

APJ ABDUL KALAM  
TECHNOLOGICAL  
UNIVERSITY

**SEMESTER III**

KTU



Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ART201	CLIMATE AND BUILT FORM- I	2-0-0-2	4	2021

**Course Objectives:** To introduce students to climate responsive architecture and enable them to apply climate responsive design strategies in the design of built environment.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	Interpret the global and local climate	Understanding
CO-2	Examine the thermal comfort of a space	Analysing
CO-3	Summarize the heat exchange process in buildings and the thermophysical properties of building materials	Understanding
CO-4	Apply climate responsive design strategies in the design of shelters for tropical climates	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and B. Part A contains 5 questions with 1 question from each module, having 4 marks for each question. Students should answer all the questions (5x4= 20 marks). Part B contains 2 questions from each of the 5 modules, of which the student should answer any one. Each question carries 8 marks (Total 5x8=40). Part B questions can have subdivisions.

**Syllabus**

Introduction to Climate, Climate in Site Study, Thermal Comfort, Heat transfer in buildings, Climate responsive design for tropical climates.

## Course Plan

Module	Topic	Course Outcome	No. of Hours
I	<p><b>Introduction to climate</b>            Definitions – climate and weather, Climate and architecture,            Need of study – comfort, sustainability, Active and passive systems, Global climatic factors            Climate classifications - global classification (Koppen), Indian climate classification (SP 41)            Tropical climates and its classification</p>	CO1	10
II	<p><b>Climate in site study</b>            Elements of climate, Macro and microclimate            Site climate – factors affecting site climate and their influence on different elements of climate            Urban climate</p> <p><b>Exercises (Lab):</b>            1. Measurement of temperature            2. Measurement of humidity            3. Measurement of mean radiant temperature</p>	CO1	15
<b>FIRST INTERNAL TEST</b>			
III	<p><b>Thermal comfort</b>            Thermal balance of the human body – regulatory mechanisms and subjective variables            Thermal comfort – factors affecting thermal comfort            Thermal comfort indices – effective temperature, corrected effective temperature, bioclimatic chart, Fanger’s model of thermal comfort</p> <p><b>Exercises (Lab):</b>            1. Calculation of ET and CET            2. Evaluation of thermal comfort using architectural evaluation System</p>	CO2	15
IV	<p><b>Heat transfer in buildings</b>            Heat exchange process in buildings, Thermophysical properties of materials – conductance, resistance and transmittance (U value), Absorbance reflectance and emittance, Specific heat and thermal capacity, Sol air temperature and solar gain factor            Periodic heat flow</p>	CO3	10

<b>SECOND INTERNAL TEST</b>			
<b>V</b>	<b>Climate responsive design for tropical climates</b> Design considerations for warm humid, hot dry and composite climates.	CO4	10
<b>END SEMESTER EXAMINATION</b>			

### Reference Books

- Koenisberger O. H., Ingersoll T. G., Mayhew A., Szokolay S. V., Manual of Tropical Housing and Building, Orient Blackswan, 1975.
- Givoni B., Man, Climate and Architecture, Elsevier Publishing Company Limited, 1969.
- Olgyay V., Design with Climate, Princeton University Press, 2015.
- Krishan A., et al., Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings, Tata McGraw-Hill Education, 2001.

### Course materials, Guidance and Evaluation methods

- Aspects of climate to be examined in the site study for architectural projects should be emphasised in module 2.
- Students should be made aware of the practical Architectural applications of each topic.



Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ART203	HISTORY OF ARCHITECTURE AND CULTURE - II	3-0-0-0	3	2021

**Course Objectives:** The course tries to understand religious and domestic architecture in India and Europe during the 5<sup>th</sup> to 15<sup>th</sup> century. In Europe, the Architectural vocabulary is studied as it evolved from Gothic to Renaissance. In India, the period of development of a style later known as Hindu architecture in India, and its regional variations are studied. An introduction to the architectural vocabulary of traditional Kerala architecture as it evolved from the climatic and cultural contexts also form part of the course.

**Pre-requisite of the course:** Understanding of historical development of architecture across Asia, Europe and Africa from prehistoric era to 10<sup>th</sup> century. Gothic period, Vedic and Buddhist Architecture studied in the second semester has to be refreshed in memory.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	Study of evolution of European architecture from Gothic to Renaissance	Understanding
CO-2	Study of Hindu temple Architecture in Asia and India	Understanding
CO-3	Study of evolution of domestic and religious architecture in Kerala from the cultural and climatic contexts	Analysing
CO-4	Understanding of elements and materials of Kerala traditional architecture	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and B. Part A contains 5 questions with 1 question from each module, having 4 marks for each question. Students should answer all the questions (5x4= 20 marks). Part B contains 2 questions from each of the 5 modules, of which the student should answer any one. Each question carries 8 marks (Total 5x8=40). Part B questions can have subdivisions.

**Syllabus**

Hindu Architecture, Early Temple form

Indo Aryan temples and Dravidian Temples. Temple towns and complexes.

An introduction to Architecture of Kerala- culture and traditional Architecture- domestic types.

**Course Plan**

Module	Topic	Course outcome	No. of hours
I	Cultural changes that led to Renaissance in Europe- Early, Middle and High Renaissance- Characteristics- Brunelleschi, Michael Angelo- Florence Dome, New St. Peter's church, Rome. Baroque, Rococo, Neo Classical- Definition.	CO1	12
II	Hindu Temple Architecture- Evolution and features. Vocabulary of Hindu temples. Kailasnath Temple at Ellora. Angkorwat temple, Cambodia.	CO2	6
<b>FIRST INTERNAL TEST</b>			
III	Evolution of Hindu temples from Buddhist stupas- Gupta Temple at Sanchi. Essential Features of Dravida and Nagara Temples. Temples at Badami, Aihole, Pattadakal, Virupaksha at Hampi, Belur, Halebid, Ladhkan, Vitthala	CO2	9

IV	Dravidian Temple Architecture- PanchRathas- Shore Temple at Mahabalipuram. Brihadeswara Temple at Tanjore. PanchaPrakara Temple planning- Madurai Meenakshi temple.  Nagara Temple Architecture- Kandara Mahadeo temple at Khajuraho, Lingaraja Temple at Orissa.	CO2	9
<b>SECOND INTERNAL TEST</b>			
V	Vernacular architecture- definition. Influence of culture on vernacular architecture. Agraharams  Introduction to Kerala Architecture- Geographic, climatic, cultural, socio-economic, occupational and religious structure that helped evolution of Kerala architecture.  Evolution of Kerala domestic Architecture. Ekashala to Chaturshala.	CO3, CO4	9
<b>END SEMESTER EXAMINATION</b>			

**Text Books:**

- Sir Banister Fletcher, “A History of Architecture”, CBS Publications (Indian Edition), 1999.
- Percy Brown, ‘Indian Architecture: Buddhist and Hindu Periods’, D. B.Taraporevala,1965
- Satish Grover, ‘The Architecture of India: Buddhist and Hindu’, Vikas, 1980
- Thampuran, Ashalatha. Traditional Architectural Forms of Malabar Coast. India, Vastuvidyapratishthanam Academic Centre, 2001.
- Koduveliparambil, Jacob Joseph. Construction Practices in Traditional Dwellings of Kerala, India. Canada, McGill University Libraries, 1997.
- Chakrabarti, Vibhuti. Indian Architectural Theory: Contemporary Uses of Vastu Vidya. India, Curzon, 1998.
- Oliver, Paul, ed. Encyclopedia of vernacular architecture of the world. Vol. 3. Cambridge: Cambridge University Press, 1997.

**Reference Books**

- Hardy, Adam. The temple architecture of India. United Kingdom, Wiley, 2007.
- Encyclopaedia of Indian Temple Architecture. India, American Institute of Indian Studies, set of 3 volumes.
- Desai, Miki. Wooden Architecture of Kerala. India, Mapin Publishing, 2018.

- Sarkar, H.. An Architectural Survey of Temples of Kerala. India, Archaeological Survey of India, 1978.
- Sarkar, H.. Monuments of Kerala. India, Archaeological Survey of India, 1978.
- Leland M Roth; “Understanding Architecture: Its Elements, History and Meaning”; Craftsman House; 1994
- A TEXT BOOK OF VASTUVIDYA (VASTUVIDYAPRAVESIKA) - by Dr.Balagopal. T.S. Prabhu and Dr. A. Achyuthan.
- Lloyd S. and Muller H.W., “History of World Architecture – Series”, Faber and Faber
- Patrick Nuttgens, “The Story of Architecture FROM ANTIQUITY TO THE PRESENT”, H.F.Ullmann Pub: 1983
- Pier Luigi Nervi, General Editor, “History of World Architecture – Series”, Harry N. Abrams, Inc. Pub., New York, 1972.
- Vincent Scully, “Architecture – The Natural and the Manmade”, Harper Collins Pub: 1991.
- Amos Rapoport: House Form and Culture

#### **Course materials, Guidance and Evaluation methods**

- Books, research papers, e-books, videos etc. to be provided to the students by the faculty and ensure that they read it, by initiating discussions.
- Faculty to act as facilitator and guide rather than one way lecturing.
- Book Reviews are to be part of assignments.
- Students are to be encouraged to watch movies and documentaries which give information about culture and architecture and prepare reviews/ reports and have discussions in class.
- As far as possible the students are to be encouraged to visit the architectural monuments in their vicinity and prepare reports and sketches, regardless of whether they are part of the syllabus.
- At the end of the course, each student has to prepare a short video on any of the topics in the syllabus.
- Each student should be encouraged to have a sketchbook with sketches of all the topics covered.



Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
AET201	THEORY OF STRUCTURES- III	2-1-0-0	3	2021

**Course Objectives:** The goal of this course is to assess the structural response of simple structures subjected to different types of loads. The students will be trained to develop mathematical models of structures and to analyse them using appropriate methods. The course will help the students to enhance their problem-solving skills. Students are introduced to the concept of determinate beams and indeterminate beams as well as to force and displacement methods of analysis. Special cases of structural response analysis of arches and cables are also introduced in this course. After this course, the students will be able to perform the analysis of similar problems in real world situations and respond accordingly.

