	Would get exposed to various types of water pollution happening in the environment and learn about their effects and potential control mechanisms
4	Would get to know about the importance of soil, its contamination and basics of solid waste management
5	Is expected to have knowledge about radiation hazards and pros and cons of noise pollution

Books Recommended:

1. Sharma and Kaur, Environmental Pollution
2. De, Environment Chemistry

SECOND SEMESTER

AR 2402 Creative Workshop Credit 2 L-T-P: 0-0-3

Course objective :

After completion of this course student will be able to

- Review various tools and techniques and incorporate them in visual communication and model making.
- Critique the property of different materials for various products for designing and model making.
- Review requirements and critique the design consideration of complementing field of architecture and designing such as photography and set designing.
- Evaluate various methods and material of model making and incorporate in product design.
- Design a functional model for real life situation.
- Evaluate complete product designing project; analyze its problem, situation, user eco friendliness and cost.

Student will do overall six minor projects and one major project as part of this sessional course .
Students will work with exercises covering the following topics and materials :

Module 1: sketching (Minimum 2 assignments)

- Study built environment, light and shade pattern, surface texture, scale and proportion.

Module 2: Model making exercise (Minimum 2 assignments)

- Study and develop 3D forms using plastic material such as clay and plaster of paris, putty.
- Develop 2/ 3D forms using hard material such as paper, paper board, thermo Cole, wire, cardboard, wax, POP, acrylic sheets, wood, plastics, glass fiber.

Module 3: Timber model making exercise. (Minimum 1 assignment)

- Exposing to carpentry tools, machines and timber joints.
- Exposing to different types of timber joints and wooden construction

Module 4: Rendering techniques exercises (Minimum 1 assignment each medium)

- Pencil rendering
- Pen and ink
- Water colour

Module 5: Photography exercises

Module 6: Set designing exercises

Module 7: Wall painting, sculpture making exercises

Course Outcome: After the successful completion of the course, student will be able:

1.	To understand the fundamentals of construction and transformation from two dimensions to three dimension forms through model making.
2.	To develop skills in the context of architectural construction and compositions.
3.	To apply the art of model making in architectural compositions.

References:

- Rendering with pen and ink by Gill
- Wenninger (Magrus. J.) Spherical Models, Cambridge University Press, 1979
- John W. Mills, The Technique of Sculpture, B.T. Batsford Ltd., New York Reinfold Publishing Corpn., London, 1966.
- Mitchell, W. J., Digital Design Media by, Published by Van Nostrand Reinhold, USA

SECOND SEMESTER

AR 2304 Architectural Design II Credit 4 L-T-P: 0-0-6

Course Objective:

After completion of this course student will be able to

- To identify and relate the concepts of space , form and order.
- To distinguish and analyze three dimensional designed space.
- To design objects based on the concept of space and form.
- To classify different functional spaces and analyze their space requirements.
- To compile data required for architectural designing.
- To identify the human standards of design based on ergonomics.
- To innovate, modify and evaluate an existing space.

1. Relationship between Basic Design and Architectural Design: comprehensive understanding of space, form, function and design.
    - Study of 3-d forms/shades and shadow study and composition.
2. Application of elements of design to achieve design principles in creative work.
    - Design of small objects (parts of building, like, window grill, boundary wall, floor tiles and similar projects) with respect to function structure aesthetics.
3. Introduction to external and internal form concept, their quality, concept of space, relation of space and volume.
    - Approach to design as a continuous process through aesthetics, function and technology; study of basic components of a building and their functions.
    - Examples of Dimensions of different rooms.
4. Principal of design with reference to function, various activities and related spaces; Data collection, environments, climate, orientation, site conditions, circulation flow diagrams.
5. Study of basic human needs, standard measurements of human activities and allocation of spaces: Concepts of Anthropometrics and ergonomics.
6. Study and concept of measured drawings of small buildings.
7. Study and design of single units like living spaces, sleeping and cooking spaces, stalls, bus-stops, telephone booths, etc detailed design of single room for simple function showing relationship with adjoining areas for other activities not more than 25sq.mts.
8. Design problems dealing with planning for activities such as individual living units shops, stalls, snack bars, unilevel activities with three to four functions of total area up to 80 sq.mts.

Sessional Work:

Assignments based on the above topics.

Course Outcome:

After the successful completion of the course, student will be able:

1.	To develop critical and analytical thinking skills in the context of the concepts of space, form and order.
2.	To understand, distinguish and analyse three dimensional designed spaces, wide range of functions and their relationships.
3.	To comprehend human standards of design based on ergonomics.
4.	To represent the forms in terms of drawings and 3D models.
5.	To design various components of different functional spaces with an integration of the principles of composition and design.

References:

1. Ching, D.K; From, Space and Order.
2. A. Peter Fawcett; Architecture Design Notebook.
http://www.scribd.com/doc/45018090/Architecture-Design-Notebook
3. Robin Boyd; Puzzle of Architecture

SECOND SEMESTER

AR 2306 Building Construction –I Credit 4 L-T-P: 0-0-6

Course Objective:

- To label the various parts of building
- To develop the brick bond for different types of wall junction
- To compare the material consumption in various brick bonds
- To apply the different types of Door Window detailing in building application
- To classify the requirement of DPC in various levels in building

	Topic	No. of Sheets
1	**BASIC BUILDING COMPONENTS:** Development of Plan & Section of a small building to understand foundation, plinth, flooring, sill, lintel, roof slab and parapet. Typical Building Skin Section for a Two Storied House	2
2	**BRICK MASONRY**: Types of Brick bonds: English, Flemish & Rat-trap bond for one and half thick walls. Detail brick layout at corners, junctions and brick columns.	2
3	**WOODEN DOORS & WINDOWS**: Details of door and ventilator. Battened /ledged/Braced door, Flush/Panelled door. Venetian door. Details of window, glazed, pivoted, louvered window, corner and bay window.	4
4	**D.P.C. DETAILS:** Waterproofing details in different levels: Details of simple foundation, wall, roof, Details of sill, lintel and roof in RCC, RB and steel, Damp proof details of basement, plinth, sill, lintel, and roof level.	2
5	**SITE STUDY & REPORT**: different types of brick bonds in wall & Paving with sketches and some photographs, Traditional building component and Wood works	Report = 1
	Total Minimum No. of Sheets & Report	**10 + 1**

Course Outcomes

After the completion of this course, students will be able:

1.	To define basic building elements
2.	To recognize the various types of masonry, arches and foundation made up of suitable materials.
3.	To recognize the various types of doors and windows and explain the suitability of given doors and windows based on functional requirement and spatial context.
4.	To recognize the importance and constituents waterproofing requirement at different levels and apply waterproofing treatment at different levels

Recommended Books:

1. B. C. Punmia; *Building Materials and Construction* .Laxmi Publications Pvt Ltd, New Delhi,1993.
2. Bindra & Arora; *Building Materials and Construction.*
3. W.B. MacKay, *'Building Construction'*, Vol. 1,2,3 longmans, U.K. 1981.

SESSIONAL SUBJECTS

SECOND SEMESTER

NCC/NSS/CA/GAMES **Credit 1** **L-T-P: 0-0-3**

3RD SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 3301	Building Science-I (Climatology)	3	0	0	3	Dept Th
AR 3303	Construction Techniques and Codes	3	0	0	3	Dept Th
AR 3305	Building Services-I (Water Supply & sanitation)	3	0	0	3	Dept Th
AR 3407	Structural Mechanics	3	0	0	3	Other Dept Th
AR 3309	Art & Culture [Breadth Subject – III]	3	0	0	3	BS 3
	SESSIONAL SUBJECTS					
AR 3402	Architectural Design - III	0	0	6	4	Dept L/S
AR 3304	Building Construction – II*	0	0	6	4	Dept L/S
AR 3306	*Building Technology – II**(RAK CENTRE)*					
AR 3308	Computer Application in Architecture	0	0	3	2	Dept L/S
	NCC/ NSS/ CA/GAMES	0	0	3	1	Co-Curricular
	TOTAL CREDIT				**26**	
Contact hours		**15**	**0**	**18**		**33**

THIRD SEMESTER

AR 3301 Building Science-I (Climatology) Credit 3 L-T-P: 3-0-0

Course Objectives:

- List the different elements of climate classify them.
- Identify the factors of comfort
- Infer the impact of climatic forces on built structures
- Assess the effects of site, sun and wind in building response
- Design of shelters in different climatic conditions.

Module 1 : INTRODUCTION

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

Module 2 : BIO-CLIMATIC APPROACH

- Human Comfort
- Thermal Comfort Factors
- Bioclimatic Requirements
- Relation of climatic elements to comfort
- The Bio-Climatic Chart

Module 3 : ENVIRONMENT AND BUILDING FORMS

- Impact of External forces on Building

Module 4 : SITE & BUILDING DESIGN

- Site Selection, Site Planning
- Building Orientation and Placement
- Effect of Landscaping

Module 5 : SUN & BUILDING DESIGN

- Basic Principles of Heat Transfer
- Daylighting
- Solar Control
- Thermal Insulation

Module 6 : WIND & BUILDING DESIGN

- Wind effect and Air Flow Pattern
- Ventilation Techniques
- Air movement around the buildings
- Stack Effect and Thermally induced air currents.

Module 7 : ARCHITECTURAL APPLICATION

- Shelter for warm-humid climates
- Shelter for hot-dry climates
- Shelter for composite climate

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand of relevance of climate consideration in built environment
2.	To apply relevant technologies to bring comfort in built environment
3.	Designing Climate responsive Architecture
4.	Understand tools & instruments utilized for measurement of climatic elements to relate with human comfort level

Recommended: Books:

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

THEORY SUBJECTS

THIRD SEMESTER

AR 3303 Construction Techniques and Codes Credit 3 L-T-P: 3-0-0

Course Objectives:

- Outline the soil properties that contribute to design of building foundation.
- Classify and discuss the application of various types of foundation system in building.
- Workout the strategy for placing and removing formwork of RCC construction.
- Develop the understanding of hollow and panel wall construction.
- Apply the various building bylaws and codal provisions in design of built environment

Module 1: Soil properties and Bearing Capacity of Different soil, Foundation: Types of foundation, different types of shallow and deep foundation, Raft foundation, foundation detail for RCC column, grillage foundation, Pile foundation – Different component of pile classification and use of pile foundation. Causes of foundation failure and remedies, excavation – timbering and dewatering techniques for loose soil and sub soil water condition.

Module 2: Temporary supporting structures: Form work and shuttering for different types of RCC elements. Different types of materials for shuttering and their specifications. Scaffolding, shoring and underpinning: Different types, uses and their specifications.

Module 3: Hollow and Panel wall: economy and advantages over solid load bearing walls, practical consideration during construction hollow concrete block construction, different types of partition wall. Reinforced brick work.

Module 4: Introduction to High rise building construction techniques: Adopted in construction of foundation, and superstructure.

Module 5: Building byelaws, submission plan, methods of municipal approval, NBC, fire prevention and safety measures, other regulatory aspects such as master plan and zonal plan

Module 6: Codal provisions with respect to Landuse classifications and use permitted, Means of Access, Community open spaces and amenities, Requirement of Plots.

Module 7: Codal provisions with respect to Classification of Buildings, Open spaces within a plot, Offstreet parking spaces, Requirement of parts or buildings.

Course Outcomes

After the completion of this course, students will be able to:

1.	Explain safety practices and procedures in construction practices;
2.	Describe commonly used construction materials and techniques for sub and super structure;
3.	Identify current construction practices and various methods of construction;
4.	Understand the application of building byelaws and codes in design and implementation;

Recommended Books:

1. B. C. Punmia; *Building Materials and Construction* .Laxmi Publications Pvt Ltd, New Delhi,1993.
2. Bindra & Arora; *Building Materials and Construction.*
3. W.B. MacKay, *'Building Construction'*, Vol. 1,2,3 longmans, U.K. 1981.
4. National Building Codes 2005

THEORY SUBJECT

THIRD SEMESTER

AR 3305 Building Services – I Credit 3 L-T-P: 3-0-0
(Water supply and Sanitation)

Objective:

- Identify the different sources of water, list them and describe the method of intake.
- List the methods of water purification and describe them.
- List and identify water distribution components and networks
- List and identify sanitation systems in India and their functioning process.
- Quantify the amount of storm water, runoff in different situations.
- Design of septic tank, sewers.
- Design Plumbing layout and draw plumbing working drawings with specifications for buildings.

Module 1

Water Supply: Sources of water supply, standards of purity and treatment of water, qualities of potable water. Domestic water demand, capacity of over head tanks and calculation of water consumption.

Module 2

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

Module 3

Sanitation: Basic principles of sanitation and disposal of waste matter from building. Brief description of various systems of sewage disposal and their principles. Details of a Septic tank and capacity calculation.

Module 4

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

Module 5

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

Module 6

Sewage treatment: The process of self purification Disposal of sewage from isolated building (septic tank, imhoff tank), sewage breakdown.

Plumbing definitions and related terms, plumbing systems (one pipe, two pipe; etc), House drainage system and sanitary appliances and traps.

Module 7

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

N.B. The treatment of the subject will be mainly descriptive along with tutorial assignments related to the architectural designs already prepared by the students and also planning and layout of water supply and sewerage system plan.

Course Outcomes

After the completion of this course, students will be able:

1.	Identification of the various sources of water supply and the intake methods
2.	Understand the water treatment processes for different types of water
3.	Understand the waste water treatment processes and the functioning of various sewer appurtenances
4.	Designing the water reservoir, septic tanks and soak pits
5.	Preparing plumbing layout drawings for water supply and sanitation for buildings

Recommended books :

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

THEORY SUBJECTS

THIRD SEMESTER ***OTHER DEPT***

AR3407 Structural Mechanics Credit 3 L-T-P: 3-0-0

Course Objective*:*

- To define the pure bending and outline the relationship between the bending to the material property and geometry
- To apply the pure bending and shear equation to compute the stresses at various level of beam
- To analysis the stress and strain conditions due to bi-axial stress system
- To compute the deflection in simply supported, cantilever and over-hang beams for a given set of loading
- To compute the Euler's critical load for a column under various set of end condition
- To outline the application of energy principle in structural elements

Module: 1

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

Module: 2

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

Module: 3

Bi-Axial state of stress at a point, complementary shear Principal stresses, Graphical representation of stresses (Mohr's Circle). Two-dimensional state of strains at a point, principal strains, Strain Gauge.

Module: 4

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

Module: 5

Deflection of beams by Area moment theorems – Applications to simply supported, cantilever and overhanging beams.

Module: 6

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

Module: 7

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

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the basic Strength of Materials theorems and to apply the concept in structural problems.
2.	Analyse different structural bodies viz.beam, frame, and column.
3.	Evaluate the influence of various geometric and loading parameters of structural bodies.
4.	Compare the results obtained from bending theory of beam and strain energy method of structural problems.
5.	Create new ideas in the field of structural mechanics.

Recommended Books:

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

THEORY SUBJECT

THIRD SEMESTER ***BREADTH SUBJECT 3***

AR3309 Art & Culture Credit 3 L-T-P: 3-0-0

Objectives:

- Analyse the development of Indian and European art and culture for the periods covered.
- Identify different styles of regional and/or periodical art forms.
- Analyse the contributing factors for the development of different styles of art.
- Appreciate the painting and sculptural art objects of different region.
- Interpret art works by analysing their components' characteristics.

