ANNA UNIVERSITY, CHENNAI

POSTGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: M. Arch. (Digital Architecture) **Regulations:** 2025

Abbreviations:

Category	Course Type	
PC – Professional Core	S - Studio	
PE – Professional Elective	T – Theory	
BS & AE – Basic Sciences & Applied Engineering	TS – Theory cum Studio	
PAE – Professional Ability Enhancement	IT – Internship Training	
SD – Skill Development	LIT – Laboratory Integrated Theory	
SL – Self Learning		
HUM – Humanities (including Languages and others)	TCP – Total Contact Period(s)	
	L – Lecture	P – Practical
	T – Tutorials	S - Studio

Semester I

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.	MH25C01	Research Methodologies for Built Environment	T	3	0	0	3	3	PC
2.	DG25101	Computational Design and Architecture	T	3	0	0	3	3	PC
3.	DG25102	Digital Fabrication	T	3	0	0	3	3	PC
4.	DG25103	AI and Machine learning for Architecture	T	3	0	0	3	3	PC
5.	DG25104	Advanced Manufacturing and 3D Printing	TS	1	0	3	4	4	PAEC
6.	DG25105	Digital Studio I : Process Based Design	S	0	0	10	10	10	PC
						Total	26	26	

Semester II (Prerequisite- Pass in Digital Studio I: Process based design)

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.		Advanced Computational Design and Machine Learning	T	3	0	0	3	3	PC
2.		Metatexts in Architecture	T	3	0	0	3	3	PC
3.		Modular Architecture	T	3	0	0	3	3	PC
4.		Geographical Information Systems for Built Environment	TS	1	0	3	4	4	PAEC
5.		Professional Elective I	---	X	X	X	3	3	PE
6.		Industry Oriented Course	---	X	X	X	---	1	SD
7.		Digital studio II: Parametric and ML-Assisted Architectural Design.	S	0	0	10	10	10	PC
						Total	**26**	**27**	

Semester III (Prerequisite- Pass in Digital Studio II: Parametric Architectural Design)

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.		Digital IoT apps	T	3	0	0	3	3	PC
2.		Sustainable Architecture and Environmental Modelling	T	3	0	0	3	3	PC
3.		Dissertation	T	0	0	4	4	4	PC
4.		Digital Studio III : Urban Computational Design	S	0	0	10	10	10	PC
5.		Professional Elective II	---	X	X	X	3	3	PE
6.		Professional Elective III	---	X	X	X	3	3	PE
7.		Internship Training	---	---	--	---	---	2	SD
						Total	**26**	**28**	

Semester IV

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.		Thesis Project	S	0	0	20	20	20	SD
2.		Professional Elective IV	---	X	X	X	3	3	PE
						Total	**23**	**23**	

Professional Elective Courses (PEC)

S. No.	Course Code	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P/S		
1.		Culture of Public Spaces	3	0	0	3	3
2.		Advanced Graphics and Interface Architecture	3	0	0	3	3
3.		Quantitative Techniques and Data Representation	3	0	0	3	3
4.		Digital Media	3	0	0	3	3
5.		Soft Skills	2	0	1	3	3
6.		User Interface and User Experience Design (UI / UX)	3	0	0	3	3
7.		Advanced BIM and Building Services	3	0	0	3	3
8.		Materials and Tectonics in DA	3	0	0	3	3
9.		Advanced Coding for Urban Design	1	0	2	3	3
10.		Psychology of Learning and Development	3	0	0	3	3
11.		Advanced Structures and Modular systems	3	0	0	3	3
12.		Metaverse	3	0	0	3	3
13.		Generative Design for Fabrication	1	0	2	3	3
14.		Ecology and Digital Architecture	3	0	0	3	3
15.		Social Theory and the City	3	0	0	3	3
16.		Theory of Architectural Education	3	0	0	3	3
17.		Ethics and policy in digital architecture	3	0	0	3	3

Semester I

MH25C01	Research Methodologies for Built Environment	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To give introduction to the importance of critical inquiry as a way of gaining knowledge and adding to it through research.
- To give exposure to the various forms of research and research methodologies/ processes.
- To understand research in the specific domain of built environment research.