**Pre-requisite of the course:** Understanding of historical development of architecture across Asia, Europe and Africa from prehistoric era to 10<sup>th</sup> century. Gothic period, Vedic and Buddhist Architecture studied in the second semester has to be refreshed in memory.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO - 1	Compute the slope and deflection of determinate beams using appropriate method	Applying
CO - 2	Explain the concept of static and kinematic indeterminacy and calculate the static and kinematic indeterminacy of structures	Understanding
CO - 3	Recognize the fundamentals of force and displacement methods of analysis	Understanding
CO - 4	Apply specific methods to analyse the structural response of beams and frames without sway subjected to different types of loading	Applying
CO - 5	Apply suitable methods to analyse the structural response of cables and arches.	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Continuous assessment tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and Part B. Part A contain 5 questions from each module, having 4 marks for each question. Students should answer all the questions. Part B contains 2 questions from each module, of which the student should answer any one. Each question can have sub divisions and carries 8 marks.

**Syllabus**

Determinate beams – Slope and Deflection of determinate beams– Conjugate beam method; Moment area method

Indeterminate beams- Static and kinematic Indeterminacy – Force and displacement methods of analysis

Force methods -Consistent deformation method – Analysis of fixed and propped cantilever

Analysis of continuous beams using Three moment theorem - Discussion on Support settlement case

Displacement method – Slope deflection method and Moment distribution method - Analysis of beams and frames without sway

Arches - Analysis of three hinged arches – Parabolic and segmental arches with supports at same level

Cables – General cable theorem – Cables under concentrated load and uniformly distributed load – Anchor cables

**Course Plan**

Module	Topic	Course Outcome	No. of hours
I	Determinate beams – Slope and Deflection of determinate beams only – Conjugate beam method; Moment area method (subjected to concentrated load and full uniformly distributed load only)	CO1	9

<b>II</b>	Indeterminate beams- Static and kinematic Indeterminacy – Force and displacement methods of analysis Force methods -Consistent deformation method – Analysis of fixed and propped cantilever (subjected to single concentrated load and full uniformly distributed load only) Analysis of continuous beams using Three moment theorem - Discussion on Support settlement case (Derivation not required)	CO2 CO3	10
<b>FIRST INTERNAL TEST</b>			
<b>III</b>	Displacement method – Slope deflection method- Analysis of beams and frames without sway (subjected to single concentrated load and full uniformly distributed load only) - Settlement case not required	CO4	9
<b>IV</b>	Displacement method – Moment distribution method- Analysis of beams and frames without sway (subjected to single concentrated load and full uniformly distributed load only) - Settlement case not required	CO4	9
<b>SECOND INTERNAL TEST</b>			
<b>V</b>	Arches - Analysis of three hinged arches – Parabolic and segmental arches with supports at same level only Cables – General cable theorem – Cables under concentrated load and uniformly distributed load – Anchor cables	CO5	8
<b>END SEMESTER EXAMINATION</b>			

### Text Books

- Junnarkar S. B. and H. J. Shah, Mechanics of Structures, Vol – II, Charotar Publishing House Pvt. Ltd., 2017.
- Punmia B. C., A. K. Jain and A. K Jain, Theory of Structures (SMTS- II), Laxmi Publications Pvt. Ltd., 2017.
- Ramamrutham S. and R. Narayan, Theory of Structures, Dhanpat Rai Publishing Company Ltd., 2020
- H. J. Shah, and Junnarkar S. B., Mechanics of Structures (Vol. I), 30/e, Charotar Publishing House Pvt. Ltd., New Delhi, 2017
- M.M. Ratwani, S. K. Duggal & V.N. Vazirani, Analysis of Structures, Vol. 1, Khanna Publishers – Delhi, 1987

**References Books:**

- Devdas Menon, Structural analysis, Alpha Science International Ltd
- Timoshenko, S.P. and D.H. Young, Elements of Strength of Materials, Fifth edition, East West Press, 1993.
- A.R. Jain and B.K.Jain, Theory and analysis of structures, Vol. 1, Nemchand and Bros, Roorkee, 1987.
- R.K. Rajput “Strength of Materials”, S.Chand & Company Ltd., New Delhi 1996

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Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
AET203	<b>BUILDING SERVICES I- (WATER SUPPLY, PLUMBING AND SANITATION)</b>	2-0-1-0	3	2021

**Course objectives:** The course is to develop an understanding of fundamentals of water supply, wastewater management and solid waste management in buildings.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	To identify and evaluate the basic elements of water supply	Understanding, Analyzing and evaluating
CO2	To analyse the various stages of water supply within buildings	Understanding and Analyzing
CO3	To acquire the ability to apply basic principles of sanitation in buildings and carryout documentation	Understand and Applying
CO4	To understand the various elements of wastewater transport and treatment and to design treatment unit for isolated buildings	Understand, Analyzing and Applying
CO5	To appreciate the importance of solid waste management in houses and suggest suitable solution	Understand and Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Continuous assessment tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and Part B. Part A contain 5 questions from each module, having 4 marks for each question. Students should answer all the questions. Part B contains 2 questions from each module, of which the student should answer any one. Each question can have sub divisions and carry 8 marks.

**Syllabus**

Introduction to water sources – water demand and factors affecting demand – characteristics - water supply – building sanitation – wastewater management – sewage and sewage treatment – plumbing systems – layout and documentation – solid waste management

**Course plan**

Module	Contents	Course outcome	No. of Hours
I	<p><b>Water</b></p> <p>Sources of water / hydrological cycle – Per capita demand –Types of water demand and factors effecting demand and consumption – population forecasting – Drinking water standards – physical and chemical characteristics of water, Flowchart of a centralized water treatment system (brief description only) -Water supply systems (Gravitational, pumping, combined) - Water distribution networks</p>	CO1	10
II	<p><b>Water supply in buildings</b></p> <p>House/service connection, upfeed and downfeed systems, capacity of over head tanks and calculation of water consumption. Domestic water piping systems: Cold and hot water distribution within the building.</p> <p>Plumbing fittings - valves, taps and other fittings for water supply and conveyance</p>	CO2	10
<b>FIRST INTERNAL EXAMINATION</b>			

III	<p><b>Wastewater and wastewater treatment</b></p> <p>Wastewater characteristics - Sanitation: Basic principles of sanitation from buildings – Plumbing systems in buildings (4 types) – Sanitary fittings – Wash basin, bath tub, water closets etc. – Types of traps</p> <p>Design of sanitary plumbing system – General principles, design considerations, Model bye laws regarding sanitation of buildings - Preliminary data for design in individual buildings, plumbing layout in residential - documentation</p>	CO3	10
IV	<p><b>Sewers and wastewater treatment system</b></p> <p>Disposal of sewage from isolated buildings (septic tank, soak pit ), Design of septic tank and soak pit</p> <p>Sewers and types of sewers - sewer systems (separate, combined, partially combined) –Self cleaning velocity - Sewer appurtenances: Manholes, Sub drains, culverts, ditches and gutters, drop inlets and catch basins, storm overflow/regulators. Flowchart of a centralised waste water treatment system (brief description only)</p>	CO4	10
<b>SECOND INTERNAL EXAMINATION</b>			
V	<p><b>Solid waste management</b></p> <p>Solid waste management – Source based classification of solid waste – factors affecting generation – 3R concept – Decentralised solid waste management systems - Composting, Vermicomposting, Bio gas systems.</p>	CO5	5
<b>END SEMESTER EXAMINATION</b>			

**Text Books:**

- B.C Punmia, “Water Supply Engineering”, Laxmi Publications Pvt. Ltd., 2016
- B.C Punmia , “Waste Water Engineering”, Laxmi Publications Pvt. Ltd, 2012
- S.K.Garg, “Water Supply Engineering”, Khanna Publishers. 2010
- S.K. Garg., Environmental Engineering, Vol. II, Khanna Publications, New Delhi, 2009.
- P.N. Modi, Sewage Treatment and Disposal and Wastewater Engineering, Standard Book House, New Delhi, 2008
- George Tchobanoglous, Frank Kreith et al “Hand book of solid waste

management.” Mc Graw hill publications –New York

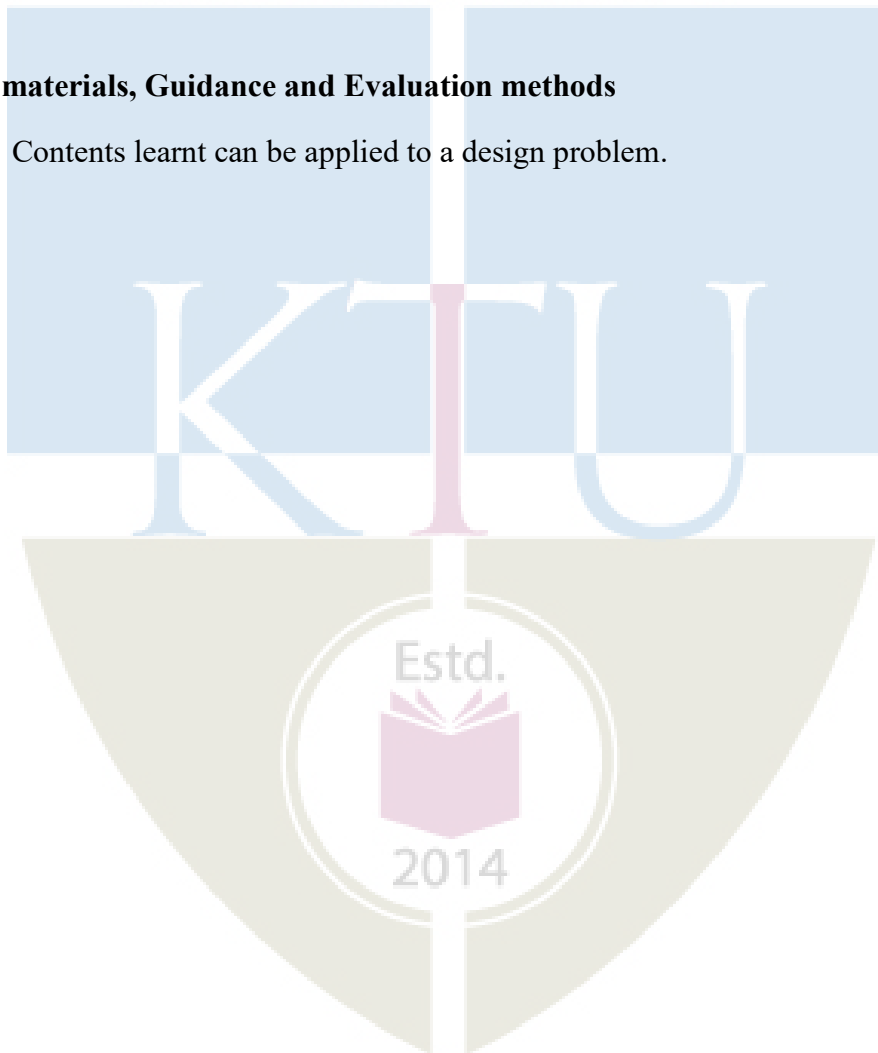
- Relevant BIS Codes, CPHEEO Manuals, KMBR, National Building Code

### Reference Books

- Metcalf and Eddy, Wastewater Engineering Treatment, Disposal and Reuse, Tata McGraw Hill, 2007.
- G. Kiely., Environmental Engineering, McGraw Hill, McGraw Hill, 2009.
- Mark J. Hammer and Mark J. Hammer Jr., Water and Waste Water Technology, Prentice Hall of India Pvt. Ltd. New Delhi, 2009.