1. **Introduction of Art and Culture and its importance**
   - Definition of "Art" and "Culture"
   - Different types of Art Forms
   - Importance of Art and Culture in the different facets of society and our daily life
   - Importance of Art and Culture in the study of Architecture and Engineering
2. **Pre-Buddhist Indian Art –**
   - Stone-Age Cave Art;
   - Art and Sculpture of Indus Valley Civilisation
3. **Buddhist art in India –**
   - Art of Stambhs during Mauryan Empire under Asoka - General characteristics of sculpture under Persian sculptors
   - Cave Art of Ajanta; Typical distinctive features of Gandhara School of Art; Relief art on Stupas – examples from Sanchi and Bharhut
4. **Temple Art Froms in India**

   (General Characteristics with few illustrative examples to be discussed)

   - Central India – Khajuraho Complex (Madhya Pradesh)
   - Western India- Modhera (Gujarat), Mount Abu (Rajasthan)
   - Eastern India- Raja-Rani Temple (Bhubaneswar), Konarak; Bengal Terracotta Temples at Bishnupur
   - Southern India - Mahavalipuram Shore Temple and Rathas; Vijayanagara Temples at Hampi; Nayaka Art at Madurai; Timber Palace Art of Kerala – Padmanabhapuram Palace
5. **Mughal Art Forms –**
   - Miniature Art forms during Akbar and Jehangir
   - Indian Miniature Schools – (a) Pahadi Schools and (b) Rajasthani Schools
   - Architectural Art Form during Shah Jahan
6. **Art Forms of Europe during Renaissance**
   - Pre-Renaissance art form in Church and Palaces / Forts of Europe
   - Different Stages of Renaissance in Europe and their general characteristics:
     i. Early Renaissance
     ii. Mature Renaissance
     iii. Late Renaissance – Baroque and Rococo
7. **Salient Modern Art Forms of Europe since Industrial Revolution**

   Art Nouveau, Cubism, Suprematism, De Stijl, Impressionism, Expressionism, Mondrian art

Recommended Books:

1. Huntington, Susan.L. *The Art of Ancient India: Buddhist,Hindu,Jain.* New York, Weatherhill, 1985.
2. Sir Banister Fletcher, *A History of Architecture*, University of London, the Antholone Press, 1986
3. Percy Brown, *Indian Architecture (Buddhist and Hindu Period*), Taraporevala and sons, Bombay, 1983.
4. Satish Grover, *The Architecture of India (Buddhist and Hindu Period)*, Vikas Publishing Housing Pvt. Ltd. New Delhi, 1981.
5. Biswas, S.S., *Terracotta Art of Bengal*, New Delhi,1981.
6. A. Volwahsen. *Living Architecture – India (Buddhist and Hindu*), Oxford and IBM, London, 1969
7. Khare , Ajay, *Temple Architecture of Eastern India* , Shubhi Publications, New Delhi , 2005

SESSIONAL SUBJECT

THIRD SEMESTER

AR 3402 Architectural Design-III Credit 4 L-T-P: 0-0-6

Objectives:

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

- Analysis of space proximity studies with the help of Proximity charts
- Use of Flow charts to analyse movements from space to space
- Use of Bubble diagrams as 'reduced drawings'
- Interpretation of climatic data to formulate design approaches

Activities:

Main Design Exercise	**Duration** (approx.)
Small residential building / guest house	6 weeks
Museum / health club, small resort	3 weeks
Restaurant (both outdoor and indoor)	2 weeks

Design (Time) Exercise	**Duration**
1. Memorial with landscaping/ Play school / Crèche	8 hrs.

Academic / Study Tour & Field Trip Drawing

The measured drawing exercise conducted during the tour, will be presented as well drafted drawings by the students.

It should be hand drafted and rendered and all the methods for proper documentation of the structure measured will be considered in the presentation.

This will follow a seminar, where the students will present their work verbally

Viva voce

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

Course Outcomes

After the completion of this course, students will be able :

1.	To understand the basic functional aspect of designing simple building type and its relevant spatial organization and accordingly design the unit
2.	The students shall learn to reciprocate and sensitize the design/concept to the environment with respect to specific site climate.

SESSIONAL SUBJECT

THIRD SEMESTER

AR 3304 Building Construction – II Credit 4 L-T-P: 0-0-6

Course Objective:

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

	Topic	No. of Sheets
1	**FOUNDATION & BASEMENT:** • Wall foundation, isolated and combined foundation in RCC. • Raft foundation. Parts of pile foundation and its type, Grillage Foundation. • Construction detail of basement wall, Retaining wall, floor and foundation with particular emphasis to their damp proofing protection against rain water and provision for natural lighting and ventilation.	3
2	**FLOORING:** • Types of flooring, methods of laying, furnishing of floors with different floor finishes like cement, colored cement, mosaic, terrazzo, tiles etc. • Special consideration for rubber, Linoleum and PVC flooring, Flag Stone Flooring, parquet flooring. • Different type of resilient and vibration resistive floor.	2
3	**ROOFING:** • Types of roof, Parts of roof and Types of Roof trusses. • Flat roof with wood and RCC, simple jack arch, Waterproofing, Rainwater gutter details. • Inclined Roof - Common roof covering and its arrangement: tiles, asbestos and metal sheets etc. with fixing and rainwater gutter	3
4	**SPECIAL DOOR & WINDOW:** • Special doors and windows: One way and both way-swinging door, sliding door (manual and automatic), folding, revolving, collapsible and rolling door with hardware details. • Window and Ventilator with Aluminum frame.	2

5 **STAIRCASE**

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

2

6 **SITE VISIT:**

At least one visit to be paid to the construction site covering various sequences of construction and a report to be submitted by individual students as a part of the sessional work. Report = 1

Total Minimum No. of Sheets & Report 12+1

Course Outcomes

After the completion of this course, students will be able:

1.	To recognize the various types of deep foundations, basement construction, flooring, roofing, special doors and windows and staircase.
2.	To explain the context and suitability of above elements under a given situation.

Reference Books:

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

SESSIONAL SUBJECT

THIRD SEMESTER

AR 3308 Computer Application in Architecture Credit 2 L-T-P: 0-0-3

Course Objectives

This course enables the students:

A.	To learn various commands in 2D operation.
B.	To learn Development of 3D objects and Surfaces
C.	To learn various commands in 3D operation and drawing of 3D objects
D	To learn 3D in higher(current) versions of AutoCAD, material attachment and Rendering in AutoCAD 2011 & 2012.
E	To get an introduction to Google Sketch up.

Syllabus:

- Drawing and modifying operations in AutoCad
- Colouring and Hatching in AutoCad
- Block making, writing Text and doing Dimensioning in AutoCad
- Formatting in AutoCad, Working in Layers in AutoCad, Use of Viewport in AutoCad
- Digitization of Images in AutoCad and Building Drawings and Composition of Sheets
- Sheet layout and toolbar generation
- Different draw and Modify operation
- Colour and hatch, Object properties
- Making of Blocks, Text and Dimensioning, Formatting operation: dimensions, text, line type etc.
- Creation and use of Layer, Assigning Line types, Line thickness, Line type Scale
- UCS generation, Use of View port
- Creation of entities
- Digitization of images
- Creation of simple Architectural elements, Building Drawings in 2D
- Composition of Drawing Sheets
- Practice and preparation of 2D documentations based on class projects in the previous semester in Architectural Designs
- Details of task to be determined each semester by the individual Instructor
- Basic operations of 3-D
- Development of regions, polylines, Generation of surfaces and solids
- 3-D operation: Union, Subtraction and Intersection; 3-D operation: Rotate, Mirror and Array;
- Material Attachment and Rendering.
- Final rendering in Photoshop.
- Operations in 3-D
- Solids editing;
- UCS operation;
- Working with 3-D Viewports and 3-D Pan/Zoom to generate different views.
- Implications and advantage of 3-D wireframe, Hide, Shade etc. in generating 3-D views
- Making of perspective views, adjustment of Camera, window orbit etc.
- Material Attachment and Rendering.
- Exercise 1: Drawing of simple 3-D objects
- Exercise 2: Drawing 3-D of a building.
- Introduction to 3DS Max, Material attachment, Light focusing, Different views, Rendering with Background and Foreground. [Application to the previous exercise]

Course Outcomes

After the completion of this course, students will be able to:

1.	Handle the software to exploreinnovative forms and geometry.
2.	Develop the concepts to produce 2D Architectural drawings.
3.	Apply the concepts in Architectural Design, Working Drawing and Landscape Design (Sessional).
4,	Explore concepts about 3D modelling and Walkthroughs.

Recommended books

- AutoCAD Manual
- AutoCAD Command Reference
- Introduction to 3DS Max

SESSIONAL SUBJECT

THIRD SEMESTER

NCC/NSS/CA/GAMES **Credit 1** **L-T-P: 0-0-3**

4th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 4301	Building Services - II (Acoustics)	3	0	0	3	Dept Th
AR 4403	Contemporary Architecture	3	0	0	3	Dept Th
AR 4305	Theory of Structure	3	0	0	3	Other Dept Th
AR 4407	Surveying (Theory)	3	0	0	3	Other Dept Th
	Foreign Language* [Breadth Elective – I]	3	0	0	3	BS/BE 4
	SESSIONAL SUBJECTS					
AR 4302	Architectural Design - IV	0	0	6	4	Dept L/S
AR 4304	Building Construction – III*	0	0	6	4	Dept L/S
AR 4306	Building Technology –III** *(RAK CENTRE)*					
AR 4308	Surveying	0	0	3	2	Other Dept L/S
	NCC/ NSS/ CA/GAMES	0	0	3	1	
	TOTAL CREDIT				**26**	
Contact hours		**15**	**0**	**18**		**33**
Note: Any one of AR 4304 / 4306 may be registered [*: for students at Mesra/Patna, ** for students at RAK international centre]						

THEORY SUBJECT

FOURTH SEMESTER

AR 4301 Building Services II (Acoustics) Credits: 3 L-T-P: 3-0-0

Course Objective:

- To explain the various characteristics of sound including origin, propagation and auditory sensation of sound.
- To distinguish the behaviour of sound for enclosed spaces and open spaces
- To identify the acoustical design criteria for theatres, cinema halls, auditorium, conference halls etc.
- To identify different acoustical defects and their remedies.
- To apply the Sabin's equation for reverberation time calculation
- To classify the different types of sound system and their suitability for different acoustical conditions.
- To classify the different types of acoustical materials and their suitability for different acoustical conditions.

Module 1. **Sound Engineering:**

Introduction to architectural acoustics - Characteristic and measurement of sound, frequency, intensity, decibel scale, auditory range, effects of sound on humans, loudness.

Module 2. **Room Acoustics:**

Acoustics and acoustical environment, Behavior of sound in an enclosed space. Principle of geometrical acoustics, Different acoustical defects in auditorium and its solution, reverberation and reverberation time calculations – Sabine's formula and its interpretation, dead and live room.

Module 3. **Design of Auditorium:**

Size, shape, sitting arrangement design criteria for speech and music, acoustical correction design and modification techniques, broadcasting studio, television studio, classroom, lecture hall, church and Cathedral.

Module 4. **Electro-acoustics:**

Introduction of Electro-acoustical systems, Unidirectional and Stereophonic sound system, Digital and Surround-sound systems, Design criteria for Theatres, Motion picture halls, Multiplexes and Multipurpose Auditoriums.

Module 5. **Open air Acoustics:**

Free field propagation of sound, absorption from air and natural elements, effect of barriers, effect of landscape element, thermal and wind gradient. Design of open-air theatre and planning of building. Reduction of noise by screening, Screening by Planting.

Module 6. **Environmental Noise Control:**

Noise sources, air borne and structure borne sound, NC curve, Propagation of noise of mechanical operation and impact noise, sound transmission through wall and partition, Vibration isolation – control of mechanical noise, floor, wall, ceiling treatment. Design Principles- reduction of noise at the source, Reduction of noise near the source. Application of sound absorption material, Reduction of noise by Structural Defense. Planning and analysis of problem. Reduction of noise by Town Planning and Regional Planning consideration.

Module 7. **Acoustical Material:**

General description of acoustical materials - acoustical tiles, fiberboard, resonator absorption unit absorber, carpets, acoustical plaster, resilient packing composite materials, etc. – Their use, selection criteria and construction.

Course Outcomes

After the completion of this course, students will be able:

1.	Understand the behaviour of sound in enclosed spaces and open spaces.
2.	Define the various acoustical defectsalong with their remedies.
3.	Apply Sabine's equation to calculate R.T and surface area of different acoustical materials.
4.	Explain acoustical design criteria of various indoor and outdoor spaces based on the function/ uses of the spaces.
5.	Synthesize the knowledge to provide the remedial measures for controlling noise, towards creating the most favourable conditions for indoor and outdoor acoustical environment.

Recommended books:

1. A. B. Wood; *A Text book of sound.*
2. T. M. Yarwood; *Acoustics*.
3. Duncan Templeton; *Acoustics in The Built Environment*.
4. J E Moore; *Design for good Acoustics and noise control.*

THEORY SUBJECT

FOURTH SEMESTER

AR. 4403 Contemporary Architecture Credits 3.0 L-T-P: 3-0-0

Course Objectives:

1. To Identify different styles and schools of contemporary architecture.
2. To Analyse the contributing factors for the design development of different styles.
3. To Analyse the works of the famous master architects introduced to the student.
4. To Evaluate the works of modern architecture that the student is coming across in everyday's life.
5. To Design buildings in the contemporary architectural styles.

Module 1	Introduction, Advent of Steel , glass and Ferro-concrete	• Late Renaissance and development of open spaces • Advent of Steel and Henry Labrouste • Great Exhibitions of 1851 and 1889 and their contributions • Gustave Eiffel • Development of Ferro concrete: Auguste Perret, Tony Garnier
Module 2	Development of 'New Art & Architecture'	• Le Art Nouveau movement and Victor Horta • H.P. Berlage, H. H. Richardson and 'True Construction' • Balloon Frame Structure and Plane Surfaces in America
Module 3	Chicago School & Organic Developments	• Chicago School: Louis Sullivan • Organic Architecture: Frank Lloyd Wright
Module 4	Programmatic Functionalism	• Walter Gropius and Bauhaus • Le Corbusier
Module 5	Development of International Style	• Mies van der Rohe • Philip Johnson • Louis I Kahn
Module 6	20th Century World Architecture	• Works of some master architects like, Eero Saarinen,,Alvar Aalto, Oscar Niemeyer, Richard Neutra, Norman Foster, Antonio Gaudi, Frank O. Gehry, I. M. Pei, Kenzo Tange.
Module 7	Indian Architecture since Independence	• B. V. Doshi, Charles Correa, Raj Rewal, A. P. Kanvinde • Laurie Baker

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand modern design philosophies in the evolution of innovative architectural forms and designs.
2.	Build their perspective towards various Architectural Styles and Product Design.
3.	Improve their appreciation towards historical sources, precursors of Modernism and evolution of Contemporary Architecture.

Recommended books:

1. Sigfried Giedion ; *Space, time and Architecture*.
2. Vincent Scully Jr; *Modern Architecture*.
3. Vikram Bhatt and Peter Sciver; *After the masters (Contemporary Architecture of India)*.
4. Kenneth Frampton; *Modern Architecture*.
5. Library of Contemporary Architects.

AR 4305 Theory of Structure Credit 3.0 L-T-P: 3-0-0

Course Objective:

- To identify and classify the structure based on redundancy and indeterminacy
- To analyze the fixed and continuous beam by force and stiffness method
- To outline the behaviour structural elements, that used in buildings
- To compute the bending moment and shear force in specific point of interest for a given beam and frame
- To determine the collapse mechanism of a beam and frame by plastic theory

Module: 1
Statically Indeterminate structures, Redundancy, Degree of Indeterminacy of Beams, Frames and Truss. Method of Consistent Deformation, Fixed end moments of a built-in-beam with concentrated, uniformly distributed and moments

Module: 2
Theorem of three moments: Determination of bending moment and shear force diagram for continuous and fixed beams

Module: 3
Castigliano's Second Theorem, Principle of least work: Analysis of Statically Indeterminate Truss and Frames.

Module: 4
Slope deflection Method – Basic formulae – Application to continuous beams and portal frames with and without sway.

Module: 5
Moment distribution Method – Steps of operating - Application to continuous beams and portal frames with and without sway.

Module: 6
Introduction to Plastic Theory. Modified Stress-Strain Diagram, Assumptions in plastic theory, Collapse load, Load Factor, Plastic bending, Plastic Moment, Shape factor of different geometrical cross-sections,

Module: 7
Plastic Theory: Upper bound and lower bound theorem. Plastic analysis of beams: simply supported, fixed, continuous. Analysis of Simple portal frames

Text Books:

1. C.K.Wang ;*Intermediate Structural Analysis*, *McGraw-Hill International.*
2. S. Ramamurtham; *Theory of Structures*, *Danpat Rai Publication.*
3. S.S.Bhavikatti ;*StructuralAnalysis (Vol-I),Vikash Publishing House Pvt.Ltd.*
4. S.S.Bhavikatti ;*StructuralAnalysis (Vol-II*), *Vikash Publishing House Pvt.Ltd.*
5. B.G.Neal ,*The* Plastic *Method of Structural Analysis*, *Chapman and Hall Ltd.*
6. B.C. Punmia, *Strength of Material and Theory of Structures (Vol-II), Laxmi Publication.*

THEORY SUBJECT

FOURTH SEMESTER ***OTHER DEPT***

AR 4407 Surveying (Theory) Credits 3.0 L-T-P: 3-0-0

Course Objective:

- To interpret the booking for field notes
- To apply the fundamental of chain and compass surveying for field survey
- To work out the contour surveying with the help of levelling instrument
- To determine the triangulation with the help of Theodolite
- To define and classify the various types of modern survey

Module 1. **Chain Surveying** -Principles of survey, equipment required, selection of station, methods of taking off sets. Booking the field notes, obstacles in chaining, errors in chaining, chaining on sloping ground and reciprocal ranging.

