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
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.	DG25201	Advanced Computational Design and Machine Learning	T	3	0	0	3	3	PC
2.	DG25202	Metatexts in Architecture	T	3	0	0	3	3	PC
3.	DG25203	Modular Architecture	T	3	0	0	3	3	PC
4.	MH25C03	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.	DG25204	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.	DG25301	Digital IoT apps	T	3	0	0	3	3	PC
2.	DG25302	Sustainable Architecture and Environmental Modelling	T	3	0	0	3	3	PC
3.	DG25303	Dissertation	T	0	0	4	4	4	PC
4.	DG25304	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.	DG25305	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.	DG25401	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.	UR25C03	Culture of Public Spaces	3	0	0	3	3
2.	DG25001	Advanced Graphics and Interface Architecture	3	0	0	3	3
3.	UR25C01	Quantitative Techniques and Data Representation	3	0	0	3	3
4.	DG25002	Digital Media	3	0	0	3	3
5.	MH25C06	Soft Skills	2	0	1	3	3
6.	DG25003	User Interface and User Experience Design (UI / UX)	3	0	0	3	3
7.	DG25004	Advanced BIM and Building Services	3	0	0	3	3
8.	DG25005	Materials and Tectonics in DA	3	0	0	3	3
9.	DG25006	Advanced Coding for Urban Design	1	0	2	3	3
10.	MH25C05	Psychology of Learning and Development	3	0	0	3	3
11.	DG25007	Advanced Structures and Modular systems	3	0	0	3	3
12.	DG25008	Metaverse	3	0	0	3	3
13.	DG25009	Generative Design for Fabrication	1	0	2	3	3
14.	DG25010	Ecology and Digital Architecture	3	0	0	3	3
15.	UR25C02	Social Theory and the City	3	0	0	3	3
16.	MH25C07	Theory of Architectural Education	3	0	0	3	3
17.	DG25011	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)

	Description of CO	PO Mapping
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)

DG25201	Advanced computational design & machine learning	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn how to use generative design & generative system architecture and their relation to computation.
- To highlight the importance of using computer as a generative tool in the design process depending on scripting and algorithmic architecture approach of designing.

Generative Design and Generative System

Introduction, definitions and Properties of Generative design. Difference between traditional method of design and generative design. Generative system design in Architecture- Definition, historical background. Generative design process and its categories. Algorithmic generative systems, Parametric systems and Formalisms- L-systems, Cellular automata systems, Fractal systems and Shape grammars. Categories of Generative Model

Introduction to Computation and Programming

Introduction. Differences between Computation and Computerization. Visions about Using Computers in the Design Process. Introduction to Computational Design Techniques. Characteristics of computational design techniques- Geometry – Composition - Algorithmic thought

Algorithmic Design

Definition of Algorithm and Algorithmic Design. Requirements of Algorithmic design. Algorithmic problems classification and problem solving. Algorithms in Computational Design. Introduction to programming. Coding, Scripting and Modeling methods in Architecture. Classification of Programming languages.

Introduction to Coding

Introduction to programming and the Python language. Variables, Conditionals, Lists, Loops, Functions, Strings, Tuples, Sets and PyCharm in Python. Loading and Storing data in Python. Python for Rhino. Importing Rhino Commands. Case studies.

Morphogenetic Design

Introduction and definition of Morphogenesis. Morphogenesis in Architecture. Digital Morphogenesis/Computational Architecture and its classification- Topological architecture, Isomorphic architecture, Animate architecture, Metamorphic architecture, Parametric architecture and Evolutionary architecture. Digital Morphogenesis and its implication- emergence, self-organization and form-finding.

Tools: Midjourney, DALL·E, DreamStudio, RunwayML
Text-to-architecture workflows
Translating AI art into architectural diagrams
Introduction to Reinforcement Learning

Sensors + ML (vision, audio, movement) (Can be adapted in Coding for Architecture subject)
Use of Arduino/Raspberry Pi for real-time inputs (Can be adapted in Advanced Computational Design & Machine Learning)

E-Resources:

1. https://topologicbim.org/
2. https://developer.rhino3d.com/guides/rhinopython/
3. https://designmorphine.com

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. Ahlquist, S., &Menges, A. (2011). Computation Design Thinking. New Jersey: John Wiley and Sons Ltd
2. Hensel, M., Menges, A., &Weinstock, M. (2010). Emergent technologies and design: towards a biological paradigm for architecture. London: Routledge.
3. Python: The Complete Reference by Martin C Brown, McGraw Hill Education; Fouth Edition, 2018
4. Emergence Morphogenetic Design Strategies by Michael Hensel, AchimMenges, Michael Weinstock, Architectural Design Journal.2004.
5. Techniques and Technologies in Morphogenetic Design, Michael Hensel, AchimMenges + Michael Weinstock, Architectural Design Journal, 2006.