### Course materials, Guidance and Evaluation methods

- Contents learnt can be applied to a design problem.





Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ARD201	ARCHITECTURAL DESIGN - II	0-0-8-2	10	2021

**Course Objectives:** To study about the spatial relationships and organization, form and space in the built environment. By the end of the course students should develop a sense of structure and enclosure along with application of concept like accessibility for differently abled and elderly in design of built environment. To enable students to understand the processes involved in the transformation of space into place as well as to involve students in design process through analysis of factors like context, site, environmental conditions.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	To get a basic understanding of standards, concepts in design of built environment and get familiarized with individual activity space, group activity space.	Understanding
CO-2	Application of knowledge to initiate architectural design process by using space standards and environmental aspects to formulate concepts and design.	Applying
CO-3	Analysis and inference through data collection, case studies of projects related to the design project and developing skills so as to create a design programme	Analysing and evaluating
CO-4	To involve students in a design project that includes design of a built space integrating site planning aspects, needs of differently abled and elderly and also climate responsive elements.	Creating

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester Jury examination marks	End semester Jury examination duration
100	50	50	2-3 days

**Continuous internal evaluation pattern:**

Attendance : 5 Marks

Design Assignments/Reviews/Tests/CAD Assignments : 45 Marks

**Syllabus:**

To understand the needs of the elderly and differently-abled, and to design accessible built environment. Study of accessibility needs in context of built environment for diverse user typologies, Design of a public building and outdoor space based on the consideration of the context. Integration of climate factors and site planning into design. Introduction to 2D drafting in CAD software. Development of design programme and concept development and detail drawings

**Course Plan:**

Module	Topic	Course outcome	No. of hours
I	<p><b>Concept of Universal Design for the Built Environment</b></p> <p>Study of Accessibility needs in context of built environment for diverse user typologies, anthropometric and spatial allowances for differently abled.</p> <p>Exercises relating to detailing of ramps, steps, handrails, circulation spaces etc for elderly and differently abled.</p>	CO-1, CO-2	30
II	<p><b>Introduction to 2D drafting in CAD software</b></p> <p>Computer aided design tools, drawing lines and shapes, modifying lines and shapes, text styles and sizes, hatches and dashed lines. Stencils and blocks, advanced editing tools, and dimensioning drawings. Drawings of plans, sections of simple single unit room using CAD tools.</p>	CO-1	30

<b>FIRST INTERNAL TEST</b>			
<b>III</b>	<p><b>Application of Universal design</b></p> <p>Design and detailing of a built space based on an understanding of factors (contextual) influencing the design of built environment. Needs of differently abled and elderly to be incorporated in design and detailing.</p> <p><i>Scale/Complexity:</i> Projects involving multi-room, single use, single floor and small span projects</p> <p><i>Typology/Project:</i> Clinic, art gallery, crèche, cafeteria, cottage etc</p>	<p>CO-1, CO-2, CO-3, CO-4</p>	30
<b>IV</b>	<p><b>Integration of climate factors and site planning into design:</b></p> <p>Introduction to site planning. Interpretation of site information as a decision making aid and to design the buildings suitable to climatic conditions</p> <p>Design of a public building and outdoor space based on the consideration of the context. Understanding usage of locally available materials and appropriate construction techniques, in addition to thermal comfort, circulation pattern, furniture arrangement, texture, colour etc. in the built environment.</p> <p><i>Scale/Complexity:</i> Multi use, multifloor, multifunctional spaces with interconnection between spaces, etc.</p> <p><i>Typology/Project:</i> Nursery school, Health club, Restaurant, library, bank, post office, etc- emphasizing on site planning, spatial relationships and organization</p>	<p>CO-2, CO-3, CO-4</p>	30
<b>SECOND INTERNAL TEST</b>			
<b>V</b>	<p>Use of standards, handling of space, and application of knowledge gained from other subjects related to design. Study &amp; analysis of various user types &amp; their activities in public buildings. Development of design programme; Concept &amp; detailed design drawings</p>	<p>CO-2, CO-3, CO-4</p>	30
<b>END SEMESTER EXAMINATION/ JURY</b>			

## Reference Books

- Arthur L. Guptill and Susan E. Meyer, 'Rendering in Pen and Ink', Watson-Guptill, 1997
- Francis D. K. Ching, 'Architectural Graphics', Wiley, 2009.
- Francis D. K. Ching, 'Architecture: Form, Space and Order', John Wiley & Sons, 2007.
- Geoffrey Broadbent 'Design in Architecture' John Wiley and Sons, 1973.
- Neuferts' Architect's Data
- Simon Unwin, 'Analysing Architecture', Routledge, 2003
- Prak, N. L, 'The Language of Architecture: A contribution to architectural theory'. Hague: Mouton & Co, 1968.
- 'Harmonised Guidelines and Space Standards for Barrier-Free Built Environment for persons with Disability and Elderly Persons' 2016, Ministry of Urban Development, Government of India
- Preiser, W. 'Towards universal design evaluation. New York', McGraw-Hill, 2001.
- Seidle, J. 'Barrier-free design.' 1st Ed. New York : Routledge, 1996.
- Story, M. F., Mueller, J. L. and Mace, R. L 'The universal design file: Designing for people of all ages and abilities, North Carolina State University Press, 1998.
- Aouad.G, 'Computer Aided Design Guide for Architecture, Engineering and Construction', Taylor & Francis Publication, 2011

Estd.



2014

Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ARS201	<b>BUILDING MATERIALS AND CONSTRUCTION TECHNIQUES III</b>	1-0-0-2	3	2021

**Course objectives :**

The goal of this course is to expose the students to elementary building materials and their applications. It aims to familiarize students to contemporary as well as vernacular and traditional building materials. It will also introduce students to prevailing & relevant BIS specifications. After this course, the students will be able to recognize materials in the market and use them in their design visualization.

**Course Outcomes:**

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Identify the relevant BIS specifications.	Remembering
CO2	Identify appropriate foundations for various construction needs.	Understanding
CO3	Work with various building materials in the construction yard and understand their behaviour.	Applying
CO4	Use the various building materials in their design processes appropriately	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	50	50	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 5 Marks
Continuous assessment tests (2 nos.)	:15 Marks
Portfolio presentation (15) / drawings(15)	: 30 Marks

**End semester examination pattern:**

There will be three parts; Part A, B and C. Part A will contain 5 questions with 1 question from each module, having 3 marks for each question. Students should answer all the questions. Part B will contain 2 questions from each module, of which the student should answer any one. Each question carries 4 marks. Part C will have two drawing questions, from any two different drawing-based modules, of which the student should answer any one. The question carries 15 marks.

**Syllabus**

Foundations: General- Types of foundations. Soil- Bearing capacity of soil. Shallow Foundations: Types of shallow foundations. Deep foundations: Types of pile foundations-Caissons. Iron: Different forms of Iron- its uses in building constructions- Steel: properties-types of steels-its uses in construction. Aluminium: its uses in building constructions. Market forms of steel and aluminium. Door&Windows: Doors- Types of Doors. Windows- Types of windows.

**Course plan**

Module	Topic	Course outcome	No. of hours
I	<p><b>FOUNDATIONS: GENERAL</b> Introduction to Foundations – definition, function, types – selection criteria – bearing capacity of soil – methods of testing – settlement of foundations, excavation and timbering of foundation trenches, setting out foundation trenches. Various types of foundations – Wall Footing, Isolated Footing, Causes of failure of foundation and remedial use. <i>Exercise: Sketches of various types of foundations &amp; site visit</i></p>	CO1,CO2, CO3,CO4	9
II	<p><b>SHALLOW FOUNDATIONS</b> Depth of footings, strip footing, isolated footing or pad footing, eccentrically loaded footings, grillage foundations, combined footings, strap or cantilevered footing, raft foundations, foundations for black cotton soil, Footings at different levels: stepped footings. Adjacent footings, machine foundations. <i>Exercise: Drawings of various types of foundations &amp; site visit</i></p>	CO1,CO2, CO3,CO4	9
<b>FIRST INTERNAL TEST</b>			
III	<p><b>DEEP FOUNDATION</b> Pile foundation: Bearing piles, friction piles – concrete, timber,</p>	CO1,CO2, CO3,CO4	9

