VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

CURRICULUM AND SYLLABUS

Master in Architecture in Digital Technologies for Buildings

School of Architecture, VIT (V-SPARC)
Vellore Institute of Technology, Vellore Campus

Program Outcomes	
PO	Statement
PO1	To create graduates who are competent in Building Information Modelling Systems. Computational modelling and related subjects oriented towards a digital transformation in architecture
PO2	To create practitioners and entrepreneurs who are competent in construction logistics and technical subjects related to the built environment.
PO3	To stimulate researchers and practitioners to investigate further aspects of design thinking through enhanced knowledge and application of construction processes and systems.

Category Credit Detail			
Sl.No.	Description	Credit	Maximum Credit
1	PC - Professional Core	54	54
2	EEC - Employability Enhancement Core	15	15
3	SE - Skill Enhancement	12	12
4	OE - Open Elective	4	4
Total Credit		85	

Category wise Break up of Credits			
Sl.No.	Category	Credit	Credit distribution (%)
1	Employability	44	52
2	Entrepreneurship	29	34
3	Skill Development	12	14
Total Credit		85	100

PFC - Professional Core									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC501P	Architectural Design Studio - I (BIM Integrated)	Lab Only	1.0	0	0	12	0	12.0
2	MARC502L	Digital Design Process	Theory Only	1.0	2	0	0	0	2.0
3	MARC503P	Parametric Architecture	Lab Only	1.0	0	0	4	0	2.0
4	MARC504L	Research Methodology for Architects	Theory Only	1.0	2	0	0	0	2.0
5	MARC510P	Architectural Design Studio - II (Building Performance Analysis)	Lab Only	1.0	0	0	12	0	12.0
6	MARC511P	Architectural Design Studio - III (Value Design)	Lab Only	1.0	0	0	12	0	12.0
7	MARC699J	Architectural Capstone Project	Project	1.0	0	0	0	0	12.0

EEC - Employability Enhancement Core									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC505L	Architectural Criticism	Theory Only	1.0	3	0	0	0	3.0
2	MARC506E	Integrated Approach to Building Services	Embedded Theory and Lab	1.0	1	0	4	0	3.0
3	MARC507L	Project Management	Theory Only	1.0	3	0	0	0	3.0
4	MARC508P	Digital Fabrication	Lab Only	1.0	0	0	6	0	3.0
5	MARC509L	Architectural Entrepreneurship	Theory Only	1.0	3	0	0	0	3.0

SE - Skill Enhancement									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC601L	Environmental Experience Design	Theory Only	1.0	2	0	0	0	2.0
2	MARC602P	Computational Design	Lab Only	1.0	0	0	4	0	2.0
3	MARC603L	Zero Energy Mass Custom Homes	Theory Only	1.0	3	0	0	0	3.0
4	MARC604L	Impact Assessment in Built Environment	Theory Only	1.0	2	0	0	0	2.0
5	MARC605L	Sustainable Built Environment	Theory Only	1.0	3	0	0	0	3.0
6	MARC606L	Future of Architecture and Design	Theory Only	1.0	2	0	0	0	2.0
7	MARC607L	Mind Mapping	Theory Only	1.0	2	0	0	0	2.0
8	MARC608L	Facilities Management	Theory Only	1.0	2	0	0	0	2.0
9	MARC609L	Environment and Behaviour	Theory Only	1.0	2	0	0	0	2.0

OE - Open Elective									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC615L	Construction Economics	Theory Only	1.0	2	0	0	0	2.0
2	MARC620J	Professional Skill Enhancement I	Project	1.0	0	0	0	0	2.0
3	MARC621J	Professional Skill Enhancement II	Project	1.0	0	0	0	0	2.0
4	MARC622P	Python for Architects	Lab Only	1.0	0	0	4	0	2.0
5	MARC623E	Virtual Reality for Architects	Embedded Theory and Lab	1.0	1	0	4	0	3.0
6	MARC624J	Architectural Travel Learning I	Project	1.0	0	0	0	0	2.0
7	MARC625J	Architectural Travel Learning II	Project	1.0	0	0	0	0	2.0
8	MARC626P	BIM for Architectural Application	Lab Only	1.0	0	0	4	0	2.0
9	MARC627L	Quality Survey, Specification and Estimations	Theory Only	1.0	2	0	0	0	2.0

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Vellore Institute of Technology, Vellore Campus

Master of Architecture in Digital technologies for buildings

Program Credit Structure

Professional Core Courses					
Course name	**L**	**T**	**p**	**C**	**Pre-requisite**
Architectural Design Studio – 1 (BIM Integrated)	0	0	12	12	Nil
Architectural Design Studio – 2 (Building Performance Analysis)	0	0	12	12	Architectural Design Studio – 1 (BIM Integrated)
Architectural Design Studio – 3 (Value Design)	0	0	12	12	Architectural Design Studio – 2 (Building Performance Analysis)
Architecture Capstone Project	0	0	12	12	Architectural design studio – 3 (Value Design)
Digital Design Process	2	0	0	2	Nil
Parametric Architecture	0	0	4	2	Nil
Research Methodology for Architects	2	0	0	2	Nil
Employability Enhancement Core Courses					
Architectural Criticism	3	0	0	3	Nil
Integrated approach to Building Services	1	0	4	3	Nil
Project Management	3	0	0	3	Nil
Digital Fabrication	0	0	6	3	Parametric Architecture
Architectural Entrepreneurship	3	0	0	3	Nil
Skill Enhancement Courses					
Environmental Experience Design	2	0	0	2	Nil
Computational Design	0	0	4	2	Parametric Architecture
Zero Energy Mass custom homes	3	0	0	3	Nil
Impact Assessment in Built Environment	2	0	0	2	Nil

Skill Enhancement Courses					
Course name	**L**	**T**	**p**	**C**	**Pre-requisite**
Sustainable Built Environment	3	0	0	3	Nil
Future Architectural Explorations	2	0	0	2	Nil
Mind Mapping	2	0	0	2	Nil
Facilities management	2	0	0	2	Nil
Environment and Behavior	2	0	0	2	Nil
Open Electives					
Construction Economics	2	0	0	2	Nil
Professional Skill Enhancement I	0	0	0	2	Nil
Professional Skill Enhancement II	0	0	0	2	Nil
Python for Architects	0	0	4	2	Nil
Virtual Reality for Architects	1	0	4	2	Nil
Architectural Travel Learning I	0	0	0	2	Nil
Architectural Travel Learning II	0	0	0	2	Nil
BIM for Architectural Application					
Quality Survey, Specification and Estimations					

PFC - Professional Core									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC501P	Architectural Design Studio - I (BIM Integrated)	Lab Only	1.0	0	0	12	0	12.0
2	MARC502L	Digital Design Process	Theory Only	1.0	2	0	0	0	2.0
3	MARC503P	Parametric Architecture	Lab Only	1.0	0	0	4	0	2.0
4	MARC504L	Research Methodology for Architects	Theory Only	1.0	2	0	0	0	2.0
5	MARC510P	Architectural Design Studio - II (Building Performance Analysis)	Lab Only	1.0	0	0	12	0	12.0
6	MARC511P	Architectural Design Studio - III (Value Design)	Lab Only	1.0	0	0	12	0	12.0
7	MARC699J	Architectural Capstone Project	Project	1.0	0	0	0	0	12.0

Course Code	Course Title	L	T	P	C
MARC501P	Architectural design studio – 1(BIM Integrated)	0	0	12	12
Pre-requisite	NIL	Version 1.0			

Course Objectives

To introduce students to the process of Building Information Modelling Systems and apply these principles to an architectural model.

Course Outcome

At the end of the course, the student will be able to

1. Understand the integration of utilities and services appropriately into the civil fabric of a building design and learn about architectural detailing.
2. Develop building models with adequate architectural detailing using BIM software and apply MEP services and be able to understand the principles of material identification and material quantity extraction through the use of application software.
3. Experiment and explore material usage in structural, internal and external applications.

Module:1		24 hours

Time problem design of a small building project like residence or small commercial establishment-understanding of application of BIM tools.

Module:2		24 hours

Identification of a mid scale project ,refinement of a base design available and integration of architectural details such as staircase interphases, external façade details, elevator and escalator shafts, etc. Provision for ducts and shafts, sunken slabs and other civil details as are required to optimize the functioning of the building. The source building could be extracted from the undergraduate thesis submission of the student, external source such as real estate promotionals on the internet, etc.

Module:3		36 hours

Preparation of a BIM drawing to adequately demonstrate all civil components of the building.

Module:4		36 hours

Integration of conceptual plumbing and sanitary services, fire protection systems into the physical building fabric.

Module:5		30 hours

Integration of conceptual mechanical, electrical services into the physical building fabric, introduction of interior components like false ceilings and shaft coverings, etc.

	Total Lab hours:	150 hours

Text Book(s)

1. David Shepherd (2015), The BIM Management Handbook. RIBA Publishing, London.

Reference Books			
1.	Fabio Roberti and Decio Ferreira (2021), Increasing Autodesk Revit Productivity for BIM projects. Packt Publishing Limited, Birmingham.		
2.	Brad Hardinand Dave McCool (2015), BIM and Construction Management: Proven Tools, Methods, and Workflows.Wiley, New York.		
3.	Bimal Kumar (2015), A Practical Guide to Adopting BIM in Construction Projects.Whittles Publishing, London.		
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC502L	Digital Design Process	2	0	0	2
Pre-requisite	Nil	Version 1.0			

Course Objectives:

The course is aimed at enabling students to acquire an in-depth knowledge of the design process and the use of digital media as a tool for creating effective designs. Students will explore various stages of the design process from research and ideation to prototyping and iteration, and gain hands-on experience using digital tools and techniques to bring their ideas to reality. The course intents to orient the students towards the importance of the design thinking approach. This course will have a combination of lectures, discussions, research seminars and hands-on workshops to develop a deep understanding of the domain.

Expected Course Outcome:

At the end of the course, the student should be able

1. To **understand** different stages of the design process.
2. To **apply**the design process in solving design problems.
3. To **develop** and utilize design thinking and creativity techniques to generate innovative design solutions.
4. To develop and conduct user research and **analysis** to inform design decisions.
5. To **collaborate** and effectively develop design solutions with stakeholders and team members.
6. To **understand** the historical continuation and divergence between the digital design process and preceding practice.

Module: 1	Introduction	3 Hours

Discussion on the basic parameters of the design process namely empathy, define, ideate, prototype and test. Introduction to the design thinking process, systems thinking, design philosophies, and optimization. Evolution of the design process (Then vs now).

Module: 2	Design Practice in the Digital era	3 Hours

Introduction to Design in the digital age, an overview of digital design media such as graphic design software, User interface (UI) and User experience tools, collaborative or participatory approaches in design, critical design practice, and generative or speculative design process. Overview of the emerging trends (Metaverse, VR/AR). Introduction to gamification. Discussion on aesthetics. Culture in the digital age.