DG25202	Metatexts in Architecture	L	T	P	C
		3	0	0	3

Course Objectives:

- To give knowledge about the role of texts in understanding various contradictions and formulation of thought in architecture.
- To give knowledge about the trajectory of architectural profession in India and abroad, in reference to the field of digital architecture.

Architectural Paradigm I: Route to Modernism

The ten books on architecture – Marcus Vitruvius; Scientific classification in history of architecture by sir Banister Fletcher; Fermentation in Architecture – Hans Poelzig; Ornament and crime - Adolf loos; Organic Architecture -F.L.Wright;The tall office building artistically considered- Louis Sullivan; Futurist Architecture - Antonio Sant'Elia; The new ideas on architecture – Walter Gropius and Brouno Tout; Towards an architecture by Le Corbusier; Analytical and Utopian Architecture – AurthorKrun; Towards a plastic Architecture – Van Doesburg; Industrialised Buildings, Technology and Architecture – Meis van der Rohe; Universal Architecture – Buckminister Fuller; Team 10 Primer – Aldo Van Eyck, Alison and Peter Smithson.

Architectural Paradigm II: Responses to Modernist Crisis

Territory of architecture - Vittorio Gregotti; Complexity and contradiction in architecture – Robert Venturi; Post Functionalism- Peter Eisenman; The case of figurative Architecture – Michael graves;Aesthetics of architecture -Roger Scruton; Post-modern Architecture – ChalesA.Jencks; introduction to five architects – Colin Rowe; Towards a Critical Regionalism - Kenneth Frampton; Towards new horizons in architecture – Tada Ando; Towards a critique of architectural Ideology-ManfredoTafuri.

Theoretical Paradigms of Postmodernism

Theoretical paradigms from social theories that shaped the architectural theories of late 20th century – Phenomenology:Building, Dwelling, Thinking- martin Heidegger; Genius Loci - Christian Norberg-Schulz; social construct of place – Henri Lefebvre and Gaston Bachelard. Aesthetics of sublime: The Work of Art in the Age of Mechanical Reproduction and the idea of flaneur – Walter benjamin; theoretical works of Siegfried Kracauer on ornamentation. Lingustics: Semiotics and Architecture -The "Deep Structures" of language, The structure of society- from strauss to Barthes, Rediscovering the meanings in architecture. Ideology and space: Frommarx to Marxism, Marxist interpretation of built spaces and the city – Ideology of Foucault, Debord, Simon Sadler and David Harvey.Body and Space: tendencies and trajectories: Feminist approaches in architecture- Jane Rendell.

Theories of The Postmodern City

The life and Death of Great American Cities- Jane Jacobs; Defensible cities - Oscar Newman; The collage city – Colin Rowe; The Architecture of the city – Aldo Rossi; The structure of the ordinary -N. John Habraken; The Meaning of the Built Environment by Amos Rapoport;Pattern language by Christopher Alexander; Learnings from Lag vegas - Denise Scott Brown and Robert Venturi; Image of the city – Kevin Lynch;what would now sexist city would look like? - Dolores Hayden; whatever happened to urbanism?- Rem Koolhaas. Understanding architecture and urbanism of the Indian Cities - After the masters (Contemporary Indian Architecture) -Peter Scriver and Vikram Bhatt.

Architecture of the Contemporary City

Architecture Depends – Jermy Till; Visions Unfolding – Architecture in the age of electronic media- Peter Eisenman; architecture and the disjunction – Bernard Tschumi; Cradle to Cradle: Remaking the Way We Make Things - Michael Braungart and William McDonough; Notes around the Doppler Effect and Other Moods of Modernism - Robert Somol and Sarah Whiting; The case for the Tectonic – Kenneth Frampton; Material tendencies - Jeanne Gang; Ebodies, E cities, E buildings - William Mitchell; Digital culture in architecture - Antoine Picon; Towards performance driven computational geometry – Neri Oxman; The Geometry of Feeling – Juhani Pallasma; System thinking Revisited – Francis Duffy; Performative architecture – Branko Kolarevic; Adaptive strategies- Simosyannas.