Introduction: Basic research issues and concepts. Orientation to research process. Types of research: historical, qualitative, co-relational, experimental, simulation and modelling, logical argumentation, case study and mixed methods. Illustration using research samples including research in the domain of built environment.

Research Process: Elements of Research process: finding a topic, writing an introduction, stating a purpose of study, identifying key research questions and hypotheses, reviewing literature, using theory, defining, delimiting and stating the significance of the study, advanced methods and procedures for data collection and analysis. Illustration using research samples including research in the domain of built environment.

Researching and Data Collection: Library and archives. Internet: New information and the role of internet. Finding and evaluating sources. Misuse. Test for reliability. Ethics.

Methods of data collection- Primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling. Collecting data from secondary sources. Socio-economic research techniques such as focused group discussions, participant observation.

Methods and Tools in Urban Research: Space syntax: key concepts of space syntax and their development, spatial properties - connectivity, integration, intelligibility, etc. - of the built environment and explore their impact on user behavior, visual field/isovist characteristics - compactness, occlusivity, clustering coefficient, etc. - of the built environment and explore their impact on user behavior, analyse architectural and urban layouts using space syntax methods - convex analysis, justified graph, axial analysis and visibility graph analysis. Use of excel software for analyzing data; applications of features of excel- basic and selected advanced features. Data analysis: Advanced Excel, SPSS. Impact of ‘Big Data’ or statistics on interpretation of urban phenomena

Report Writing & Case Studies: Research writing in general and its components. Developing the outline, referencing, writing the bibliography, presentation, etc,. Case studies of competent research, from project inception to completion with a focus on research in the domain of built environment. Review of research publications.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.

One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Groat, L., & Wang, D. (2013). *Architectural research methods* (2nd ed.). John Wiley & Sons Inc.
2. Booth, W. C., Williams, J. M., & Colomb, G. G. (2008). *The craft of research* (3rd ed.). University of Chicago Press.
3. Borden, I., & Ruedi, K. (2005). *The dissertation: An architecture student's handbook* (2nd ed.). Architectural Press.
4. Kumar, R. (2014). *Research methodology: A step-by-step guide for beginners* (4th ed.). Sage Publications.
5. Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications.
6. Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method and research* (1st ed.). Sage Publications.
7. Ward, K. (2013). *Researching the city*. Sage Publications Ltd.
8. Gaur, A. S. (2011). *Statistical methods for practice and research: A guide to data analysis using SPSS*. Response Books.

E-resources:

1. Bell, J., & Waters, S. (2018). Doing your research project: A guide for first-time researchers (7th ed.). McGraw-Hill Education. ISBN 9780335243396
2. Sheppard, V. (2020). Research methods for the social sciences: An introduction. B Ccampus & Open Textbook Library https://open.umn.edu/opentextbooks/textbooks/1589
3. Schulman, J. S. (2024, March 28). An exploration of research methods (ResearchMethod.net). Manteio Company.https://researchmethod.net.
4. Phelps, J. (2021). Engaging Research Communities in Writing Studies: Ethics, Public Policy, and Research Design (1st ed.). Routledge. https://doi.org/10.4324/9781003082002
5. Joore, P., Stompff, G., & van den Eijnde, J. (Eds.). (2022). Applied Design Research: A Mosaic of 22 Examples, Experiences and Interpretations Focussing on Bridging the Gap between Practice and Academics (1st ed.). CRC Press. https://doi.org/10.1201/9781003265924

	Description of CO	PO Mapping
CO1	Identify, decipher and interpret issues relating to architecture based on research enquiry methods.	PO1 (3) PO2 (2)
CO2	Exemplify different methods of conducting research and research writing	PO1 (3) PO2 (2)
CO3	Interpret specific research related to built environment.	PO1 (3) PO2 (2)

DG25101	Computational Design and Architecture	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To provide understanding of the role of technology and digital media in contemporary architecture.
- To give knowledge about parametric design and generative / algorithmic design and the differences between them through case studies.

