

FIRST AND SECOND SEMESTER SYLLABUS

MAHATMA GANDHI UNIVERSITY
SYLLABUS OF BACHELOR OF ARCHITECTURE
(U.O No: 3241/1/2017/ELEN dt. 29/08/2019)



19AR12001

Architectural Design 1 & 2

Course Overview:

The course aims to deliver the fundamentals of Architecture and provide a brief introduction to the design process.

- To Introduce architectural and design vocabulary to familiarize students with the grammar of design
- To introduce the elements and principles of basic design
- To enable design thinking and basic principles of 2D and 3D composition
- To develop an understanding of the methods of architectural drawing
- To develop the ability to translate abstract principles into design solutions
- to familiarize students with design development methodology and the process involved

Course Outcomes:

Upon completion of the course, the student should have an:

- Understanding of definition of architecture
- Understanding of elements of space making, various design principles and its application
- Understanding of architectural drawings and various techniques for visual representation

- Understanding of design as a multidimensional creative art
- Understanding nature as a contextual setting
- Understanding of design development methodology and its process.

Module 1: Orientation Course

Module Contents:

- Introduction to the fundamentals of architectural education
- Introduction to how Architecture is connected to other realms of knowledge
- Introduction to the multi-faceted role of an architect
- Exposure to the works of master architects and their philosophies
- Introduction to tools and mediums of visual representation

Suggested exercises: Mind mapping, Story boards

Module 2: Fundamentals of Design and Drawing

Module Contents:

- Exploring Elements and Principles of Design by creating 2 dimensional and 3 dimensional compositions
- Introduction to Principles of two-dimensional compositions- Balance, Movement, Scale, Proportion, Rhythmic.

- Introduction to principles of three-dimensional composition - Form, Mass, Volume, Scale etc.
- Introduction to Colour Theory
- Introduction to fundamentals of architectural drawing. Measured drawing exercise of familiar objects & spaces
- Introduction to dimensioning systems and standard unit conversions

Suggested exercises: Poster Design, Product design, use of patterns to synthesize 2D and 3D models, Form making exercise, Application of colours in built form and objects, measured drawing exercise etc.

Module 3: Art in Design & Space Articulation

Module Contents:

- Introduction to the evolution of Art and Design
- Factors influencing the process of Art, Design and Architecture.
- Relationship of art and design with space and environment
- Introduction to Perceptual bases for Architectural Design
- Introduction to theories of scale and proportion in Space articulation
- Introduction to anthropometry
- Observation and study on People-Space interaction



Suggested exercises: Creative visual expressions representing culture and context, Simple activity mapping and space correlation, Space illustrations related exercises and models, Exercises to illustrate basic proportions and spatial concepts

Module 4: Introduction to Design Process

Module Content:

- Introduction to Concepts InDesign
- Introduction to Design in Nature and Context
- Introduction to methods of design in architecture through Generation of Circulation diagram, Bubble Diagram and Activity Proximity Matrix to establish a functional relationship among various spaces.
- Introduction to basic concepts of structures in design
- Architectural study tour of spaces or buildings which has to be concluded with a report incorporating studies based on the aspects discussed in the syllabus

Major project: Design of a simple structure (Not more than 50 sqm) illustrating the fundamentals of architecture discussed in the syllabus. The context may be hypothetical.

Time bound project: Design of a functional space to demonstrate the process of design development and fundamentals of architectural design representation

Reference:

- Broadbent, G. (1973). Design in Architecture - Architecture and Human Science. New York: John Wiley and Sons.
- Ching, F. (2014). Architecture: Form, Space, and Order, 4th Edition. John Wiley & Sons.
- Ching, F. (2015). Architectural Graphics. Wiley & Sons Canada, Limited, John.
- Ching, F., Jarzombek, M. and Prakash, V. (2010). A global history of architecture. 2nd ed. John Wiley & Sons.
- Conway, H. and Roenisch, R. (2003). Understanding architecture: an introduction to architecture and architectural history. London: Routledge.
- Kleiner, F. (2009). Art through the ages a Global History. 3rd ed. ClarkBaxter.
- Pramara, V. (1973). Design fundamentals in architecture. Bombay: Somaiya Publications.
- Roth, L. (n.d.). Understanding architecture: Its Experience History and Meaning.
- Snyder, J. and Catanese, A. (1979). Introduction to architecture. New York: MacGraw-Hill.
- Unwin, S. (2009). Analysing architecture. London: Routledge.

Notes:

- Students may be encouraged to Read and discuss books/journals related to the topics discussed in the semester

- Discussions of the topics given above may include relevant contents from the other subjects in the semester as well.

19AR12002

Building Materials and Technology 1 & 2

Course Overview:

The subject primarily aims at developing understanding in the use of appropriate construction technique and material in building design based on feasibility of technology, physical properties (like density & specific gravity, strength, thermal properties), aesthetic value, socio-cultural impacts and relevance, socio-economic factors, Ecological footprint etc.