Module: 3	Analytical Thinking	3 Hours

Employing the design thinking approach in architectural / built-form projects. Data collection and techniques. Creative thinking, reasoning and logical deduction. Understanding the design problem and identifying its root cause. Discussion or using techniques such as mind mapping and brainstorming. Exploration of digital tools

Module: 4	Conceptualization / Ideation	3 Hours

Using lateral thinking, brainstorming, and mind mapping. Collaborative projects in developing an idea. Using appropriate tools such as MindMeister, ClickUp or similar mind-mapping tools. Interpretation of data. Introduction to Python, R or similar programs to support data visualization		
Module: 5	**Evaluation Methods**	**3 Hours**
Techniques for evaluating and refining ideas, simulations and types, the importance of prototyping, and feedback on the design's effectiveness, reliability, and user experience. Identifying the strengths and weaknesses. Exploring gamification as a method of evaluation. Evaluation is part of the decision-making process and a contributor to the final product.		
Module: 6	**Ethical Concerns**	**3 Hours**
The module focuses on the potential impact of design decisions on individuals, society and the environment at large. Discussions on ethical considerations in design. Introduction to intellectual property and rights associated with it. Introduction to copyright and its associated legislation (local as well as global context). Creative commons and the idea of copyleft.		
Module: 7	**Research Seminars/discussions on Case Studies**	**6 Hours**
Seminars based on research topics onthe design process, future trends, UI –UX, ethical and aesthetical issues etc. Case studies of projects where digital media is used. Debate on the appropriate usage of digital technologies. Case study on Google Cultural Institute…		
Module: 8	**Workshop on Emerging Trends.**	**6 Hours**
Guest Workshop by external expert dealing with emerging trends such as Metaverse, usage of AI, VR/AR as part of the design process. The focus would be on emerging trends.		
	Total Lecture Hours	**30 Hours**

Text Books	
1	Ching, F. D. (1979). Form, Space and Order. JOHN WILEY NP.
2	Lewrick, M., Link, P., & Leifer, L. (2018). The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems. Wiley
3	de Bono, E. (1985). Six Thinking Hats. Little Brown and Company
4	De Bono, E (1990), Lateral Thinking – a Textbook of Creativity, Penguin Books
Reference Books	
1	Alexander, C., Ishikawa, S., & Silverstein, M. (1977). A Pattern Language. Oxford University Press.
2	de Botton, A. (2006). The Architecture of Happiness. Pantheon Books
3	Jones, J. C. (1970). Design Methods: Seeds of Human Futures. Wiley.
4	Krier, L. (2009). The Architecture of Community. Island Press; 2nd None ed. edition.

5	Norman, D. (2014). The Design of Everyday Things -Revised and Expanded. Basic Books		
6	Zumthor, P. (2010). Thinking Architecture. Birkhauser; 3rd, expanded ed. edition		
Mode of evaluation: Continuous Assessment Test, Digital Assignments, Research Seminars, Final Assessment Test			
Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC503P	Parametric Architecture	0	0	4	4
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

1. To impart the significance and role of parametric Architecture
2. To Create Architectural geometry modeling through the development of parametric schemes for architectural applications
3. To test, improve, represent, and effectively communicate to others the specific qualities and potentials of an associative parametric design solution.

Course Outcome

At the end of the course, the student will be able to

1. Understand the core structures and workflows of parametric modeling
2. Apply elementary algorithmic thinking to design problems
3. To synthesize, within the given methodology, a parametric design of an architectural and tectonic system.
4. Creating complex forms and relationships using geometric concepts and parametric tools

Module:1	Introduction to Parametric Architecture	12 hours

Parameters, shape forms, Data-Driven Design, tools like Rhino and Grasshopper, etc. layout of the software. 3D modeling and 2D drafting, Various modes of modeling.

Module:2	Elements of parametric design and design patterns	8 hours

The structure of parametric design processes, their characteristics, and reusable parametric design approaches

Module:3	Fundamental concepts of geometric modeling:	8 hours

Spatial coordinates, projections, Boolean operations, formal transformations, freeform surface creation, surface development and deformations aimed at architecture applications, discretization and meshing, digital prototyping, and geometry reconstruction.

Module:4	Parametric modeling techniques and tools:	12 hours

Geometric modeling, Surface Construction, Surface Development, Deformations, Discretization, Digital Prototyping, and Geometry Reconstruction

Module:5	Parametric Design and Scripting	8 hours

sequential, conditional, loop statements, basic data types – strings, lists, tuples, and dictionaries, objects and classes, recursion and recursive functions, simple event-driven graphics program, simple form generators

Module:6	Advanced parametric modeling techniques	12 hours

Design & Computation, Parametric Building Volumes – Massing, advanced tools. organic design, structural analysis, form-finding, digital fabrication, and Basic material for prototyping (MDF, Foam, etc., and PLA, ABS for the 3D printers).		
	Total Lab hours:	**60 hours**
Text Book(s)		
1.	Arturo Tedeschi, AAD_ Algorithms-Aided Design.(2020) Le Penseur Publisher, Italy.	
2.	Arturo Tedeschi Parametric architecture with Grasshopper(2011), Le Pensevr	
3.	Carlo Aiello eVolo 6: Digital And Parametric Architecture(2014) eVolo; English edition	
4.	Robert Francis Woodbury Elements of Parametric Design, (2010) Routledge; 1st edition	
Reference Books		
1.	Koichi Takada and Philip JodidioKoichi Takada: Architecture, Nature, and Design, (2021) Rizzoli	
2.	Min- Gyu Seol and Mu- Jung Kang, Evolution – Architectural design using Grasshopper. (2016)Kyong – Won Suh Publisher, Seoul.	
3.	Michael Hensel, Achim Menges and Michael Weinstock, Emergent Technologies and Design – Towards Biological paradigm in architecture. (2010) Routledge, New York.	
4.	Wassim Jabi (2013), PARAMETRIC DESIGN FOR ARCHITECTURE, (2013) Laurence King Publishing	
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT		

Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC504L	Research Methodology for Architects	2	0	0	2
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

1. To impart knowledge about research design, methods, and techniques relevant to the built environment
2. To formulate a research plan through the application of research techniques, data collection, analysis, and interpretation.
3. To critically read, interpret, and evaluate research proposals and publications
4. To employ qualitative, quantitative, and mixed research methodologies to conduct research in architecture

Course Outcome

5. Skill to identify, decipher and interpret issues relating to the built environment based on research inquiry methods.
6. Knowledge of different methods of conducting research and research writing.
7. Understanding and use of the research terminology and integrating the elements of the research process within quantitative, qualitative, and mixed scientific methods approaches
8. Familiarity with specific research related to the built environment.

Module:1	Introduction	2 hours

Research in the built environment- its importance and scope; Areas of research and types of research in the built environment

Module:2	Research Paradigms and Strategies	4 hours

Problem Identification & Formulation – Research Question – Hypothesis -Null Hypothesis & Alternative Hypothesis, Hypothesis Testing, Overview of different research strategies relevant to research in the built environment.

Module:3	Research Methods	8 hours

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design &Descriptive Research Designs – concept, types, and uses. Experimental Design: Concept of Independent & Dependent variables- Qualitative and Quantitative Research: Concept of measurement, Inductive and Deductive methods, Merging the two approaches; Strengths and weaknesses of different methods

Module:4	Experimental and Simulation Research Methods	4 hours

Their basic assumptions, techniques used, and strengths and weaknesses

Module:5	Tools and Techniques	4 hours

Survey tools and techniques; Analytical- tools and techniques; Quantitative, qualitative, statistical-multivariate analysis, and software applications for different research methods, Sampling design

Module:6	**Technical Report Writing**	**8 hours**
Need and process of literature review, Research writing in general, and its components. Developing the outline, referencing, writing the bibliography, presentation, tools to maximize the clarity of the paper,etc		
	Total hours:	**30 hours**

Text Books

1.	Linda Groat and David Wang, 'Architectural Research Methods', 2nd edition, John Wiley and Sons Inc, Hoboken, New Jersey, US, 2013
2.	Kothari, C.R.. '*Research methodology: Methods and techniques',* Fourth revised edition New Delhi: New Age International (P) Limited, Publishers, 2019.

Reference Books

1.	Knight, A. and Ruddock, L., "Advanced Research Methods in Built Environment", John Wiley & Sons,2008.
2.	JA Smith, P Flowers, M Larkin -Interpretative Phenomenological Analysis: Theory, Method and Research (English) FIR Edition- Sage Publication -2009
3.	Kothari, C. R., "Research Methodology – Methods and Techniques", New Age International, 2004.
4.	John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2011

Mode of Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC510P	Architectural design studio – 2(Building Performance Analysis)	0	0	12	12
Pre-requisite	Architectural design studio – 1(BIM Integrated)	Syllabus version 1.0			

Course Objectives

To enable students to understand the parameters involved in evaluating building performance and to apply software in analysing the impact of various building construction parameters and arrive at conclusions relating to optimization of building performance.

Course Outcome

At the end of the course, the student will be able to

1. Identify the parameters involved in determining building performance including those relating to climatic, material, volume orientation and articulation and dynamic technologies.
2. Apply software to building performance analysis relating to the above parameters separately tutored elsewhere.
3. Conceptually quantify the impact of changes in building design to building performance.

Module:1		30 hours

Parameters involved in determining building performance-energy consumption-lighting, thermal performance, Water sustainability, air movement enabled by passive and active means of building volume articulation and orientation, material application, planning methods. Post construction and occupancy evaluation, facility management optimization.

Module:2		36 hours

Case study of a modern building which has been constructed within the last fifty years for which adequate civil engineering data is available based upon which the building performance is conceptually analysed. preparation of BIM drawings to document the physical attributes of the building.

Module:3		24 hours

For the modern building, using BIM techniques, theoretical variations are effected upon individual parameters such as open window percentage, external envelope material characteristics, orientation, etc. to understand the impact of these changes upon the building performance.

Module:4		36 hours

Case study of a heritage building of vintage in excess of 100 years for which adequate civil engineering data is available based upon which the building performance is conceptually analysed, preparation of BIM drawings to document the physical attributes of the building.

Module:5		24 hours

For the heritage structure,using BIM techniques, theoretical variations are effected upon individual parameters such as open window percentages, external envelope material characteristics, orientation, etc. to understand the impact of these changes upon the building performance.		
	Total Lab hours:	**150 hours**
Text Book(s)		
1.	Pieter de Wilde (2018), Building performance Analysis. Wiley- Blackwell, New York.	
Reference Books		
1.	Jarek Kurnitski,Andrea Ferrantelli and Martin Thalfeldt(2019), Energy Performance and Indoor Climate Analysis in Buildings.Mdpi AG, Switzerland.	
2.	Greg Gegana(2016), Autodesk Revit Building Performance Analysis.Createspace Independent Pub.	
3.	B. Gherri(2015), Assessment of Daylight Performance in Buildings. WIT Press, United Kingdom	
4.	Bill Addis(2020),Building with Reclaimed Components and Materials: A Design Handbook for Reuse and Recycling. Routledge, England.	
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT		

Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC511P	Architectural design studio – 3 (Value Design)	0	0	12	12
Pre-requisite	Architectural design studio – 2(Building Performance Analysis)	Syllabus version 1.0			

Course Objectives

To create a comprehensive building model of moderate volume incorporating the classic principles of form and function while optimizing building performance and integrating MEP services and dynamic technologies through the use of appropriate applied BIM and building performance software.

Course Outcome

At the end of the course, the student will be able to

1. Design a building incorporating the best of planning principles and spatial design while providing for all technical inputs to facilitate optimized building performance.
2. Create a BIM format for the project.
3. Integrate schematic MEP services into the project.
4. Integrate material specifications.
5. Create a set of three dimensional presentation drawings and digitally fabricated physical building model.

Module:1		**30 hours**

Initial phase of conventional architectural design including a variety of three to four small to medium scale studio design briefs any one of which may be adopted by each student wherein there is sufficient scope for demonstration of architectural design principles while accommodating integration of technical inputs into the timeline. A process of intrastudent involvement in client-architect-contractor gaming engagement as well as interactive resource sharing would be part of the process.

Module:2		**36 hours**

Creation of a BIM format for the project

Module:3		**24 hours**

Integration of MEP and fire protection services services into the project, resolution of architectural details.

Module:4		**24 hours**

Integration of material specifications and extraction of sample BOQs.

Module:5		**42 hours**

Preparation of presentation drawings for the project including digitally enabled physical models.

	Total Lab hours:	**150 hours**

Text Book(s)

1. Daniel John Stine(2022), Design Integration Using Autodesk Revit 2023: Architecture, Structure and MEP.SDC Publications, United states.

Reference Books

1.	Allan Ashworthand Keith Hogg(2000), Added Value in Design and construction.Longman, London.
2.	Mike Riley, Alison Cotgraveand Michael Farragher(2017),Building Design, Construction and Performance in Tropical Climates.Routledge, England.
3.	Deepak Maini(2021), Up and Running with Autodesk Navisworks 2022. Independently Published
4.	Paul F. Aubinand Darryl Mcclelland(2014), BIM Collaboration with Autodesk Navisworks. Createspace Independent Pub
5.	Lennart Andersson,Kyla Farrell, Oleg Moshkovichand Cheryle Cranbourne(2016), Implementing Virtual Design and Construction using BIM: Current and future practices. Routledge, England

Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT

Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC699J	Architectural Capstone Project	0	0	12	12
Pre-requisite	Architectural design studio – 3 (Value Design)	Syllabus version 1.0			

Course Objectives

To provide sufficient hands-on learning experience related to the design, development and analysis of construction product / process so as to enhance the technical skill sets in the field of digital technology in buildings.