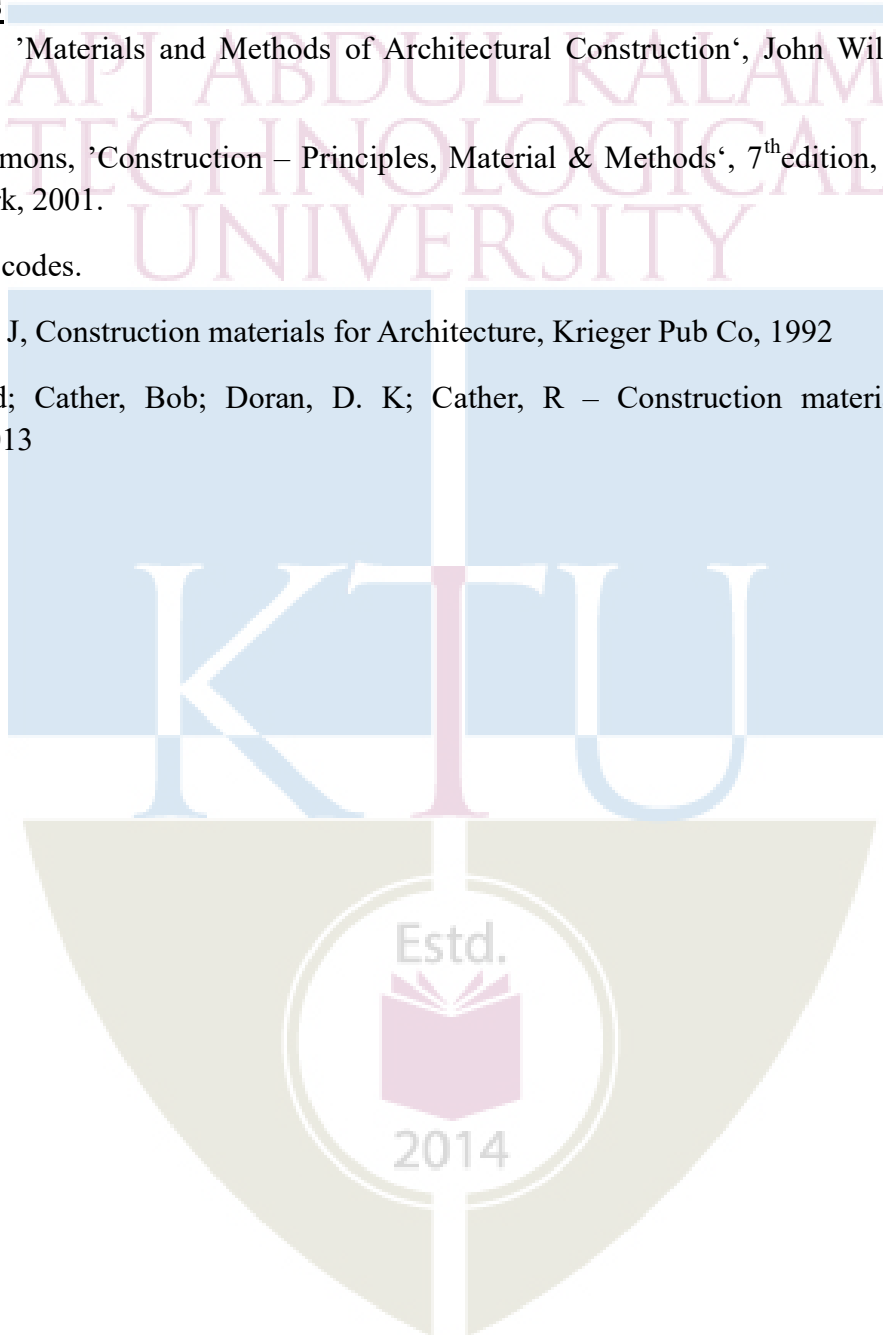
Module	Topic	Course outcome	No. of hours
	<p>steel and composite piles. Cased and uncased cast in situ concrete piles, Bored piles, pressure piles and precast concrete piles. Screw piles &amp; disk piles. Under reamed piles. Bored compaction piles. Sand piles. Sheet piles. Pile cap.</p> <p>Caissons: Box caissons, Open caissons &amp; pneumatic caissons, Timbering and trenching of foundations</p> <p><i>Exercise: Drawings of various types of Pile foundations. Site visits and case study of deep foundation constructions shall be done.</i></p>		
IV	<p><b>IRON, STEEL, ALUMINIUM</b></p> <p>Iron: Forms of Iron used for building construction–Properties and uses - Cast iron, Wrought iron.</p> <p>Steel: Properties, uses, Anti corrosive measures, mechanical and heat treatment of steel, Forms of steel used for building construction: steel for reinforcement-Hot rolled bars, Cold rolled steel, TMT bars, Welded wire fabrics. Structural Steel, Stainless steel, Steel alloys, current developments.</p> <p>Aluminium in building construction: Properties, Advantages, Available Forms-</p> <p>Extrusion, casting, foil, powder &amp; sheet - uses- finishes - anodizing, surface texture, colour coating &amp; painting.</p> <p>Applications in buildings</p> <p><i>Exercise: study of standard aluminium &amp; steel products and profiles used for building construction.</i></p>	CO1,CO2, CO3,CO4	9
<b>SECOND INTERNAL TEST</b>			
V	<p><b>DOORS&amp;WINDOWS</b></p> <p>Door: Different types of doors and uses. Wooden doors, PVC doors, glass doors,</p> <p>Steel doors Solid doors, Flush doors, revolving doors, folding doors, sliding doors, swinging doors, collapsible doors.</p> <p>Windows: Aluminium, Steel &amp; UPVC windows - French windows, bay windows - fixed, casement, sliding &amp; pivoting windows</p> <p><i>Drawings: Joinery details, Panelled door, battened door; glazed door, sliding door, folding door Aluminium and steel window.</i></p>	CO1,CO2, CO3,CO4	9
<b>END SEMESTER EXAMINATION</b>			

**Text Book**

- P.C. Varghese, 'Building Materials', Prentice hall of India Pvt Ltd, New Delhi, 2005
- Dr.B.C Punmia , Building Construction.

**Reference Books**

- Harry Parker, 'Materials and Methods of Architectural Construction', John Wiley & Sons Canada, 1958.
- H Leslie Simmons, 'Construction – Principles, Material & Methods', 7<sup>th</sup> edition, John Wiley & Sons Inc., New York, 2001.
- Relevant BIS codes.
- Rosen Harold J, Construction materials for Architecture, Krieger Pub Co, 1992
- Doran, David; Cather, Bob; Doran, D. K; Cather, R – Construction materials reference book, Routledge, 2013





Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
AEL201	SURVEYING AND LEVELLING	1-0-0-1	2	2021

**Course objectives :** To understand various techniques of site surveying.

To learn the importance of site and its content in Building and Infrastructure Design

To bring about awareness of the role of surveying and levelling in architectural and planning projects..

To develop skills using surveying instruments including tapes, compass, levels, theodolites, and advanced measurement equipment such as total stations.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Describe the importance, objectives and principles of surveying and determination of area using chain/tape	Understanding and applying
CO2	Discuss the fundamental aspects of theodolite and compass survey and apply various triangulation techniques in surveying	Understanding and applying
CO3	Apply the principles of levelling to find the level difference between points in the field	Applying and analysing
CO4	Use of Plane Table as an instrument involved in surveying with respect to utility and precision.	Understanding and applying
CO5	Know the use of modern equipments like GPS, EDM, Total station in surveying and area calculations	Understanding and applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks
100	100

**Continuous internal evaluation pattern:**

Attendance : 10 marks

Presentation/Demonstration (course work including tests) : 40 marks

- Internal tests (2 no.s) : 20 marks
- Assignments/ practicals:20 marks

Marks for record/ report

: 25 marks

B.Arch 2021 Regulations

Final test & Viva

: 25 marks

- Final test :20 marks
- Viva :5 marks

### Syllabus

Introduction to surveying and relevance of surveying in architecture. Introduction to chain surveying. Compass survey and computation of bearings and angles. Introduction to theodolite surveying. Measurement of horizontal and vertical angle using theodolite. Principles of levelling and reduction of levels. Introduction to plane table survey. Different methods used for calculation of area. Introduction to modern surveying equipments.

### Course plan

Module	Contents	Course Outcomes	No. of hours
I	<p>Introduction: Importance and principles of Surveying.</p> <p><b>Chain Surveying:</b>Types of chains and tapes, chaining and ranging, method of taking offsets. Chaining on sloping ground. Errors in chaining.</p> <p><b>Calculation of area:</b> General methods of determining areas-by dividing the area into triangles. By offsets to base lines-average ordinate rule, trapezoidal rule and Simpsons rule</p> <p><b>Practical: Computation of area using chain surveying</b></p>	CO1	7
II	<p><b>Compass Surveying:</b> Bearings and angles, computation of angles from bearings, designation of bearings.</p> <p><b>Theodolite Surveying:</b> Theodolite, its temporary and permanent adjustment, measurement of horizontal &amp; vertical angles.</p> <p><b>Practical: Computation of height of a building using Theodolite</b></p>	CO2	6
<b>FIRST INTERNAL EXAM (THEORY BASED)</b>			
III	<p><b>Levelling:</b> Principles of leveling; Study of instruments – Dumpy level and leveling staff, Temporary and permanent adjustments of level, Booking and reduction of levels – ‘line of collimation method’ and ‘rise and fall method’. Basic ideas on plotting of longitudinal and cross sections</p> <p><b>Practical: Determination of elevation of points on ground by differential levelling</b></p>	CO3	7

<b>IV</b>	<p><b>Contouring:</b> Contour interval, Contour Maps characteristics, use and interpretation.</p> <p><b>Plane Table surveying</b> – instruments and accessories, advantages and disadvantages of plane table surveying. methods – radiation, intersection, traversing, resection.</p> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>● <b>Determination of elevation of points on ground by differential contouring</b></li> <li>● <b>Plane table survey using radiation and intersection method</b></li> </ul>	CO4	5
<b>SECOND INTERNAL EXAM (PRACTICAL BASED)</b>			
<b>V</b>	<p><b>Introduction to modern surveying equipments:</b> Total Station, GPS, Distomat, Digital Levels and Auto-Levels</p> <p>Electromagnetic distance measurement (EDM) - Principle of EDM</p> <p><b>Total Station</b> – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey.</p> <p><b>Practical: Computation of height, distance and area using Total Station</b></p>	CO5	5
<b>FINAL TEST (THEORY BASED) AND VIVA</b>			

**Text Books**

- Punmia, B. C., Jain and Jain, A. K., Surveying (Vol. I and II), Laxmi Publications (P) Ltd., New Delhi, 16th Edition, 2016.
- Edward. T. Q. Site Analysis – Architectural Media, 1983
- John Ormsbee Simonds, Landscape Architecture, Fourth Edition: A Manual of Land Planning and Design
- Joseph De.Chiarra and Lee Coppleman - Planning Design Criteria - Van Nostrand
- Kanetkar and Kulkarni, 'Surveying and Levelling', Vol I, Pune VidyarthiGriha, 2008.