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. Jencks, Charles, and Karl Kropf. Theories and Manifestoes of Contemporary Architecture. Wiley-Academy, 2006.
2. Gausa, Manuel. The Metapolis Dictionary of Advanced Architecture. Actarbirkhauser, 2003.
3. Hays, K. Michael. Architecture Theory since 1968. MIT Press, 2000.
4. Braham, William W., and Jonathan A. Hale. Rethinking Architectural Technology. London: Routledge, 2013.
5. Picon, Antoine. Digital Culture in Architecture: An Introduction for the Design Professions. Birkhäuser, 2010.

E -resources

1. https://www.arch.columbia.edu/books/reader/321-arguments
2. https://www.gsd.harvard.edu/event-type/lectures/
3. https://www.routledgehandbooks.com/doi/10.4324/9780203096539.ch1

DG25203	Modular Architecture	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the idea of mass production and advance building technologies in architecture
- To introduce advanced materials and pre-fabricated modules.3

Introduction

Introduction to prefabrication, manufacturing, modular, flat pack modular, volumetric modular - Modular co-ordination, standardization and tolerances - Moulds –construction design, maintenance techniques. Utopian concepts, principles and ideology on modular construction like pug in cities etc., - Philosophies of fuller, Corbusier, Eames, Scott Brown, Timberlake etc.,

Techniques and Industrial Structures

Modular casting techniques - Planning, analysis and design considerations - Handling techniques -Transportation Storage and erection of structures.Tectonic strategies- structural core systems – Delivery strategies - Joints -Curing techniques - skeletal and large panel constructions.

Design Principles and Application

Disuniting of structures - design of cross section-based efficiency of material – problems in design because of joint flexibility – allowance for joint deformation – joints for different structural connections – modular technology for low cost and mass housing schemes. Small products like door frames, shutters in housing - Water tank service core unit. Quality control - Repairs and economical aspects on prefabrication.

Digital Fabrication

Study of various industrial mass production systems - CNC cutting and milling (for mass customization)- Laser Cutting -3D Printing (SLS & FDM) & 3D Scanning - 3Axis CNC cutting & milling on non-planar surfaces. Digital & analogue experiment on various materials and their challenges.

Best Practices

Understanding and exploring the various successful project at national and international level on the aspects of Material, Mass Production, Finance / project costing, climate response and energy efficiency.

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. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
2. Hand Book on Construction Safety Practices, SP 70, BIS 2001.
3. John Fernandez, Material Architecture, Architectural Press, UK.
4. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
5. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997
6. Peters, S.(2010) Material Revolution : Sustainable And Multi-Purpose Materials For

Design And Architecture. Birkhäuser Architecture
7. Borden, G P. Matter: Material Processes In Architectural Production. Routledge
8. Lindsey, B. (2001) Digital Gehry: Material Resistance Digital Construction.Birkhäuser Basel

E -resources

1. https://iaac.net/research/projects/
2. https://cinark.dk/en
3. https://designbuildbluff.org/
4. https://www.weforum.org/whitepapers/shaping-the-future-of-construction-a-breakthrough-in-mindset-and-technology/

MH25C03	Geographical Information Systems For Built Environment	L	T	P/S	C
		1	0	3	4

Course Objectives:

- To introduce role of GIS in
- To give basic familiarity with the concepts, tools and techniques of GIS
- To give training in the application of GIS for built environment.

Introduction to G.I.S: Introduction to Geographical Information System (GIS). Defining the objectives of GIS in problems related to the macro environment. Outline of commercial and open source GIS software and introduction to basic components of GIS software. Outline of Spatial and non spatial data. Understanding of Projection and Coordinate systems. Preparation of map with appropriate format for specific purposes.

Spatial and Attribute Data Input: Passive and Active Remote Sensing, Image Processing – Spectral Signature Curve, GPS, Aerial Photograph, Satellite Imagery, LIDAR and Drones. Identification of required spatial data layers. Coding schemes. National Urban Information System. Digitisation of spatial data. Editing. Geo-referencing of Satellite Imagery, Cadastral Map, Role of attribute data in defining geographic features. Adding attribute

Spatial Analysis Using GIS: Generation of 3-D Model in GIS. Performing overlay functions. Manipulating attribute data. Preparation of Existing Land use. Map and report generation. Network Analysis.