Course Outcome

1. Specific problem statements for well-defined real-life problems with reasonable assumptions and constraints.
2. Perform literature search and / or patent search in the area of interest.
3. Conduct experiments / Design and Analysis / solution iterations and document the results.
4. Synthesize and document the results in the form of technical report / presentation
5. Or Internship in a reputed office to gain practical experience in the BIM and its applications
6. Documentation of the works as internship report / thesis report / project report

Module Content

1. Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities.
2. Project for one semester, individual work and completion of required number of credits as per the academic regulations.
3. Project work must be carried out inside or outside the university, in any relevant industry or research institution.
4. Publications in the peer reviewed journals / International Conferences is mandatory
5. For internship of 90 working days in an architect/ construction and related office with submission of internship report with month progress report.
6. For thesis abroad, must follow the content and syllabus of the selected international university.

Mode of Evaluation: Assessment on the project / thesis - project report to be submitted, Internship - presentation and internship project report.

Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

EEC - Employability Enhancement Core									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC505L	Architectural Criticism	Theory Only	1.0	3	0	0	0	3.0
2	MARC506E	Integrated Approach to Building Services	Embedded Theory and Lab	1.0	1	0	4	0	3.0
3	MARC507L	Project Management	Theory Only	1.0	3	0	0	0	3.0
4	MARC508P	Digital Fabrication	Lab Only	1.0	0	0	6	0	3.0
5	MARC509L	Architectural Entrepreneurship	Theory Only	1.0	3	0	0	0	3.0

Course Code	Course Title	L	T	P	C
MARC505L	Architectural Criticism	3	0	0	3
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To inculcate architectural understanding as both internal (disciplinary) concerns and external (cultural) circumstances.
2. Understand the paradigm of theory, methods and criticism in the discipline of built environment.
3. To inculcate skills of analytical and critical research skills in the discipline and formulate progressive evaluation/expressions of creative opportunities through written, verbal and graphic means.

Course Outcome

At the end of the course, the student will be able to

1. Understand the phenomena of virtual scripting to develop architectural geometries and design
2. Apply algorithms to develop architectural solutions
3. Validate the functionality, structural stability, climatic compliance and other aspects of architectural designs using computational tools
4. Analyze and develop pool of design iterations and solutions using evolutionary design algorithms.

Module:1	Introduction to architectural criticism	3 hours

Origins of Art and Architectural Criticism, Ideas of History , theory and Criticism

Module:2	World view and Indian concepts	6 hours

Theorizing the Critical (Ideas from Philosophers like Georg Lukacs, Theodor W. Adorno, and Walter Benjamin), Indian context (Manasara, NatyaShastra, Traditional architectural knowledge system approach)
Types and characteristics of Architectural criticism

Module:3	New paradigms	6 hours

Meaning-Technology-Modernism (Sullivan, Wright, Banham), Indian context, Negotiating paradigms, The idea of isms, Critical regionalism

Module:4	Architecture as a interdisciplinary discourse	9 hours

Urban sociology, Cultural sociology, Classical sociology of Architecture (Marcel Mauss, Walter Benjamin), Anthropology and built environment, Architectural cultural ecology, Knowledge transfer and retention, Economics and architecture

Module:5	Architectural appreciation	6 hours

Architectural Appreciation, Metaphysics, Architectural Language and Notation, formalism, anti-formalism

Module:6	Architectural Ethics and Architectural expressions	15 hours
Architecture and the Political, Architectural Ethics Power of images, Media and Photography, Journalism, Creative writing, Architectural expressions		
	Total Lab hours:	**45 hours**

Reference Books

1	Acharya, P. K. (2006). Architecture of Manasara. India: Low Price Publications
2	Architecture Beyond Criticism: Expert Judgment and Performance Evaluation. (2014). United Kingdom: Taylor & Francis
3	Atwood, A. (2018). Not Interesting: On the Limits of Criticism in Architecture. United States: Applied Research and Design Publishing
4	Colquhoun, A. (1981). Essays in Architectural Criticism: Modern Architecture and Historical Change. United Kingdom: MIT Press
5	Das, P. (2021). Built from the Puranas. India: Copal Publishing
6	K. (1992). The Arthashastra. India: Penguin Books India
7	Lahiji, N. (2020). Architecture Or Revolution: Emancipatory Critique After Marx. United Kingdom: Taylor & Francis
8	Lange, A. (2012). Writing About Architecture: Mastering the Language of Buildings and Cities. United Kingdom: Princeton Architectural Press
9	Pandya, Y. (2005). Concepts of Space in Traditional Indian Architecture. India: Mapin
10	Rāmakr̥ṣṇakavi, M., B. M. (1956). Nāṭyaśāstra of Bharatamuni: with the commentary Abhinavabhāratī of Abhinavaguptācāry; vol. 1, chapters 1-7 illustrated. Italy: Oriental Institute
11	Thapar, B. (2012). Introduction to Indian Architecture. Singapore: Tuttle Publishing
12	The New Urban Condition: Criticism and Theory from Architecture and Urbanism. (2021). United Kingdom: Taylor & Francis
13	Tillotson, G. H. R. (2014). Paradigms of Indian Architecture: Space and Time in Representation and Design. United Kingdom: Taylor & Francis

Mode of Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC506E	Integrated approach to building services	1	0	4	3
Pre- requisite	Nil	Syllabus version 1.0			

Course Objectives

The course aims at understanding the need forintegration of building services in the architectural design and construction process.
The course aims at familiarizing integration of building services for automation through present day technologies.

Course Outcome

At the end of the course, the student will be able to
1. Understand the need for overlapping various building services in various stages of building design and construction.
2. Understand the basic concepts and operation of building services through BIM soft wares.
3. Analyse the use of these platforms in building automation systems

Module:1	**Introduction, Electrical and HVAC Services**	**1 hours**
Introduction to integration of building services, need for the integration of Building services		
Module:2	**Electrical, HVAC Services and acoustics**	**3 hours**
Electrical and HVAC systems and integration with architectural design, components and design strategies, present technologies available in the market - VRV technology, FCU units, etc., Acoustics – acoustic design and vibration control, widely used technologies – distributed mode loudspeakers etc.,		
Module:3	**Lighting services**	**2 hours**
Basic lighting layout design and control systems, Present technologies available in the market, DALI Systems etc., integration with HVAC and structural systems for design and construction.		
Module:4	**Plumbing, water supply and fire safety**	**3 hours**
Plumbing design and control strategies, water supply and water recycling, rain water harvesting, solar water heating, integration with architectural design Fire safety services, water based, hydrant, total flood gas systems and integration with architectural design.		
Module:5	**Integration of services using BIM Soft wares**	**3 hours**
Need for integration, BIM soft wares (eg. REVIT), Simulation soft wares to understand the integration of building services for design coordination and construction, Concept of sustainability in building services integration BMS systems - operation and control, IoT based Building Management System.		
Module:6	**Integration of Building services for automation**	**3 hours**
Integration process for automation, strategies, role of an architect in automation, integration and automation for access control, lighting control, HVAC, AV integration, HNS systems for plumbing		
Total theory hours:		**15 hours**

Reference Books	
Text books	
1.	Akhil Kumar Das, Principles of fire safety engineering, 2014. Paperback, India
2.	Norbert M. Lechner, Plumbing Electricity, Acoustics: Sustainable Design Methods for Architecture, 2011, John Wiley & Sons
3.	Fred Hall,Roger Greeno, Building Services Handbook, 2017, Routledge, London
4.	Shengwei Wang, Intelligent Buildings and Building Automation, 2009 Routledge, London
Reference Books	
6.	Alan Obrart, Building Services: Engineering for Architects and Building Design Professionals, 2016, Integral Publishing, Sydney
7.	William J. Cavanaugh, Gregory C.Tocci, Joseph A. Wilkes, Architectural acoustics: principles and practice, 2009, John Wiley & Sons
8.	Paul K. Barton, Building Services Integration, 1983, E. & F.N. Spon, London; New York
	Fire Safety in Buildings by V K Jain, 2007, Taylor & Francis, Philadelphia
Mode of Evaluation: CAT / written assignment / Quiz / FAT / Project / Seminar / group discussion / field work (include only those that are relevant to the course. Use,to separate the evaluations. Eg. CAT, Quiz and FAT	
Indicative Experiments	
1.	Analysis of the integrated building services in existing building lay out (part of a building if the scale is large) – **10 hours**
2.	AUTODESK REVIT– BIM workshop on simulation of building integration, future possibility on augmented reality – **15 hours**
3.	Site visit to study the application of the integrated building systems, understanding the coordination between client, contractor and labours to execute the same – **10 hours**
4.	Introduction of automation in integration of building services, linking the automation to various devices - **10 hours**
5.	Introduction of sustainability principles to integrated building services - **5 hours**
6.	Available systems and products in the market for integration of building services, comparative analysis of their strength and weakness, the specifications of the products/maintenance and durability - **10 hours**
Total Laboratory Hours	**60 hours**
Text Book(s)	
1.	By Dominik Holzer - The BIM Manager's Handbook: Guidance for Professionals in Architecture, Engineering, and Construction, 2016 John Wiley & Sons
Reference Books	
1.	Charles M. Eastman, Chuck Eastman, Paul Teicholz, Rafael Sacks, 2018 Kathleen Liston, John Wiley & Sons
2.	Autodesk Revit 2023 BIM Management, 2022 Published, ASCENT
Mode of assessment: Continuous assessment / FAT / Oral examination and others	

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	J	C
		3	0	0	0	3
MARC507L	Project Management	Syllabus version				
Pre-requisite	Nil	1.0				

Course Objectives:

1. To impart detailed knowledge of all aspects related to management of Real Estate projects to train the students as Project Managers.
   The primary focus of course is on project controlling processes to be disseminated its Overall change control, scope change control; cost control, performance reporting and risk response control.
2. The project closing processes, in administrative closure and contracts close out. Post construction management would include organization structures and contractual aspects of maintenance management, financial management of activities.

Expected Course Outcome:

1. To disseminate about the application of Project Management during the "Bid and Award Phase" of the project life cycle
2. Functions of Real Estate development like project formulation, feasibility studies, developing, costing and financing, managing including planning, scheduling and monitoring of real estate projects, risk management, facilities management, post construction management etc.
3. The process of project management covers topics related to selection of contract types, various international and national contract forms, Pre-qualification of contractors, Preparation of documents, Evaluation of project execution.

Student Learning Outcomes(SLO):	9, 12, 18

9.Having problem-solving ability- solving social issues and engineering problems
12.Having adaptive thinking and adaptability
18. Having critical thinking and innovative skills

Module 1	Legal and planning process	6 hours

Introduction to Legal process of project management: Details on Bid, Contracts, agreements and tender. Understanding on statutory approvals ,
Project Planning Process: Plan development process, time planning process, work scheduling process, resource planning process, Importance of planning, scheduling and controlling projects.

Module 2	Project formulation:	7 hours

Project Feasibility Studies, Different types of process (build operate transfer (BOT), Design build operate transfer (DBOT), Public Private Partnership project (PPP) etc.). Cost time Analysis, cash flow determinant.