Module 2. **Compass Surveying**- The prismatic compass; its construction and uses. Other types of compasses. Reduced and whole circle bearing, magnetic declination, effects local attraction. Compass traverse & balancing the closing error.

Module 3. **Levelling** - Different types of levels, their temporary and permanent adjustment levelling staff. Book of the readings and reduction of levels, errors in levelling. Curvature and refraction reciprocal levelling profile, levelling cross sections.

Module 4. **Plane table Survey and Contouring**– Equipment and methods of plane table survey. Two points & three points' problems. Characteristics of contour lines, direct and indirect methods of contouring, interpolation of contours.

Module 5. **Minor Instruments** – The hand level, abney level, tangent chinometer bon, sextant and pantograph.

Module 6. **Theodolite Surveying** - Theodolite its temporary and permanent adjustment measuring of magnetic bearings, horizontal & vertical angles. Theodolite traverse and balancing the closing error.

Module 7. **Introduction to modern surveying equipments**

Total Station, GPS, Use of Distomat and Theomat, Aerial Photography, Digital Levels and Auto-Levels. (Preliminary information and use).

Recommended books:

- B.C. Punmia – *Surveying Vol.* I – Standard Book House, New Delhi – 1983.
- P. B. Shahani – *Text of surveying Vol. I*, Oxford and IBH Publishing Co – 1980

THEORY SUBJECT

FOURTH SEMESTER ***OTHER DEPT***

Foreign Language* **[Breadth Elective – I] Credits 3 L-T-P: 3-0-0**

SESSIONAL SUBJECT

FOURTH SEMESTER

AR 4302 Architectural Design-IV Credit: 4 L-T-P: 0-0-6

Course Objectives

This course enables the students:

A.	Understand how to interpret terms like Allowable FAR, Ground Coverage, Setbacks, Required Parking to be provided, etc as per Municipal Corporation bye-laws and National Building Code.
B.	Learn how to do Area-Calculations of spaces depending on number of users and nature of use to prepare Area-Statement and based on area-statement do functional space-zoning.
C.	Learn to make proper architectural space layout ensuring adequate natural light and ventilation, using either column-beam system or load-bearing walls. Also understand how to have large span structures using waffle-slab, etc.
D	Learn to integrate building aesthetics with functionality for designed building along with application of issues taught in all architectural subjects taught in first three semesters.

Activities:

Main Design Exercise	**Duration** (approx.)
1. Primary school / Neighborhood Shopping	5 weeks
2. Nursing Home / Artists' Exhibition Space	6weeks
3. Critical appraisal of a major building	2 weeks

Design (Time) Exercise	**Duration**
Any one of the above, not covered in the class	8 hrs.

Viva voce

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

Course Outcomes

After the completion of this course, students will be able to:

1.	Design of Low rise / Medium rise buildings with issues of moderate complexity to be tackled covering zoning regulations, byelaws, functional relationship, climatic condition, and social aspects along with basic-level structural considerations.
2.	To produce architectural design presentation drawings with site-plan, floor-plans, elevations, sections, views (exterior as well as internal) and model.

SESSIONAL SUBJECT

FOURTH SEMESTER

AR 4304 Building Construction – III Credit: 4 L-T-P: 0-0-6

Course Objective:

- To identify low cost construction technologies
- Understand the layout and construction details of different types of Partitions
- Understand the need for providing expansion joints and its construction details
- To know the construction details of ramps, elevators and escalators
- To know the different types and forms of large spans structures
- Site visits to be organized to make the students aware of various technical aspects, practical difficulties, onsite decisions which will strengthen the knowledge for handling and executing a project

	Topic	No. of Sheets
1	**RURAL / LOW-COST TECHNOLOGIES:** Introduction to Cost Effective Construction Technologies • Stub Foundation • Rat Trap Bond (Walls) • Brick arches (at lintel level), • Filler Slab (roof), • Use of Ferro cement	2
2	**PARTITIONS:** • Details of Timber Paneled and Soft board Partitions • Glazed Partitions using Aluminum and Timber sections • Glass Block Partitions. • Partition with timber, metal, stone, PVC / plastic etc.	2
2	**EXPANSION JOINTS:** • Construction details at foundation, walls, floors and roof level for both concrete and brick work.	1
3	**ESCALATORS, RAMPS AND ELEVATORS:** • Construction Details of Ramps and Elevators • Details of Escalators	3
4	**LARGE SPAN STRUCTURES:** • Types and forms of roofing in steel and RCC, their applications to factories sheds, halls, • Hangers, canopies, North light roofing in steel and RCC, Patent Glazing. • Coffered Slab, Flat Slab.	3
5	**SITE VISIT:** At least two visit to be paid to the construction site covering various sequences of construction and a report to be submitted by individual students as a part of the sessional work.	Report = 1
	Total Minimum No. of Sheets & Report	11+1

Course Outcomes

After the completion of this course, students will be able:

1.	To recognize the various types of partitions, cladding, suspended ceiling, expansion joints,

	vertical transportation and large span structures.
2.	To explain the context and suitability of above elements under a given situation

References:

Text books:

1.Building Construction - W.B. Mc. Kay Vol. 1- 4
2.Building Materials and Construction - B. C. Punmia
3.Building Materials and Construction - Bindra& Arora

SESSIONAL SUBJECT

FOURTH SEMESTER

AR 4308 **Surveying** **Credit: 2** **L-T-P: 0-0-3**

Actual field Survey by the following methods:

1. Chain Surveying
2. Compass Surveying
3. Plane table Surveying
4. Levelling
5. Theodolite Surveying

Recommended Books:

1. B.C. Punmia – *Surveying Vol.* I – Standard Book House, New Delhi – 1983.
2. P. B. Shahani – *Text of surveying Vol. I*, Oxford and IBH Publishing Co – 1980

SESSIONAL SUBJECT

FOURTH SEMESTER

NCC/NSS/CA/GAMES **Credit 1** **L-T-P: 0-0-3**

5th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 5301	Building Services – III (Electrical & Lighting)	3	0	0	3	Dept Th
AR 5303	Site Planning & Landscape Architecture	3	0	0	3	Dept Th
AR 5405	Concrete Structure	3	0	0	3	Other Dept Th
	Breadth Elective – II*	3	0	0	3	BS/BE 5
	SESSIONAL SUBJECTS					
AR 5302	Architectural Design - V	0	0	9	6	Dept L/S
AR 5304	Working Drawing-I	0	0	6	4	Dept L/S
AR 5306	Landscape Design	0	0	3	2	Dept L/S
AR5308	Structural Design (R.C.C)	0	0	3	2	Other Dept L/S
	TOTAL CREDIT				**26**	
Contact hours		**12**	**0**	**21**		**33**

* Sociology & Environmental Psychology
Or
Organizational behaviour..

THEORY SUBJECT

FIFTH SEMESTER

AR 5301 Building Services III (Electrical & Lighting) Credit:3.0

L-T-P: 3-0-0

Course Objective:

- To list the various components required in electricity distribution system
- To explain the electrical distribution in campus
- To develop the electrical layout diagram for building for the estimation and installation purpose
- To identify the various types of light requirement for different purpose
- To apply the fundamental of laws of illumination for analyse the light requirements of any space (both exterior and interior)
- To design the lighting scheme for interiors spaces

A. Electrical Services

Module 1

Sources of Electricity, Electricity generation, Basic Electrical Distribution System – Substation, transformer, over head line, underground line. Three phase supply. Electrical distribution in campus

Module 2

Domestic wiring system, Material, classification, merits and demerits, Electrical accessories, Symbols and representation in architectural layout drawings, Single line-wiring diagram, Safety aspects, protection of buildings against lightning, NBC Recommendations, Earthing, Short circuit and overloading, Preliminary Estimation of Electrical & illumination works

B. Lighting & Illumination

Module 3

Fundamentals of light. General definition of terms related to optical sensitivity, visual performance & vision, Visual field, Application of lighting and illumination in Architecture.

Module 4

Artificial sources of light; Lamps and their characteristics: Incandescent lamp, Fluorescent lamp, Gas filled lamp, HID lamp. Neon lamp and LED lamp. Polar Curves Luminaries and their applications

Module 5

Definition of Light power, light flux Light intensity, Laws of Illumination: inverse square law and Lambert's Cosine law. Application of law of illumination. General formula for illumination calculation of distributed source. Coefficient of utilization.

Module 6

Standard level of illuminations for various tasks, Basic lighting design, Direct, Indirect and semi-direct lighting. General and local lighting, Glare and glare control.

Module 7

Lighting design of: Residential units, Shops & Restaurants, general office, conference hall, Art – gallery and Museum Parks & playgrounds Road/area lighting and Landscape Lighting.

Course Outcomes

After the completion of this course, students will be:

1.	Understand about the basic services and their generation
2.	Apply their knowledge in Professional life
3.	Develop a sense of organization of appropriate solution in their design

Reference:

1. Derek Philips; *Lighting in Architectural Design*.
2. G.K.Lal, *Elements of Lighting, 3-D Publishers*.
3. R.G. Hopkinson and J.D.Kay, *The lighting of buildings*, Faber and Faber, London, 1969.
4. Philips Lighting in Architectural Design, McGraw Hill, New York, 1964.
5. I.E.S. Handbook.
6. International Lighting Review – Quarterly Journal.

THEORY SUBJECT

FIFTH SEMESTER

AR5303 Site Planning and Landscape Architecture Credit: 3.0

L-T-P: 3-0-0

Course Objective:

- To define site planning process and identify basic principles and list them.
- To classify historical gardens and identify their characteristics.
- To illustrate the different processes of site study and its application.
- To classify natural and man-made elements, list them, identify their use and infer their application.
- To design, develop and prepare landscape plan.

Module 1: Introduction to Site Planning Process:
Need, Definition, scope and relationship in between Site planning & Landscape Arch. Basic principles of landscape design.

Module 2: Evolution of Garden Design:
Origin of the concept of garden. A brief study of different garden types: Egyptian, Mesopotatmian, Persian, Mughal gardens, Indian Vedic Gardens, Japanese gardens, Chinese Gardens,French Gardens, Renaissance Gardens, English Gardens.

Module 3: Site Analysis:
Site study and analysis of all natural and man-made factors of site like site-topography and slope, soil, hydrology and drainage, vegetation, climate and visual analysis.

Module 4: Natural Elements of Landscape:
Landforms- soil dynamics, rock, water, vegetation. Plant types, characteristics, structure and colour. Climate and their role in landscape design.

Module 5: Manmade Elements of Landscape:
Hard and soft landscaping, garden furniture, lighting fixtures, signage and sign boards, fences, garden hardware and surface treatment, paving materials, surface drainage, artworks, planters, garden shelters, artificial rocks, plants and waterfalls.

Module6: Modern gardens: Rock garden, terrace garden, Indoor garden and other Contemporary thoughts of landscape.

Module 7: Guidelines for different landscape situations:
The interconnection of areas, nodes, circulation, passive and active recreation spaces, and aesthetics in Residential parks, Industrial zones, Commercial areas and tot lots.

Course Outcomes

After the completion of this course, students will be able to:

1.	Improve their concepts, ideas and techniques prevalent in landscape architecture.
2.	Develop knowledge about various techniques of site analysis and planning, which will help in Architectural Design and Landscape Design (Sessional).
3.	Build their understanding about the design process used in landscape architectural practice.

Recommended books:

1. Charles W. Harris & Nicholas T. Dines; *Time Saver Standards for Landscape Architecture*
2. Kevin Lynch ;*Site planning* ;MIT Press, Cambridge, MA – 1967
3. J. O. Simonds; *Landscape Architecture*; McGraw Hill.
4. J. E. Ingels; *Landscaping – Principles and Practice*.
5. P. Walker, Theodre D; *Planting Design.*

THEORY SUBJECTS

FIFTH SEMESTER ***OTHER DEPT***

AR 5405 Concrete Structure Credit:3.0 L-T-P: 3-0-0

Course Objective:

- To classify various types of RCC material depending upon the strength and durability parameter
- To design a beam for a given system of loading and structural geometry, for flexure and shear
- To design a slab for given building floor for different end support conditions
- To design a column for given axial load and moments
- To design a dogleg staircase for given stair well space in residential or public building
- To outline the features of IS code provisions regarding limit state method for designing concrete structure
- To summaries the conceptual idea behind the development of pre-stressed structural component for general use

Module: 1

Basic Material Properties & Design Concept

Introduction to Concrete Technology, Composition of Concrete and the properties, Strength and Durability, Modulus of Rupture, Creep and Shrinkage of Concrete, Reinforcing Bars, Types and grade, Stress-Strain Diagram of Steel and Concrete. Concrete Mix Design: Nominal Mix and Design Mix. Design Philosophies, Working Stress Method, Limit State Method, Various Limit States.

Module: 2

Design for Flexure

Introduction, assumption, flexure design of singly reinforced & doubly reinforced and T-beams by Limit State Methods. IS-Coded provisions, Numerical Problems.

Module: 3

Design for Shear, Bond

Shear failure of beams. Shear reinforcement, Curtailment of reinforcement. Bond, Anchorage and Development length, IS-Code provisions, Design of a beam with flexural and shear consideration. Reinforcement Detailing, Numerical Problems.

Module: 4

Design of Compression Members

Short and Long Columns, IS-Code Provisions, Design of Short Columns under Axial compression, Design of Columns under bi-axial bending, use of interaction diagram for design. Lateral ties. Reinforcement Detailing, Numerical Problems.

Module: 5

Design of Footing

Isolated footings for rectangular and circular columns. Reinforcement Detailing, Numerical Problems.

Module: 6

Design of Slabs & Stairs

Effective span, one way and two way slabs. Design of Slabs with various boundary conditions by IS-Code methods. Reinforcement Detailing, Numerical Problems.

Types of stairs, Design of Dog Legged & Open Wall Stairs. Reinforcement Detailing, Numerical Problems.

Module: 7

Introduction to Pre-stressed Concrete

Introduction to Pre-stressed Concrete, Pre and Post tensioning systems, Advantages, Basic design concept of Pre-stressed concrete beam, Analysis of prestress and bending stress, Resultant Stress, Thrust Line, Concept of Load balancing, Various losses of stresses. Simple Numerical Problems

IS Codes:

1. IS 465: 2000.
2. SP-16
3. SP-34

Note:

1. All the Design of Concrete Structural Elements must be based on "Limit State Method"

2. Students are allowed to bring IS 465: 2000 and SP-16 in the examination hall for referring the design solutions.

Course Outcomes

After the completion of this course, students will be to:

1.	Identify and apply appropriate parameters, assumptions and design criteria
2.	Design a simple reinforced concrete structural system
3.	Have familiarity with the IS456:2000 code of practice

Recommended Books:

1. B. C. Punmia; *Reinforced concrete structure (Vol - I).*
2. S. Unnikrishna Pillai & Devdas Menon; *Reinforcement Concrete Design, Tata McGraw Hill, New Delhi.*
3. N.Krishna Raju; *Structural Design and Drawing, Reinforced Concrete and Steel, University Press (India) Ltd.*
4. Mallick and Gupta; *Reinforced Concrete*.
5. P.C.Varghese; *Limit State Design of Reinforced Concrete Structures*.
6. James R. Libby, *Prestressed Concrete Design and Construction*, *The Ronald Press Company.*
7. N.Krishna Raju; *Prestressed Concrete*, *Tata McGraw Hill, New Delhi*.