Introduction: Investigation of contemporary theories of media and their influence on the perception of space and architecture. Technology and Art, Technology and Architecture, Technology as Rhetoric, Digital Technology and Architecture. Aspects of Digital Architecture – Design and Computation, Difference between Digital Process and Non-Digital Process, Architecture and Cyber Space, Qualities of the new space, Issues of Aesthetics and Authorship of Design, Increased Automation and its influence on Architectural Form and Space.

Parametric Design: Diagrams, Diagrammatic Reasoning, Diagrams and Design Process, Animation and Design, Digital Hybrid Design Protocol, Concept of Emergence – Problematization, variable, constraints application

Generative and algorithmic design: Delineating design parameter- deconstructing work flows. Fractal Geometry and their properties - Architectural applications, Works of ZviHecker. Shape Grammar - Shapes, rules and Label. Shape Grammar as analytical and synthetic tools, Combining Shape grammar and Genetic algorithm to optimize architectural solutions. Hyper Surface – Introduction to Hyper surface and concepts of Liquid architecture, Cellular Automata and Architectural applications. Genetic algorithms and Design Computation

Digital Media: Interactivity and connectivity to virtual data and digital information. Augmented reality - virtual to production. Digital fabrication, virtual collaboration.

Case Studies: Case studies- Study, understanding and analysis of known examples at the national and international levels which demonstrates the contemporary theories of media and their influence on the perception of space & architecture, contemporary design processes and its relation to computation.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Novak, M. (2000). *Invisible architecture: An installation for Greek Pavilion, Venice Biennale*.
2. *Contemporary techniques in architecture*. (2002). Halsted Press.
3. Rahim, A. (2000). *Contemporary process in architecture*. John Wiley & Sons.
4. Menges, A., & Ahlquist, S. (Eds.). (2011). *AD reader: Computational design thinking*. John Wiley & Sons Ltd.
5. Jabi, W. (2013). *Parametric design for architecture*. Laurence King Publishing Ltd.

6. Bernal, M., Haymaker, J. R., & Eastman, C. (2015). On the role of computational support for designers in action. *Design Studies, 41*.
7. Kolarevic, B. (Ed.). (2003). *Architecture in the digital age: Design and manufacturing*. Taylor & Francis.
8. *Work of architecture in the age of mechanical reproduction*. (1997). Differences. MIT Press.
9. Mitchell, W. J. (1995). *The logic of architecture: Design, computation & cognition*. MIT Press.
10. Barrios, C. (2005). Transformations on parametric design models: A case study on the Sagrada Familia columns instances of a parametric model. In *Proceedings of the 11th International Conference on Computer Aided Architectural Design Futures*.

E -resources

1. https://ocw.mit.edu/courses/architecture/4-520-visual-computing-fall-2020/
2. https://parametric-architecture.com/
3. https://onlinelibrary.wiley.com/journal/15542769

	Description of CO	**PO Mapping**
CO1	Describe the effects of contemporary theories of media on contemporary architectural design.	PO1(1) PO2(3) PO4(2) PO5(3)
CO2	Explain various contemporary design processes and their relation to computation	PO2(2) PO4(3) PO5(3)

DG25102	Digital Fabrication	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To give exposure to various digital production tools to build artefacts as part of creative design process.
- To give knowledge about utilizing prototyping and modelling as a design medium that supports the full spectrum of digital design as a paperless process.
- To give knowledge about fabrication process in Digital Architecture as a way to bring software models into reality.

Materials and Properties: Plastics & Composites- Polymers, Thermoplastics, Honeycomb materials.

Wood and Fibrous Materials - Case Studies and Application, Laminated wood products, Veneers, Steam bent members.

Metals and Ceramics - Case Studies and Applications - Steel, Aluminium, Alloys - Ceramic Hybrids - Production and Fabrication Standards.

Additive Fabrication Processes: Additive Fabrication Processes Case Studies - Fused Deposition Processes - Injection Molding, Roto-Molding- Casting Technologies - 3D Printing (SLA, SLS, FDM)

Subtractive Fabrication Processes: Subtractive Fabrication Processes Case Studies, Laser Cutting [vaporization cutting and industrial manufacturing] , Water Jet Processes, CNC 3, 5, & 7 Axis Milling, Cutting, Planning, Drilling.