Module 3	Process of execution	7 hours

Pre execution: Expression of interest (EOI), Request for proposal (RFP), execution Process: mode of evaluation, award of work. Managing projects vis-à-via Managing Routine activities, Qualities of Project Manager, Request for Information(RFI) ,addendum.		
Module 4	**Planning & scheduling Tools**	**10 hours**
Workflow diagrams structure (WBS) to track project progress, Gantt chart, Flow chart, PERT chart and Critical path method. Bar charts, mile stone charts. Network Techniques: Brief Historical development, Basic elements of network, Event activity, simple logics of network, AOL& AON network, their construction, and probable errors in network, Analysis of network, Critical event, critical activity, critical path and semi critical path, Non critical activity.		
Module 5	**Risk and Safety Managements**	**7 hours**
Project risk management strategies, plans,mitigation and quantitative determination .Risk Response and Probabilistic approaches. Safety management: Types of accidents on construction work sites and their common causes, direct and indirect cost of accidents, occupational health hazards, general precautions to be followed for avoiding accident, training for safety.		
Module 6	**Management Information Systems**	**8 hours**
Scope, significance, design criteria of MIS; Formats of MIS for construction stages; Information Technology in Construction; Application software used in construction project management for scheduling (such as BIM, MS Project)		
Total lecture hours		**45 hours**
Text Book(s)		
1.	Srinath, L.S., PERT and CPM Principles and Applications, 3rd ed. Affiliated East-West Press, New Delhi, 2003	
Reference Books		
1.	Human Factors in Project Management, Zachary Wong	
2.	Effective Project Management – Traditional, Agile, Extreme, Hybrid, Robert Wysocki	
3.	Loraine, R.K, Construction Management in Developing Countries. Thomas Telford, London, 1993	
4.	Construction project management: a practical guide to field construction management. By s. Keoki sears	
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,3 Assessments with Term End FAT (Computer Based Test)		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No.69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
MARC508P	Digital Fabrication	0	0	6	3
Pre-requisite	Parametric Architecture	Syllabus version 1.0			

Course Objectives

1. To understand various digital design tools and manufacturing techniques to fabricate designs
2. To evaluate the link between materiality and machine parameter in digital fabrication technology
3. To have investigative approach towards role of varied machines such as CNC, Laser cutter, 3D printers and robots to manufacture designs.

Course Outcome

At the end of the course, the student will be able to

1. Demonstrate methods to execute non-planar surface geometries using Bi-dimensional cutting or subtractive manufacturing technologies
2. Validate the functionality and limitations of varied printable technologies to develop prototypes
3. Understand the concepts and significance of robotic fabrication.

Module:1	**Introduction**	**8 hours**
Link between design and fabrication, Introduction to varied digital fabrication machines and its compliance to material employability; Detailing and Pre-fabrication process		
Module:2	**Bi-dimensional cutting**	**16 hours**
Cutting based technologies such as laser cutter and CNC routers; Assembling Methods such as sectioning and waffling		
Module:3	**Additive techniques**	**12 hours**
Modelling printable objects for 3D printing; Differences between SLA, SLS and FDM technologies and its employability based on geometrical characteristics of the design.		
Module:4	**Subtractive techniques**	**12 hours**
CNC milling technologies; CNC Foam cutting machines, Hot wire cutters		
Module:5	**Robotic fabrication**	**12 hours**
Combination of robotic arm and turntable to fabricate using fibrous materials; An overview of Parametric pick and place.		
	Total Lab hours:	**60 hours**

Text Book(s)

1. Asterios Agkathidis (2012), Computational Architecture – Digital design tools and manufacturing techniques. BIS Publishers, Netherlands

Reference Books			
1.	Christopher Beorkrem(2017), Material strategies in Digital Fabrication. Routledge, New York.		
2.	Nick Dunn (2012), Digital fabrication in Architecture. Laurence King publishing, London		
3.	Lisa Iwamoto (2009), Digital Fabrications: Architectural and Material techniques. Princeton Architectural Press, NewYork		
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC509L	Architectural Entrepreneurship	3	0	0	3
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

To stimulate powers of observation, develop creative and critical thinking in creating and running an Architectural practice
To instil an orientation to disciplined and collaborative practice with various stakeholders.

Course Outcome

At the end of the course, the student will be able to

1. Understand the meaning of entrepreneurship and process involved in setting up an architectural office
2. Analyse the legal and practical implications of being an entrepreneur
3. Apply the skills, principles in the management of architectural practice
4. Develop skills for effective communication between various stake holders
5. Understand the emerging technologies and sustainable practices

Module:1	Introduction To Entrepreneurship	9 hours

Definition, identifying philosophies of architectural practice, innovation in setting up of a professional practice in Indian context
Ownership - Basic concepts of collaborative practice and partnerships (LLP, LMP),
Growth, operation and management
Membership and practice – COA, qualifications, ethics for practice, ancillary memberships and their role in practice- IIA, IUDI etc.,

Module:2	Legal procedures, risks and uncertainties	8 hours

Statutory requirements and formalities for starting a practice, spatial requirements
Act, rules and regulations by COA to set up practice, Legal liabilities and risk management with respect to failure, hazard, losses and wastages in Indian context,
Maintenance of records, taxation, insurance, balance sheets and records of soft data.

Module:3	Project and Principles of management	8 hours

Capital and revenue studies, financial management, review of strategies, utilizing lateral opportunities and funds
Preparing project proposal, process of addressing a tender, request for proposals, ways of securing a project, project management, time management, software management,
Coordination with clients, contractors and labours.

Module:4	Soft skills	8 hours

Cognitive skills, Communication skills, presentation using latest technologies with clients and collaboration with consultants.
Outreach and Marketing strategies as per COA norms, website for communication, social media platforms to showcase projects

Module:5	Changing context and emerging technologies	8 hours

Presentation of the project to the clients - BIM, Augmented reality, virtual reality and Metaverse etc.,

Sustainable practice: Optimization and reduction of renewable energy, reducing operational costs, GREEN, LEED certifications in professional practice			
Module:6	**Guest Expert lecture**		**4 hours**
Lectures on the experiences of setting up an office, challenges and outcomes by practicing architects from India and Abroad.			
	Total theory hours:		**45 hours**
Reference Books			
Important reading			
1.	Acts, Rules and Regulations, COA, updated 2023 ww.coa.gov.in		
Reference Books			
1.	Eric Reinholdt - Architect and Entrepreneur: A Field Guide to Building, Branding and Marketing Your Startup Design Business. 2015, Paperback – Import		
2.	Eric Reinholdt, Architect and Entrepreneur: A How-to Guide for Innovating Practice: Tactics, Strategies, and Case Studies in Passive Income, 2016, Paperback – Import		
3.	American institute of Architects, The architect's handbook of profession practice, 2013, John Wiley and sons		
5.	H Nandan, Fundamentals of Entrepreneurship, 3rd Edition 2013, PHI Learning Pvt. Ltd		
6.	Rajeev Roy, Entrepreneurship, 2nd edition 2011, Oxford press		
Mode of Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

SE - Skill Enhancement									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC601L	Environmental Experience Design	Theory Only	1.0	2	0	0	0	2.0
2	MARC602P	Computational Design	Lab Only	1.0	0	0	4	0	2.0
3	MARC603L	Zero Energy Mass Custom Homes	Theory Only	1.0	3	0	0	0	3.0
4	MARC604L	Impact Assessment in Built Environment	Theory Only	1.0	2	0	0	0	2.0
5	MARC605L	Sustainable Built Environment	Theory Only	1.0	3	0	0	0	3.0
6	MARC606L	Future of Architecture and Design	Theory Only	1.0	2	0	0	0	2.0
7	MARC607L	Mind Mapping	Theory Only	1.0	2	0	0	0	2.0
8	MARC608L	Facilities Management	Theory Only	1.0	2	0	0	0	2.0
9	MARC609L	Environment and Behaviour	Theory Only	1.0	2	0	0	0	2.0

Course Code	Course Title	L	T	P	C
MARC601L	Environmental Experience Design	2	0	0	2
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

1. Human traits, physical and psychological abilities inevitably direct how they response to their surroundings and perform their tasks. These abilities and the external influences help in the optimization of their performance in various scenarios. This course helps in understanding the interaction between the two.
2. Helps to decipher the challenges of human interactions with and within the constructed built environment through theoretical and practical indulgence.
3. The influences of the environment, stimulus-response compatibility in a variety of real-world settings, and accidents are some of the specific subjects covered.
4. To initiate a discourse on how technology might be modified to enhance human performance in a built environment.
5. This course will also give a general overview of various important environmental issues, such as climate change, and investigate how these problems affect particular people and what can be done to advance sustainability.

Course Outcome

At the end of the course, the student will be able to

1. Understand how the environment affects human well-being
2. Be capable to critically assess theories and data pertaining to human behaviour and the environment.
3. Ability to recognize, analyze, compare and apply various usability standards (heuristics) and methods for mental workload assessment and understanding human error
4. Understand how evidence-based tactics for encouraging pro-environmental action critical comprehension of the psychological and behavioral aspects of environmental challenges.

Module:1	Fundamentals of Anthropometry , human Factors (HF) and Ergonomics	4 hours

Anthropometrics: Static & dynamic Measurement, Design constraints, Musculoskeletal system and Human variability in sex, Body proportion, strength, developmental, ethnicity, social class, occupation, ageing,etc.

Sensation and Perception, Effectors- Hand, Feet & Voice, Senses – Sight, Hearing, Touch, Taste and smell.- Depth and Perception, Optic Flow and Proprioceptors.
Hassenzahl's Three Level Hierarchy of Needs.
Ergonomics- Introduction , History & applications in Architecture.

Introduction to safety, foreseeable use, vulnerable populations, safety standards.

Module:2	Cognitive Dimensions, Information Processing and human decision-making	6 hours

Perception, memory, and attention

Information Processing, Signal Detection, Perception Attention, Distraction, Vigilance.

Memory, Selection, Decision Making and Human Error, heuristics in decision Making		
Module:3	**Cognitive-Ergonomics**	**4 hours**
Basics of Cognition and theoretical Frameworks, User Experience (UX) design – Introduction, Factors Involved, Interactive Design, Conceptual Models of Interaction, Social Interaction & Design, and Emotional Interaction & Design. Physiology, Workload, and Physical Work Capacity.		
Module:4	**Architectural Design Orientation towards User Centric Thinking**	**6 hours**
Fundamentals of Visual Design, Introduction to Colors Theory and Psychology. Demystifying Experience-Emotions and Perception. Immersive Observation & Opportunity identification, Understanding Users, Scenario, Context and User Empathy. Ten Principles of Good Design Principles: Dieter Rams.		
Module:5	**Measurement, Evaluation and Interrelation of Human to Built Environment.**	**2 hours**
Measurement and Evaluation: Physical Environment: Visual Environment, Thermal Environment and Auditory Environment. Notion and practice of “Affordance” in Built Environment.		
Module:6	**Application to Built Environment Design**	**8 hours**
Workspace design Environmental considerations: thermal comfort, lighting, noise, air quality. Sitting & seating: spine considerations, anthropometric principles of seat design and evaluation. Hands & handles: handedness, strength, handles design, biomechanics, and neutral posture. Design Evaluation Methods - David Meister: Human Factors in System Design, Development and Testing. Experiences, and energy & environmental design consequences		
	Total Lab hours:	**45 hours**

Text Book(s)	
1.	Handbook of Human Factors and Ergonomics by Gavriel Salvendy (2012)
2.	Introduction to Ergonomics by R.S. Bridger (McGraw-Hill).
3.	Ten principles of Good Design by Dieter Rams (2017)
Reference Books	
1.	Experience Design: Technology for All the Right Reasons by Hassenzahl, M. (Morgan & Claypool).
2.	The Rules of Work: a practical engineering guide to ergonomics by Dan MacLeod

3.	The History of Human Factors and Ergonomics by David Meister		
4.	Human Factors in System Design, Development, and Testing by David Meister, Thomas P. Enderwick		
Mode of Evaluation: Continuous assessment and Viva Voce/FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC602P	Computational Design	0	0	4	2
Pre-requisite	MARC505P – Parametric Architecture	Syllabus version 1.0			

Course Objectives

1. To impart the significance and role of computational algorithms
2. To demonstrate the application of visual scripting to develop dynamic architectural forms
3. To have investigative approach towards intersection of architecture, computation and digital technologies

Course Outcome

At the end of the course, the student will be able to

1. Understand the phenomena of virtual scripting to develop architectural geometries and design
2. Apply algorithms to develop architectural solutions
3. Validate the functionality, structural stability, climatic compliance and other aspects of architectural designs using computational tools
4. Analyze and develop pool of design iterations and optimized solutions using evolutionary design algorithms.