**Reference Books:**

- Duggal, S. K., Surveying (Vol. I and II), Tata Mc Graw Hill, 2015.
- N. Madhu, R. Sathikumar, SatheeshGopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India Publishers 2006
- Shahani P.B., 'Surveying and Levelling', Vol I and Vol II, Oxford and IBH Publishing Company, 1971.

APJ ABDUL KALAM  
TECHNOLOGICAL  
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**SEMESTER IV**

KTU



Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ART202	CLIMATE AND BUILT FORM II	2-0-0-2	4	2021

**Course Objectives:** To introduce students to climate responsive architecture and enable them to apply climate responsive design strategies in the design of built environment.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	Apply climate responsive design strategies in the design of shelters for tropical climates	Applying
CO-2	Experiment with the factors affecting ventilation and daylighting	Applying
CO-3	Analyse the climate responsive design strategies used in the existing buildings of tropical climates	Analysing
CO-4	Summarise the need for energy simulation in architecture	Understanding

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and B. Part A contains 5 questions with 1 question from each module, having 4 marks for each question. Students should answer all the questions (5x4= 20 marks). Part B contains 2 questions from each of the 5 modules, of which the student should answer any one. Each question carries 8 marks (Total 5x8=40). Part B questions can have subdivisions.

**Syllabus**

Sun and design process, Ventilation and air movement, Daylighting, Application of climate responsive design – examples, Energy modelling.

**Course Plan**

<b>Module</b>	<b>Topic</b>	<b>Course Outcome</b>	<b>No. of Hours</b>
<b>I</b>	<p><b>Sun and design process</b></p> <p>Solar geometry – sun path at different latitudes, Solar angles – altitude and azimuth angles, Solar chart, Designing for the sun – orientation, planning of the rooms</p> <p>Shading – types of shading devices, Shadow angles and design process of shading devices</p>	CO1	11
<b>II</b>	<p><b>Ventilation and air movement</b></p> <p>Ventilation and air movement, Functions of ventilation</p> <p>Wind and ventilation – factors affecting ventilation, Stack effect and ventilation, Induced ventilation – sun induced and wind induced ventilation</p> <p><b>Exercises (Lab):</b></p> <p>1. Measurement of wind velocity and wind direction – study on the factors affecting ventilation in indoor spaces</p>	CO2	16
<b>FIRST INTERNAL TEST</b>			
<b>III</b>	<p><b>Daylighting</b></p> <p>Photometric quantities, Components of daylight entering a building</p> <p>Daylight factor and design sky concepts</p> <p>Daylighting in tropical climates – warm humid and hot dry climates</p> <p><b>Exercises (Lab):</b></p> <p>1. Measurement of indoor illumination – study on the effects of opening positions and sizes, effects of shading devices</p>	CO2	16
<b>IV</b>	<p><b>Application of climate responsive design - examples</b></p> <p>Climate response in vernacular buildings – examples from tropical climates.</p>	CO3	11

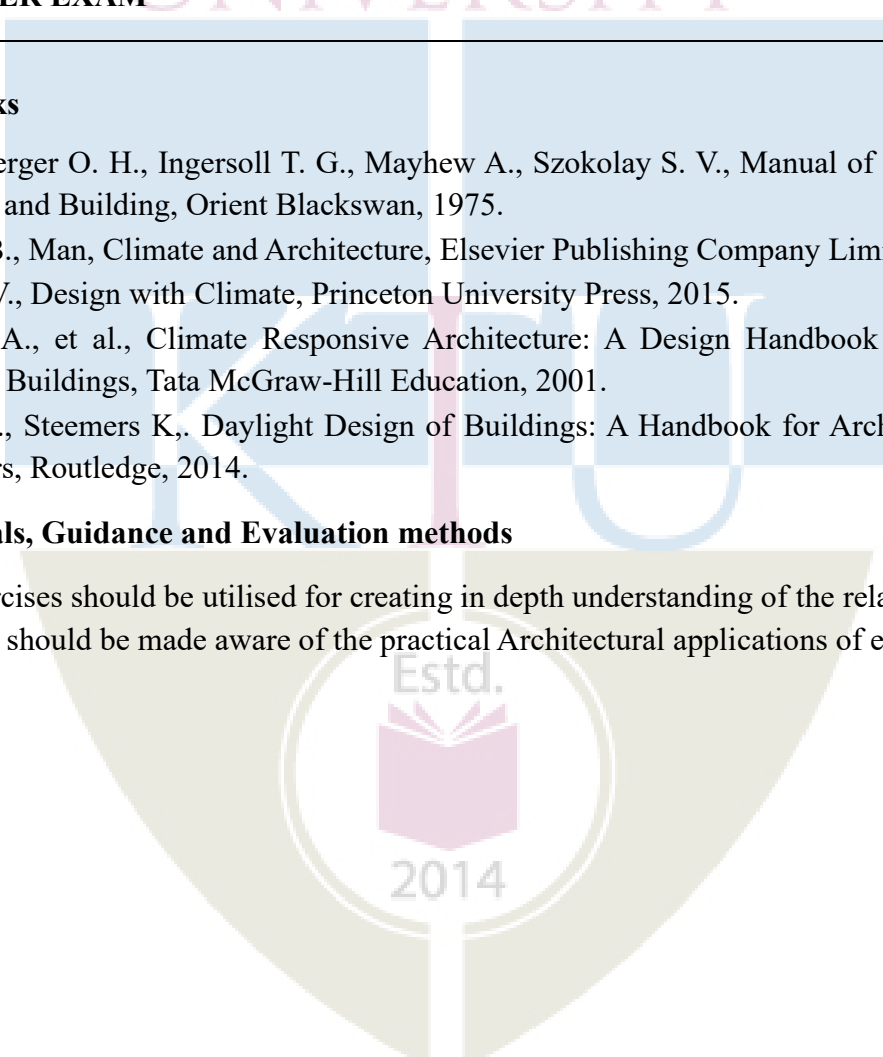
	Climate response in the vernacular architecture of Kerala. Case studies of climate responsive modern buildings from tropical climates		
<b>SECOND INTERNAL TEST</b>			
V	<b>Energy Modeling</b> Introduction to energy modeling. Advantages. Brief introduction to commonly used energy modelling softwares.	CO4	6
<b>END SEMESTER EXAM</b>			

### Reference Books

- Koenisberger O. H., Ingersoll T. G., Mayhew A., Szokolay S. V., Manual of Tropical Housing and Building, Orient Blackswan, 1975.
- Givoni B., Man, Climate and Architecture, Elsevier Publishing Company Limited, 1969.
- Olgyay V., Design with Climate, Princeton University Press, 2015.
- Krishan A., et al., Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings, Tata McGraw-Hill Education, 2001.
- Baker N., Steemers K., Daylight Design of Buildings: A Handbook for Architects and Engineers, Routledge, 2014.

### Course materials, Guidance and Evaluation methods

- Lab exercises should be utilised for creating in depth understanding of the related topics.
- Students should be made aware of the practical Architectural applications of each topic.



Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ART204	HISTORY OF ARCHITECTURE AND CULTURE- III	3-0-0-0	3	2021

**Course Objectives:** The course traces the development of architecture across Asia, Europe and Africa during 10<sup>th</sup> to 19<sup>th</sup> centuries. Architectural development is to be understood as an outcome of socio-political, economic and religious influences. Focus is given to Islamic Architecture, Mughal Architecture and provincial variations of Islamic architecture in India. Special reference is to be given to important religious and secular architecture in Kerala, and the architectural elements of Traditional Kerala buildings.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	Islamic architecture and its features, typologies	Understanding
CO-2	Important Islamic buildings in India and provincial variations	Analysing
CO-3	Mughal Architecture in India	Understanding
CO-4	Religious Architecture in Kerala	Understanding
CO-5	Secular and traditional Architectural elements of Kerala	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and B. Part A contains 5 questions with 1 question from each module, having 4 marks for each question. Students should answer all the questions (5x4= 20



marks). Part B contains 2 questions from each of the 5 modules, of which the student should answer any one. Each question carries 8 marks (Total 5x8=40). Part B questions can have subdivisions.

## Syllabus

Pre Islamic Architecture of Persia and Iran, Islamic Architecture in India and abroad, Imperial Style, Oriental Architecture, Mughal Architecture, Regional styles, Religious and Secular Architecture in Kerala, Elements of traditional Kerala Architecture

## Course Plan

Module	Topic	Course outcome	No. of hours
I	Rise of Islam in Arabia- Structure of typical mosque- Ummayyad Mosque, Damascus- Great Mosque of Cordoba. Muqaranas, Madrasas. Palace of Alhambra. Ottoman Architecture- Topkapi palace.	CO1	6
II	Islam in India- Salient features of Mosques- QutbMinar. Quwwat-ul-Islam mosque complex. Architectural developments during Imperial Era- Alai Darwaza- Tomb of Tughlaq. Khirki Masjid- Sheesh Gumbaz- Purana Kila  Provincial styles- Gujarat, Bengal, Bijapur and Hyderabad with significant examples. Stepwells- vav typology.	CO2	12
<b>FIRST INTERNAL TEST</b>			
III	Mughal Architecture- Humayun's Tomb, BulandDarwaza, Fatehpur Sikhri- layout and buildings, Taj Mahal, Red Fort- planning and design. Mughal landscape with special reference to Shalimar Bagh.	CO3	9
IV	Religious architecture of Kerala- Vadakkunnathan temple, Sree Padmanabhaswamy temple. Indigenous church Architecture of Kerala -St Mary's Orthodox church, Kalloppaara, Basilica of St. Mary, Champakkulam, Our Lady of Life, Mattanchery, Synagogue in Mattanchery, Juma Masjid at Thazhathangady, Cheraman mosque.	CO4	9
<b>SECOND INTERNAL TEST</b>			
V	Secular- Padmanabhapuram Palace, Krishnapuram palace.  Cultural- Koothambalam at Vadakkunnathan Temple complex.  Documentation and drawing of features of traditional Kerala architecture- roof forms, joinery- study of proportions, materials and landscape in traditional Kerala architecture as observed during	CO5	9

	documentation.		
<b>END SEMESTER EXAM</b>			

**Text Books:**

- A Global History of Architecture/ Francis. D. K. Ching, Mark Jarzombek, Vikramaditya Prakash. Published by John Wiley and sons, Third edition 2017
- A History of Architecture: Settings and Rituals/ Spiro Kostoff. Revisions by Greg Castillo. Published by Oxford University Press, 1985, 1995
- Sir Banister Fletcher, “A History of Architecture”, CBS Publications (Indian Edition), 1999.
- Brown, Percy. (1975). Indian architecture (Islamic period). Bombay : D.B. Taraporevala
- Shokoohy, Mehrdad. 2013. Muslim Architecture of South India: The Sultanate of Ma'bar and the Traditions of Maritime Settlers on the Malabar and Coromandel Coasts (Tamil Nadu, Kerala and Goa). London and New York: Routledge.
- Thampuran, Ashalatha. 2001. Traditional Architectural forms of Malabar Coast. Calicut: Vastuvidyapratisthanam Academic Centre.
- Zeiphudin, P.A; and Krishnakumar, K.G. 2012. Ponnanni Ponvahini Ponnayam. Journal of Kerala Local Historians, 1: 1-30.