The course introduces the technological aspects of a building design from the perspective of functional building component where use of natural and artificial materials is discussed based on their application. Each material would be taught in a manner such that its application would be discussed in a sequential manner, starting from foundation level, followed by plinth & others (sill, lintel, sunshades, window/door openings, walling material, as a floor & flooring) and culminating at roof and parapet wall. Construction technology and appropriate materials for structural systems, roofing, enveloping and interior finishes shall be considered under this subject from simple examples to complex.

Course Outcomes:

Upon completion of the course, the student should:

- The student should develop necessary decision-making skills in using appropriate construction

technologies and materials while designing buildings, based on understanding of their potentials and properties.

- The student should develop the skill to represent various construction techniques as well as materials through drawings supporting their building design.
- Three drawing sheets shall be drafted based on the contents of each module.

Module 1: Introduction to Fundamental Components of a Building

Learning Strategies:

- Lecture on various building components and various techniques as well as materials used.
- Demonstration at building construction sites, workshops etc. on various building components and various techniques used.
- Market study on materials.
- Drawing studios on representation of different building components and materials.

Module Contents:

- Foundation: Function, Types based on structure, Techniques & materials used in construction.
- Building envelope: Function, Desirable properties, Types based on materials.
- Floor: Function, Types based on material and construction used, Techniques used in construction.

- Fenestrations: Function, Types based on application, Techniques & materials used in construction.
- Roof: Function, Types by shape and structure, Techniques & materials used in construction.
- Overview of load bearing and framed structures – related components – columns, beams, trusses etc.

Module 2: Soils and Foundations

Learning Strategies:

- Lecture on various soil types, various techniques of soil tests for different properties of soil and types of foundations for each situation.
- Demonstration at building construction sites, workshops etc. on various building foundations used for different types of buildings.
- Site visits to soil testing facilities.
- Drawing studios on representation of different foundation types.

Module Contents:

- Soils – Their classification, physical properties and behaviour – Bearing capacity, safe bearing capacity, Determination of SBC, Standard Penetration test – Sand – fineness, bulking qualities - Methods of improving bearing capacity.
- Shallow Foundations – Types- Pad, Strip, Raft-Method of construction.



- Deep Foundations-Types- Piles, Piers, Caissons- Materials and method of construction.
- Execution problems in loose and clayey soil, Shoring, Timbering.
- Vernacular construction methods of foundation – stone, rammed earth, bamboo, coconut etc.

Module 3: Construction Using Wood

Learning Strategies:

- Lecture on various building components using wood as construction material.
- Demonstration at timber yards, saw mills, carpentry workshops etc.
- Market study on various wood and wood-based materials.
- Drawing studios on representation of different wood construction techniques.

Module Contents:

- Timber/ wood as construction material: Properties, Types of timber, defects, seasoning and preservation of timber, ecological impact due to use of wood, joinery details & systems, BIS Specifications etc.
- Wooden doors & windows - Wooden joinery & details.
- Structural members: application of wood as a structural member – framed structure, roof structure - King post truss, Queen post truss.

- Timber Floors – Single, double and framed floors with joints between joists with wall plate joist with beam and sub beam with main beam, strutting of joists.
- Roof & Ceiling: wooden ceiling systems – members of the system, detailing, wooden roof systems – members, detailing.

Module 4: Masonry

Learning Strategies:

- Lecture on various building components in elementary load bearing construction using concrete.
- Demonstration at construction sites on various stages.
- Market study on cement, bricks, steel etc. used in elementary concrete load bearing constructions.
- Drawing studios on representation of different building components.
- Hands on workshop on masonry types.

Module Content:

- Material Study- Burnt bricks and alternative building blocks: Mud Bricks, Stones, concrete blocks, mud blocks, rammed earth, their BIS specifications.
- Wall: Masonry techniques & tools, Types of masonry bonds – Stretcher, Header, English, Flemish, Stack, Dutch, Facing and rat trap bonds.
- Properties of cement concrete, preparation, cement, aggregates and other components of concrete, techniques and tools.

- Vernacular materials like mud, bamboo, lime, surkhi, clay products – applications, environmental aspects.

List of drawings for viva (Minimum 7 sheets)

- Typical Wall section
- Strip foundation
- Column footing
- Pile & Pile cap
- Wooden joinery
- Timber floors
- King post truss
- Queen post truss
- English bond – different thickness and T joint
- Flemish bond – different thickness and T joint

Reference:

- Barry, R. (1999). The Construction of Buildings Vol. 2. 5th Ed. New Delhi: East-West Press.
- McKay, W. B. (2005). Building Construction Metric Vol, I – IV. 4th Ed. Mumbai: Orient Longman.
- Chudley, R. (2008). Building Construction Handbook. 7th Ed. London: Butterworth-Heinemann.
- Foster, J. and Mitchell, S. (1963). Building Construction: Elementary and Advanced, 17th Ed. London: B.T. Batsford Ltd.
- H Leslie Simmons, 'Construction – Principles, Material & Methods', 7th edition, John Wiley & Sons Inc., New York, 2001.