Transformative Fabrication & Mass Production Manufacturing Processes:
Transformative Fabrication Processes Case Studies- Methods of Factory-Based production

Experimental Fabrication Processes: Experimental Fabrication Processes Case Studies,
Biological Growth Formation - Crystal Structure Formation, Explosion Forming - Muscle Wire and Self-Assembling Structures.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Kolarevic, B., & Klinger, K. (2014). *Manufacturing material effects: Rethinking design and making in architecture*.
2. Andersen, P., Salomon, D., Kwinter, S., & Carson, D. (2010). *Digital fabrication, architecture of patterns*. W. W. Norton & Co.
3. Engel, H. (1997). *Structure systems*.
4. Iwamoto, L. (2009). *Digital fabrications: Architectural and material techniques*. Princeton Architectural Press.

5. Kolarevic, B. (2005). *Architecture in the digital age: Design and manufacturing*. Taylor & Francis.
6. Shiel, B., & Glynn, R. (2011). *Fabricate: Making digital architecture*. Riverside Architectural Press.
7. Emergent Design Group. (2004). *Morphogenetic design strategies*. AD.
8. Moussavi, F., Lopez, D., Ambrose, G., Fortunato, B., Ludwig, R. R., & Schricker, A. (n.d.). *The function of form*.
9. Oxman, R., & Oxman, R. (n.d.). *The new structuralism: Design, engineering and architectural technologies*.
10. Weinstock, M., Hensel, M., & Menges, A. (Eds.). (2004). Emergence: Morphogenetic design strategies. *AD, 74*(3).

E -resources

1. https://mml.mit.edu/
2. https://www.hubs.com/knowledge-base/
3. https://research.gsd.harvard.edu/drg/

	Description of CO	PO Mapping
CO1	Summarize the machines, different methods of fabrication and the workability with materials	PO1(3) PO2(3) PO4(2) PO6(2)
CO2	Correlate between the design processes and digital prototype or model attributes.	PO1(2) PO2(3) PO4(2) PO6(2)

DG25103	AI and Machine Learning for Architecture	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To introduce fundamental concepts of Artificial Intelligence and Machine Learning in architectural design and presentation.
- To understand data-informed and adaptive design methods.
- To gain the ability to use basic ML models to support form generation, spatial analysis, and environmental performance.

Introduction to AI & ML in architecture: Overview of Artificial Intelligence and Machine Learning, Definitions, history and evolution, Types of learning: supervised, unsupervised, Key applications in architecture: generative design, simulation, user behaviour modelling, Positioning AI within digital architecture.

Python Programming for Architectural Intelligence: Basic Python programming: variables, data types, loops, and functions, Libraries for ML: NumPy, Pandas, Matplotlib (intro only), Writing a simple classification or clustering algorithm, Hands-on exercises with architectural datasets (e.g., occupancy, material usage, sunpath data), Python as a bridge to Grasshopper scripting or Rhino compute.

Design Data and Learning Systems: Understanding architectural data: spatial, environmental, user-behaviour data (movement, Occupancy and usage patterns), Basics of data pre-processing, Cleaning and Formatting data, Preparing datasets for design analysis, Feature identification, Basics of classification, clustering, and regression, Interpreting results in design contexts.

Architectural Workflows Using AI/ML: ML in space planning and form-finding – Design automation and pattern recognition, Environmental analysis using data-driven models, Post-occupancy evaluation, Real-world case studies: Demonstration of how ML outputs can inform architectural decision-making.

Tools & Frameworks (Design-Oriented): Introduction to Google Teachable Machine, Visual learning through RunwayML, Basics of ML integrations in Rhino/Grasshopper (Owl), Using Colab notebooks for spatial data experiments, Discussion of workflows, not coding, heavy.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Geron, A. (2022). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow (3rd ed.). O'Reilly.
2. Barry, P. (2016). Head first Python (2nd ed.). O'Reilly.
3. Burry, M. (2020). The new mathematics of architecture. Thames & Hudson.
4. Asadi, E., et al. (2023). Artificial intelligence for sustainable building design. Springer.