Module:1	**Generative and Algorithmic explorations**	**16 hours**

An overview of NURBS, MESH and SuBD Modelling; Advanced data management in visual scripting approach; Creating Architectural forms using algorithm; Usage of visual scripting to develop pool of iterations and design solutions for a common problem using computational components such as random, gene pool, Series etc

Module:2	**Mapping Organic structures**	**8 hours**

Usage of algorithms such as Voronai, Fractal, Delaunay etc to develop and simulate nature inspired designs.

Module:3	**Kinetic Façade and Structural Frames**	**12 hours**

Developing dynamic and interactive façade designs using visual scripting, Paneling components, Simulation of the movement using point and curve attractors according to the sun-path

Module:4	**Environmental and Structural Analysis**	**12 hours**

Using Algorithmic components to analyze and simulate environmental and structural behavior of architectural designs.

Module:5	**Topology optimization**	**12 hours**

Apply evolutionary solvers for optimization problems to test and develop iterations for maximum efficiency and minimum use of materials. An overview of other optimization techniques such as Genetic algorithm etc

	Total Lab hours:	**60 hours**

Text Book(s)			
1.	Arturo Tedeschi (2020), AAD_ Algorithms-Aided Design. Le Penseur Publisher, Italy.		
Reference Books			
1.	Min- Gyu Seol and Mu- Jung Kang (2016), Evolution – Architectural design using Grasshopper. Kyong – Won Suh Publisher, Seoul.		
2.	Michael Hensel, Achim Menges and Michael Weinstock (2010), Emergent technologies and Design – Towards Biological paradigm in architecture. Routledge, New York.		
3.	Joy ko and Kyle Steinfeld (2018), Geometric computation: Foundations for Design. Routledge, New York.		
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC603L	Zero Energy Mass Custom Homes	3	0	0	3
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

1. To impart the significance of net zero energy mass custom homes
2. To understand the need for social, economic, and environmental sustainability – and provide all of the knowledge required for the delivery of zero energy mass customized housing
3. To have investigative approach towards understanding diverse contexts (India) and make zero energy mass custom home viable and sustainable

Course Outcome

At the end of the course, the student will be able to

1. Understand the phenomena of net zero energy mass custom homes
2. Identify the need for social, economic, and environmental sustainability in the discourse of zero energy and custom homes
3. Identify and apply various latest technologies towards achieving net zero energy mass custom homes
4. Understand the paradigm of 'homes' in various socio-cultural zones of India
5. Analyze different zero energy approaches towards incorporating environmental, economical, social and human dimensions of sustainable into the built environment

Module:1	Home: Indian and global context	5 hours

Idea of home, Meaning of home in global context, home in India's varied bio-geographic zones and socio-cultural zones, housing planning, laws and jurisprudence regarding housing in India, socio-cultural dimensions

Module:2	Mass customization: Architecture	8 hours

Introduction to mass customization in architecture, mass housing, social and human factors, paradigm of identities in residential architecture, history and latest trends. The future of mass customization, prefabrication, housing affordability and inclusiveness.

Module:3	Zero energy buildings	8 hours

Introduction, renewable energy technologies, energy efficiency measures, knowledge from the traditional Indian systems, latest trends, passive and active buildings energy systems, energy efficiency under extreme climate, green building certification.

Module:4	Building performance simulations: toward zero energy mass custom homes	1 hours

Building energy modeling for consumption and production, performance and technology, thermal simulation, lighting simulation, acoustical simulation and air flow simulation, latest trends and the future.

Module:5	Urban and Rural: zero energy mass custom homes	6hours

urban resilience and climate change, sustainable transportation, rural and urban planning: Indian housing, smart cities: AI tools.		
Module:6	**Contemporary paradigm and future of Zero energy mass custom homes**	**10hours**
Latest trends, global experiments, possible exploration in Indian context, case studies, Legislative and organizational frameworks of operations, social impact assessment.		
	Total Lab hours:	**45hours**

Reference Books

1.	Hu, M. (2019). Net Zero Energy Building: Predicted and Unintended Consequences. United Kingdom: Taylor & Francis.
2.	Attia, S. (2018). Net Zero Energy Buildings (NZEB): Concepts, Frameworks and Roadmap for Project Analysis and Implementation. United Kingdom: Elsevier Science.
3.	Masa, N., ed. (2018). ZEMCH: Toward the Delivery of Zero Energy Mass Custom Homes. (n.d.). Germany: Springer International Publishing.
4.	Building Performance Simulation for Design and Operation. (2019). United Kingdom: CRC Press.
5.	Cities and Affordable Housing: Planning, Design and Policy Nexus. (2021). United Kingdom: Taylor & Francis.
6.	Housing for All. (n.d.). (n.p.): KHANNA PUBLISHING HOUSE.
7.	Mass Customisation and Personalisation in Architecture and Construction. (2013). United Kingdom: Taylor & Francis.
8.	Attia, S. (2018). Net Zero Energy Buildings (NZEB): Concepts, Frameworks and Roadmap for Project Analysis and Implementation. United Kingdom: Elsevier Science.
9.	Zero-Energy Buildings: New Approaches and Technologies. (2020). United Kingdom: IntechOpen.
10.	Johnston, D., Gibson, S. (2010). Toward a Zero Energy Home: A Complete Guide to Energy Self-sufficiency at Home. United Kingdom: Taunton Press.
11.	Voss, K., Musall, E. (2012). Net Zero Energy Buildings: International Projects of Carbon Neutrality in Buildings. Germany: DETAIL.

Modeof Evaluation**:** Continuous assessment andViva Voce/FAT

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC604L	Impact Assessment in Built Environment	2	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To give exposure to the need, methodology, documentation, and usefulness of environmental impact assessment
2. To explore the methods and techniques used in the stages of the EIA process
3. Evaluate the operation of EIA in India and other countries
4. To enable the students to have an understanding of EIA review & management
5. To enable skill development to prepare an environmental management plan.

Course Outcome

1. Understanding the significance of environmental impact assessment
2. The students will be exposed to EIA, its evaluation, and report making and reviewing process
3. Skills to prepare an environmental management plan

Module:1	Introduction	2 hours

Introduction to Impact Assessment in the built environment- Environment Management- Legal policy and regulatory requirements of EIA studies in India; Global Perspective– EIA in Project Cycle

Module:2	EIA Process	4 hours

EIA Procedure - Establishing Baseline Conditions- screening – scoping - setting– analysis – mitigation -Types and limitations of EIA – Cross-sectoral issues, Planning of EIA studies-Team formation, expert identification, etc

Module:3	EIA Methods- Tools and Techniques	10 hours

Prediction and Assessment of Impacts- Phases of impact assessment, Various methods & techniques used in impact identification; Techniques used in impact prediction- Weighting, Scaling techniques, ecological rating systems - Goals-achievement matrix, priority-trade off- Network- overlay- Quantitative methods, simulation methods, Impact Evaluation techniques- Cost- Benefit Analysis, Multi-Attribute Utility theory, DELPHI method, SDG IA Tool; Predicting Impact on the Physical Environment, Ecosystem, Biodiversity, and habitats, Cultural and Heritage process and impact assessment, Documentation of EIA findings - Evaluation of Alternatives & Decision making for the Preferred Alternative, Structuring and Writing an EIA report.

Module:4	Impact on Socio-Economic Systems	4 hours

Definition of social impact assessment. Social impact assessment model and the planning process. Rationale and measurement for SIA variables. Relationship between social impacts and change in community and institutional arrangements. Public participation and involvement in EIA

Module:5	Environmental Management	4 hours

Environmental resource management, Development of environmental management systems with a focus on ISO14000, Environmental Management Plan - preparation, implementation, and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programs – Post-project audit, Energy management		
Module:6	**Case study**	**6 hours**
EIA Case Examples- testing and accuracy- EIA Reporting and review of EIA Quality-		
	Total lecture hours:	**30 hours**

Text Book	
1.	Nick Harvey, Beverley Clarke, Environmental Impact Assessment: Procedures and Practices, Oxford University Press, USA, 2012.
2.	Anjaneyulu Y., Manickam Valli, “Environmental Impact Assessment Methodologies”, BS Publications, Third Edition, 2023
Reference Books	
1.	Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003
2.	Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.
3.	Shrivastava A.K., Baxter Nicola, Grimm Jacob, “Environmental Impact Assessment”, APH Publishers, 2003
4	Marriott B., “Environmental Impact Assessment: A Practical Guide”, McGraw-Hill Publication,1997
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT	

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC605L	Sustainable Built Environment	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

The course serves both as an introduction to the physical processes lying behind the design of a building's envelope, interior and equipments, and as an initiation for a proper integration of technology in architecture.

Course Outcome

At the end of the course, the student will be able to

1. Understand the thermal behavior of built environment.
2. Analyze the concepts of sustainability and energy efficiency.
3. Evaluate the strategies and systems for sustainable built environment.
4. Create energy conscious design in different climatic conditions.

Module:1	Built Environment and Sustainability	6 hours

Definition, issues and impacts of built environment - physical impacts on water, air, land, noise, natural environment; social impacts (stress); environmental degradation. Sustainability and its various dimensions (economic, social and ecological); History of sustainability; Sustainable development; Global warming and climate change; Sustainable architecture and built environment; Culture and sustainability.

Module:2	Thermal behaviour of built environment	9 hours

Thermal response of Buildings to the local thermal environment, heat exchange in buildings, climate responsive building design, Thermal Comfort in buildings, Factors of comfort, Adjustment mechanisms, Thermal Comfort indices and comfort zone, Thermal Comfort models, new developments in the field of Thermal Comfort, thermal comfort modelling, simulation and prediction.

Module:3	Energy audit	9 hours

Energy Performance Assessment for building envelope, fenestration and embodied energy, it also emphasizes on Equipment and Utility systems, simulation and prediction.; Life Cycle Assessment-concept, terminologies, methodologies, tools and processes; Carbon footprint.

Module:4	Environmental Codes and Energy Ratings	6 hours

Study of rating systems; Strategies to earn credits; Introduction and guidelines of ECBC 2007, SP41, The Indian Green Building Council and LEED, The Energy and Research Institute and the GRIHA System, policy guidelines of sustainable architecture, mandatory requirements

Module:5	Strategies and Technologies	6 hours

Elements and principles of sustainability in vernacular architecture, Passive design strategies, Current developments in sustainable strategies, Smart built environment. Sustainable waste management, sustainable water management.

Module:6	**HVAC and IAQ, Design**	**9 hours**
Basics of HVAC, Ventilation requirements of various buildings & spaces, Ventilation standards, Ways of natural ventilation. types of air conditioning unite, mechanical ventilation and evaporative cooling, heating and humidity controls and design considerations and directions. Outdoor and indoor air quality standards (NBC, ASHRAE, etc.,), methods and models for designing desirable levels IAQ. IAQ and health, Causes of SBS, air contaminants of indoor origin, international standards, IAQ in offices, residential and commercial and Industrial buildings etc., NBC, ASHRAE guidelines for ventilation. Accepted IAQ for different functional spaces and uses.		
	Total theory hours:	**45 hours**

Text Book(s)	
1.	Steven V Szokolay “Introduction to Architectural science : The basis of sustainable design” Elsevier 2012
2.	Mat Santamouris, “Environmental design of urban buildings- An integrated approach”Earth scan, 2006
Reference Books	
1.	Santamouris, “Energy Performance of Residential Buildings”, James & James, London 2005
2.	Moncef Krarti, “Energy Audit of Building Systems: an Engineering approach” CRC Press, LLC, Florida 2000
3.	Chris P Underwood and Francis W H Yik, “Modelling methods for Energy in Buildings”, Blackwell publishing co., Oxford 2004.
4.	Arvind Krishan, NickBaker,Simons Yannas “ Climate responsive architecture- a design handbook for energy efficient building”, McGraw-Hill,2001
5.	Knight, A. and Ruddock, L., “Advanced Research Methods in Built Environment”, Wiley-Blackwell.2008
6.	Yudison, J., “The Green Building Revolution”, Island Press.2008
Modeof Evaluation**:** Continuous assessment and Viva Voce/FAT	

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC606L	Future of Architecture and Design	2	0	0	2
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To explore the continuum of architectural design development in the future through the parameters of physical, social, economic, technological and environmental lenses towards a predictive model to direct the progress of future research and application.
2. To analyze, speculate, develop, and simulate qualitative and quantitative outcomes within predetermined limitations as indicated by trends of development.
3. To initiate a discourse on criticality, need and sustenance of the emerging trends and theories pertaining to the future of architectural design.