- Sushil-Kumar, T. B. (2003). Building Construction. 19th Ed. Delhi: StandardPublishers.
- P.C. Varghese, 'Building Materials', Prentice hall of India Pvt. Ltd, New Delhi,2005

19AR12003

Professional Skill Enhancement 1 & 2

Course Overview:

This course intends to provide/ enhance the soft skills in order that students perform well in their academics and beyond. These skills are intended to support the student to perform better in her/his core subjects and also build up robust performance through hands-on workshops and laboratory training. This course is subdivided into two categories – Mandatory and Optional. Mandatory courses help in preparations for respective semester subjects. The optional category helps students to take personal initiatives to develop in specific areas that can widen their horizon of their understanding of architecture and also initiate action at the society level. There are also options to work on competitive exercises alongside other similar institutions.

- The aim of this subject is to familiarise students with different types of materials and manufacturing techniques for creating art forms/models.
- Students will be able to use different kinds of tools and machinery for production of design models.
- The subject will be taught in congruence with subjects like Design and Graphics. Assignments for the subject will be linked to design exercises to achieve higher level of learning and understanding the practical application of the same.

- Considering the significance of English language as a tool for global communication, the course aims to develop and enhance the linguistic and communicative competence of the students. The focus is on honing the skills of reading, writing, listening, and speaking. By providing suitable examples, the students will be exposed to various forms of personal and professional communication. The self-learning tasks designed will facilitate to enhance effective communication skills in a modern, globalised context.

Course Outcomes:

Upon completion of the course, the student should:

- be given an exposure of varied skills that can bring in confidence in handling their core subjects such as workshops, communication skills, computer application etc.
- be able to develop team spirit and interpersonal skills to manage complex situations.
- be able to cope with stress and develop multi-tasking capabilities.

Module 1: Architecture Model Making Workshop

Learning Strategies:

- Practical hands on sessions
- Model making lab and equipment
- Suggestive Materials: Paper, thermocol, clay, ceramic, plastic sheet, sheet metal, wood etc.

Module Contents:

- Training in translating ideas into three dimensional forms.
- Training sessions using different materials and techniques pertaining to Architectural model making.
- Training in safe handling of equipment for production of design models.

Module 2: Communication Skills

Learning Strategies:

- Language lab
- Group discussions and Interactive sessions

Module Contents:

- Scope and Importance of effective communication.
- The Process of Communication: Levels of communication; Flow of communication; Use of language in communication; Communication networks; Significance of technical communication.
- Barriers to Communication: Types of barriers; Miscommunication; Noise; overcoming measures.
- Listening Skills: Listening as an active skill; Types of Listeners; Listening for general content; Listening to fill up information; Intensive Listening; Listening for specific information; Developing effective listening skills; Barriers to effective listening skills.



- Reading Skills: Previewing techniques; Skimming; Scanning; Understanding the gist of an argument; Identifying the topic sentence; Inferring lexical and contextual meaning; recognizing coherence and sequencing of sentences; Improving comprehension skills.

Module 3: Co-curricular Activities

Learning Strategies:

- Technical and hands on workshops
- Group discussions and Interactive sessions
- Self-initiatives

Module Contents:

- Optional content to be developed by each institution in order to help students to take part in activities that involve larger groups and facilitate peer learning.
- The activities could be skill oriented like Photography or Crafts training or student initiated societal activities or participation in NASA or similar student led group initiatives which have an academic content as well.

Reference:

- Dunn, N. (2014). Architectural model making. Laurence King Publishing.
- Kaplan Test Prep. (2018). IELTS prep plus 2019-2020. Kaplan Pub.

- Knoll, W. (2014). Architectural models: Construction Techniques. 1st ed. CengagePublications.
- Lougheed, L. (2010). Barron's IELTS. 2nd ed. Barrons Educational Series.
- Werner, M. (2011). Model making. Princeton Architectural Press.



19AR12004

History of Architecture 1 & 2

Course Overview:

The subject principally aims at sensitizing the students towards understanding architecture as a product of historic evolution process of human kind along the timeline through socio cultural and political changes as well as technological advancements at different geographies around the planet earth. The subject intends to inculcate in the students a sense of curiosity to understand the origins and meanings of the various forms of architectural details, expressions as well as functional design elements or space standards used extensively in the practice.

Course Outcomes:

Upon completion of the course, the student should:

- Be able to relate and identify built forms through socio cultural, climatic, political, economic influences on them in respective geography and timeline.
- Possess the skill to formally (visually and theoretically) analyse and appreciate architectural works.