5. Del Campo, M., & Manninger, S. (2022). Machine hallucinations: Architecture and artificial intelligence. ORO Editions.
6. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.
7. RunwayML, Google Teachable Machine, & Owl plugin documentation. (n.d.). [Software documentation].

E -resources

1. https://www.youtube.com/watch?v=mAZzImzYK6Q
2. https://teachablemachine.withgoogle.com/
3. https://towardsdatascience.com
4. https://www.shapediver.com/blog

	Description of CO	**PO Mapping**
CO1	Interpret core AI/ML concepts relevant to architectural thinking.	PO1(3) PO2(2) PO4(2) PO6(2)
CO2	Correlate data-driven reasoning to basic spatial design problems.	PO1(3) PO2(3) PO4(2) PO6(2)

DG25104	Advanced Manufacturing and 3D Printing	L	T	P	C
		1	0	3	4

Course Objectives:

- To impart design thinking, knowledge and skills related to advanced manufacturing (additive manufacturing and 3D printing technologies).
- To provide familiarity with tools, material and equipment related to additive manufacturing and 3D printing.

Introduction: Introduction to Advanced manufacturing types and processes. Emergence of 3D printing and AM, additive manufacturing. Differences between AM, additive manufacturing design process vs. conventional DTM, design theory and methodology, with respect life-cycle objectives. Additive manufacturing applications for rapid prototyping to the end-of-use product manufacturing process. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defense, Automotive, Construction, Food Processing,

Additive Manufacturing and 3D Printing Enabled Design Process: Design thinking and advanced manufacturing. Parametric design and additive manufacturing. Rapid prototyping, rapid tooling and Rapid manufacturing. Design and shape complexity, material complexity, hierarchical complexity, and functional complexity in additive manufacturing. Function integration and structure optimization in additive manufacturing. Impact of AM on conventional DTM and manufacturing, in terms of design for manufacturing (DFM), design for assembly (DFA) and Design for Performance (DFP).Story boarding additive manufacturing process.

Additive Manufacturing Techniques, Materials and Equipment: Stereo-Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Machine Tools. Materials-Polymers, Metals, Non-Metals, Ceramics. Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Materials and Equipment.

Additive Manufacturing Coding, Tools and Parametric Design: CAD Data formats, Data translation, Data loss, STL format. C and tools for additive manufacturing. Coding, visual scripting and software tools for parametric design and additive manufacturing

Additive Manufacturing Project : Design methodologies, parametric processes and tools of additive manufacturing will be deployed in a parametric design and additive manufacturing project.

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations 50%.

Assessment Methodology: Three Assessments with equal weightage.

One Assessment as Internal written Test /Examination (approx.33.33%), other two Assignments (approx.33.33% each) incorporate continuous marking of the work and performance during the particular assessment period such as drawings, models, study, seminar, etc.

References:

1. Gibson, L., Rosen, D. W., & Stucker, B. (2010). *Additive manufacturing technologies: Rapid prototyping to direct digital manufacturing*. Springer.
2. Gebhardt, A. (2011). *Understanding additive manufacturing: Rapid prototyping, rapid tooling, rapid manufacturing*. Hanser Publisher.

3. Chua, C. K., & Leong, K. F. (2017). *3D printing & rapid prototyping: Principles & applications*. WS.
4. Child, H., & Kareem, B. (2011). *Digital processes: Planning, design and production*. Birkhäuser.
5. Majumdar, J. D., & Manna, I. (2013). *Laser-assisted fabrication of materials*. Springer Series in Material Science.
6. Lu, L., Fuh, J., & Wong, Y. S. (2001). *Laser-induced materials and processes for rapid prototyping*. Kluwer Academic Press.
7. Fan, Z., & Liou, F. (2012). *Numerical modelling of the additive manufacturing (AM) processes of titanium alloy*. InTech.
8. Parolek, D. G., Parolek, K., & Cram, P. C. (2000). *Form based codes*. John Wiley.