Course Outcome

At the end of the course, the student will be able to

4. Develop a personal and professional inquiry, as well as the development of a versatile skill set and a strategic perspective for designing in a changing world.
5. Direct the innovation in the tools to be developed to apply to Futuristic Design Interventions.
6. Critically analyze groundbreaking theories and technology that have predicted the future of Architecture.

Module:1	History, Theory and Introduction: Futurist Architecture	4 hours

Rise of Futurism, Manifesto of Futurism, Future concepts envisioned by earlier theorists, artists and architects like Antonio Saint Elia, Giacomo Balla, Umberto Boccioni, David Burliuk, Vladimir Mayakovskyand F.L. Wright, etc.

Module:2	Futurism after World War II	4 hours

Googie Architecture – History, Origin and Influences, Concepts ofTemporal Structure, Retro futurism, Influences on Animation series and movies. Neo-Futurist, Avant-Garde group of Architects (Alvar Aalto, Buckminster Fuller, Renzo Piano, etc), Neo-Futuristic City Manifesto (By Vito Di Bari)

Module:3	Predictive Architecture	6 hours

Understanding the principles and factors influencing change in human lifestyles, Predictive Analysis of the dimensions of the future physical matrix that may manifest architectural creation through an understanding of the projectedsocial, economic and technological changes of the future, social groupings, occupational structure, the role of artificial intelligence.

Module:4	Planning Trends and the Environment	6 hours

Research on Futuristic City Planning directions, the protection of the environment, ecological sustainability, understanding the impact of development on planetary stability.

Module:5	Futuristic spatial design and visual aesthetics	4hours

Predictive exploration of probable futuristic spatial configurations for various envelope applications, investigations into the probable directions of volumetric design, external and internal visual characterizations, articulation and material impact.		
Module:6	**Design Research**	**6 hours**
Design Exploration through research and a seminar to discuss multiple predictive options of future planning concepts and architectural models based upon a programme of specific application - housing, commerce, industry, institution, etc.		
	Total Lab hours:	**30 hours**

Text Book(s)	
1.	Manifesto of Futurist Architecture 1914 by Antonia, Sant Elia, Lacarba
Reference Books	
1.	The tale of tomorrow- utopian architecture in the modernist realm by Robert Klanten
2.	The Work of Antonio Sant'Elia: Retreat into the Future by Meyer, Esther da Costa.
3.	Googie: Fifties Coffee Shop Architecture by Hess, Alan, Chronical Books (CA)
4.	Utopia and architecture by Coleman, Nathaniel.
5.	Visionary Architecture: Un-built Works of the Imagination by Burden, Ernest, McGraw-Hill Professional.
Mode of Evaluation**:** Continuous assessment and Viva Voce/FAT	

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC607L	Mind Mapping	2	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To understand the role of the mind-mapping tool in generating the design solutions
2. To understand the process of mind mapping to create various design ideas that best suit the context.
3. Ability to develop multiple ideas and concepts to solve problems.

Course Outcome

At the end of the course, the student will be able to

1. Analyzing the concept of mind mapping to create design ideas
2. Apply the tools of mind mapping to develop architectural solutions
3. Understand the principles of design thinking which can be applied in the process of mind mapping.
4. To Create design ideas using the tools of mind mapping which helps to work on complex design problems.

Module:1	**Introduction to Mind Mapping**	**4 Hours**
Diagramming,Image-centered diagram, elements of mind mapping, the connection of radial, non-linear graphical manner. Introduction to text mapping		
Module:2	**Mind Mapping Process**	**6 Hours**
Central Topics, branch out of maps, mapping types, use of colour and fronts in mapping, generate ideas, revisit the ideas, transformation of ideas into the design.		
Module:3	**Design Thinking and Problem-Solving**	**4 Hours**
Lenses for Design Thinking, Creativity, Motivation and Observation, Preparing Mind for Innovation, Idea Generation, Design process, and design solutions.		
Module:4	**Mind Mapping Tools**	**8 Hours**
ClickUp's Mind Maps, ConceptDraw MINDMAP, Edraw Mind Map, etc		
Module:5	**Mind Mapping for Architects**	**4 Hours**
Case studies of architects using Mind Mapping for generating their design process.		
Module:6	**Expert talks and project**	**4 Hours**
Guest lecture by an architect using mind mapping. Architectural Project – Use Mind mapping as a tool to generate design ideas.		
	Total Hours:	**30 Hours**

Text Book(s)

1. Belardi, P. and Nowak, Z. Why Architects Still Draw. Cambridge (2014). The MIT Press

2.	**Garcia, M.. The Diagrams of Architecture. Chichester: Wiley (2010) AD Reader**
3.	Zdebik, J. Deleuze and the Diagram: Aesthetic Threads in Visual Organization (Continuum Studies in Continental Philosophy).(2012) Continuum International Publishing Group Ltd.
Reference Books	
1.	Garner, S. (2008). Writing on Drawing: Essays on Drawing Practice and Research. Bristol, UK: Intellect.
2.	Kam Knight (2017) Mind Mapping: Improve Memory, Concentration, Communication, Organization, Creativity, and Time Management
3.	**Thomas M. Sterner The Practicing Mind (2017) Jaico Publishing House**
4.	Tony Buzan The Ultimate Book of Mind Maps (2012) Thorsons; UK ed. edition
Modeof Evaluation**:** Continuous assessment and FAT	

Recommended by the Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC608L	Facilities Management	2	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To understand Facilities Management (FM) as a strategic tool for enhancing efficiency and functionality of the built environment.
2. To assess concepts related to space and utility management, operations & maintenance, services etc.
3. To analyze the distinctive roles of Facility Management involving multiple aspects of people, place, process and technology.

Course Outcome

At the end of the course, the student will be able to

1. Understand the role of facility manager and examine facility management through architectural planning and design, maintenance & operation, management & integration of services.
2. Create facility management plan for various typologies like commercial, residential and institutional areas
3. Evaluate and problem solve based on the technical competencies of facilities management at building level.
4. Analyze the various components of FM in intelligent buildings ranging from facilities planning and ICT

Module:1	Introduction To Facilities Management	2 hours

Introduction-key concepts-Role of Architects in facility management – key roles, responsibilities & accountabilities-core competencies in FM-organizational management, financial management & User service

Module:2	Space Design And Management	6 hours

Importance of managing space in a facility- Space planning - Design & construction for operability- design development - Using technology for space management – user behavior- internal environment –health, safety, security & environment- user service management

Module:3	Strategic Facility Management	4 hours

Introduction to FM strategy plan – understanding operational plans - Strategy formulation, analysis, development & implementation-forecasting-scenario planning

Module:4	Operations And Maintenance Management	6 hours

Facility Operations – Building performance, Maintenance and Repair - Facility Services- technical issues associated with building services & design - Contracting and Types of Contracts – introduction to service operation management – building management & sustainability

Module:5	**Ict In Facility Management**	**6 hours**
Intelligent buildings – IT infrastructure management – computer aided facilities management – information systems & other technology – integrated workplace management systems – BIM technology for facility management – requirements & challenges – AR – Data management - future of facility management		
Module:6	**Workshop/Group Work/Discussions**	**6 hours**
Case studies – Brainstorming and creating a strategic Facility Management plan for any design typology ssss		
	Total hours:	**30 hours**

Text Book(s)	
1.	Total facilities management by Brian, Atkin; Brooks, Adrian : (5th edition) Publisher: Wiley-Blackwell 2021
Reference Books	
1.	Building performance and its relevance to facilities management by J Douglas (1996)
2.	Facilities Management: Towards Best Practice (2nd Edi). Barrett, P.S and Baldry, D, 2003
3.	Facilities Management Handbook (4th edi). Booty, F (edi) 2009, Oxford: Elsevier Butterworth Heinemaan Journal of Facilities Management
4.	The Facility Management handbook – 4th Edition – Kathy O. Roper and Richard P. Payant
5.	International Facility Management, Kathy O. Roper, Lisa J. Borello Publisher Wiley-Blackwell 2014
6.	RICS Facilities Management Case studies
7.	BIM for Facility Managers by IFMA. Teicholz, Paul 2013
Modeof Evaluation**:** Continuous assessment and FAT	

Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC609L	Environment and Behavior	2	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To establish an interdisciplinary thinking on the interrelationship between physical environment and human behavior.
2. To understand key concepts from theories of psychology and the broader social sciences and articulating the design program through the lens of environmental perception and cognition, spatial behavior etc.
3. To have investigative approach and examine spatial gestures to social and psychological requirements to create sensuous socio-spatial patterns rooted in architecture form and space.

Course Outcome

At the end of the course, the student will be able to

1. Understand the human- environment relationship to develop architectural solutions in response to cognitive and behavioral aspects.
2. Ability to make a comprehensive analysis and evaluation of building in real-world situations to articulate problems through the lens of EBS and gain awareness and sensitivity towards the physical and natural environment.
3. To understand the diverse needs, values among key stakeholders – local community, authority in the design process.

Module:1	Man- Environment relationship	4 hours
Introduction to interdisciplinary and multidisciplinary aspects of environmental psychology and human behavior, cultural and psychological meanings of architectural built spaces.		
Module:2	**History of EBS**	**4 hours**
Nature and scope of environmental psychology, characteristics and functions of environmental psychologists, the effect of environmental stress on human performance, environmental perception and cognition. Models and acquisition of spatial cognition and cognitive maps.		
Module:3	**Fundamental theories and basic concepts**	**6 hours**
Proxemics theory – the language of space,spatial behavior such as personal space and Territoriality, Privacy, Way finding, Ambient environment. Gestalt theory, Density. Crowding. Behaviour Setting, Stress, Patterns and activities.		
Module:4	**Theories of Environmental Psychology**	**4 hours**
Environmental Determinism, Environmental possibilism vs Environmental probabilism, Arousal approach, Stimulus load theory, Behavior constraint theory, Adaptation level theory, Environment stress approach and Perception or cognition theory		
Module:5	**Participatory approach**	**4 hours**
Observing physical traces, combination of questionnaires, photography and recorded interviews, self-reporting, post occupancy evaluation. Methods and case studies to apply environment-behavior studies in design.		
Module:6	**Various applications of EBS in architecture**	**6 hours**
Behavioral concepts in Neighborhood and Urban Design, Contemporary Socio-physical issues in environmental design		
Module:7	**Guest Lectures and discussions**	**2 hours**

How the concepts of EBS apply and translate into a more responsive theory of design.		
	Total Lecture hours:	**30 hours**
Text Book(s)		
1.	Hall, Edward.**"**The Hidden Dimension".Knopf Doubleday Publishing Group. 1990	
2.	Rapoport, Amos. "House, Form and Culture". (Foundations of Cultural geography), Prentice hall. 1969	
3.	Rapoport, Amos. "Human Aspects of Urban Form: Towards a Man—Environment Appproach to urban form and design". Elsevier Science and Technology, Pergamon Press .1977	
4.	S. Kaplan and R. Kaplan (Eds.). "Humanscape: Environments for people". Ann Arbor, MI: Michigan Publishing (originally Belmont, CA: Duxbury, 1978; republished by Ann Arbor, 2017	
5.	Desy, C. M. and Lasswell, T. "Designing Places for People, a Hand Book on Human Behavior for Architects", Designer and Facility Managers. New York : Whitney Library of Design. 1990	
6.	Gwen Bell, Edwina Randall, "Urban Environment and Human Behaviour"- An Annotated Bibliography", Dowden Hutchinson Ross, 1973.	
7.	Clovis Heimsath, "Behavioural Architecture", McGraw Hill, 1977.	
Reference Books		
1.	Kopec, D. "Environmental psychology for design" (3rd ed.). New York. NY: Fairchild Books. 2018.	
2.	Hansson, Mats G.**"**The private sphere: an emotional territory and its agent". Sweden : Springer Science and Business Media B.V., 2008.	
3.	John Zeisel. "Enquiry by Design: Tools for Environment-Behaviour Research", Cambridge University Press.1984.	
4.	Robert Bechtel. "Enclosing Behaviour", John Wiley.1977.	
Modeof Evaluation**:** CAT, Written assignment, Quiz and FAT		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No.69	Date 16-03-2023