Introduction to History of Architecture and its relevance in design (not part of evaluation)

Learning Strategies

- Lecture on chronological evolution of architecture in various geographical contexts.

- Drawing exercises on various significant architectural works in various eras/geographies.
- Lecture/ discussion on observation of changes in built form design across timeline.
- Lecture on architectural history its relevance in modern day architecture design.
- Lecture/ discussions on human experience of architectural built forms and their appreciation based on the physical and metaphysical influences on architecture.
- Drawing exercises on applications of architectural history in design.
- Lecture/discussion on Physical and metaphysical influences by architecture: Brief introduction to use of various principles of design such as Unity, Focal Point, Scale and Proportion, Rhythm and Balance using examples like Pyramid complex at Giza, Acropolis, Parthenon, Pantheon, etc. (cross-study with Theory of Design).
- Lecture/discussion on applications of architectural history: Analysing buildings through historical perspectives, use of details, construction techniques, materials etc. in sensitive design projects with modern day examples.

Contents

Study of architectural history and its relevance in modern day architecture design
Brief Early History: A very brief introduction to landmark architectural works during

different periods in different geographical regions- Early cultures (before 12,000 BCE) up to 1200 CE- Changes occurring to the built form design across timeline as well as geographies based on socio cultural, climatic, geographic, economic factors as well advancements in construction techniques (ref. Ching, Introduction to Architecture, Ch. 2)

Brief History from Renaissance to Contemporary: A very brief introduction to landmark architectural works during different periods in different geographical regions c. 1200 CE to 1950s Changes occurring to the built form design across timeline as well as geographies based on socio cultural, climatic, geographic, economic factors as well advancements in construction techniques (ref. Ching, Introduction to Architecture, Ch. 3)

Module 1: Architecture in Pre-Historic and Ancient Times – 1

Learning Strategies:

- Unit wise lectures on how the built form in the region is a manifestation of its socio cultural, climatic, political, economic context.
- Drawing exercises on various significant architectural works in various eras/geographies.
- Lectures/ assignments on construction techniques.
- Lecture/ discussion on observation of periodical changes and cross influences between various geographies.

- Each lecture will have pre- requisite readings and each module will have to specify self-learning component in the lecture plans.

Module Contents:

- Early cultures: Palaeolithic-Society, Culture & Settlements, Dolni Vestonice, Megdalenian tents, Ice age - Relevance of ice age, dwellings, Neolithic Age - Society, Culture & Settlements, Jomon Culture.
- Indus Valley: Introduction to Bronze Age and its impact in the region, Geography, society and culture, Dholavira, Architecture and urban infrastructure of Mohenjodaro - Citadel, Dwelling units.
- Mesopotamia: Sumerians- culture and social structure, City of Ur, Ziggurat at Ur.
- Egypt: Culture and social structure, Pre-dynastic Egypt- royal tombs at Abydos, Old Kingdom Mortuary complex of Zosur, Pyramid complex at Giza, New Kingdom - Temple complex at Karnak, Temple of Amun.

Module 2: Architecture in Ancient Times – 2

Learning Strategies:

- Lecture on how built form is a manifestation of its socio cultural, climatic, political, economic context.
- Drawing exercises on various significant architectural works in various eras/geographies.
- Lectures/ assignments on construction techniques.

- Lecture/ discussion on observation of periodical changes and cross influences between various geographies.
- Each lecture will have pre- requisite readings and each module will have to specify self-learning component in the lecture plans.

Module Contents:

- China: Early Chinese cultures- Yangshao- Banpo (brief) | Shang Dynasty- rites and rituals, tombs | Zhou Dynasty- Mandate of Heaven, Ritual complex at Feng Chu (brief), Wangcheng, an ideal city (brief) | Qin Dynasty- Tomb of first emperors (brief) | Han Dynasty - Mingtang Biyong ritual complex (brief) | Great Wall of China(detail)
- Greece 1: Mycenaean civilisation- Palace complex at Pylos | Geometric period- emergence of Greek temple form, Temple of Poseidon (brief) | Archaic period-architectural characteristics, Temple of Apollo at Delphi (brief)
- Greece 2: Classic - Athens' Acropolis (detail) | Hellenistic age- Temple of Apollo at Didyma (brief) | Greek Orders
- Rome 1: Founding and expansion of Rome (brief) | Engineering and construction technology | Forums- Forum of Augustus, Imperial Forums (brief)
- Rome 2: Roman Urban Villa (brief) | Roman Baths (brief) | Colosseum and Pantheon(detail)