E -resources

1. https://www.autodesk.com/technology-centers
2. https://www.hubs.com/knowledge-base/3d-printing-handbook/
3. https://discourse.mcneel.com/

	Description of CO	**PO Mapping**
CO1	Identify appropriate tools, materials and equipment for additive manufacturing and 3D printing process	PO2(3) PO3(1) PO4(2) PO6(3)
CO2	Summarize the design process and skill sets for parametric design and additive manufacturing.	PO2(2) PO3(1) PO4(2) PO6(2)

DG25105	Digital Studio I: Process Based Design	L	T	P	C
		0	0	10	10

Course Objectives:

- To give understanding of importance of diagramming and translating the ideas into geometry.
- To give exposure to the various processes of user centric designs and computer exploration of form finding for smaller scale spaces or products.
- To give understanding of principles behind product design, explore tools and techniques for prototyping.
- To give exposure to the various methods of manual or 3D printed prototyping

Content

This course will emphasise on designing and prototyping a product or small scale space. The design process involves identifying the user needs, analyzing the product attributes such as function, emotions, Diachronic, Synchronic, parallel situations, future situations etc.

Analyze selective products to understand its geometry, mathematical principles, materials and technique behind manufacturing the product, ergonomics user analysis, techniques behind its prototyping and also analyze its packing and display designs. After the user centric analysis the concept of translating ideas into geometry and form generation or form finding can be made with the help of Computer Explorations of Fractals, Chaos, Complex Systems, Shape grammar, generative iterations and exploring the 3D lattice and structures.

The design detailing can be based on modularity and modular systems for mass production, study on various materials for prototyping and algorithm of packing design and display system of the designed product. The design output can be any product not limited to furniture /kiosk / bus-stop or bus shelter / street furniture/ packaging design/ book shelf/ workstations/speaker design/mouse/ other small products. The final design output should be explored with different types of prototype fabrications. The prototype fabrications can be either of manual or 3d printing.

The building shall be designed to minimize energy use and operating costs without affecting the functionality, accommodation standards, occupant health, safety or comfort. Quantification of the results should be based on theoretical and mathematical principles. Manual quantification is essential for the following aspects.

- Microclimatic analysis - Bio climatic and psychometric analysis of comfort zone (based on eco charts, and graphs)
- Whole building Analysis for Energy performance, (based on heat gain and heat loss calculations etc.,)
- Indoor thermal comfort, (Solar Analysis for optimizing Orientation, Shading and shading analysis, TSI, Thermal neutrality, time lag, Decrement factor etc.,)

- Passive energy conservation measures (performance evaluation of passive strategies like, stack effect, thrombe wall, radiant cooling system etc.,)
- Indoor lighting levels (based on Day light factor method, lumen method etc.,)
- Air quality analysis (IAQ)
- Analysis on Life cycle assessment/ Embodied energy and carbon foot print
- Site contour analysis, Net perforated area, annual run off calculations.

The project submission should be in the form of Drawings, calculations, models and reports.

Weightage: Continuous Internal Assessment:50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with equal weightage (approx.33.33% each).
Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period.

References:

1. Coelho, D. (Ed.). (2011). *Industrial design: New frontiers*. BoD – Books on Demand.
2. Ulrich, K. T. (2003). *Product design and development*. Tata McGraw-Hill Education.
3. Flake, G. W. (1998). *The computational beauty of nature: Computer explorations of fractals, chaos, complex systems, and adaptation*. MIT Press.
4. Falconer, K. (2003). *Fractal geometry: Mathematical foundations and applications*.
5. Maeda, J. (2001). *Design by numbers*. MIT Press.
6. Hekkert, P., & Schifferstein, H. (2008). *Product experience*. Elsevier Science Limited.
7. Baird, E. *Alt. fractals: A visual guide to fractal geometry and design*. Chocolate Tree Books.
8. Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic Books.

E -resources

1. https://dschool.stanford.edu/resources/design-thinking-bootleg
2. https://www.shapediver.com/blog
3. https://www.instructables.com/

	Description of CO	PO Mapping
CO1	Understanding of the concepts and basics of mathematics (Geometry) behind computational design	PO1(3) PO2(1) PO4(2) PO5(1) PO6(3)
CO2	Basic knowledge of 3D Modelling and prototyping techniques.	PO1(2) PO2(1) PO4(3) PO6(3)