THEORY SUBJECT

FIFTH SEMESTER BREADTH ELECTIVE-2

Sociology and Environmental Psychology Credit:3 **L-T-P: 3-0-0**

Course Objectives:

- Analyze how architectural sociology assists in perceiving the human use of space
- Examine the social issues and changes and draw directions for designs.
- Analyze determinants of social context and apply the in architectural design.
- Synthesize on the dependency of economic parameters on social and built forms and appraise future solutions.
- Develop and implement solutions for contemporary social issues
- Design built environment integrated with social institutions.

Module 1: SOCIOLOGY - BASIC CONCEPTS

Sociology and its uses in human settlement studies; Social structure, concept of culture and differentiation of space; Socio-cultural processes: Socialization, competition, accommodation, culture change, Cultural-lag; Social stratification, class structure, family structure and human community development; Socio economic parameters of community planning; Sociology and its relationship with Architecture**;**

Module 2: SOCIETY AND ARCHITECTURE

Historical moorings of the world society and development of architecture; Social Impact on human living environment: examples from Industrial and French Revolution; Social diversity and choices on community settlements- impact of House-form and culture; Socio-cultural transformation through the ages and impacts on built environment; Social identity and architectural relevance.; Contribution of society, social structure and culture on the development of Vernacular architecture; High rise and low rise structure – design approach with social perspective.

Module 3: SOCIAL DEMOGRAPHY

Population size, growth, composition, and distribution; Components of population growth-births, deaths and migration; Causes and consequences of population growth; Population and social development; population policy; Moving houses and residential mobility;

Module 4: BUILDING AS A CONSUMER GOOD

Social and built environment in an existing society; House form and the expression of social identity; Concept of vulnerability among the old; Housing decision and the community; Decision in home purchasing

Module 5: IMPACT OF URBANISATION AND ECONOMIC CLASS STRATIFICATION

Urbanization, rural-urban continuum, urban growth; Impact of urban growth on society and urban area; Social aspects of Housing; Territoriality and neighborhood; Impacts of socio-economic parameters on built form; Slum and Squatter settlements; Design for weaker sections.

Module 6: TECHNIQUES OF DATA COLLECTION AND SOCIO-ECONOMIC ANALYSIS
Appreciating the contribution of social research; Data Collection: Participant and quasi-participant observation; interview, questionnaire and sampling-size; Structuring the questioner; Analysis: scaling techniques-social distance; Interpreting results

Module 7: ENVIRONMENTAL PSYCHOLOGY & SPACE SYNTAX ANALYSIS
Introduction, processes, principles and issues related to environmental psychology; Human spatial behavior and environmental stressors; Environmental designs – Assessing and planning, architectural psychology; Nature deficit disorder and green prescriptions; Introduction to Space syntax analysis; Techniques of integrating space syntax in social space analysis.

Recommended Books:

1. D. R. Sachdeva ; *An Introduction to Sociology* - Vidya Bhushan,; Kitab Mahal.
2. James C. Snyder, Anthony J. Catanese; *Introduction to Architecture*-; McGraw-Hill.
3. G.H.R. Tillotson – *The tradition of Indian Architecture Continuity, Controversy – Change since 1850*, Oxford University Press, Delhi, 1989.
4. Anthony D. King, *Building and Society*. Routledge Kegan & Paul, 1980.
5.Oscar Newman, *Defensible Space*; Macmillan Publishing,1976.
6.Amos Rapoport,; *House Form and Culture*, Milawaukee: University of Wisconsin,1969.
7.Edwars T hall; *The Hidden Dimension*; Anchor Books Editions;1990.
8.Bill Hillier, Julienne Hanson; Space Syntax;

SESSIONAL SUBJECT

FIFTH SEMESTER

AR 5302 Architectural Design-V Credit: 6 L-T-P: 0-0-9

Course Objectives:

Application of Design theory and principles and

Design of Low rise / medium rise /high rise buildings with complex issues to be tackled covering functional relationship, climatic condition, social aspects along with structural considerations and building services

Application and use of relevant building bye-laws and provisions of **National Building Code**

Activities:

Main Design Exercise	**Duration** (approx.)
1. Commercial–cum- Residential complex (high rise) / Town Hall & Civic Centre	8 weeks
2. Exhibition Pavilion / Country Club house	5 weeks
Design (Time) Exercise	**Duration**
Any one of the above, not covered in the class	8 hrs.

Academic / Study Tour & Field Trip Drawing

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

Section (A) Report should include the following:

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

Section (B) Field Trip Drawing

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

Viva voce

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

Course Outcomes

After the completion of this course, students will be able to:

1.	To demonstrate design, structural systems, services and construction systems in the design of a modern medium to high rise building in the urban context.
2.	To apply and use building byelaws and codal provision contextually.
3.	To design structures with lighting and circulation efficiency.

SESSIONAL SUBJECTS

FIFTH SEMESTER

AR. 5304 Working Drawing - I Credits 4 L-T-P: 0-0-6

Course Objectives

- Explanation and demonstration of basics in working drawing study of process and symbols of working drawings.
- Building construction drawings to be prepared as a part of contract document with proper labelling and dimensioning techniques.
- Working drawing to be made of one building in a complex chosen from earlier design projects carried out in the 4th semester.

Pre-requisites: BC sessionals.

Topics	*A1 size sheet*
Layout plan of the whole complex and excavation plan of one building	2
Foundation plan	1
Ground floor plan along with schedule of internal finishes	1
Upper floor plans along with schedule of internal finishes	Minimum 1 [*as required]
Terrace/ roof plan including roof drainage	1
All 2 side elevation with labelling of one building	1
External finishes of all types included in the complex; the drawings shall include all details required.	1
Minimum 3 sections including one through staircase and toilets and one skin section showing required detailing.	2
Door window schedule to be prepared for the undertaken building.	2

Minimum of 11 sheets to be done in the semester.

Course Outcomes

After the completion of this course, students will be:

1.	Able to understand the basics in working drawings and its use and implementation on site.
2.	Able to read the drawing and know the implementation and challenges on construction site.
3.	This will improve the understanding of the principles of design detailing as applicable to various situations.
4.	It will be helpful in detailing out the drawings for the subject working drawing-I and understand the various stages of construction for estimation and costing.

SESSIONAL SUBJECT

FIFTH SEMESTER

AR 5306 Landscape Design Credit: 2 L-T-P: 0-0-3

Course Objective:

- To identify and infer challenges from existing landscape
- To interpret the functional aspects.
- To design, develop and prepare landscape plan.
- To develop written communication skills.

Syllabus:

1. Introductory exercises in Art, Architecture & Landscape-using basic principles of landscape.
2. Critical –Appraisal of Urban and Rural Landscape.
3. Site Planning & Landscape Analysis for medium sized sites (up to 2 Ha)
4. Landscape Design of small recreational or civic spaces.
5. Preparation of Project report.

Course Outcomes

After the completion of this course, students will be able to:

1.	Produce drawings of Planting Plans, Outdoor Lighting Design etc.
2.	Design of exterior and interior landscapes for hospitals, Educational institutions, resorts etc.

Recommended books:

6. Charles W. Harris & Nicholas T. Dines; *Time Saver Standards for Landscape Architecture*
7. Kevin Lynch ;*Site planning* ;MIT Press, Cambridge, MA – 1967
8. J. O. Simonds; *Landscape Architecture*; McGraw Hill.
9. J. E. Ingels; *Landscaping – Principles and Practice*.
10. P. Walker, Theodre D; *Planting Design*

SESSIONAL SUBJECT

FIFTH SEMESTER ***OTHER DEPT***

AR 5308 Structural Design (R.C.C.) Credit:2 L-T-P: 0-0-3

1. Properties of Concrete, Tests on concrete and its ingredients: Fineness and soundness of cement, Slump test, compaction factor test, cube test
2. Model design of different R.C. Structural components: Beam, Slab, Column, Stair and Foundation.
3. Design Exercise: Complete Analysis and Design of a R.C Frame building, under different types of load combination.
4. Seminar presentation on various aspects of Reinforced concrete structures.

IS Codes:

4. IS 465: 2000.
5. SP-16
6. SP-34

Same IS-Code and books should be referred as mentioned in the theory course

6th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 6301	Building Services-IV (Mechanical Services)	3	0	0	3	Dept Th
AR 6303 AR 6405 AR 6407	Depth Elective I Pre-fabrication & Modular Co-ordination #;or Vernacular Architecture#; or Vernacular Architecture in India & Arab## Note - # for students at Mesra/Patna, ## for students at RAK international centre	3	0	0	3	Dept Th [E1]
AR 6309	Steel Structures	3	0	0	3	Other Dept Th
	Breadth Elective –III*	3	0	0	3	BS/BE 6
	SESSIONAL SUBJECTS					
AR 6302	Architectural Design - VI	0	0	9	6	Dept L/S
AR 6304	Working Drawing II	0	0	3	2	Dept L/S
AR 6406	Specification ,Estimation and Costing	0	0	3	2	Dept L/S
AR 6308	Structural Design (Steel)	0	0	3	2	Other Dept L/S
	TOTAL CREDIT				**24**	
Contact hours		**12**	**0**	**18**		**30**

*Any one from:
Business Economics; or,
Land & Building Economics; or,
Engineering Economics

THEORY SUBJECT

SIXTH SEMESTER

AR 6301 Building Services- IV (Mechanical & Fire Safety Services) Credit: 3

L-T-P: 3-0-0

Objective:

- To differentiate between Natural Ventilation and Mechanical Ventilation.
- To identify the factors responsible for comfort conditions.
- To define the different Psychrometric Processes.
- To identify the factors responsible for cooling load calculation.
- To classify different types of Air Conditioning systems and their suitability for different psychrometric conditions.
- To identify different Air Conditioning equipments and their suitable location in buildings.
- To explain the function of mechanical equipments for vertical transportation (elevators and escalators for buildings).
- To explain the different fire fighting methods to be adopted in buildings.
- To plan buildings as per the fire safety norms.

Module 1 Introduction –

- Mechanical Services required in Buildings
- Role of an Architect regarding mechanical Services.
- The scope and impact of Mechanical system- Impact of space planning
- Impact on Architectural Design
- Impact on High rise Bldg
- Impact on construction cost
- Impact on Global environment

Module 2 Mechanical Ventilation –

- Standard requirements of ventilation for different conditions of living and works.
- Conditions for comfort
- Control of quality, quantity, temperature and humidity of air.

Module 3 Psychrometry-

Introduction, meaning of air conditioning, different psychometric properties,psychrometric processes, Psychometric chart & its application summer air conditioning system, winter air conditioning system, year round air conditioning system

Module 4 Principles of refrigeration & Air -Conditioning

- Different types of Air-Conditioning.
- Cooling load Calculation

Module 5 Air Conditioning Equipments -

-Major equipment used in Air conditioning - their characteristics & suitable place for location, consideration for reduction of heat gain and economic layout of supply and return air ducts.

- Schematic drawings showing the Air conditioning system of an office building, hotel, auditorium etc.

Module 6 Mechanical Equipments for vertical transportation – Building design and vertical transportation, Demand for vertical transportation

- Lift and Escalators: types, uses, functioning, automatic control system.
- Plans & sections to explain different parts of lifts and escalators.
- Planning for vertical transportation

Module 7 Fire Safety

- Role and Importance, Fire safety design, planning for fire protection.
- Fire detection & fire fighting
- Different fire fighting methods to be adopted in buildings.

books

Course Outcomes

After the completion of this course, students will be able:

1.	To design schematic HVAC drawings for a building, (Air conditioning system of an office building, hotel, auditorium etc.) showing AHU location(s), ductwork (main trunk duct as well as branch ducts), position of registers & diffusers, etc.
2.	To calculate Duct Sizing, Total Air Volume Requirement, AHU Size and Approximate Cooling Load for a Room, all conditions and required parameters been given and to calculate Combined Thermal Transmissivity (U) value for a wall, having different layers (for e.g. Insulation layer, brick, plaster, etc.)
3.	To know how to provide appropriate elevators/ lifts/escalators and represent them appropriately in section drawings for different buildings like residences, apartments, offices, hospitals, hotels, stations, airports.
4.	To plan buildings as per the fire safety norms.
5.	Learn to use simple software for measuring extent of human comfort zone in different climatic zones (Climate Consultant & Autodesk Ecotect) and for calculating duct sizing, airflow requirement, etc. like RHVAC (R-9).

Recommended Books

1. Arora & Duinkand,; "*Text book of Refrigeration & Air conditioning"*
2. Architectural Graphic Standard (HVAC System)
3. National Building code.
4. William.K.Y.Tao; "*Mechanical and electrical Systems in Buildings"*
5. V.P.Lang*," Principles of air conditioning*"
6. Rodney R.Alder *;"Vertical Transportation for Building"*

THEORY SUBJECT

SIXTH SEMESTER ***DEPTH ELECTIVE***

AR6405 Vernacular Architecture Credit: 3.0 L-T-P: 3-0-0

Course Objectives

- The subject looks at specific vernacular architectural communities of India
- Identifies and interprets specific local, regional, and national vernacular traditions from India
- Develops a broader sense of understanding of the relationship between architecture, environment and culture

Module 1: Introduction to the field of Vernacular Architecture

Defining and differentiating vernacular architecture from contemporary architecture, Scope of Vernacular Architecture in Indian Context , Factors Influencing Vernacular Architecture, Building Material and Construction Techniques in Indian Vernacular Architecture, Vernacular Architecture in 21st Century

Module 2: Vernacular Architecture of Rajasthan

Banni Community and their Bhunga House from Rajasthan, Brahmin Caste and their Havelis, Rajputs and their Havelis , Hindu Merchants and their Havelis from Rajasthan, Shekawati Haveli of Rajasthan, Construction techniques and materials of the region.

Module 3: Vernacular Architecture of Gujarat

Rathva Tribe of Gujarat , Chodri Tribe, Sociology and Planning of North Gujarat
Sciology and Planning of Rural South Gujarat , Sociology and Planning of Saurashtra , Sociology and Planning of Muslim Community in Gujarat, Woodwork Details of Gujarat

Module 4: Vernacular Architecture in the Eastern Hills

Rural Villages and Houses of Bengal, Khasi community of Meghalaya
Bodo Kachari tribe, Adi Gallong folk of Sian district, Arunachal and their settlement pattern , Naga house , Morung of Naga Community , Thadou Kukis Community of Manipur

Module 5: Vernacular Architecture of Bengal

Eight Roof House Structure of Bengal style, Four Roof House Structure of Bengal style, Bunglow Construction.

Module 6: Vernacular Architecture of the North

Regional topography, local climate, settlement pattern, TOQ construction, Dhajji Diwari Construction, local material.

Module 7: Vernacular Architecture of the South

Regional topography, local climate, variation in settlement pattern and architecture in different part of the region.

Course Outcomes:

After the completion of this course, students will be able:

1.	To define and outline the vernacular styles of different traditional settlements in India.
2.	To identify and interpret specific local, regional and national vernacular traditions from India in socio-cultural context.
3.	To analyse the association between architecture, environment and culture.

4.	To explain the requirement and application of traditional construction techniques.
5.	To evaluate the applicability of vernacular styles in present practice in architecture.

Recommended Books:

1. Dawson Bary, Cooper Ilay : *Traditional Buildings of India*,1998
2. Michell, G., *Penguin Guide to the Monuments of India, Vol I*, Viking, London 1989.
3. Tadgell, *The History of Indian Architecture, Design and Technology Press*, London 1990.
4. Paul Oliver, *Encyclopedia of Vermacular Architecture of the World*, Cambridge University Press, 1997.
5. V.S. Praman, Havali – *Wooden Houses & Mansions of Gujarat*, Mapin Publishing Pvt. Ltd., Ahmedabad, 1989.
6. Kullrishan Jain & Minakshi Jain – *Mud Architecture of the Indian Desert*, Aadi Centre, Ahmedabad, 1992.
7. G.H.R. Tillotsum ;*The tradition of Indian Architecture Continuity, Controversy – Change since 1850,* Oxford University Press, Delhi, 1989.
8. Richardson,Vickey; *New Vernacular Architecture*: Laurance King Publishing,2001

THEORY SUBJECT

THIRD SEMES ***DEPTH ELECTIVE***

AR. 6409 Conservation and Heritage Management LTP: 3 0 0 Credit: 3.0

Course Objective:

- Explore the history, philosophy and science of building conservation through lectures and seminar discussions;
- Encourage appropriate methodologies and tools for recording, documentation, inventories and information management of historic structures;
- Develop professional level skills on conservation using various techniques.