- Vedic period and Buddhist architecture 1: Aryan invasion, Vedic village, Aryan house | Origin and spread of Buddhism | Mauryan School of Art- Asoka pillar (brief), Sanchi Stupa (brief) | Sunga school of Art- Growth of Sanchi Stupa (detail), Viharas and Chaityahalls
- Buddhist Architecture 2: Satvahana School of Art- Amaravati Stupa (brief), Chaitya hall at Karle (details) | Kushana School of Art- Mahayana Buddhism and monastery at Takht-i-Bahi (brief) Gupta period- Ajantha caves(detail)

Module 3: Architecture in Kerala

Learning Strategies:

- Lecture/ Individual history of Kerala Architecture during the medieval era.
- Lecture/ discussion on observation of changes and influences on Kerala architecture during theera.
- Lecture/ Individual student assignments on significant buildings.
- Drawing exercises on various significant architectural works.
- Model making exercises on significant architecture works in Kerala during theera.
- Lecture on theories such as planning principles, use of Vasthu Purusha Mandala, etc. can be added to understand its impact on the built form.

Module Contents:

- Pre-historic built structures of Kerala: Megalithic structures- Dolmens, Umbrella stones, Burial caves, and Cave temples.
- Influencing factors of indigenous architecture in Kerala: Geography, Climate, Building materials, Social, Political, Religious and Traditional planning principles.
- Indigenous residential architecture of Kerala-1: Characteristics of sala typology of houses – Development of four types of sala house configuration, Evolution and expansion of ekasala, causal and other complex courtyard based residential typology, example of ekasala (Thampuran, 2001 p. 143), example of catusala: (Thampuran, 2001 p. 154), example of complex sala: Pathinarukettu (Thampuran, 2001 p. 201), One example of Muslim and ChristianTharavadu.
- Indigenous religious architecture of Kerala: Characteristics of Kerala temple architecture Types of Kerala 'Sreekovils'(Moola-prasada) Five types-with/without Antharala and with/without Mukhamandapa.
- Schematic layout of a full-fledged Kerala temple with names of important structures. Sectional elevation of a typical Kerala Sreekovil(Moola-prasada).
- Architectural characteristics of Kerala type mosques and churches (Study of relevant examples).

Reference:

- Achuthan, A. and Prabhu, B. (1998). Manushyalayachandrikabhasyam - An engineering

commentary on manusyalayachandrika of Tirumangalat Nilakanthan Musat. Calicut:Vastuvidyapratisthanam.

- Chandrashekara, U & Joseph, S.P. & Ashtamoorthy, Sreejith. (2002). Ecological and socio-cultural dimensions of sacred groves of Northern Kerala. Man in India. 82.323-340.
- Ching, F. (2013). Introduction to architecture. Hoboken, N.J: Wiley Publishers.
- Ching, F., Jarzombek, M. and Prakash, V. (2010). A global history of architecture. Hoboken, NJ:Wiley.
- Fletcher, B. (1999). A History of Architecture. CBS Publication (IndianEdition).
- Jarzombek, M. (2013). Architecture of first societies: A Global Perspective. Hoboken, N.J.: Wiley Publishers.
- Jayashankar, S. (1997). Temples of Kerala. Census ofIndia.
- Koduveliparambil, J. (1997). Construction practices in traditional dwellings of Kerala. India: McGill University, Montreal.
- Kostof, S. (1985). A history of architecture: Setting and Rituals. London: Oxford University Press.
- Nuttgens, P. (1983). The Story of Architecture from Antiquity to the Present. London: H. F. Ullmann Publishers.
- Prabhu, B. and Achuthan, A. (1996). A text book of Vasthuvidya, Vasthuvidya Prathishtanam. Calicut.
- Sarkar, H. (1978). An Architectural survey of Temples of Kerala. Archeological Survey ofIndia.

- Scully, V. (1991). Architecture - The Natural and the Manmade. New York: Harper Collins Publisher.
- Thampuran, A. (2001). Traditional architectural forms of Malabar Coast. Vastuvidyapratisthanam AcademicCentre.
- Vatsyayan, K. (1997). The square and the circle of the Indian arts. New Delhi: AbhinavPublications.

19AR12005

Theory of Structures 1 & 2

Course Overview:

The course primarily aims at understanding importance of structures in Architecture. It focuses on making the students aware of the role of structural design as an integral part of Architecture design. It provides the fundamental understanding of various possibilities in exploring Architectural design with the help of different structural forms. It also acts as the orientation to basic structural design terms and fundamental governing principles. It also emphasizes on making students aware of different external loads and forces acting on the structural elements and giving a conceptual idea of the behaviour of these elements.

Course Outcomes:

Upon completion of the course, the student should:

- be able to develop a habit of inclusive structural aspects in their Architectural design.
- be able to visualize the flow of forces in their Architectural design elements to develop a stable and practical structure.
- be able to develop basic skill to choose appropriate structural form from various possibilities.
- be able to develop an intuitive understanding of how structures behave and thereby enhancing their skills in conceptual Architectural design.