Modelling the Macro Environment: Need for modelling the macro environment for different scales and purposes. Modelling for suitability/ projects/ situations/ problems in the realm of landscape design, urban design, urban and environmental planning.

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

Assessment Methodology: Three Assessments with equal weightage.
One Assessment as Internal written Test /Examination (33.33%), other two assessment (each assessment weightage - 33.33%) as continuous marking of the work and performance during the particular assessment period such as drawings, models, study, seminar, etc.,

References:

1. Arthur. H. Robinson et al., 'Elements of Cartography', John Wiley & Sons, New York, 1995.
2. Judith. A. Tyner, ' Principles of Map Design', The Guilford Press, New York, 2010.
3. Ramesh Elmasri and Shamkant.B.Navate, 'Fundamentals of Database Systems', Pearson Education Limited, USA, 2010.
4. Anji Reddy.M., 'Text book of Remote Sensing and Geographical Information Systems', B.S.
5. Publications, Hyderabad, 2008.
6. Michael Law and Amy Collins, 'Getting to know ArcGIS Pro', ESRI Press, USA, 2016.
7. Paul. D. Zwick and Margaret.H. Carr, 'Smart Land-use Analysis: The LUCIS Model', ESRI Press, USA, 2007.
8. David Maquire, Michael Batty and Michael F.Goodchild, 'GIS,Spatial Analysis and Modeling', ESRI Press, 2005.
9. Cynthia A. Brewer, 'Designing Better Maps: A Guide for GIS Users' – 2nd Edition, ESRI Press, 2015.

E-resources:

1. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2005). *Geographic Information Systems and Science* (2nd ed.). Wiley. https://archive.org/details/geographicinforma0000long

2. de By, R. A., et al. (2009). Principles of Geographic Information Systems. ITC, University of Twente.https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf (A free textbook developed for university-level GIS courses)
3. Nushi, B., & Bejleri, I. (2017). *The use of GIS for analysis and visualization of building energy consumption*. *IFAC-PapersOnLine*, 50(1), 11736–11741. https://doi.org/10.1016/j.ifacol.2017.08.2189
4.UN-Habitat. (2015). *Using ICTs and GIS for Urban Planning and Service Delivery in the Developing World*. https://unhabitat.org/books/using-icts-and-gis-for-urban-planning-and-service-delivery-in-the-developing-world/
5.Pérez, D., & Ranasinghe, D. (2020). *Smart cities and the role of GIS in urban resilience and planning*. *World Bank Group Technical Report*. https://openknowledge.worldbank.org/handle/10986/34744

Course Outcomes

- Awareness of GIS and the context of its use for different purposes
- Knowledge of concepts, techniques, methods of GIS
- Ability to apply GIS for specific situations/ realms involving the built environment

DG25204	Digital Studio II: Parametric & ML-Assisted Architectural Design.	L	T	P	C
		0	0	10	10

Course Objectives:

- To introduce explorative and creative thinking expressed through the application of digital software to design propositions.
- To develop the ability to use digital software for the development and execution of a designed building typology, parametrically.

Course Content

The course will focus on the design and development of built spaces using parametric design softwares and digital design tools. This architectural design process will be collaborative, iterative and with an evolutionary vector framework.

There will be emphasis on diagramming in analysis and data mapping, followed by their translation into parametric platforms. These platforms are powerful design tools that augments the design and execution process.

From the project brief, individual visual communication concepts can be developed and documented. Campus studies and sketch walks are done to help prepare cognitive diagramming, figure-ground analysis with satellite images and ground corroboration.

Based on the design objectives, appropriate vector oriented software are chosen as a designing tools. Creative design outcomes are to be developed in a digital environment with reference to appropriate parametric software used for designing a building typology.

The studio will focus on parametric design process and will demonstrate link between the employment of advanced digital design tools and the realm of digital fabrication through a built form within an architectural domain that will augment the character of a specific built environment. Probable projects may include hospitality projects, housing and high rise buildings etc.