**Course materials, Guidance and Evaluation methods**

- Books, research papers, e-books, videos etc. to be provided to the students by the faculty and ensure that they read it, by initiating discussions.
- Faculty to act as facilitator and guide rather than one way lecturing.
- Book Reviews are to be part of assignments.
- Students are to be encouraged to watch movies and documentaries which give information about culture and architecture and prepare reviews/ reports and have discussions in class.
- As far as possible the students are to be encouraged to visit the architectural monuments in their vicinity and prepare reports and sketches, regardless of whether they are part of the syllabus.
- At the end of the course, each student has to prepare a short video on any of the topics in the syllabus.
- Each student should be encouraged to have a sketchbook with sketches of all the topics covered.

Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
AET202	THEORY OF STRUCTURES-IV	2-1-0-0	3	2021

**Course Objectives:** This course provides fundamental concept of reinforced concrete and its design. It enables the students to design and detail reinforced concrete structural elements such as beam, slab, column, and footing. The course also trains the students to use the code of practice of reinforced concrete design, IS 456: 2000.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO - 1	Comprehend the design philosophy of Limit state method.	Understanding
CO - 2	Recall the structural behaviour of elements subjected to flexure and compression	Remembering
CO - 3	Analyse the reinforced concrete elements such as beam, slab, column and footing subjected to dead and live loads to determine BM, SF, AF, and deflection	Applying
CO - 4	Applying the principles of limit state method to design the reinforced concrete elements such as beam, slab, column and footing subjected to dead and live loads following IS 456 and SP 16.	Applying
CO - 5	Preparation of structural drawings of the designed reinforced concrete elements such as beam, slab, column and footing following SP 34	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and Part B. Part A contain 5 questions from each module, having 4 marks for each question. Students should answer all the questions. Part B contains 2 questions from each module, of which the student should answer any one. Each question can have sub divisions and carry 8 marks.

**Syllabus**

Introduction to plain and reinforced concrete – Design loads and load combinations - Design philosophy of Limit state method – Limit state of collapse and Limit state of serviceability - Analysis and design of singly and doubly reinforced beams by limit state method, Check for deflection. Detailing - Concept of T-Beams and L – beams.

Slabs – Classification- Load distribution and structural action of one way and two way slabs - Design of One Way slab – Detailing - Design of two way slab with corners free to lift up and corners held down condition - Detailing

Columns - Classification- Effective length - Limit state of collapse: Compression - Design of short column subjected to axial loads. Detailing - Column interaction curves. Design of short columns subjected to combined axial load and uniaxial bending [ Using SP 16 Charts]. Detailing

Footings-Types of footings. Design of isolated footings of Square and Rectangular shapes subjected to axial compressive loads- Detailing Stair case – Structural action of stairs spanning longitudinally and transversely (Concept only)

**Course Plan**

Module	Topic	Course Outcome	No. of hours
I	Introduction- Plain and reinforced cement concrete – Design loads and load combinations - Design philosophy of Limit state method – Limit state of collapse and Limit state of serviceability - Analysis and design of singly reinforced beams by limit state method, Check for deflection. Detailing	CO1 CO2 CO3 CO4 CO5	10
II	Analysis and Design of Doubly reinforced beams by limit state method- Check for deflection - detailing T-Beams and L - beams (Concept only)	CO2 CO3 CO4 CO5	9
<b>FIRST INTERNAL TEST</b>			
III	Slabs – Classification- Load distribution and structural action of one way and two way slabs - Design of One Way slab – Detailing Design of two way slab with corners free to lift up and corners held down condition - Detailing	CO2 CO3 CO4 CO5	9

IV	Columns - Classification- Effective length Limit state of collapse: Compression Design of short column subjected to axial loads. Detailing Column interaction curves. Design of short columns subjected to combined axial load and uniaxial bending [ Using SP 16 Charts]. Detailing	CO2 CO3 CO4 CO5	8
<b>SECOND INTERNAL TEST</b>			
V	Footings-Types of footings. Design of isolated footings- Square and Rectangular shapes only - Subjected to Axial compressive loads alone.- Detailing Stair case – Structural action of stairs spanning longitudinally and transversely (Concept only)	CO2 CO3 CO4 CO5	9
<b>END SEMESTER EXAM</b>			

**Text Books:**

- Unnikrishnan Pillai and Devadas Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1999
- M. L. Gambhir, Fundamentals of reinforced concrete design, Prentice Hall India Learning Private Limited, 2006
- M. L. Gambhir, Design of reinforced concrete structures, Prentice Hall India Learning Private Limited, 2008

**References Books:**

- R. Park and T. Paulay, Reinforced concrete structures, Wiley, 1975
- P. C. Varghese, Limit state design of reinforced concrete, Prentice Hall India Learning Private Limited, 2008
- S.N. Sinha, Reinforced Concrete Design – Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1998.
- P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford and IBH Publishing Co., 1983.
- C. Sinha and S.K. Roy, Fundamentals of Reinforced Concrete, S.Chand & Co., New Delhi, 1983.
- B.C. Punmia, Reinforced Concrete Structures, Vol, 1 & 2 Laxmi publications, Delhi, 1994.

**Standards:**

- IS 456:2000, Indian Standard, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards.
- SP -16 Design Aids for reinforced concrete to IS 456, Code of Practice, Bureau of Indian Standards.
- SP 34 Handbook on concrete reinforcement and detailing, Code of Practice, Bureau of Indian Standards.

CourseNo.	Course Name	L-T-S-P/D	Credits	Year of Introduction
AET204	<b>BUILDING SERVICES-II (ELECTRICAL, LIGHTING &amp; ILLUMINATION)</b>	2-0-0-1	3	2021

**Course Objectives :** To introduce students to electrical services and illumination and to sensitize them with respect to their integration into Architectural Design.

**Course Outcomes:** After the completion of this course, the student will be able to

Course Outcome	Description of Course Outcomes	Prescribed learning level
CO 1	Understand the concept of electrical systems	Remembering
CO 2	Acquire knowledge about protection of equipments, and need of earthing,	Understanding and analysing
CO 3	Acquire knowledge about household electrical appliances, various types of wiring systems, and design of electrical installation in domestic dwellings	Analysing and evaluating
CO 4	Understand the need for good illumination and knowledge of the various Electric light sources	Understanding and analysing
CO 5	Enable the students to design of interior and exterior lighting systems- illumination levels for various purposes light fittings- flood lighting- street lighting	Understanding and analysing

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	40	60	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 4 Marks
Continuous assessment tests (2 numbers)	: 20 Marks
Assignment/Quiz/Course project	: 16 Marks

**End semester examination pattern:**

There will be two parts; Part A and Part B. Part A contain 5 questions from each module, having 4 marks for each question. Students should answer all the questions. Part B contains 2 questions from each module, of which the student should answer any one. Each question can have sub divisions and carry 8 marks.

**Syllabus**

Introduction, Basics of electricity, Electrical installations in buildings, protection equipments, Indian electricity rules, Electrical wiring design, Load calculation, Illumination and lighting, Lighting and electrical scheme.

**Course Plan**

Module	Contents	Course outcomes	Hours
I	<p>Basics of Electrical systems Introduction to electrical services, General awareness of IS codes- Introduction of IS 732, IS 5216, IS 2309 Classification of voltages, standards and specification, Single and three phase supply basics, Supply and distribution of electricity to buildings- Transformer basics, Substations-Types, Symbols used in electrical wiring drawing layouts</p> <p><b>Exercises (Lab):</b> Demonstrate the precautionary steps adopted in case of electrical shock</p>	CO 1	8
II	<p>Electrical installations in buildings Main and distribution boards -Diagram Electric meter-basics, Panel board, MCB, RCCB, MCCB- working, uses, fuses-basics and types, Earthing for safety – Types-Pipe earthing, plate earthing, ISI specifications, Lightning protections</p> <p><b>Exercises (Lab):</b> Identify different types of cables, wires, switches, fuses, MCB, RCCB and MCCB with ratings</p>	CO 2	9
<b>FIRST INTERNAL TEST</b>			

<p style="text-align: center;"><b>III</b></p>	<p>Introduction to Indian electricity rules. Electrical wiring design- Electrical wiring system in domestic and light commercial buildings- Conduits, types of wiring, UG cables-basics, Accessories (Switches and Outlets, switch boards), Basic household wiring components (eg: Ceiling rose)</p> <p>Electrical load calculations Exercise in load calculation. (Numerical based on problems up to sub circuit calculation only) for exams</p> <p><b>Exercises (Lab):</b></p> <p>Wiring of a power distribution arrangement using a single phase MCB distribution board with RCCB main switch and Energy Meter</p>	<p style="text-align: center;"><b>CO 3</b></p>	<p style="text-align: center;"><b>10</b></p>
<p style="text-align: center;"><b>IV</b></p>	<p>Illumination and lighting Commonly used terms in illumination. Laws of illumination, Measurement of luminous flux and lux meter – Working Lighting systems for building Natural/ Artificial Direct/Indirect General/Local Light sources (Incandescent, Fluorescent, HID, HPS and LPS,LED-Comparison) and Luminaries Day lighting and day lighting factor.</p> <p>Energy efficient lighting, Alternative sources of lighting, Basic idea of solar panels and its installation Scope of ECBC-Lighting and controls, Electrical and renewable energy systems Introduction to GRIHA- Criterion 5(Energy efficiency) and 6 (Renewable Energy utilization)</p> <p><b>Exercises (Lab):</b></p> <ol style="list-style-type: none"> <li>1. Experiments proving inverse square law of illumination using a light source .</li> <li>2. Experiment using Lux meter . (Eg : Measurement of Illumination Indoors- Natural and artificial , Measurement &amp; analysis of daylight factor at room level )</li> <li>3. Market survey of different types of light sources &amp; luminaries.</li> </ol>	<p style="text-align: center;"><b>CO 4</b></p>	<p style="text-align: center;"><b>9</b></p>
<p><b>SECOND INTERNAL TEST</b></p>			