Module 1: Structural Design and its relevance in Architecture. Introduction to basic structural design and various structural forms and elements in Architecture.

Learning Strategies:

- Lectures on the below contents by presentation and discussion on Architectural projects and structural behaviour diagrams to make students understand structures in the context of Architecture
- Lectures by using analogies and examples to explain structural concepts.

Module Contents:

- Introduction – Definition of Structure, Role of Structures in Architecture
- Historical evolution of structures - Walls, Post and beams, Arches, Vaults, Domes, Suspended structures, Truss, Skyscraper
- Force types – Definition of force, Moment of a force, Bending & Buckling Force concepts - principle of transmissibility, principle of superposition.
- Resultant of co planar concurrent forces, parallelogram law of forces and numerical problems.
- Resolution and composition of forces, numerical problems.

- Moment of force concept, Varignon's theorem, Couple and moment of a couple concept. Numerical problems on coplanar non- concurrent force system.

Module 2: Principles of structural design.

Fundamental governing principle in behaviour of the external loads (Statics) acting upon different structural elements.

Learning Strategies:

- Lectures on the below contents by presentation and discussion with relatively accessible mathematical equations and calculations.
- Lectures by using analogies and examples to explain structural concepts.

Module Contents:

- Equilibrium concept and free body diagram. Condition of static equilibrium for different force system. Lami's Theorem. Numerical problems on equilibrium of coplanar concurrent force system.
- Types of supports and loads in statically determinate beams, equilibrium of coplanar non concurrent force system, to find the support reaction for statically determinate beams.
- Loads on structure as a whole - Dead Load - Live Load - Seismic Load - Wind Load
- Tributary Load & load path. Basic concepts of Strength - Stiffness - Stability–

- Load tracing – Understanding load flow by tributary load and load path, Load paths – Pitched Roof systems, Wall systems, Roof and floor systems, and Foundation systems.

Module 3: Principles of resistance of structural members to the various external forces acting upon them. Importance of cross section in resisting the external loads. Truss analysis

Learning Strategies:

- Lectures on the below contents by presentation and discussion with relatively accessible mathematical equations and calculations.
- Lectures by using analogies and examples to explain structural concepts.

Module Contents:

- Resistance of Structural Members – Material strength and cross-sectional properties.
- Centre of gravity and centroids, Locating the centroid of plane and compound figures.
- Moment of Inertia - of an area, Theorem of parallel and perpendicular axis- Principle axis and Principle moment of inertia;
- Moment of inertia of composite areas. Radius of Gyration.
- Truss analysis: - Method of joints- cantilever and simply supported trusses

Reference:

- Ambrose, J. and Tripeny, P. (2013). Building structures. Hoboken, N.J.:Wiley.
- Babu, J. (n.d.). Engineering Mechanics. Pearson PrenticeHall.
- Bansal, R. and Bansal, S. (n.d.). Engineeringmechanics.
- Becker, H. (2015). Structural competency for architects. New York, N.Y.:Routledge.
- Bedi, A. and Dabby, R. (2013). Structure for architects. Hoboken, N.J.:Wiley.
- Beer, F. and Johnston, E. (1984). Vector mechanics for engineers. New York:McGraw-Hill.
- Benjamin, J. (n.d.). Engineering Mechanics. Pentex Book Publishers andDistributors.
- Bhavikatti, S. (2010). Mechanics of Solids. New Age InternationalLimited.
- Bjorn, N., Arne, P. and Mark, R. (n.d.). The Structural Basis ofArchitecture.
- Garrison, P. (n.d.). Basicstructures.
- Garrison, P. (2005). Basic structures for engineers and architects. Oxford: Blackwell PublishingLtd.
- Ji, T., Bell, A. and Ellis, B. (n.d.). Understanding and using structuralconcepts.

- Macdonald, A. (1997). Structural design for architecture. Oxford: ArchitecturalPress.
- Ochshorn, J. (n.d.). Structural elements for architects andbuilders.
- Onouye, B. and Kane, K. (2015). Statics and Strength of Materials for Architecture and Building Construction. Boston, MA:Pearson.
- Prasad I.B (n.d.). Applied mechanics -Dynamics & Statics. KhannaPublishers.
- Punmia, B. and Jain (n.d.). Strength of Materials and Theory of Structures - Vol1.
- Rajasekaran, S. and Sankarasubramanian, G. (n.d.). Engineering Mechanics. Vikas Publishing House PrivateLimited.
- Ramamrutham, S. (n.d.). Strength of Materials. Dhanpat Rai Publishing Company PvtLimited.
- Salvadori, M. (1975). Structure in architecture; the building of buildings. Englewood Cliffs: Prentice Hall.