OE - Open Elective									
S. No	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	MARC615L	Construction Economics	Theory Only	1.0	2	0	0	0	2.0
2	MARC620J	Professional Skill Enhancement I	Project	1.0	0	0	0	0	2.0
3	MARC621J	Professional Skill Enhancement II	Project	1.0	0	0	0	0	2.0
4	MARC622P	Python for Architects	Lab Only	1.0	0	0	4	0	2.0
5	MARC623E	Virtual Reality for Architects	Embedded Theory and Lab	1.0	1	0	4	0	3.0
6	MARC624J	Architectural Travel Learning I	Project	1.0	0	0	0	0	2.0
7	MARC625J	Architectural Travel Learning II	Project	1.0	0	0	0	0	2.0
8	MARC626P	BIM for Architectural Application	Lab Only	1.0	0	0	4	0	2.0
9	MARC627L	Quality Survey, Specification and Estimations	Theory Only	1.0	2	0	0	0	2.0

Course Code	Course Title	L	T	P	C
MARC615L	Construction Economics	0	0	2	2
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

1. To provide students a comprehensive overview of the key concepts of the economics of building designs, national and international economic issues, economic principles necessary to understand the various factors that shape or affect the property markets and construction activities.
2. To investigate the issues and topics associated with the structure and maintenance of building performance in terms of efficiency, capacity, productivity and profitability of construction industries and firms.
3. To understand the role of significant key players - the design professionals, the construction supply chain as well as infrastructure sectors in terms of strategic decisions and operational decisions.

Course Outcome

At the end of the course, the student will be able to

1. Understanding the interrelationship between the management of construction, infrastructure project and corporate financial strategy.
2. To understand students how real estate driven by market strategies in terms of land acquisition and operation, government policies, economic uncertainty, predicting demand and managing risk.
3. To impart knowledge on cost benefit analysis, economics accounting, contract bidding and budgeting procedures.

Module:1	**Understanding the nature and scope of construction industry**	**4 hours**
Engineering economics and Construction accounting, Cost value and price, laws of demand and supply and the economic context in terms of material, labour etc		
Module:2	**Principles of Economics**	**4 hours**
Introduction to Micro and macro-economics, general equilibrium, price elasticity, market failure, Factors of production.		
Module:3	**Value Engineering and concepts in Economics**	**8 hours**
Overview of systematic process of value engineering. Benefit-cost analysis, Rate of return, Comparison of NAV and NPV, Replacement analysis, Break even comparative analysis, Monte-carlo simulation, Budgeting, Risks and uncertainties and management decision in capital budgeting, Depreciation, Taxation and inflation, Work pricing – Equipment and ownership cost, operation costs etc		
Module:4	**Economics in Contracts**	**4 hours**
Contract - bidding and award, revision – escalation, Turnkey activities, Project appraisal and yield,		
Module:5	**Performance analysis**	**4 hours**
Economic performance analysis in building projects, benefits of economic analysis, type of estimates (parametric and approximate), practical problems		

Module:6	**Globalization**	**4 hours**
International and local economics and policy instruments , Current economic issues and future directions		
Module : 7	**Guest Lectures and discussions**	**2 hours**
	Total Lab hours:	**30 hours**

Text Book(s)	
1	Danny Myers. Construction economics: A new approach, Taylor and francis publisher.2004.
2	Ofori, G. The construction industry aspects of its economics and management, Singapore university press. 1990.
3	Ivor H. Seeley. Building Economics, Palgrave Macmillan. 1995
4	Peter E. Bathurst and David A. Butler Building cost control techniques and economics, London. 1973
5	Blank, L.T. and Tarquin, A.J. Engineering Economy (Seventh Edition) McGraw Hill Book Company, ISBN 978-0-07-337630-1.2012
6	Duncan P. Cartlidge. Cost Planning and Building Economics.Hutchison. 1973
7	Thuesen, H.G. Engineering Economy, (Second Edition) Prentice-Hall, Inc.1959
Reference Books	
1.	*Patricia M. Hillebrandt. Economic Theory and the Construction Industry* in Palgrave Macmillan Books. 2000
2.	Stephen Gruneberg.Construction Economics: An Introduction, Maxmillan Education.UK. 1997
3.	1.Peterson, H.C., Lewis, W.C .“Managerial Economics”, Prentice Hall of India Pvt. Ltd. 2001
4.	Parkin, M. & Bade R.“Modern Macroeconomics” 4th Edition, Prentice Hall.1996

Modeof Evaluation**:** Continuous assessment, Assignments and FAT			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
MARC620J	Professional Skill Enhancement - I	0	0	0	2
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives:

To provide sufficient hands-on learning experience related to design and professional practice and to inculcate additional learning of subject matter in a professional working environment so as to enhance the technical skill sets in the architectural or allied fields

Course Outcome:

At the conclusion of the coursework, the student will be able to:

1. Collaborate and work in teams towards achievement of specific goals.
2. Apply academic skills to specific architectural problems and arrive at appropriate solutions.
3. Conduct experiments, analyse and document results
4. Engage with diverse social situations and technological environments and adopt appropriate thought processes to evolve solutions.

Module Content

The Professional Enhancement Skills may be any one of the following:

1. Participation in two or more camps/workshops of minimum cumulative duration of 30 working days over one academic year of engagement.
2. Engaging in vacation internships in architectural offices/construction organisations/other allied industries over a minimum period of 30 working days.
3. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project.
4. Carried out inside or outside the university, in any relevant industry or researchinstitution.
5. Publications in peer reviewed journals / International Conferences will be an addedadvantage.

Mode of Conduct and Evaluation:

1. Project/s Proposal Approval by guiding committee.
2. Periodic review of progress
3. Submission and evaluation of report/other deliverables as required by the project.

Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
		0	0	0	2
MARC621J	Professional Skill Enhancement - II	Syllabus version			
Pre-requisite	Nil	1.0			

Course Objectives:

To provide sufficient hands-on learning experience related to design and professional practice and to inculcate additional learning of subject matter in a professional working environment so as to enhance the technical skill sets in the architectural or allied fields

Course Outcome:

At the conclusion of the coursework, the student will be able to:

1. Collaborate and work in teams towards achievement of specific goals.
2. Apply academic skills to specific architectural problems and arrive at appropriate solutions.
3. Conduct experiments, analyse and document results
4. Engage with diverse social situations and technological environments and adopt appropriate thought processes to evolve solutions.

Module Content

The Professional Enhancement Skills may be any one of the following:

1. Participation individually or as a team member in one or more publicly advertised competitions cumulatively including a minimum of 120 hours of self-directed engagement.
2. In case of group projects, the individual project report of each student should specify theindividual's contribution to the group project.
3. Carried out inside or outside the university, in any relevant industry or researchinstitution.
4. Publications in peer reviewed journals / International Conferences will be an addedadvantage.

Mode of Conduct and Evaluation:

4. Project/s Proposal Approval by guiding committee.
5. Periodic review of progress
6. Submission and evaluation of report/other deliverables as required by the project.

Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
MARC622P	Python For Architects	0	0	4	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

7. To provide exposure to basic problem-solving techniques through programming
8. To implant the art of logical thinking for problem solving and arriving solutions for real world problems using Python Programming constructs

Course Outcome

6. Apply the algorithm design techniques to analyze, design and solve problems.
7. Explore the basic programming constructs and the types of functions in Python programming language.
8. Develop solutions using decision making and looping constructs in Python programming.
9. Epitomize compound data using various Python collections such as Lists, Tuples, Sets and Dictionaries.
10. Identify and abstract the programming skills in solving computational problems.
11. Implement Python programs for bio-inspired geometric simulations.

Module:1	Introduction to Computer Problem Solving	8 hours

Problem Solving: Definition and Steps - Problem Analysis Chart - Developing Algorithms: Sequential, Conditional and Iteration Algorithms (Samples: Exchange the values, Counting, Summation, Factorial Computation, Fibonacci Sequence, Reverse, Base Conversion, Character to Number Conversion) - Pseudocode and Flowchart

Module:2	Python Programming Fundamentals	12 hours

Basics: Interactive and Script Mode – Indentation – Comments – Variables – Keywords – Datatypes – Operators and precedence - Expressions – Buil-in Functions – Used-defined Functions – Types of Arguments - Importing from Packages

Module:3	Python Control Structures	12 hours

Decision Making and Branching: if, if-else, nested if, if-elif statements – Looping: while, for, nested loops – break – continue – pass

Module:4	Collections in Python	12 hours

Lists: Create, Access, Slicing/Indexing, List Methods, List Comprehensions – Tuples: Create, Access, Slicing/Indexing, Tuple Methods – Sets: Create, Access, Set Methods – Dictionaries: Create, Access, Dictionary Methods, Iterating through Dictionaries

Module:5	Architectural Design, Modeling and Visualization with Python	16 hours

Computational Design: Introduction - Generating Geometric Shapes and Patterns - Algorithmic Modeling Techniques – Simulating Bio-inspired Geometric in Python - Parametric Modeling: Introduction - Python Libraries for Parametric design - Data Analysis and Visualization: Pandas,

Matplotlib, Seaborn for Architectural Data - Overview of architectural software APIs - Interfacing Python with CAD and BIM software			
Total Lab hours			**60 hours**
Text Book(s)			
1.	Dromey R G, “How to Solve it by Computer”, Prentice-Hall international, 2007		
2.	“Introduction to Computer Science Using PYTHON: A Computational Problem-Solving Focus”, 1/e, Wiley, 2015. ISBN 978-0470555156.		
3.	“Python for Architects: A practical guide to computational design, parametric modelling and data analysis”, Emily Smith		
4.	“Python Scripting for ArcGIS”, Paul A. Zandbergen		
Reference Books			
1.	G. Brassard and P. Bratley - Fundamentals of Algorithmics - PHI – 2001		
2.	Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd, Pearson, 2011		
3.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist (2 ed.), O’Reilly, 2015. ISBN 978-9352134755.		
4.	Martin C. Brown, Python: The Complete Reference (1 ed.), McGraw-Hill, 2001. ISBN 978-9387572942.		
Mode of Evaluation**:** Continuous Assessments and Viva Voce/FAT			
Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
MARC623E	Virtual Reality for Architects	1	0	2	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives

1. To enable students to understand the concepts of Virtual Reality
2. To educate the students on Virtual Reality technology and its application in the field of architecture
3. To create Virtual environments and applications

Course Outcome

By the end of this course, students will:

1. Understand the hardware technology and development tools used in Virtual Reality
2. Be able to adopt virtual reality technologies to improve architectural visualization
3. Create immersive virtual reality tours

Module:1	INTRODUCTION TO VIRTUAL REALITY	1 hours

Definitions – History of VR – Key VR terminologies – VR and its relations to human perception – The science and theory of human sensory and cognitive systems - multi-sensory interactions with virtual environments – Output Devices – Input devices – Immersive and Non-immersive VR – Immersion and Presence – VR Software - Glossary of VR hardware – Tracking – Rendering - Visual Displays - CAVE

Module:2	360-DEGREE VIRTUAL TOURS	2 hours

Panoramas - Google Street view – Immersive and interactive virtual tours – 3D virtual tours – 360 Degree cameras and software – Key terminologies – 360 Degree camera rigs/mounts - Case studies

Module:3	PRE-PRODUCTION	2 hours

Scope definition – Content planning – Requirement analysis – Location scouting - Shot list – Storyboarding

Module:4	PRODUCTION	4 hours

Camera handling techniques – Accessories – Lighting – Camera software – Remote Capturing techniques – Spot editing – 3D models

Module:5	POST-PRODCUTION	4 hours

Stitching – Retouching – Editing – Panorama editing – 360 Degree video editing – Interactivity – Navigation – Guided tour – Narration – Music

Module:6	DEPLOYMENT AND TESTING	2 hours

Hosting virtual tours – Optimization of virtual tours – Compatibility testing – Mobile – Desktop – Head Mounted Display – Google cardboard – User testing – Improvisation

Total Lecture hours	15 hours

Text Book

1. Doerner, R., Broll, W., Grimm, P., & Jung, B. (Eds.). (2022). Virtual and Augmented Reality (VR/AR). Springer International Publishing.