Module 1: Definition of conservation and its socially accepted meanings, objectives, Theories, Principles and concepts of conservation and its application. Values and Ethics in conservation and Degrees of intervention in historic buildings & monuments & Why to conserve issues.

Module 2: History of conservation movement in the world and Indian response to the movement. History of Indian conservation movement. Development of theory of conservation and various charters of International importance like Venice Charter, Burra Charter, Bombay Heritage Act.

Module 3: Causes of Decay in Cultural property, External causes of Decay, Biological & Botanical causes, Natural disasters & Man made causes of decay, Remedies for these decay. The context of inspecting historic building – Inventory – Initial inspections of buildings – continuing Documentation, norms for grading and enlisting.

Module 4: Actual conservation techniques for relevant building materials. Some specifications & instruction about parts of buildings. Such as foundations walls, chhajjas, wall tops, roofs & terraces with various examples of conservation practised globally.

Module 5: Concept of Historic towns, quarters & areas concept of Heritage zone and concept of Integrated conservation with global examples.

Module 6: Conservation Planning based on inspections and surveys. Examples of Revitalization projects all over the world. Reuse and Redevelopment of historic building and areas with examples of actual projects. Procedures for giving new uses to old buildings, examples of infill.

Module 7: Planning and Management aspects in conservation. Policies, legislation and agencies of conservation. Intra-disciplinary monitoring and management techniques. Economics in conservation, Public management of heritage, heritage ecosystem,

Course Outcomes

After the completion of this course, students will be able to:

1.	To understand the development of the philosophy and ethics of conservation and the legislation that protects the historic environment.
2.	To survey, record and analyze the development of historic buildings through the examination of their materials, construction and style.
3.	To arrive at environmentally sustainable solution for conservation of build structuresusing practical techniques for conservation, repair and restoration.

Books :

1. Sir Bernard M. Feilden; *Conservation of Historic Buildings, Architectural Press, London.*

2. Sir Bernard M. Feilden; *Guidelines for conservation; Architectural Press, London.*
3. A. G. K. Menon & B. K. Thapar; *Heritage Zones*
4. Xavier Greffe; *Managing our Cultural Property; Aryan Book International, New Delhi.*
5. Robert Pickard; *Policy involved in Heritage Conservation*;
6. Eduardo Rojas & Claudio de Moura Castro; *Lending for Urban Heritage Conservation.*
7. Nahoum Cohen, *Urban Conservation.*

AR 6309 Steel Structures Credit 3 L-T-P: 3-0-0

Course Objective:

- To explain the structural property of structural steel
- To list the various market form of structural steel section available and their respective use
- To analyze the equilibrium of a riveted and welded joint
- To design a beam for a given system of loading and structural geometry, for flexure and shear
- To design a column and associate foundation for given axial load and moments
- To design a case specific connection between beam to beam and beam to column
- To outline the features of IS code provisions regarding design method of steel structure

Module**: 1 Basic Material Properties & Design Concept**
Material property of steel, Ductility, Behaviour of steel in cyclic loading, Different structural steel section used in India and their use. Different types of steel structural systems. Steel cable structural system, Structural configuration of tall steel structures Innovative use of structural steel, Hollow Tubular steel sections, Corrosion and fire resistance property of steel.

Module: 2 **Rivet & Weld**
Rivet and Welded connections. Property and the merits and demerits of Rivet and Weld. Different types of joints, Failure of Rivet and Weld. Rivet value. Bracket connection with eccentricity with Rivet and Weld. Numerical Problems

Module: 3 **Design of Beam**
Design Fundamental of Beam, Laterally supported and laterally unsupported beam, IS code provisions, Built-up-beams. Numerical Problems

Module: 4 **Design of Truss**
Design fundamental of compression and tension member with angles. Design of simple trusses. Numerical Problems.

Module: 5 **Design of Column**
Design Fundamental of Axially and eccentrically loaded column, IS code provisions, Built-up-Columns, Lacing and battened column. Column Splice, Numerical Problems

Module: 6 **Design of Connection**
Framed connection; unstiffened and stiffened seated connections for the connection for beam-beam and beam-column-beam, Numerical Problems

Module: 7 **Design of Foundation**
Slab base and gusseted base, column base subjected to axial load and moment; design of isolated grillage foundation, Numerical Problems

IS Codes:

1. IS 800
2. Steel Section Handbook

Course Outcomes

After the completion of this course, students will be able to:

1.	Enhance confidence on designing abilities for steel structures.
2.	Apply IS 800:2007 codal provisions to design various structural steel elements.

3.	To design primary steel structural elements and their connections.
4.	Self-motivated inquiry.

Recommended books:

1. S.K.Duggal; *Design of Steel Structures* , *Tata McGraw Hill, New Delhi*.
2. Ramchandra; *Design of Steel Structures* (Vol. I).
3. Negi; *Design of Steel Structures*.
4. Sarwer Alam Raz; *Structural Design in Steel*, *New Age International Publication*
5. Thomas Burns; *Structural Steel Design*, *Delmar Publication*

THEORY SUBJECT

SIXTH SEMESTER BREADTH ELECTIVE-III

Land and Building Economics **Credit 3** **L-T-P: 3-0-0**

Course Objective:

- Discussion of fundamental elements of economics.
- Identification of components of Land Economics.
- Discussion of rules of financial analysis and demand analysis.
- Computation of different money values and demand forecasting.
- Comparison of projects through evaluation methods.
- Discussion of definitions of building valuation.
- Computation and analysis of property valuation.
- Appraisal and critical assessment of land, properties and projects by using the financial and valuation methods discussed throughout the session.

Module 1	Introduction	1. Elements of economics- Functions of utility, demand, production, cost and profit 2. Land economics- concept, scope and objectives 3. Levels of decision making
Module 2	Financial Analysis	1. Times values of money 2. Financing mechanism 3. Concepts and factors governing cost of capital 4. Risk and return
Module 3	Demand Analysis	1. Concept of Demand forecasting and its common methods-Delphi, Trend projection and Exponential 2. Uncertainties of demand forecasting
Module 4	Analysis of Projects	1. Project constraints 2. Project analysis and Ranking 3. Introduction to project appraisal and feasibility study
Module 5 and Module 6	Concept of Valuation and Measurement of Depreciation	1. Concept and purpose of valuation 2. Function of a Valuer 3. Concepts of value and cost and its different types 4. Characteristics of an ideal investment 5. Annuity, Sinking fund and Year's purchase 6. Appreciation, Depreciation, Obsolescence and Amortization 7. Process and types of depreciation calculation
Module 7	Techniques of Valuation for Land and property	1. Rental method, 2. direct comparison method, 3. profit based method, 4. development method, 5. land and building method

Recommended Books:

1. Prasanna Chandra, *"Projects: Planning, Analysis, Selection, Implementation and Review";Tata Mc-Graw Hill Publishing Company Limited;ISBN 0-07-462049-5*

2. Baumol, *"Linear Programming";Tata Mc-Graw Hill Publishing Company Limited;ISBN 0-07-462049-5*
3. Hamdy H. Taha, *"Operations Research: an Introduction";Prentice Hall of India Private Limited ISBN 81-203-1222-8*
4. M. Chakraborty, *"Estimating, Costing, Specification and Valuation in Civil Engineering";Published by the author*
5. BK Sengupta, Somnath Sen; ITPI Reading Journal; "Land Economics

SESSIONAL SUBJECT

SIXTH SEMESTER

AR 6302 Architectural Design-VI Credit: 6 L-T-P: 0-0-9

Course Objectives:

Application of Design theory and principles and
Design of Low rise / medium rise /high rise buildings with complex issues to be tackled covering functional relationship, climatic condition, social aspects along with structural considerations and building services

Application and use of relevant building bye-laws and provisions of **National Building Code**

Activities:

Main Design Exercise	**Duration** (approx.)
1. Sports Complex / Three Star Hotel	8 weeks
2. Auditorium (1000 Capacity) / Amusement park	5 weeks

Design (Time) Exercise	**Duration**
Any one of the above, not covered in the class	8 hrs.

Viva voce

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

Course Outcomes

After the completion of this course, students will be able:

1.	Design of the built structures incorporating the local building bye-laws and the relevant provisions of of NBC applicable to the design assignment
2.	Design of various components and aspects associated with the urban environment in terms of physical infrastructure, socio cultural aspects etc, with an integration of the various building services.

SESSIONAL SUBJECTS

SIXTH SEMESTER

Arc 6304 Working Drawing - II Credits 2 L-T-P: 0-0-3

Course Objectives

Building construction drawings to be prepared as a part of contract document with proper labelling and dimensioning techniques.

Working drawings to be made in continuation of Working Drawing I for the building complex chosen earlier in Working Drawing I.

Prerequisites: Working Drawing I, Architectural Detailing.

Topics	*A1 size sheet*
Details of toilets including plan, elevation, sections of it.	2
Details of kitchen including plan, elevation, sections of it.	2
Layout of sanitary and plumbing lines on site and connection with the main sewer/ septic tank	1
Designing and detailing of septic tank and soak pit and a typical G.T., I. Chamber etc.	1
Electrical layout of a typical floor including specification of fixtures	1
Detail Flooring Plan and internal Finishing Plan	1
Specific details required in the building complex, eg, Special carpentry detail, Metal finish detail, etc	1
Municipal submission drawings	2

Minimum of 11 sheets to be done in the semester.

Course Outcomes

After the completion of this course, students will be:

1.	Exposed to various materials, furniture's, fittings and the equipments that are needed in buildings.
2.	The students are also exposed to integration of Structure and Services components and to deal with the project as a whole.
3.	The students will have a better understanding that Architectural Drawings is detailed out on the basis of services layouts and other important features which are to be used in the designed building to be executed and constructed..

SESSIONAL SUBJECT

SIXTH SEMESTER

AR 6406 Specification, Estimation & Costing Credit: 2

L-T-P: 0-0-3

Course Objective:

- To differentiate between the general specification and detailed specification.
- To write the detailed specification of different items of work
- To define different types of estimates and their suitability to different types of works..
- To distinguish between the approximate estimates and the detailed estimate
- To identify the different units of measurement for different items of work.
- To calculate the quantity of different items of work using various methods of estimating.
- To calculate the rate for different items of work
- To classify different types of tenders/contracts
- To prepare BOQ for item rate contract

GENERAL SPECIFICATION & TYPES OF CONTRACT.

- Definition of specification, need of the specification.
- General specification and Detailed Specification
- Types of Tender / contract and the reflection in BOQ.
- Writing Items for BOQ for Item rate contract.
- Definition of "Building estimate"
- Purpose of Estimating.

Different Types of Estimate.

APPROXIMATE ESTIMATE

- Importance & purpose of Approximate / Rough estimation
- Different methods of approximate estimate.

DETAILED ESTIMATE.

- Preparation of Detailed estimate.
- Function of "Measurement form" & "Abstract of estimate form".
- Description & significance of Item in BOQ.

METHODS OF MEASUREMENT OF WORKS.

- Different methods of estimating building works.
- Estimation of a simple building at different stages:
    a) Foundation up to plinth
    b) Superstructure
    c) Finishing works

REINFORCEMENT QUANTITIES FOR RC WORKS.

- Calculation of quantity for Reinforced concrete(RC) for:
  Column, Lintel, Slab & Beam.

ANALYSIS OF RATE & QUANTITY OF MATERIALS.

- Purpose of Rate analysis.
- Quantity of Materials.
- Different components of rate

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the relevance and importance of Estimation and costing for building projects.
2.	Develop the basic skill to prepare the building estimate and costing with suitable specification
3	Have brief understanding of Rate analysis of a composite item

Reference Book

1. M. Chakraborty; *Estimating, Costing, Specification & Valuation*
2. B.N. Dutta; *Estimating & Costing*
3. D.D.Kohli & R.C.Kohli ; A Text Book of Estimating and Costing

SESSIONAL SUBJECT

SIXTH SEMESTER ***OTHER DEPT***

AR 6308 Structural Design (Steel) Credit 2 L-T-P: 0-0-3

1. Model design of different Steel Structural components: Beam, Column, Connection and Foundation.
2. Design Exercise: Complete Analysis and Design of a Simple roof truss. With various load combinations
3. Design Exercise: Complete Analysis and Design of a Steel Moment Resistant Frame building, under different types of load combination.
4. Seminar presentation on various aspects of Steel structures.

Same IS-Code and books should be referred as mentioned in the theory course

7th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 7301	Structural Concepts in Architecture	3	0	0	3	Dept Th
AR 7303	Housing and Settlement System	3	0	0	3	Dept Th
AR 7305	Building Science-II (Energy Efficient Architecture)	3	0	0	3	Dept Th
	Free Elective I MUP2101 Urban Ecology & Environment Planning	3	0	0	3	Other Dept/Masters Th [E2]
	SESSIONAL SUBJECTS					
Arc 7302	Architectural Design - VII	0	0	9	6	Dept L/S
AR 7304	Interior Design	0	0	3	2	Dept L/S
	TOTAL CREDIT				**20**	
Contact hours		**12**	**0**	**12**		**24**

THEORY SUBJECT

SEVENTH SEMESTER

AR 7301 Structural Concepts in Architecture Credit: 3.0

L-T-P: 3-0-0

Course Objective:

- To identify the concept of various structural elements and system
- To illustrate the use of different structural systems in building industry
- To analyze the structural geometry based on strength and stability criteria
- To outline the development of structural forms during the passage of architectural time line
- To design the effective use of structural systems for complex architectural need
- To apply the fundamentals of temporary systems to design the shelters for disaster mitigation
- To create an integrated systems based on structural models and new material for modern sky scrapers
- To critically appraise the built environment based on specific structural system

Module: 1

Introduction to Structures:

Introduction to Structures and its Elements, Structural Grids, loads, methods of analysis and design parameters,

Module: 2

Arches, Shells and Domes

Arch Action, Classification and Advantages of Arch, Shell, Vaults and Domes: Structural Concept and Classification and Application in Architecture

Module: 3

Tensile Structures

Concept of Tensile Structures, Formation, Classification, Use and Examples of various cable structures, Application of Cable Structures in Contemporary Architecture, Materials and Construction Methods of Membrane Structures

Module: 4

Trusses and Space frames

Truss Components, Classification and application in Architecture, Long Span Trusses: Advantages and Use, Space Frame: its Formation and Applications in Buildings

Module: 5

Plate Structures

Plate Structures: Definition, Classification and Application, Concept and Application of Folded plates, Flat slab and Coffered Slab

Module: 6

Special Structures

Concept, Classification and Application of Pneumatic Structures, Kinetic Structures and Mobile Structures: Definition, and Application

Module: 7

Structural Systems for Modern Sky scrapers

High Rise Buildings: Structural Systems and Application, Sky Scrapers: Structural Concept and Modern Methods of Construction Application, Case Studies on Structural Systems of Sky Scrapers, Eco-sky Scrapers: Concept and Necessity

Course Outcomes

After the completion of this course, students will be:

1.	Able to understand the various structural systems and their application in various buildings as per the requirement.
2.	Able to design and apply various modern structural systems in the high rise and large span structures in design.
3.	Able to increase their ability to identify the structural forms suitable for architectural expression.
4.	Able to understand and explore about use of various structural systems for various building applications.

Recommended Books:

1. P.Dayaratnam, *Prestressed Concrete Structures;* Oxford and IBM Publishing Co.;New Delhi,1982
2. Wolfgang Schuller- *High Rise Building Structures*, John Wiley & Sons; New York1976.
3. Frei Otto; *Tensile Structures ; Vol-II, Pneumatic Structures, Cable Structures:* The MIT Press London.
4. N.Subramaniam; *Principles of Space Structures*: Wheeler& Co.; Allahabad 1983.

THEORY SUBJECTS

SEVENTH SEMESTER

AR 7303 Housing and Settlement Systems L T P: 3 0 0 Credits: 3

Course Objectives

- To select different types of housing and methods of delivery for housing schemes
- To explain the issues involved with changing contextual policies for housing and generalise the new directions of opportunities
- To analyse the different factors affecting the housing market
- To assess housing shortage and decide criteria for selection of land for development in order to bridge the gap in a settlement/ part of a settlement
- To analyse the nature and causes of growth of deficient housing / slums and identify differentiated needs across income categories
- To explain the significance of current slum related contextual programmes, identify scope of improvement and formulate slum improvement schemes
- To evaluate and apply the settlement plan provisions affecting the housing delivery and development
- To apply the standards, norms and statutory regulations affecting the housing development and design of housing neighbourhoods
- Parametric assessment of housing quality.