19AR12006

Theory of Design

Course Overview:

The course shall introduce the students to the basic theories of design as a cross disciplinary phenomenon. The course shall engage the students with various important design philosophies, their evolution and their major design directions. The course aims to supplement the broader understanding of design at the foundation level.

Course Outcomes:

Upon completion of the course, the student should:

- develop the vocabulary skills to effectively communicate design and its process.
- be able to critically review design and analyse them.
- be able to develop and understanding of the various design philosophies and their evolution.

Module 1: Elements of Design

Learning Strategies:

- Lecture
- Group Discussion
- Assignments

Module Contents:

- Dot: Illusion of roundness;

- Line: Types, Direction, Gesture, Contour, Quality & Value.
- Planes: Depth, Thickness, Boundary, Levels.
- Shape/Volume/Mass: Positive & Negative, Naturalism, Idealism, Abstraction, Distortion & Illusion.
- Operations: Detached, Within, Overlapping, And Intersecting.
- Texture: Tactile, Visual, Actual & Implied, Pattern, Homogeneity.
- Colour: Colour theory, Psychology, Characteristics, Schemes. Properties of Colour, Symbolism and Psychology.
- Value: Light & Dark, Variations: Movement, Pause, Control, Focus.
- Motion: Anticipated, Suggestive, Actual and Illusion.
- Perception of spaces: Elements of spatial definition, Depth, Density, Opening, Juxtaposition and interpenetration, Spatial Characteristics of elemental shapes, Perspectives and projections.

Module 2: Principles of Design

Learning Strategies:

- Lecture
- Group Discussion
- Assignments

Module Contents:

- Unity: Gestalt Laws, Harmony, Variety, Factors of Coherence, Order in disorder, Gradation.
- Emphasis and Focal point: Axis, Datum, Hierarchy, Contrast, Complexity, Contradiction, Presence and Absence, Regularity and irregularity.
- Scale and proportion: The notion of scale, Ergonomics
- Anthropology and proxemics: Proxemics and Space bubbles, Commensurate and Incommensurate proportions, Vitruvian man, the modular, golden ratio and the Fibonacci series.
- Rhythm and Balance: Symmetry, Asymmetry, Interaction of design elements, Radial and crystallographic balance.
- Rhythm: Movement and Sensation, Shapes and Repetition, Pattern and Sequence, Progressive Rhythm and Gradation.

Module 3: Evolution of Design Discipline

Learning Strategies:

- Lecture
- Group Discussion
- Assignments

Module Contents:

- Built Environment, human condition and Social Relevance of Design Solutions: Abraham Maslow and built environment - needs vs wants and deficiency vs growth; Irvin Altman and behavioural concepts: Privacy,

Territoriality, Crowding and Personal Space, understanding of different contexts to ascertain perception of meanings.

- Evolution of design discipline: Definition of design-physical, conceptual, Design since 1700s
- Design Process: Different maps of design process: Analysis, Synthesis and Evaluation.
- Design Thinking: Different Types and styles of thinking, Design strategies, Tactics and Guiding principles, Design as communication.

Module 4: Nature as Primary Reference

Learning Strategies:

- Lecture
- Group Discussion
- Assignments

Module Contents:

- Evolution of natural forms and Natural growth patterns: Golden spiral, Fractals.
- Emergent Designs: Self -similarity, Self-organisation, Indeterminacy
- Nature-inspired design: Bio mimicry, Janine Benyus and ideas from Biology, Contributions of Michael Pawlyn.
- Bio-inspired Design: Material ecology, Explorations of Nerioxman.
- Works of Ross Lovegrove, Concept of Maximum with minimum: Works of Buckminster Fuller and Frei Otto.

Reference:

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19AR12007
Architectural Graphics

Course Overview:

This course is designed to generate comprehensive understanding of technical drawing techniques and architectural presentation. To introduce students to the fundamental concepts and techniques of graphical drawings, and multi-angle representations of built elements and built forms with applicable renderings.

Course Outcomes:

Upon completion of the course, the student should:

- develop visual communication through technical drawings.
- enhance 3D visualisation capability connecting to real-world.
- develop 2-D & 3-D perception through observation, interpretation and logical understanding.
- stimulate and expand the skill of observing, interpreting and representing spaces and objects.

Module 1: Introduction of the Architectural Design Language – technical drafting and presentation.