V	<p>Lighting design and calculation  Local/general lighting calculation-Lumen method  Criteria and standards for different purpose/activity illumination-Residence, Office,Institution,Hospital and commercial display lighting.  Outdoorlighting–  Street Lighting –(Arrangement, Types), flood lighting(Sportsstadia)Swimming pool lighting and underwater luminaries.</p> <p><b>Exercises (Lab):</b></p> <ol style="list-style-type: none"> <li>1. Preparationoflightingschemeasapartofassignment.</li> <li>2. Market Survey of energy efficient lighting Systems.</li> </ol>	CO 5	9
<b>ENDSEMESTER EXAM</b>			

### References

- Aly.S.Dadras,Electrical systems for Architects, McGraw-Hill Inc.,US, 1995
- M K Giridharan, Electrical Systems Design Data Hand book, M/s I K International Publishers, New Delhi, 2011 (Data book approved for use in examination)
- H.Cotton,ElectricalTechnology, Sir Isaac Pitman & Sons, Ltd, 1922
- L.Uppal,Electrical wiring, Estimating and Costing, Khanna Publishers, 1987
- LightingManual
- MarcSchiler,Simplified design of building lighting, Wiley, 1997
- NationalElectricalCode
- Raina&Bhattacharya,ElectricalWiring,DesignandEstimation, New Age International Publishers, 1991
- <https://www.youtube.com/watch?v=FhTPAuK7LQo>(Reference for experiment proving inverse square law)

Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ARD202	ARCHITECTURAL DESIGN-III	0-0-8-2	10	2021

**Course Objectives:** To enable the students to get introduced to issues related with the design of human habitat, its components and space standards. To understand residential spaces in a specific context, relationship between human behaviour and space through site visits and studio exercises. To explore volume of space, shape, form, function, climatic consideration and material sensitivity through design exercise, and to understand the needs of privacy, communal spaces, efficiency of open spaces and ideas of extended living areas. The objective will be on understanding residential spaces in both the urban and traditional contexts.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	Understand and identify different residential typologies and how they relate to spatial use and experience	Understanding
CO-2	Application of knowledge to initiate architectural design process by using space standards and environmental aspects to formulate concepts and design. Visualize design concepts and make simple and complex 3D objects	Applying
CO-3	Analysis and inference through data collection, case studies of projects related to the design project and developing skills so as to create a design programme	Analysing and evaluating
CO-4	To generate design in through conscious consideration of human scale, environmental conditions, material and form	Creating

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester Jury examination marks	End semester Jury examination duration
100	50	50	2-3 days

**Continuous internal evaluation pattern:**

Attendance : 5 Marks

Design Assignments/Reviews/Tests/CAD Assignments : 45 Marks

**Syllabus:**

Study based on residential typologies, Consideration of climate and site contours in design development process. Study on usage of local materials, Concept development and design of a building with residential use. Introduction to 3D Modelling and Rendering.

**Course Plan:**

Module	Topic	Course outcome	No. of hours
I	Study based on residential typologies. Exercises relating personal experiences to behavioural needs and translating them into architectural program requirements  Consideration of climate and site contours in design development process. Study on usage of local materials and innovative construction techniques.	CO-1, CO-2, CO-3	30
II	<b>Introduction to 3D-modelling technique in CAD</b>  3D basics, 3D Object Modification, 3D Boolean operations, 3D primitive objects.  Introduction to 3D Modelling and Rendering, Building Modelling and basic rendering techniques, Drawings of 3D models of buildings using CAD tools.	CO-2	30

<b>FIRST INTERNAL TEST</b>			
<b>III</b>	<i>Design of built environment for residential use in the immediate or observable environment with a focus on program and use.</i> Introduction to the initial design parameters which include choice of Geography/situation (context), User Group/development model, and Development guidelines (bylaws).	CO-1, CO-3	30
<b>IV</b>	Space Standards and building codes for residential typologies. Data Collection, Case studies, Site studies, Analysis and Inferences	CO-1, CO-3	30
<b>SECOND INTERNAL TEST</b>			
<b>V</b>	Concept development, Design development/ Form Development Detailed drawings, Detailing of architectural features	CO-4	30
<b>END SEMESTER EXAMINATION/ JURY</b>			

### Reference Books

- Francis D. K. Ching, 'Architecture: Form, Space and Order', John Wiley & Sons, 2007.
- Geoffrey Broadbent 'Design in Architecture' John Wiley and Sons, 1973.
- Neuferts' Architect's Data
- Simon Unwin, 'Analysing Architecture', Routledge, 2003
- Simon Unwin, 'An Architecture Notebook :Wall' Routledge, 2000
- Roth, L. M. 'Understanding Architecture: Its Experience History and Meaning', 3rd Ed. Philadelphia : West-view press, 2013.
- Rudolf, A 'The dynamics of architectural form', Berkeley and Los Angeles: University of California Press,1977.
- Aouad.G, 'Computer Aided Design Guide for Architecture, Engineering and Construction', Taylor & Francis Publication, 2011

Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ARS202	<b>BUILDING MATERIALS AND CONSTRUCTION TECHNIQUES IV</b>	1-0-0-2	3	2021

**Course objectives :** The goal of this course is to expose the students to elementary building materials and their applications. It aims to familiarize students to contemporary as well as vernacular and traditional building materials. It will also introduce students to prevailing & relevant BIS specifications. After this course, the students will be able to recognize materials in the market and use them in their design visualization.

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

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Identify the relevant BIS specifications.	Remembering
CO2	Identify appropriate walls, floors and roofs for various construction needs.	Understanding
CO3	Work with various building materials in the construction yard and understand their behaviour.	Applying
CO4	Use the various building materials in their design processes appropriately	Applying

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	50	50	3 hours

**Continuous internal evaluation pattern:**

Attendance	: 5 Marks
Continuous assessment tests (2 nos.)	:15 Marks
Portfolio presentation (15) / drawings(15)	: 30 Marks

**End semester examination pattern:**

There will be three parts; Part A, B and C. Part A will contain 5 questions with 1 question from each module, having 3 marks for each question. Students should answer all the

questions. Part B will contain 2 questions from each module, of which the student should answer any one. Each question carries 4 marks. Part C will have two drawing questions, from any two different drawing-based modules, of which the student should answer any one. The question carries 15 marks.

### Syllabus

Wall Systems: Concrete- Masonry- steel- wooden. Floor system: Concrete- steel- wooden, Roof systems: Types of roofs- Types of trusses- Materials for roof coverings. Shoring, Underpinning and Scaffolding: Types of scaffoldings. Glass: Types of glass used in building constructions- Purposes and properties of glass. Glazing: Structural glazing and curtain walls.

### Course plan

Mod ule	Topic	Course outcome	No. of hours
I	<p><b>SHORING, UNDERPINNING AND SCAFFOLDING</b></p> <p>Shoring: racking shores, flying or horizontal shores, dead or vertical shores.</p> <p>Underpinning: pit method, pile method</p> <p>Scaffolding: component parts, types of scaffolding- single, double, cantilevered or needle, suspended, trestle, steel scaffolding, patented scaffolding.</p> <p><i>Exercises: Sketches of types of shores, underpinning methods and scaffolding types</i></p>	CO1, CO2, CO3, CO4	9
II	<p><b>WALL SYSTEMS</b></p> <p>Concrete System: Concrete columns, concrete walls. Lintels and sunshades</p> <p>Masonry System: Masonry walls unreinforced and reinforced, solid walls and cavity walls, masonry columns and pilasters, Arches.</p> <p>Steel System: Structural steel framing, steel columns, light gauge steel studs, balloon framing.</p> <p>Wooden System: Wood stud framing, stud wall sheathing, wood columns, wood post and beam framing. Partition wall systems.</p> <p><i>Drawings: Types of arches, RCC lintel and sunshade</i></p>	CO1, CO2, CO3, CO4	9
<b>FIRST INTERNAL TEST</b>			
III	<p><b>FLOOR SYSTEMS</b></p> <p>Concrete: One-way slab, One-way joist slab, Two-way slab,</p>	CO1, CO2, CO3, CO4	9