1.0 Module 1: **Introduction to Housing**

1.1 Definition & concept of Housing

1.2 Types of Housing: Detached, semi-detached, row, town house, apartment, Farmhouses etc.

1.3 Form of Housing provision: Plotted, Group Housing, Cooperative, Self Help, Leasehold, Freehold / Condominium, Rental Housing etc.

1.4 Special Housing types: Barrier free, Mobile homes, congregate housing for assisted living, disaster housing, Student & public housing, Guest house, Night shelters, Incremental Housing etc.

2.0 Module 2: **Housing Scenario & Housing Finance**

2.1 Housing situation in India: an overview

2.2 Census classification of houses, Computation of Housing Shortage

2.4 Housing Finance: Formal & Informal Housing Finance Markets, Mobilisation of Savings, Sources of Capital & Institutional Finance

2.5 Housing Micro-finance for Poor: Issues & Constraints

2.6 Housing Need vis-à-vis Demand, Public vis-à-vis Private Sector

3.0 Module 3: **Housing & Urban slums**

3.1 Understanding the causes of growth of Slums, Squatter settlements & Urban sprawl

3.2 Types and generic characteristics of slums

3.3 An overview of measures & approaches to slums & squatter settlements

3.4 Objectives of National Slum Policy (2002)

3.5 Concept of few schemes e.g.: Site & Services, EIUS, BSUP, VAMBAY, IHSDP

4.0 Module 4: **Affordable Housing, new trends & Housing Policy**

4.1 Components of Housing Cost & approach for affordable housing

4.2 Characteristics of Urban housing vis-à-vis Rural housing

4.3 Goals, Objectives & contents of National Housing & Habitat Policy (2007)

4.4 Examples of housing schemes & programmes e.g., IAY, IHSDP etc.
4.5 Trends in Housing Design

5.0 Module 5: **Urban Settlement Planning System & Processes**
5.1 Recommended Planning system & inter-related plans
5.2 Scope, purpose & inter-relationship of various plans
5.3 Plan formulation process
5.4 Public sector & private sector actions & concept of joint venture
5.5 Contents of a Development plan

6.0 Module 6: **Norms & Standards for Urban & Housing Development**
6.1 Town & Residential density, FAR, Different types of codes/ norms affecting settlement development planning,
6.2 Land –use Classification & compatibility of uses (e.g., compatible uses in residential zone)
6.3 Factors affecting space standards / land requirements for facilities
6.4 Land area requirement for different uses in a town & for community facilities in a sector/ residential planning area
6.5 Design Considerations based on subdivision norms / regulations

7.0 Module 7: **Concept of Neighbourhood & Housing Quality Indicators**
7.1 Concepts of cluster, Blocks & Neighbourhood
7.2 Neighbourhood planning principles & examples
7.3 Indicators and checklist for safe communities or neighbourhoods
7.4 Housing Quality Indicators

Course Outcomes

After the completion of this course, students will be:

1.	To define basic elements of housing, neighbourhood, community and slums.
2.	To outline various housing policies and programmes
3.	To explain housing typologies or differentiate settlement design in terms of local context (Physical, economical, socio-cultural, ecological, environmental aspects)
4.	To interpret cause and effects housing demand and supply
5.	To Apply zoning regulations and sub-division techniques and computation for density, FAR, built-up area, as per development norms.

Recommended books:

1. J.D.Chiara et al; *Time Saver Standards For Housing & Residential Development*.
2. Bawa R. L., Fernandes B. G.*; Design for Living: A Guide for Planning of Residential Neighbourhoods; Galgotia Publishing Company; N. Delhi*
3. Ilay Cooper, Barry Dawson, *Traditional Buildings of India*
4. Modak & Ambedkar; *Town & Country Planning & Housing*
5. Poulose K T(compiled); *Reading Material on Housing; Institute of Town Planners, India; New Delhi; 2002*
6. ITPI; Urban Development Plan Formulation & Implementation Guidelines; Ministry of Urban Development & Poverty Alleviation; Govt. of India
7. Charles Abrams; *Housing in the third world*

AR7305 **Building Science-II (Energy Efficient Building)** Credit3.0

L-T-P: 3-0-0

COURSE OBJECTIVES:

- Apply technical knowledge to conserve energy in the building sector.
- Understand the impact of global energy crisis and accordingly commit to professional responsibilities involved in it.
- Recognize the need for decreasing energy consumption in buildings and thus can incorporate specific measures for increasing energy conservation.
- Provide design solutions for energy efficient buildings.
- Create, select and apply appropriate resources and modern engineering tools to reduce waste, pollution and environmental degradation caused by buildings.
- Conduct investigation to promote efficient use of energy, water and other resources related to the buildings.
- Demonstrate knowledge related to sustainable development.

Module 1 : **Background**

- Energy its use & Energy Efficiency,
- Growth pattern of Energy use,
- Energy Sources – renewable energy ,
- Global Energy Scenario,
- Energy Crisis,
- Energy Efficiency Aspects of Building Design.

Module 2: **Energy and Building**

- Energy Consumption in Building,
- Factor Effecting Energy Consumption,
- Energy Model,
- Energy Audit ,
- Conserving Energy,
- Introducing Green Buildings

Module 3:**Energy Performance of a Building**

- Thermal Performance of a Building,
- Visual Performance of a Building,
- Ventilation & Air Movement,
- Performance of Building Materials,
- Solar Energy- the prime renewable energy source in Building Sector.

Module 4: **Energy Conservation : Passive Solar Techniques**

- Basic Architectural Design Strategy,
- Thermal Comfort Criteria and Heat Flow within a building,
- Passive Heating Techniques,
- Passive Cooling Techniques,
- Daylighting

Module 5: **Energy Conservation: Active Solar Techniques**

- Active Space Heating Techniques,
- Active Solar Water Heating,
- Solar Collectors,
- Storage of Solar Energy,
- Active Cooling Techniques

Module 6: **Energy Efficient Landscaping**

- Integrating Landscape with the building design,
- Climate, Site and Design Consideration,
- Sun and Wind Control through Landscaping,
- Water as Energy Efficient Landscaping Element,
- Urban Design and Outdoor Spaces

Module 7: **Green Building Concept**

- Green Building – definition and attributes,
- Genesis of Green Building,
- Reducing Environmental degeneration and wastage,
- Implementation and Application measures in Green Buildings,
- Green Buildings in India

Course Outcomes

After the completion of this course, students will be able to:

1.	Interpret and apply technical knowledge related to energy conservation in building sector.
2.	Provide passive and active design solutions for energy efficient buildings.
3.	Conduct investigation to promote efficient use of energy, water and other resources related to the buildings.
4.	Demonstrate knowledge related to sustainable development.

Recommended Books:

1. Bruce Anderson; "Solar Energy: Fundamental in Building Design"
2. Anna Main, S. Rangaranjan," Solar radiation over India."
3. B. J. Brinkworth "solar energy for Man"
4. H.P. Garg, "Advances in solar energy Tech."
5. Lunde; " Solar Thermal Engg."

SEVENTH SEMESTER ***FREE ELECTIVE***

MUP2101 Urban Ecology & Environment Planning Credit: 3.0
L-T-P: 3-0-0

COURSE OBJECTIVES:

- To understand and discuss how humans are components of urban ecosystems
- To be aware of the impact of urbanization and industrialization on natural environment To introduce the concepts and theories of ecology in urban context
- To explain the principles and strategies for natural resource conservation and management and the associated conflicts.
- To gain knowledge on evaluating the environmental impacts of urban development
- To be aware of best practices in urban-planning related to urban ecological planning.

Syllabus

Module 1: Man-Environment Relationship and Concept of Urban Ecosystem Man, and Environment - Changing Perspectives in Man-Environment Relationship with Focus on Issues of Population, Urbanization, Resource Depletion and Pollution, Concepts of Ecology and fundamentals of ecosystem; Components of natural and built environment, Eco-systems and their relevance to environment, resources and human settlements, Environmental Zones (Hill, coastal, arid, characteristics, resources, settlements pattern, problems and potentials. Impact of urbanization and industrialization on nature and modifications in natural environment, causes and consequences, Issues of the urban environment: pedestrian-vehicular conflict, City Centre Environment, Housing areas, dereliction, Urban climatology and thermal pollution, factors causing heat sink effects, direct radiation, climatic effects on urban areas, Need for urban ecosystem approach, its evolution and significance. Resource analysis for various ecosystems and development imperatives (land, geology, soil, climate, water, vegetation) characteristics, exploitation, causative factors for degradation, analytical techniques.

Module 2: Ecological Principles in Planning Concepts and relevance of Environmental Planning, Integrated resource planning approach, Preparation and analysis of resource inventories and resource matrices, Resource regions in India, their problems and potentials, Sustainability, and environmental criteria for location of human settlements, Ecological parameters for planning at different levels: site planning, settlement planning and regional planning, Carrying Capacity Based Planning- Concept, Parameters, and Indicator Measures; Models and Case Studies in Urban and Regional Development

Module 3: EnvironmentalMonitoring and Impact Assessment Air Pollution-sources, causes/pollutants and their effects, emission sources, vehicular emissions, techniques of monitoring of emissions, emission standards, and ambient air quality. Concepts of relevant meteorological parameters, and interpolation of data, wind system measurement, turbulence; mixing height, plume use, dispersion, and dispersion models. Air pollution mitigation and abatement. Water Pollution – sources, water quality tests, minimum standards of disposal (for different uses), performance criteria, Water pollution mitigation and abatement. Noise Pollution- sources, techniques of measurement, noise level standards, noise levels; Noise attenuation; EPA Guidelines, Land Pollution -sources, soil erodibility tests, minimum standards of disposal (minimum standards for different uses), performance criteria. Interpretation of analytical trends of various parameters of quality of environment. Role of EIA in the planning and decision-making process; definition, need, evolution and objectives, tasks and scope; Methods of EIA; advantages and limitations; Assessment of impacts on resources (Including air, water, flora and fauna); Assessment of impacts on Land use; Case studies, Environmental Impact and

Strategic Environmental Assessment for Urban Areas; Ecological Footprint Analysis of Cities; Sustainable Lifestyle Assessment

Module 4: Urban Environmental Management and Planning Objectives of environmental planning and design, Integration of environmental assessments and planning options, Environmental management approach; Environmental Protection Techniques: Role of Government and Non-Government Organizations in Environmental Protection; Best practices in Environmental Protection and Conservation; International Co-operation for Environmental Protection. Environmental Management: Resource Management: Including management of land, water bodies and water channels, forests and wildlife, minerals; Management of Urban Areas; Management of sensitive areas – hills, coasts, arid, wetlands etc. (including participatory approaches); Management of Watersheds; Human activities and energy in cities; Contribution to GHGs Appropriate Technologies and Applications: Techniques and case studies related to water harvesting, water treatment, recycling, waste disposal, waste minimization, and their implications, Low cost and cleaner technologies, Environmental Management in the Indian context;

Module 5: Environmental Legislation, Policies and Practices: Global concerns for environment and bio-diversity, International Environmental Policies and initiatives including policies, strategies, protocols, treaties, and agreements; Overview of Government of India's policies.

Course Outcomes

After the completion of this course, students will be able:

1.	To gain a wider understanding of urban ecological and environmental issues and appreciate potential approaches for cities to deal with ecological and environmental challenges and threats.
2.	To enhance abilities and skills relating to evaluation of environmental impacts of urban development.
3.	To make scientifically informed decisions about environmental issues related to urban areas

Text books:

T1 - Odum, E.P., Barrett, G.W., Brewer, R., Fundamentals of Ecology, Thomson Brooks, T2 - Westman W., Ecology, Impact Assessment and Environmental Planning, JohnWiley and Sons
T3 - James K. Lein, Integrated Environmental Planning, Blackwell Publishing

Reference books:

R1 - Paul R. Ehrlich et al. Ecoscience: Population, Resources, Environment,
R2 - O. L. Gilbert, Chapman & Hall, The ecology of urban habitats,
R3 - Michael Hough, Cities and Natural Process: A Basis for Sustainability,
R4 - AITP Reader on Ecology & Resource Development, AITP
R5 - Prof A. K. Maitra, AITP Reading Material on Environmental Planning and Design, SPA Delhi
R6 - Gadgil, M. and Guha, R Ecology and Equity - The Use and Abuse of Nature in Contemporary India, Penguin
R7 - Bahuguna, S., Natraj, Environment Crisis and Sustainable Development, Dehradun, R8 - Agarwal, S.K. and Garg, R.K (eds), Environmental Issues and Researches in India, Himanshu Publications
R9 - Divan, S. and Rosencranz A., Environmental Law and Policy in India - Cases Materials and Statutes, Oxford
R10 - Hardoy, J.E., Mitlin, D., and Satterthwaite ,D., Environmental Problems in Third World Cities, Earthscan
R11 - Wilson Richards & Jones Willium Energy, Ecology & Environment,
R12 - McEnro James Handbook of Environmental Planning,
R13 - Lein, J. K. Integrated Environmental Planning,
R14 - Khanna, D.D. Sustainable Development,

SESSIONAL SUBJECT

SEVENTH SEMESTER

AR 7302 Architectural Design-VII Credit: 6 L-T-P: 0-0-9

Course Objectives

This course enables the students:

A.	To apply the design theory and principles in the design of a multi-functional, service (advanced services) oriented buildings.
B.	Low rise / medium rise /high rise buildings with complex issues to be tackled covering functional relationship, climatic condition, public spaces, physical infrastructure, socio-cultural aspects along with structural considerations and building services.
C	To apply and use the relevant building bye-laws and provisions of National Building Code in the design assignments
D	To estimate the approximate cost of the areas

Activities:

Main Design Exercise	**Duration** (approx.)
1. General or Specialist Hospital / Group Housing Project	8 weeks
2. Multiplex / ANDC project	5 weeks

Design (Time) Exercise	**Duration**
Any one of the above, not covered in the class	8 hrs.

Viva voce

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

Course Outcomes

After the completion of this course, students will be able:

1.	Design of various components and aspects associated with the urban environment in terms of physical infrastructure, socio cultural aspects etc, with an integration of the various building services.
2.	Development of site planning/ constructional details with a focus on understanding the designing of a complex building with all aspect of site planning and services in urban setting.

SESSIONAL SUBJECTS

SEVENTH SEMESTER

AR 7304 Interior Design Credit:2 L-T-P: 0-0-3

Interior design, being one of the important/essential area of Architectural practice, the subject deals in detail with various aspects of space interiors. Students will get an opportunity to understand the qualities of spaces and develop their skills in designing for functional and meaningful space interiors.

Objective–

- To know the definition, scope and necessity of Interior design
- Understanding the parameters related to qualitative aspects of space.
- To study Space organization and alteration of interior space.
- Study of devices used for manipulation of the interior space as texture, pattern, colour, light, paintings, sculptures and their psychological effects in interior
- To know different surface treatments in interiors, e.g. on walls, floors, ceilings etc.
- Understanding of various materials used in Interiors (from traditional to latest) along with its technology of application and specification
- Awareness will be given regarding various technical aspects, practical difficulties, onsite decisions which will strengthen the knowledge for handling and executing a project of interior design.
- Assimilation of various aspects of space interior such as advanced services, acoustics, illuminations and developing the skills to design functional and meaningful interior space to meet the expected ambience.

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Theoretical Input:

- Elements of Interior Design. Transformation of design elements. Optical illusion. Study of geometric patterns.
- Enveloping space, contained space and residual spaces, Spaces within space.
- Principles of lines; wall composition guidelines.
- Colour for interiors: hue, chroma and tonal values, Effect of light on colour, various colour schemes like analogues, complementary, triadic etc. Colour symbolism. Colour planning process.
- Interior lighting: direct and indirect lighting, location and light grid systems, luminaire types, quality of lighting. Ambient, task and accent lighting.
- Various systems of Air Conditioning.
- Furniture design. Modular approach in system furnishings. Selection and design of accessories.
- Principles of interior landscaping, texture, height grouping and layout. Plant species specifications.
- Open office system, Industrial interiors and specialized interior space design. Styles of Interiors: Italian, English, French, Japanese styles etc.
- Exposure to eminent interior designers works.
- Presentation of interior design schemes with detail specification for the materials and technology used.