Reference Books

1. Badotra, S., Tanwar, S., Rana, A., Sindhwani, N. & Kannan, R. (2023). Handbook of

	Augmented and Virtual Reality. Berlin, Boston: De Gruyter.
2.	Fink, C., Fine, R. and Rosedale, P. (2018) Charlie Fink's metaverse: An AR enabled guide to AR & VR. United States, LA: Cool Blue Media.
Indicative Experiments	
1.	Case study on types of VR devices
2.	Creating Virtual Environment
3.	Pre-Production for a Virtual 360-Degree Tour
4.	Documenting a site using VR: Production
5.	Creating an interactive virtual tour: Post-Production
6.	Compatibility testing
Mode of Evaluation: CAT, Written assignment, Digital assignment, Quiz, Case Study, and FAT	

Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No. 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
MARC624J	Architectural Travel Learning I	0	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives:

The course is aimed at

- To visit sites of historic, social or cultural significance
- To learn thought engagement with the other school of architecture/alleged fields
- To provide direct personal experiences of built environment
- To explore building with their context

Course Outcome:

At the end of the course the student should be able to

1. **Develop** knowledge, awareness and understanding of architectural development form a theoretical and historical standpoint
2. Critically **evaluate** and contribute to discussions on architectural theory and history
3. Acquire knowledge and awareness of the historical development of structures, construction systems and architectural elements relevant to contemporary concerns
4. Analyse built forms in relation to historical context
5. Demonstrate proficiency in research methodologies and effective communication of findings

Module: 1	Engaging in thoughtful discussions about the observation, to deepen understanding and gain valuable insights	**8 Hours**
Module: 2	Systematically recording the daily rhythms, customs and cultural practices of communities provides valuable insights into way of inhabitants	**16 Hours**
Module: 3	Capturing architectural proportions and elements through drawings or /and photography.	**16 Hours**
Module: 4	Chronicle material and technological aspects	**16 Hours**
Module: 5	Actively discussing functional utilization of architectural spaces through informed dialogues.	**8 Hours**
Module: 6	Participating in global architectural events, collaborating with peers and learning through workshops and seminars. Visiting Industries.	**32 Hours**
Module: 7	Creating a comprehensive set of architectural drawings, details and project reports, accompanied by well-captured photographs, to document the social, cultural and historical context.	**24 Hours**
Total Hours		**120 Hours**

Mode of Evaluation:

1. Active participation: Demonstrated engagement in workshops and seminars
2. Quality and Quantity: Consistent production of quality technical details, sketches and photo documentation
3. Submission of report & Travelogue

4. Viva voce.			
Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
MARC625J	Architectural Travel Learning II	0	0	0	2
Pre-requisite	Nil	Syllabus version			
		1.0			

Course Objectives:

The course is aimed at

- To visit sites of historic, social or cultural significance
- To learn thought engagement with the other school of architecture/alleged fields
- To provide direct personal experiences of built environment
- To explore building with their context

Course Outcome:

At the end of the course the student should be able to

6. **Develop** knowledge, awareness and understanding of architectural development form a theoretical and historical standpoint
7. Critically **evaluate** and contribute to discussions on architectural theory and history
8. Acquire knowledge and awareness of the historical development of structures, construction systems and architectural elements relevant to contemporary concerns
9. Analyze built forms in relation to historical context
10. Demonstrate proficiency in research methodologies and effective communication of findings

Module: 1	Discussing observations for insights, to deepen understanding and gain valuable insights	**8 Hours**
Module: 2	Recording community practices reveals valuable insights into inhabitants' way of life.	**16 Hours**
Module: 3	Documenting architectural features via sketches or photography.	**16 Hours**
Module: 4	Chronicle material and technological aspects	**16 Hours**
Module: 5	Engaging in informed dialogues about functional architectural space utilization	**8 Hours**
Module: 6	Participating in international architectural events, collaborating with colleagues, and acquiring knowledge through workshops and seminars. Additionally, explore local specialized manufacturing industries.	**32 Hours**
Module: 7	Producing a comprehensive collection of architectural drawings, detailed documentation, and project reports, complemented by meticulously captured photographs, to chronicle the social, cultural, and historical context.	**24 Hours**
Total Hours		**120 Hours**

Mode of Evaluation:

5. Active participation: Demonstrated engagement in workshops and seminars
6. Quality and Quantity: Consistent production of quality technical details, sketches and photo documentation
7. Submission of report & Travelogue
8. Viva voce.

Recommended by Board of Studies	13.02.2024		
Approved by Academic Council	No: 73	Date	14.03.2024

Course Code	Course Title	L	T	P	C
MARC626P	BIM for Architectural Application	0	0	4	2
Pre- requisite	Nil	Syllabus version			
		1.0			

Course Objectives

The course aims to build skills and turn them into practical results with comprehensive course on Building Information Modelling (BIM).
The course aims at familiarising the tools, workflow and best practices to efficiently create, manage, and document architectural BIM project models while collaborating with multi discipline project teams using international industry standards and workflows

Course Outcome

At the end of the course, the student will be able to
1. Understand the foundational skills required to design,
2. Understand and create BIM documents, and collaborate effectively in BIM projects
3. Apply the tools for sustainability and professional workflows.

Module:1	**BIM for Architecture**	**4 hours**
Introduction to integration of building services, need for the integration of Building services		
Module:2	**Transition from 2D drafting to 3D BIM workflows**	**10 hours**
Creating Walls, Adding Doors and windows to a project model, Creating Ceilings, Creating Floors, Multi-storey Modelling, Creating Roofs, Creating Curtain Walls, **Adding Rooms,** Creating Area Plans, converting other 2D file formats to 3D models		
Module:3	**Information and Data Management**	**10 hours**
Creating and Managing Schedules, Working with Parameters, Asset Data Management, Drawing Documentation, Multidisciplinary Collaboration		
Module:4	**Collaborating a BIM PIM (Project Information Model)**	**12 hours**
Linking BIM model Construction Cloud, Using Copy/Monitor for Coordination, Conducting a Coordination Review		
Module:5	**Outcome Based BIM: Design for Sustainability**	**12 hours**
Outcome Based BIM, Concept Modelling, Site and Environmental Analysis, Integration in to BIM		
Module:6	**Creating Photorealistic Renders with Twin motion**	**12 hours**
Export BIM models to Twin motion for real-time rendering, Apply materials, textures, and lighting to enhance the realism of your scenes, Add environmental elements such as landscapes, skies, and vegetation to create lifelike renderings, Generate photorealistic renders and animations to communicate design intent effectively.		
	Total Lab hours:	**60 hours**

Text Book(s)

	By Dominik Holzer - The BIM Manager's Handbook: Guidance for Professionals in Architecture, Engineering, and Construction, 2016 John Wiley &

Reference Books

	1. Charles M. Eastman, Chuck Eastman, Paul Teicholz, Rafael Sacks, 2018 Kathleen Liston, John Wiley & Sons 2. Autodesk Revit 2023 BIM Management, 2022 Published, ASCENT		
Mode of Evaluation: Lab FAT and Digital Assignments			
Recommended by the Board of Studies		25-2-2025	
Approved by Academic Council	77	Date	__.03.2025

Course Code	Course Title	L	T	P	C
MARC627L	Quality Survey, Specification and Estimations	2	0	0	2
Pre-requisite	Nil	Syllabus version 1.0			

Course Objectives

9. To demonstrate a deep understanding of quantity surveying, specification, and estimation principles.
10. To prepare accurate and detailed cost estimates for construction projects.
11. To utilize BIM and computational tools for efficient specification and estimation.
12. To assess and analyze rates for different construction activities and write detailed specifications.

Course Outcome

At the end of the course, the student will be able to

12. Grasp the principles of quantity surveying, detailed specifications, and estimation techniques, including cost planning, rate analysis, and tender documentation.
13. Develop proficiency in preparing accurate cost estimates and evolving rates for various building works.
14. Apply Building Information Modelling (BIM) and computational tools to streamline specification and estimation processes.

Module 1	**Introduction to Quantity Survey, Specification and Estimation**	**2 hours**
Introduction and basic understanding: Overview of quantity surveying, importance of specifications and estimation in architecture & basic principles and methodologies.		
Module 2	**Components of Specification and Estimation**	**2 hours**
Detailed components and their significance: Detailed study of specification components - comparative analysis of general and detailed specifications & techniques for writing effective and comprehensive specifications., types of specifications: general and detailed & estimation components and their significance - contingency allowances and risk management in estimation.		
Module 3	**Cost Estimation for Works**	**4 hours**
Methods and preparation of cost estimates: Methods of cost estimation, preparing detailed cost estimates - estimation software and tools for accurate cost estimation (e.g., CostX, Plan Swift) & case studies and practical examples.		
Module 4	**Evolving Rates for Building Works**	**4 hours**
Factors and practical exercises in rate evolution: Factors affecting rates, rate analysis and its importance & practical exercises in rate evolution.		
Module 5	**Detailed Specifications**	**6 hours**
Detailed specifications across architecture, civil & interior domains: Specifications - Civil works, architecture, building services & interior design		
Module 6	**BIM and Its Process Related to Specification and Estimation Reports (Part 1)**	**6 hours**

Introduction and application of BIM: Introduction to Building Information Modelling (BIM), BIM processes and tools – Step by step process of creating and managing BIM models, data exchange and interoperability in BIM, introduction to BIM Execution Plans (BEP) and project workflows & application of BIM in specification and estimation - BIM with cost estimation tools (e.g., Cost X, BIM 360 Cost Management), Real-time cost estimation and budget tracking with BIM & Case studies highlighting successful BIM implementation in specification and estimation.		
Module 7	**BIM and Its Process Related to Specification and Estimation Reports (Part 2)**	**4 hours**
Advanced BIM techniques and integration: Advanced BIM techniques (e.g., AutoCAD, MS Project), case studies and practical applications & integration of BIM with other computational tools - Utilizing BIM for sustainability and energy analysis (e.g., Green Building Studio, Insight) - Future trends in BIM and its impact on the construction industry.		
Module 8	**Interactive session & Professional training**	**2 hours**
Expose to practical implications & Real time projects with Industrial engagements		
	Total Theory hours:	**30 hours**

Text Book(s)	
1.	Dutta, B. N., Estimating and Costing in Civil Engineering, UBS Publishers & Distributors pvt. ltd, 2021
2.	Brad Hardin, Dave McCool., BIM and Construction Management: Proven Tools, Methods, and Workflows by John Wiley & Sons, 2015
3.	Donald Towey., Construction Quantity Surveying: A Practical Guide for the Contractor's QS by John Wiley & Sons, 2017
4.	Allan Ashworth, Srinath Perera., Cost Studies of Buildings by Taylor & Francis, 2015
Reference Books	
1.	Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria & Sons, New Delhi. 2021
2.	S.C. Rangwala, Estimating And Costing, Charotar Publishing House, Anand, 2017
3.	Chuck Eastman (Author), Paul Teicholz (Author), Rafael Sacks (Author), Kathleen Liston (Author)., BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors by John Wiley & Sons Inc; 2nd edition, 2011

Mode of Evaluation**:** Continuous Assessment Test, Quizzes, Assignments, Final Assessment Test			
Recommended by the Board of Studies	25-2-2025		
Approved by Academic Council	77	Date	__.03.2025