Learning Strategies:

- Lectures
- Studio

Module Contents:

- Introduction to visual communication through technical drawings, tools & techniques for visual communication.
- Graphical Annotations and Symbols – Line types, line weights, labelling, titling etc. (T&S)
- Lettering -Introduction to Typography(T) – Free hand lettering – Block lettering(S)
- Dimensioning – Types of Dimensions with applications.(T&S)
- Scales- Plain Scale – Introduction to Graphical Scale – Diagonal Scale - Use and Applications. (T&S)

Module 2: Visual Representation

Learning Strategies:

- Lectures
- Studio
- Study Models

Module Contents:

- Orthographic projection – Introduction, Theory of projection, Systems of projection, projection of points, lines and planes-(With particular emphasis of first angle projection)(T)
- Orthographic Projection - Solids - Simple solid in simple position - top & front views, Auxiliary Projection-

Axis inclined to one plane & parallel to other, Axis inclined to both planes –Altering the position method and Auxiliary plane method(T&S)

- Intersection of Solids - Method of drawing intersection between prism & prism, cylinder & cylinder, cone & cylinder. (Cases with mutually perpendicular axes only) - Applications (T&S)
- Section of Solids - (T&S) - True shape of section - Sectional views from the true shape of section
- Development of simple surfaces – Parallel Line Method- Triangulation Method – Radial Method – Approximate Method.(T&S)
- Conic Sections - Eccentricity, Types -Ellipse, parabola and hyperbola - Construction methods. Application of conics(T&S)

Module 3: Advanced Visual Representation

Learning Strategies:

- Lectures
- Studio
- Study Models
- Heliodon or related light & shadow casting equipment

Module Contents:

- Isometric and Axonometric Views (T&S)- types, construction methods, applications and advantages.
- Perspective View (T&S)– Visual Ray Method – Vanishing Point Method. Nomenclature of perspectives -

Objects, study of picture plane, station point, vanishing point, eye level, ground level etc., its variation & effects.

- Application of Perspective in Architectural Drawings (T&S)– Interior and Exterior Views, Sectional perspectives.
- Sciography of Solids (T&S)- Principles of shade & shadow, shadows of architectural elements, application of sciography on pictorial views.
- Rendering Techniques (T&S)- using pen & ink, colour, values, tones, and general approach to rendering.

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19AR12008

Mathematics for Design

Course Overview:

- To equip the students with necessary mathematical background to comprehend the aspects of design elements and structural stability.
- To recap students about the mathematical concepts of geometry, trigonometry, statistics and calculus; and make them understand the application of these concepts to architecture.
- Each of these core concepts will help students learn the skills associated with various subjects studied in B.Arch. Course.

Course Outcomes:

Upon completion of the course, the student should:

- Be able to understand mathematical concepts applied in architectural drawing.
- Acquire mathematical skills for analysing and effective understanding of architectural works.

Module 1: Geometry

Learning Strategies:

- Widen knowledge 3D and 2D shapes

Module Contents:

- Basic two-dimensional shapes- curves, straight lines, triangles, quadrilaterals, rectangle, parallelogram,

circles, ovals, squares, and spirals (Simple numerical problems on area, perimeter etc. and theory only)

- Basic Three-dimensional Shapes- Cube, Cylinder, Pyramid, Sphere (Simple numerical problems on Volume, Surface Area and theory only)
- Standard equation and problems based on properties of Conics
- Standard equation and problems based on properties of Parabola
- Standard equation and problems based on properties of Ellipse
- Standard equation and problems based on properties of Hyperbola
- Standard equation and problems based on properties of Rectangular Hyperbola (Note: Problems involving foci, eccentricity, directrix, latus rectum, tangent, chord, normal- Chap: 7, 8,9,10 of Coordinate Geometry)

Module 2: Trigonometry

Learning Strategies:

- To include angles and corners in architectural design.
- Enables to draw properly load-bearing walls in the right places in the building

Module Contents:

- Trigonometric ratios for angles less than the right-angle
- Heights and Distances

- Trigonometric ratios of sum, difference and multiplication of two angles
- Identities and Trigonometrical equations
- Pythagoras Theorem and simple problems using the theorem
- Length of tangent to a circle – Simple problems (Note: Problems involving Length of tangent to a circle from Chap: 2,3,7,8 of Plane Trigonometry)

Module 3: Calculus

Learning Strategies:

- To better define curves of a structure, in order to produce the right reverberations within the building
- Enables to evaluate the physical forces a building must tolerate during and after construction

Module Contents:

- Differentiation; Maxima and Minima
- Successive differentiation – nth derivative using Leibnitz rule
- Radius of curvature (Cartesian and parametric form)
- Evolute
- Area bounded by plane curve
- Arc Length of plane curves
- Volume of a solid of revolution

Module 4: Sequences & Statistics

Learning Strategies:

- To define and understand sequence
- To learn about important statistical measures essential for data analysis.

Module Contents:

- Arithmetic, Geometric Progression
- Golden Ratio- Its application InDesign
- Statistics - Measures of Central Tendency-Mean-median-mode
- Measures of Dispersion- Mean deviation-standard deviation-variance.
- Covariance, Correlation – Karl Pearson coefficient
- Rank Correlation – Spearman's coefficient for repeated and non-repeated ranks
- Regression coefficient–Lines of Regression-Fitting of straight line by method of least square

Reference:

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