Sessional Input:

- Interior Design of Minimum two projects must be undertaken: Interior designs for homes, offices, factories, library, hospitals, hotels, shopping malls, showrooms, Hotel lobbies, Banquet halls, cinema and exhibition halls.

    - Exercises to be taken to demonstrate:
        1 multiple interrelated activity spaces designed for functional and ergonomic efficiency and ambience and
        2 role of building materials, furnishings, furniture, illumination, services, fixtures, hardware, plants and the cost of the proposed design work etc in Interior design;

- Site visits and workshops, guest-lectures, seminars to be organized including professionals, consultants, and skilled artisans etc. from various coordination fields from interior design.

    - The student shall submit the reports on various lectures, site visits etc

Course Outcomes

After the completion of this course, students will be able:

1.	To demonstrate the application of design principles, building services and construction systems in developing and providing contextual interior design solutions.
2.	To demonstrate capabilities of research, analysis, and synthesis gained through the course work to generate appropriate and creative design solutions for the interior projects undertaken.
3.	To develop knowledge, abilities and attitudes essential to the practice of Interior Design

Reference Books:

1. Interior Design in the 20th Century by Allen Tate, C.Ray

2. Interior Graphic & Design Standards by S.C.Reznikoff.
3. Beginnings of Interior Environment by Phyllis Sloan, Allen & Miriam F. Stimpson (10th edition).
4. Interior Design, John F. Harry Abrams Inc.
5. Interior Design Course, Mary Gilliat Coyran, Octopus Ltd. London
6. Interior Design, Francis D. K. Ching, John Wiley & Sons, New York
7. Time Savers Standard for Interior Design, Joseph De Chiara, McGraw Hill New York
8. Archi World.Interior Best Collection: Residence, Commerce, Office, Restaurant Asia I-IV.Archi World Co., Korea, 2003.
9. Friedmann, Arnold and Others. Interior Design: An Int. to Architectural Interiors. Elsevier,New York, 1979.
10. Miller, E. William.Basic Drafting for Interior Designers. Van Nostrand Reinhold, NewYork, 1981.
11. Kurtich, John and Eakin, Garret. Interior Architecture, Van Nostrand Reinhold, NewYork, 1993.
12. Rao, M. Pratap. Interior Design: Principles and Practice, 3rd ed. Standard Pub., 2004.

Magazines and Journals to be referred pertaining to the subject

8th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 8401	Principles of Human Settlements & Urban Design	3	0	0	3	Dept Th
AR 8307 AR8309#1 AR8311	**Depth Elective II*#1** Disaster Management Industrial Architecture Sustainability and Built Architecture	3	0	0	3	Dept Elective
#1 for BIT, RAK.						
MUP 3109	**Free Elective II** City & Metropolitan Planning	3	0	0	3	Other Dept/Masters Th [E3]
	SESSIONAL SUBJECTS					
AR 8302	Architectural Design - VIII	0	0	9	6	Dept L/S
AR 8304	Introduction to Thesis Project & Research Methodology	0	0	3	4	Dept L/S
	TOTAL CREDIT				**19**	
Contact hours		**9**	**0**	**12**		**21**

THEORY SUBJECTS

EIGHTH SEMESTER

AR. 8401 Principles of Human settlement and Urban Design LTP: 3 0 0 Credit: 3.0

Course Objective:

- Obtain insight into how evolutionary processes have determined the state of human settlements and urban design around the world today.
- Understand various issues and issues related to human settlements and urban design and their implications.
- Integrate theories with the practical world through the different elements and forms so as understand urban form and design.
- Extend the substantive knowledge of past human settlements to anticipate possible future outcomes and provide design interventions for them.

Course Content:

Module 1. Evolution of human settlements in ancient period, early examples of urban design in medieval, classical and pre-industrial cities. Ancient text and treatise on planning in India.

Module 2. Industrial revolution and town planning concepts, heritage and the roots of our modern concepts in urban design, settlement and area planning in India.. Planning of new towns in India: Chandigarh, Gandhinagar and Bhubaneswar

Module 3. Contribution of the following: Ebenzer Howard, Prattrick Geddes, Lewis Mumford, Robert Owen, C.A. Doxiadis, Tony Garnier and Le Corbusier and their modern planning concepts.

Module 4. Objectives and scope of Urban design, Basic functions, principles and techniques. Value enhancement, aesthetics and conservation aspects.

Module 5. Surveys in Urban Areas, Scale in Urban design, Urban mass, perceiving & mapping a city, Urban Space. Urban activity & circulation. Examples at regional, metropolitan, Urban and project level.

Module 6. Designing the parts of city - central areas, the town center, civic spaces, shopping centres, Industrial Areas and estates. Residential areas & Housing.

Module 7. Techniques of Urban Design with emphasis on public policies, conservation and economic considerations, Road forms, serial, grid iron, Hierarchy of access routes - Pedestrian areas and malls & Urban elements.

Course Outcomes

After the completion of this course, students will be:

1.	To explore the students about the dynamics of Urban Form and various Human Settlements pattern
2.	To understand the interrelationship between Human Settlements structure and Social Dynamics
3.	The main aim of the subject is to make the student aware of the factors that constraint and assist in architectural design of the settlements
4.	The students were able to understand the factors which determine formation of settlements from prehistoric to the contemporary era.

5.	The students understood the expressions of settlements in terms of cultural, social, economic and political context of a region.
6.	The students were able to understand how sustainability is important in the future of any settlement.

Recommended Books:

1. Paul D. Spreiregen :*Urban Design. The Architecture of towns & cities*- McGraw Hill
2. Gorden Cullen ; *Town Scape*
3. Frederick Gibberd ; *Town Design*
4. Edmond Bacon ; *Design of cities*
5. Kevin Lynch; *Image of the city*
6. Lewis Mumford*; The City in history*
7. S. C. Rangwala*; Town Planning*
8. M. N. Buch ; *Planning the Indian City*
9. Gallion ,A.B*; The Urban Pattern.*

THEORY SUBJECTS

EIGHTH SEMESTER ***DEPTH ELECTIVE***

Course: AR 8311 Sustainability & Built Architecture LTP: 3 0 0 Credit: 3.0

Course Objectives

Objective 1: Identify sustainable planning principles of ancient Indian cities and analyze sustainability in traditional and contemporary vernacular architecture.

Objective 2: Sustainability in Built Environment: discussing various definitions and principles associated with it.

Objective 3: To explore the fundamental Materials and Methods Used to Construct Green Buildings and assess the impact of buildings on their Global and Local environment.

Syllabus

Module 1- **Introduction to Sustainable Built Environment**: Principles of Sustainability, Environmental Impact of Buildings, Sustainable Design Checklist and Priorities, Cultural and Economical aspects.

Module 2 - **Sustainable Architecture - Historical & Community Perspective**: Planning Principles of Ancient Indian Cities, Vastu – Sashtra and Passive Solar design, Sustainability in Vernacular Architecture, Sustainable Human Settlement Planning and housing, Community Participation in Developing Sustainable Design.

Module 3 - **Climatology and Building Physics:** Science of Climate and Climatic Zones, Human Thermal Comfort, Steady state heat transfer through building fabric, Ventilation and air movement.

Module 4- Sustainable Buildings Material & Technology: Traditional sustainable materials, Contemporary innovation in sustainable construction materials, recycled building materials, Techniques of Designing Sustainable Habitat.

Module 5- **Green Building Concept**: The Fundamental Materials and Methods Used to Construct Green Buildings, The Impact of Buildings on their Global & Local Environment, The Economics of Green Buildings.

Module 6 - **Green Building Certification:** Introduction to low environment impact design strategies: LEED, TERI, GRIHA rating systems, Energy Simulation Software uses.

Module 7 - **Contemporary Sustainable/Green Projects in India and Aboard**.

Course Outcome

Outcome 1: The students will be able to apply the principles of Sustainable Architecture in Built Environment

Outcome 2: The students will be able to implement various technologies to achieve Sustainability in Built Environment

Outcome 3: The students will promote efficient use of resources and healthy environment to design Green Buildings and will achieve Green Building certification

Recommended Books:

1. Olgyay , V. , 1963. Design With Climate- Bioclimatic Approach to Architectural Regionalism, 4th Edition,Van Nostrand Reinhold, New York.

2. Vyas, D.,2005. Traditional Indian architecture- the future solar buildings. Passive and Low Energy Cooling for the Built Environment, Santorini, Greece.

3. Nicol, J. F., 2001. Climate and thermal comfort in India, in: Krishan, A.,Baker, N., Yannas, S. and Szokolay, S.V. (Eds.), Climate responsive architecture: A designhandbook for energy efficient buildings. Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Koenigsberger,Ingersoll,Mayhew,Szokolay. Manual of tropical housing and building. Orient Longman. 1997.
5. Givoni,B. ,1969. Man Climate & Architecture, 2nd Edition, Allied Science Publishers Ltd.
6. The Energy and Resource Institute (TERI) guidelines, Solar Passive Design for buildings.
7. Bansal,N.K. and Minke,G.,1988. Climatic zones and rural housing in India. Zentralbibliothek Publishers.
8. Annexure 3 - Passive Architecture Design Systems, Eco-housing Assessment Criteria- Version II, Implemented under Eco-housing Mainstreaming Partnership by IIEC with funding support from USAID.
9. Minke, G., 2006, Building with earth, design and technology of a sustainable architecture. Basel-Berlin-Boston: Birkhäuser –Publishers for Architecture.
10. Cooper, I., & Dawson, B.,1998. Traditional buildings of India. London: Thames & Hudson.
11. Gupta., Ranajit., 1997. Vastu and Passive Solar Design. In Ghosh,S.,Gupta,R. & Gupta,S. (Eds.), Solar Architecture and planning. Centre for Built Environment.
12. Puri, BB., Mass Scale Housing for Hot Climate, Auroville Earth Institute, Oxford & IBH Publishing Co. Pvt. Ltd.

THEORY SUBJECTS

EIGTH SEMESTER ***DEPTH ELECTIVE***

AR 8307 Disaster Management Credit: 3.0 L-T-P: 3-0-0

Course Objectives:

- Define the scope and objectives of the field of disaster management.
- Introduce concepts and terms of disaster assistance examine tools and methods, and learn some technology appropriate to the field.
- Develop knowledge on various types of disasters, acquire techniques for lessening impact of disaster and be all to involve community in disaster preparedness.
- Apply modern skills and scientific technologies to combat disasters.

MODULE I

Contemporary, Natural & Man-made Disaster: Fundamentals of Disaster, Dimension & typology of Disaster, Phases of Disaster, Social & Political imperatives, Scale of Disaster, Causes of Disaster, and Disaster Cycle.

MODULE II

Agencies in Relief: Organisations dealing with disaster, UNDRO's mandate in Disaster relief and management, Role of UN in emergencies, IDNDR. Risk assessment & Analysis: Estimation of Risk, Problems with risk assessment, Risk perception and communication, instruments and equipments involved, Objectives of assessment, Type of risk.

MODULE III

Common Disasters: Causes, General characteristics, Predictability, Factor contributing to vulnerability, Risk reduction measures, Management measures, Specific preparedness, Plan for cyclone, flood, drought, earthquake, landslides and arsenic contamination.

MODULE IV

Earthquakes: Causes, Plate tectonic and seismic waves, Magnitude and Intensity of earthquake, Seismic Zones, BIS provisions on earthquake resistant built environment for non-engineered and reinforced concrete buildings. Fundamental of ductile detailing.

MODULE V

Planning Considerations: Study of disaster and effects on settlements, disaster atlas, Intervention into land use plan. Post disaster action, Community rehabilitation, Temporary and permanent basis, Institutional involvement and policy institutes

MODULE VI

Capacity building of disaster management teams, Role of Financial Institutions in Mitigation Effort, Group Dynamics, Concept of Team Building, Motivation Theories and Applications, School Awareness and Safety Programmes.

MODULE VII

Remote-sensing and GIS applications in real time disaster monitoring, prevention and rehabilitation, Laser Scanning Applications in Disaster Management, Quick Reconstruction Technologies, Role of Media in Disasters, Management of Epidemics, Forecasting / Management of Casualties.

Course Outcomes

After the completion of this course, students will be able:

1.	To explain about natural disasters, factors that cause them and their types
2.	To explain about the significance, concept, components, and phases of disaster management cycle
3.	To identify and apply strategies for preparing effective disaster management plan
4.	To identify earthquake, cyclone and flood resilient building features and construction techniques and design regulations and codes and incorporate the same in designing a resilient building against these hazards
5.	To identify the role of land use and zoning control, site planning and land management measures for disaster risk reduction against natural hazards like earthquake, cyclones and floods.

Recommended Books:

(Disaster Management)

1. Vinod Kr. Sharma; *Disaster Management*, *IIPA, New Delhi.*
2. Robest McNamara; *Blundering into Disaster, 1987, Bloomsbusy, London*.
3. Disaster Prevention and Mitigation, 1984, UNDRO Publication, Geneva.
4. Disaster Response,- A Handbook for Emergencies, Babu Thomas, 1993

THEORY SUBJECTS

EIGHTH SEMESTER ***FREE ELECTIVE II***

MUP 3109 City & Metropolitan Planning (Elective) Credit: 3 L-T-P: 3-0-0

Course objectives:

1. To develop knowledge on issues related to growth of urban areas and their complexities.
2. To enrich students with patterns and policies of urban development and related problems
3. To present studies of various metropolitan planning initiatives in India.

Syllabus

1. Urban growth and system of cities: growth of metropolitan and mega cities – scale, complexity and its impact on national development.

2. National and international concepts of human settlement planning and urban development, relevance to Indian context.

3. Metropolitan growth – trends, characteristics, problems. Socio-economic and political issues in India with reference to Asia.

4. Changing urbanity between a city and a metropolis. Anatomy, growth and trends of metropolitan development, components of metropolitan plan; economics, transportation, etc. in evolving metropolitan framework.

5. Multi-nuclei developments: hierarchy of urban centers and their functional linkages.

6. Metropolitan region and problems of major agglomerations, studies in conjunction with the theories of major cities, Dynapolis and Megalopolis, special problems of the central area; migration and sub-urban development; emerging social and economic characteristics of the central city and the suburbs; impact on government systems and public services.

7. Patterns and policies of urban developments and decentralization as alternative to metropolitan growth, their merits and demerits.

8. Inter-city issues and problems, approach to development, urban redevelopment and renewal – goals, objectives, costs and benefits.

9. Alternative strategies to metropolitan growth - planning for New towns: types, design criteria, development process and issues. New town approach in India: small and medium town development.

10. Case studies of metropolitan planning in India and abroad. The inter-disciplinary policy issues and public action for guiding metropolitan development, including inter-governmental relations and national urban policy.

Course Outcomes

After the completion of this course, students will be able to:

1.	To Learn the aspects related to growth of urban areas.
2.	To Examine problems of urban development and relate possible solutions
3	To Apply knowledge derived from various case studies to soling real-time problem.

Reference Books:

1. The Urban pattern: City planning & design / GALLION, A B
2. Design of cities / BACON, EDMUND N
3. The Image of the City / LYNCH, KEVIN
4. The Building of Cities: Development and Conflict / KALSER HARVEY H
5. Cities in Evolution / GEDDES, P
6. City Planning: Problems and Prospects / YADAV C S
7. Morphology of Indian cities / TANEJA, K L
8. Metropolitan planning – the planning system of Greater London / PETER, S

SESSIONAL SUBJECT

EIGHTH SEMESTER

AR 8302 Architectural Design-VIII Credit: 8.0 L-T-P: 0-0-9

Course Objectives:

Application of Design theory and principles and
Design of Low rise / medium rise /high rise buildings with complex issues to be tackled covering functional relationship, climatic condition, social aspects along with structural considerations and building services

Application and use of relevant building bye-laws and provisions of **National Building Code**

Estimation of areas and approximate cost

Activities:

Main Design Exercise	**Duration** (approx.)
1. Terminal facilities for Bus or Modal interchange for Railways / Campus Planning for Institutional Project	8 weeks
2. Public building / Bank or Departmental store	5 weeks

Design (Time) Exercise	**Duration**
Any one of the above, not covered in the class	8 hrs.