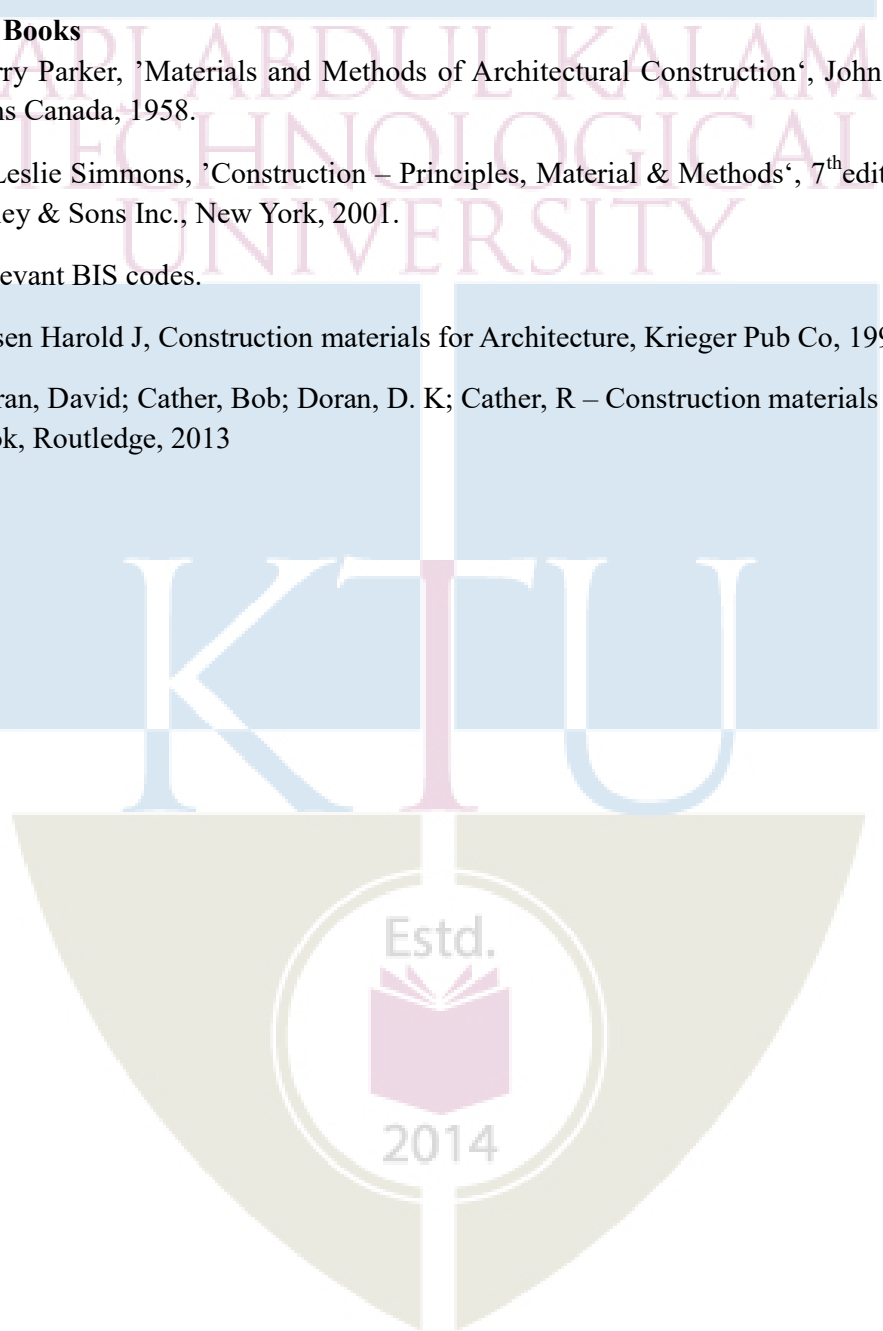
Module	Topic	Course outcome	No. of hours
	<p>Two-way slab and Beam.            Steel: One-way beam system, Two-way beam system, Triple beam system, Semi rigid connections,            Open- web steel joists, Metal decking, Light-gauge steel joists.            Wood: Wood joists, Wood joist framing, wood beams supports and connections, plank and beam framing.  <i>Drawings: RCC column, slab and beam</i></p>		
IV	<p><b>GLASS AND GLAZING</b>            Glass products: Types of glass – wired glass, fibre glass, laminated glass, glass building blocks,            Heat strengthened glass- toughened glass, laminated glass            Special purpose glasses- Low emissivity glass,            Solar control glasses and variable transmission glass, Fire resistant glass, Self-cleaning glass their properties and uses in buildings            Glazing: Single, double and triple glazing Glazed curtain walls &amp; sky lights.  <i>Exercise: Sketches: Structural glazing, Market surveys of glass products – sizes and cost. Collection of samples Glazing accessories</i></p>	CO1,CO2, CO3,CO4	9
<b>SECOND INTERNAL TEST</b>			
V	<p><b>ROOF SYSTEMS</b>            Flat roof, Sloping roof and curved roof. Deciding the slope or curvature of roof, Roof terminology            Wood trusses: Different types of trusses, King post truss, Queen post truss, Fink Truss,            North light truss, Structural Steel roof framing: Different types of Steel trusses and their construction details. Roof covering - thatching, tiling, AC sheets, GI and Aluminium sheets, FRP and RMP sheets and modern roofing. Roof drainage systems.            Introduction to Space frames and Composite roof Systems  <i>Drawings: Types of Arches, Truss – King post truss, Queen post truss, Steel angular and tubular truss, details of roof covering and gutter details</i></p>	CO1,CO2 ,CO3,CO4	9
<b>END SEMESTER EXAMINATION</b>			

**Text Book**

- P.C. Varghese, 'Building Materials', Prentice hall of India Pvt Ltd, New Delhi, 2005
- Dr.B.CPunmia , Building Construction

**Reference Books**

- Harry Parker, 'Materials and Methods of Architectural Construction', John Wiley & Sons Canada, 1958.
- H Leslie Simmons, 'Construction – Principles, Material & Methods', 7<sup>th</sup> edition, John Wiley & Sons Inc., New York, 2001.
- Relevant BIS codes.
- Rosen Harold J, Construction materials for Architecture, Krieger Pub Co, 1992
- Doran, David; Cather, Bob; Doran, D. K; Cather, R – Construction materials reference book, Routledge, 2013





Course No.	Course Name	L-T-S-P/D	Credits	Year of introduction
ARS204	SITE PLANNING	1-0-1-0	2	2021

**Course Objectives:**

- To understand the importance of site in architectural design whereby the relationship between the built and the un-built environment and principles of site planning is established.
- To analyse ecological and geomorphological characteristics of a site which govern the siting of a building or group of buildings in a given site.
- To teach various techniques of site analysis through exercises and case studies.

**Course Outcomes:** At the end of successful completion of the course students will be able

Course Outcome	Description of Course Outcome	Prescribed learning level
CO-1	To learn various terms involved in site planning and their relevance in design of buildings of varying scales	Understanding
CO-2	To understand various parameters that need to be considered in site analysis and its implications on site	Understanding
CO-3	To evaluate the consequences of interventions in a site at micro and macro scales	Applying Analysing Evaluating
CO-4	To apply the principles of site planning learnt in real/ studio projects	Applying Analysing Evaluating Creating

**Mark distribution:**

Total marks	Continuous internal evaluation marks	End semester examination marks	End semester examination duration
100	50	50	3 hours

**Continuous internal evaluation pattern:**

Attendance : 5 Marks  
Tests (2 numbers) : 15 Marks

Portfolio presentation (15) / drawings (15) : 30 Marks

**End semester examination pattern:** There will be three parts; Part A, B and C. Part A contains 3 questions with 1 each from module 1, 2 and 4, having 4 marks for each question. Students should answer all the questions (3 x 4 = 12 marks). Part B contains 2 questions each from 1, 2 and 4 modules, of which the student should answer any one. Each question carries 8 marks (Total 3 x 8 = 24). Part C will have one question from module 3 or 5 to assess the student's capacity for analysing the site and arrive at findings that lead to decisions in site planning and building design. The question carries 14 marks. Part B and C questions can have subdivisions.

### Syllabus

Introduction – Stages in Site Analysis - Preparation of Site Analysis Diagram - Site Context - Site Planning and Site Layout Principles - Site design - Design Application

### Course Plan

Module	Topic	Course outcome	No. of hours
I	<p><b>Introduction</b></p> <p>Objective of Site Planning, Site Planning Process</p> <p>Definition of plot, site, land and region, units of measurements. Contouring – Contour interval – Characteristics, uses of contours.</p> <p><b>Site Planning And Site Layout Principles</b></p> <p>Organization of vehicular and pedestrian circulation, types of roads, hierarchy of roads, networks, road widths and parking, regulations. Turning radii and street intersections.</p>	CO1 CO2	6
II	<p><b>Stages In Site Analysis</b></p> <p>Importance of site analysis, Understanding site as an active network, Contextual Analysis</p> <p>Assessing various contexts -Physiographic,Biological,Land use, Infrastructure, Regulatory, Cultural and Historic</p> <p>On site and off site factors, Integration, Synthesis and Analysis leading to inference about the context</p>	CO2	8
<b>FIRST INTERNAL TEST</b>			
III	<p><b>Preparation of site analysis diagram</b> – Case studies and exercises on the above as studio assignments.</p>	CO1 CO2	4

		CO3	
IV	<p><b>Site Context</b></p> <p>Introduction to existing master plans, land use for cities, development control rules and their implications on the site. Preparation of maps of matrix analysis and composite analysis. Site selection criteria for housing development, commercial and institutional projects - Case studies.</p> <p>Drawing marking out plan, layout plan and centre line plan – Importance, procedure for making these drawings and dimensioning. Setting out the building plan on site – Procedure and Precautions.</p>	CO2 CO3	6
<b>SECOND INTERNAL TEST</b>			
V	<p><b>Site design</b></p> <p>Elements in site design, considerations and methods used, design process.</p> <p>Design application – Develop a site plan for any one typology as a studio exercise</p>	CO3 CO4	6
<b>END SEMESTER EXAM</b>			

**Text Books:**

- Kevin Lynch, 'Site Planning', MIT Press, Cambridge, MA. 1957.
- White T. Edward, 'Site Analysis : Diagramming Information for Architectural Design', Architectural Media Publisher, 1983
- James A La Gro, Site Analysis, Informing Context Sensitive and Sustainable Site Planning and Design, John Wiley and Sons, 2013

**Reference Books**

- John Ormsbee Simonds, 'Landscape Architecture: A manual of Site Planning and Design', McGraw Hill, 1961.
- McHarg, Ian, 'Design With Nature', Wiley Series in Sustainable Design, 1995
- Joseph De Chiarra and Lee Copleman, 'Planning Design Criteria', Van Nostrand Reinhold Co., New York, 1988.
- Thomas H. Russ, 'Site Planning and Design Hand Book', Pearson Education, 2002.
- Christopher Alexander et.al., A Pattern Language: Towns, Buildings, Construction (Center for Environmental Structure Series), 2015

**Course materials, Guidance and Evaluation methods**

- Books, research papers, e-books, videos etc. to be provided to the students by the faculty and ensure that they read it, by initiating discussions.

- Case studies of site analysis, site planning and preparation can be given as class exercises
- Students are to be encouraged to watch movies and documentaries which give information about ecological and environmental aspects of human intervention of natural settings. Based on these reviews/ reports can be prepared and this can be discussed in class.
- The students can be encouraged to visit a site and photo/ video document the various stages in site preparation
- Each student should be encouraged to have a sketchbook with notes, graphical interpretations, sketches of all the topics covered.