Viva voce

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

Course Outcomes

After the completion of this course, students will be able to:

1.	To demonstrate design capabilities in designing of service oriented building or user centric building involving complex structural systems, services and construction systems;
2.	To apply and use building byelaws and codal provision contextually.
3	To design live urban pockets / squares / blights taking local parameters and issues into consideration, adding contemporary layer to urban aesthetics.

SESSIONAL SUBJECT

EIGHTH SEMESTER

AR 8304 Introduction to Thesis Project & Research Methodology Credit: 2

LTP: 0 0 3

Course Objectives:

- Application of literature review / study and/or case - study methodology for a preparation of a minor research / dissertation on any topic in architecture (relevant to any chosen objective or any aspect of the Thesis Project)
- Application of scientific methods / tools and techniques for conducting post – occupancy evaluation of buildings / built complexes / built-environment [case studies] and drawing inferences [for application as design guidelines in the next phase: Thesis project]
- Application of Presentation techniques [for presenting dissertation / outcome of the study] and techniques of Thesis / Dissertation / Project Report writing
- Preparation of the initial synopsis for the selected thesis project

Activities:

A. Minor Dissertation:

Each student shall prepare a a minor research / dissertation on any topic in architecture relevant to any chosen objective or any aspect of the Thesis Project. The minor dissertation shall be a research –based **conceptual study** directly associated with the thesis topic. It shall be submitted in the form of a report with appropriate referencing, bibliography etc. and the highlights shall be also presented as a seminar.

B. Thesis Project Proposal

Each student shall submit three proposals for the project, he/she wants to undertake in order of preference from which the final topic may be selected. The project shall be LIVE as far as possible. Each of the proposals should be furnished with the following information:

(a) Title of Project
(b) Authority Proposing the project with address
(c) Site area, location
(d) Brief about the project giving broad requirement, cost etc.

C. Thesis Project Introduction and Case Studies

After the thesis topic is finalized, the student has to present a seminar on his/her topic. (Stage I)
The introductory seminar will include presentation of the topic furnishing the above mentioned information along with selection of case studies of the buildings, structures that are directly associated with the thesis topic [minimum 2], format / questionnaire for case studies, literature review / study [also minimum 1 case study from secondary sources], requirements, current design trends/ philosophies etc.

[The case study activities are expected to be done during the vacation available after completion of the semester]

Course Outcomes

After the completion of this course, students will be able to:

1.	To understand the basics of research and its related methodological approach
2.	To inculcate ideas to do literature survey; record and analyze the development of the aspect of research on a time-line and understand its current trends.
3	To evolve on one or more aspect of design in form of a report and linking the same with future thesis.

9th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	THEORY SUBJECTS					
AR 9301	Professional Practice and Tendering Process	3	0	0	3	Dept Th
AR 9103	Construction Management	3	0	0	3	Dept Th
	SESSIONAL SUBJECTS					
AR 9302	Thesis Project	0	0	15	10	Dept L/S
Contact hours		**6**	**0**	**15**		**21**
	TOTAL CREDIT				**16**	

THEORY SUBJECTS

NINTH SEMESTER

AR 9301 Professional Practice and Tendering Process Credit : 3

L-T-P: 3-0-0

Course Objective:

- To introduce to the professional, vocational and legal aspects of architectural practice.
- To inform about the professional services and ethics to be shown towards society, clients, fellow architects and co-workers.
- To inform about the scope of services to be provided and project responsibilities during design and construction.
- To inform about the scale of charges for the different architectural services to be rendered
- To give a know-how about the establishment and management of a private architectural office and familiarize the students with project and office management aspects.
- To familiarize with various kinds of building regulations and codes to followed to control and promote the ordered growth of a city/town.
- To inform about the different types of tenders and contracts, its merits and demerits, tendering process and suitability w.r.t to different types of architectural projects.
- To inform about the method of seeking municipal approval and submission plans.
- To explain about the significance, purpose and types of architectural competitions

Module: 1

Architects Act 1972

Detailed study of the act, its provisions and recent amendments, Role and responsibilities of Council of Architecture, role of its electorate, procedure of membership.

Module: 2

Role of Professional body - Indian Institute of Architects

Its working, constitution and bye laws, categories of membership, election procedures, Code of conduct, Role of its conventions, its publications, etc.

Module: 3

Role of an Architect in Society

Architectural profession as compared to other professions; Architects approach to works; ways of getting works; types of works, works partly executed by other architect; conditions of engagement between the architect and client; Architects (Professional Conduct) Regulations, 1989; Architects' Professional Liability; Professional Misconduct; Scope of work; Copy rights; Scale of charges; Variation of charges; Mode of payment; Schedule of payment; Termination of services; Specialized building services; Professional service tax; Architects relation with other parties connected with works such as client, contractor, sub-contractors, consultants, municipal and public authorities.

Module: 4

Architectural Competitions

Its purpose, types of Architectural competitions, its guidelines for participation, prizes, assessment, etc.

Module: 5

Architects in practice

(a) Private practice - Partnership office management, methods of organization, filing,

documentation and working. Tax- liability
(b) Salaried appointment - Public sector, Private sector jobs, procedure of operation in government organization.

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Module: 6

Tendering process

Preparation of tender documents, method of writing tenders, opening of tenders. Tender valuation process, Contracts; types of contracts such as item rate, labour, lump-sum, cost plus percentage etc; their merits and demerits. General principles of Indian contract Act; Building contracts, conditions and forms of contract, study of standard contract of the Indian Institute of Architects. Preparation of contract documents, general conditions of contract, Administration of contract;

Interim certificates, defect liability periods, retention amount, security deposits, mobilization money and virtual completion

Module: 7

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Principle of Arbitration, Indian Arbitration Act 1940, Powers and duties of arbitrators, revoking authority; umpire, award etc.

Easement: definition; various types of easements; document and servant owners; essential conditions for enjoyment of easement; Fire insurance's definition, cover note; insurance for new work and additions; insurable value of property, claim for damage due to fire

Preliminary knowledge of transfer of property Act; registration, stamp duty under Registration process . Tax Liability, wealth, land acquisition Acts; general information about land acquisition procedures. Accidents during progress of work and after completion, damage to persons and properties affected; workmen's compensation Act with regards to the affected persons and properties. Consumer protection Act and related acts on Architects.

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the various aspects of Professional Practice and intricacies of execution of a project
2.	Exposure to the entire Tendering procedures for construction field
3	Exposure to the merits and demerits of different options available for an architect to enter into the profession
4	Understand the basic requirements of taking part in Architectural competitions,and also to organize such competitions.

Recommended Books:

1. Roshan Namavati; *Professional practice*.
2. Code of Professional Practice : I. I. A.
3. Architect Act 1972.
4. Handbook of Professional Documents- 2005, by Council of Architecture.

THEORY SUBJECTS

NINTH SEMESTER

AR 9103 Construction Management Credit : 3 L-T-P: 3-0-0

Course Objective:

- Develop a bar chart for construction project of medium scale
- Analyze the recourse allocation and cost requirement from bar chart
- Apply the network theory to assess the critical path for a project
- Compare the financial feasibility of various project options
- Evaluate the optimum cost-time relation of a small scale project
- Explain and adopt the concept of different project monitoring technique

Module 1. **Introduction and various stages of Construction Management.**
Introduction to Management Principles. Introduction and objective of Construction Management. Types of construction Projects. Responsibilities of Project Manager. Life cycle of Project and various stages of Construction Management.

Module 2. **Bar Chart & Milestone chart**
Introduction to Construction Planning & Scheduling techniques. Traditional techniques: concept of Bar Charts and Milestone charts. Cost & Resource Scheduling through Bar Chart Examples. Merits and demerits of Bar Chart.

Module 3. **Network Theory –I (CPM)**
Introduction of Network Theory. Definitions and different types of: Event, activity, dummy, Network rules, Network event numbering (Fulkerson Rule), Hierarchies of complex network, Examples. CPM. Different element of CPM network with examples, Floats, Numerical Problems. Introduction of Project management software.

Module 4. **Network Theory –II (PERT)**
Introduction to PERT, Conceptual difference between PERT and CPM, Time Estimates, Event times, Slack, Time Computations with normal probability theory. Numerical Problems

Module 5. **Project Feasibility & Monitoring Technique**
Project alternative selection technique, Time value of money, Investment Criteria: Pay Back Period, IRR NPV, Benefit Cost Ratio, and Break-Even Analysis.
Project Monitoring Technique: Work Breakdown Structure, Progress Curve Method, Line of Balance.

Module 6. **Cost & Resource Optimization Techniques**
Cost Model: Direct & Indirect Cost component of Project, Cost Slope. Project Cost-Time analysis and optimization. Resource Usage Profile, Histograms. Resource allocation, smoothing & levelling Techniques. Project Updating

Module 7. **Construction Equipments, safety and quality control**
Different types of Construction Equipments, Construction Safety requirements, Factor effecting quality of construction, Introduction to computer aided project management techniques.

Course Outcomes

After the completion of this course, students will be able to :

1.	Enumerate the attributes of a project, phases in project cycle, stakeholders involved and their management.
2.	Describe the time, cost, quality, safety and contract management processes involved in a construction project.
3.	Prepare project schedule through identification of critical tasks and path in a project.

Reference books:

1. Dr. B. C. Punmiya and K. K. Khandelwal – *Project Planning and Control with PER\CPM* Laxmi Publications, New Delhi, 1987.
2. Jerom wiert and F. K. Lavy; "*A management Guide to PERT/CPM"*
3. S. P. Mukhopadhaya; "*Project Management for Architect and Civil engineers"*
4. Peurifoy & Schexnayder; "*Construction Planning, Equipment, and Methods"*
5. Prasanna Chandra; "*Projects Planning, Analysis, Financing, Implementation, & review"*
6. D.Upadhayay; "*Construction Management"*
7. Mantri Institute; "*Building Construction Management"*
8. James J .O'Brien,Fredrick L Plotnik,;*CPM in Construction Management*; Mc Grawhill;Construction Engineering.

SESSIONAL SUBJECTS

NINTH SEMESTER

AR 9302 Thesis Project Credit: 10 L-T-P: 0-0-15

Course Objectives:

- Application of all theory and principles learned as well as skills acquired in the previous semesters in a design project being called a thesis project for academic as well as professional evaluation to indicate readiness for professional induction
- Application of scientific methods / tools and techniques for conducting post – occupancy evaluation of buildings / built complexes / built-environment [case studies] and drawing inferences for application as design guidelines
- Application of techniques for Thesis / Dissertation / Project Report writing

Activities:

Students have to submit and present their work for this project in following stages:
In continuation to the Thesis project presentations made in Stage I, as part of the subject **AR 8034 Introduction to Thesis Project & Research Methodology**, the next stages will follow:

Stage II:

Site Analysis, Case Studies and Project Requirements

'Detailed site analysis', which will reflect complete physical and environmental characteristics of the project site as detailed in 'Guidelines for sequence of Project presentation'

Case Studies [minimum 2] and literature case study [minimum 1] in the form of post- occupancy evaluation to draw drawing inferences for application as design guidelines

'Project requirements', which should have complete requirement of the project under the scope, in terms of facilities and area (as detailed) in the guidelines, with reference to the case studies made earlier

Stage III:

Concept Design

This stage will have the following:-

- Basic concept/principal ideas leading to the design
- Site Plan, Zoning of activity spaces, movement pattern and building blocks/ envelopes
- Schematic floor plans of all the buildings under the scope of the project
- Conceptual built form, in terms of elevations, sections, views, study models etc.

Stage IV:

Design Development

This stage will have detail design of the projects, which will comprise the following drawings in suitable scale:

- Site plan
- Building plans of all the building units and all floors.
- 'Furniture layout' of typical areas.
- Elevations and sections of all building units.
- Working Drawings (min 2 nos) and services drawing (min 2 nos).
- Study model
- Perspective/view of interior
- Walk through (optional)

Stage V:

Finalization of Project drawings
Students have to produce all the drawings of the previous review along with the corrected drawings based on the comments of that review for final approval on the design

Stage VI:

Project Synopsis
Students have to submit a Thesis synopsis in the form of a report (3 copies) comprising the salient points /features of their project

Stage VII:

Thesis report
Students have to submit Thesis report (3 copies) comprising write ups, case studies and drawings in the specified format as stated in guidelines

Stage VIII:

Final presentation to external jury
Final design, comprising project introductions, case study/literature study, site analysis and the final proposal and model, is to be put up and presented to a panel of jury members comprising external experts

Course Outcomes

After the completion of this course, students will be able to:

1.	To demonstrate design capabilities in approaching complex design at various scales;
2	To design live projects taking local parameters and issues into consideration, adding contemporary layer to urban aesthetics
3	To apply knowledge of services, working drawing and special attributes in a complete design of their own.
4	To comprehend the entire solution in the form of a report and present the same through appropriate medium.

10th SEMESTER						
Subject Code	**Subject**	**L**	**T**	**P**	**Credit**	**remarks**
	SESSIONAL SUBJECTS					
AR 10302	Architectural Apprenticeship	0	0	0	3	Office Training
AR 10304	Field Studies	0	0	0	6	Office Training
AR 10306	Comprehensive Viva & Time Test	0	0	3	3	
	TOTAL CREDIT				**12**	
Contact hours						**3**

SESSIONAL SUBJECTS

TENTH SEMESTER Office Training

AR. 10302 Architectural Apprenticeship Credit: 3 LTP: 0 0 0

Course Objective:

- Introduce apprentices to the fundamental processes of designing of real buildings on real sites;
- Develop apprentice's confidence in interacting with various key players in building design and construction processes;
- Harness skill in apprentices in aspects related to quantity survey, detailing etc.;
- Develop understanding of contemporary issues and techniques of building construction.

Course Content:

Each candidate shall have to prepare a detailed report along with necessary drawings, readings, observations, log sheets about the following aspects.

1. Log Sheet and Office Certificate – A student shall fill the log sheets, as a record of his every day work and shall submit the same, along with the certificate and confidential report from his Employer.
2. A student shall submit all the working details prepared by him during his practical training along with quantity survey of a small project or any special work done during his training such as any computer programme, lighting scheme, glazing details for energy efficiency and calculations, acoustical details, etc.

For report making, the following guidelines have to be followed:

`*The student is advised to stick to the syllabus and keep preparing his training report while working in the office where he is undergoing the training and make himself ready for his Grand Viva to be held in the institute.

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the various aspects of design and execution of a real life project
2.	Exposure ofworking in practical field with the usual complexities
3	Exposure to various aspects of Tendering process and its relevance in the construction field and interaction with various key players in construction process.

AR. 10304 Field Studies Credit: 6 LTP: 0 0 0

Course Objectives

A	To develop ability to critically appraise a completed and already used building
B.	To develop the skill of translating the user feedback for the built environment in the design process
C.	To develop ability to supervise and execute work at site.

Course Content:

Each candidate shall have to prepare a detailed report along with necessary drawings, sketches, measurement records, readings, observations, survey analysis about the following aspects.

1. Critical appraisal of any building that his office has designed and executed. The building should be in use and the students may record the reactions of the users to support his appraisal in addition to photographs, drawings etc.

2. Site Supervision and practices – A detail report of any part of a building that has been personally supervised by the student/ his supervisor. If the student does not get an opportunity to supervise their office work, he can give site report of any other work. It may include checking site measurements, preparation of a bill, Site instructions and checking of the executed work.

Course Outcomes

After the completion of this course, students will be able to:

1.	Understand the various aspects of building or project in terms of basic function, services, aesthetics etc which are in use
2.	Understand the built environment from user point of view and translate the findings in future design
3	Exposure to various aspects of supervision in construction process.

SESSIONAL SUBJECTS

TENTH SEMESTER

AR. 10306 Comprehensive Viva Voce and Time Test Credit: 3 LTP: 0 0 3

Course Objective:

- Examine a end-of-course student's knowledge about building and site services.
- Evaluate a student's development in Architectural Design over the last three years.

Course Content:

1. Time Test of 3 hours duration on aspects of Water supply, Electrical, Sanitation and Sewage, Structures will be conducted on any given building.

2. Grand Viva in the Institute on the portfolio of student's work of all five years. It will be important here to see the progressive development of the student since the time he joined the architecture course. It will be conducted by minimum three internal examiners and one external examiner.

Course Outcomes

After the completion of this course, students will be able to:

1.	Self-understanding of the overall knowledge base of the student, who is about to step in to the job market, after graduating from the institute on successful completion of the program.