Students will work on above mentioned in detail and will submit the work in the form of drawings and/ models and supplementary documentation as found suitable to explain the design process and product judiciously

Weightage: Continuous 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. Techniques and technologies in morphogenetic design (Architectural Design). Hoboken, NJ: John Wiley & Sons, Inc.
2. From control to design: Parametric/algorithmic architecture. Barcelona, Spain: Actar. Meredith, M., Aranda, B., Lasch, C. &Sasaki, M. (Eds.). (2008).
3. Digital fabrications: Architectural and material techniques. New York, NY: Princeton Architectural Press. Iwamoto, L. (2009).
4. Elements of Parametric Design, Routledge New York, Woodbury, Robert.
5. Matlab: A practical introduction to programming and problem solving. Burlington, MA: Butterworth-Heinemann. Attaway, S. (2009).

E -resources

1. https://parametric-architecture.com/learning-hub/
2. https://www.food4rhino.com/
3. https://parametricstudio.airwiki.net/
4. https://www.designmorphine.com/

Semester III

DG25301	Digital IoT Apps	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable students to understand IoT and IoT application in Building Management System.
- To familiarize students with IoT architecture, interface and key design considerations.

Introduction

IoT basics. IoT architecture. Building management systems (BMS) and Automation. Interface of IoT networks and BMS. IoT based analytical platforms. IoT ecosystems. IoT and Big Data interface.

Sensors, Devices and Connectivity

Hardware capabilities. Scaling and operations. Manufacturing and getaways. Introduction to connectivity. LPWAN, Cellulat, Satellite, WiFi and Bluetooth. Interface with BMS.

Data Processing

Introduction to cloud. Introduction to IoT platforms. Choosing an IoT platform. APIs. Data Analytics vs Machine learning.

User Interface and User Experience

Basics of UX and UI. Native apps and web apps, hybrid apps, beyond mobile apps. UX and UI protocols for IoT. BMS UX and UI. Key considerations for UI design for IoT: user profile, alerts and notifications, responsiveness.

The Future of IOT

Intelligent, efficient and user friendly IoTs, IoTs for large building complexes and master plans. IoT and the city. Simple IoT apps for BMS, Occupancy monitoring and estimation model, leveraging of IoT data, tenant experience, service innovation, innovations for smart cities, etc**.**

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. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012
3. ArshdeepBahga, Vijay Madisetti, Internet of Things, Hands-on approach, University Press, 2015
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things‖, Springer, 2011.
5. Simon Monk, —Programming Arduino, McGrawHill Michael Margolis, —Arduino Cookbook, O'Reilly

E - Resources:

1. https://www.coursera.org/learn/internet-of-things
2. https://www.thethingsnetwork.org/docs/lorawan/
3. https://aws.amazon.com/iot-core/
4. https://www.interaction-design.org/courses/ux-design-for-the-internet-of-things

DG25302	Sustainable Architecture and Environmental Modelling	L	T	P	C
		3	0	0	3

Course Objectives:

- To train students in Incorporating digital tools in creating more sustainable and adaptive structures.
- To give knowledge about responsive forms of architecture, through the precision guided by digital tools.

Introduction to Sustainable Architecture

Role of traditional practices and development of those practices, Definitions, Opportunities in Contemporary architecture, minimization of energy usage in all building processes. Passive systems, life cycle assessment. Effects of work cycle and energy consumption of an individual.
Innovative materials and products to formation of regenerative building materials, Green facades and building envelops. Assessments of building materials: ecological impacts, integrated systems inclusive of recycle, reuse, reduce and recovery, Eco-design and Eco-labelling.asd

Built Environment and Environmental Assessment Methods

Design with nature and Passive systems, Building information modelling and transformative design, role of circular economy, smart houses and flexible designs, tall building and digitally induced sustainable **techniques**, brown field projects, Cognitive empirical and simulation assessment methods.

Mathematical Models to Assess Building Performance

Mathematics behind building performance simulation (BPS), basic relationships of BPS systems such as climate analysis (ambient air temperature, RH, Radiation, wind velocity and direction), thermal comfort (PPD &PMV concepts, Radiant asymmetry, C02 concentration, Indoor air quality), energy calculations (cooling and heating energy demands, Load profiles-lighting and auxiliary systems, system sizing), daylight simulation (BIS method, Daylight factor method, overshadowing etc.). Case studies based on manual calculations of existing building examples.

Advance Building Simulation and Energy Modelling

Integration of simulation tools with BIM, RAPID ENERGY MODELLING. Modeling and performance simulation of existing buildings – residential and institutional. Urban Environmental Modelling.

Crowdsourcing and Community Participation

Education and training for Community participation and consumer engagement. Ecological and cultural sensitivity: Study of occupants' behavior, post-occupancy evaluation and end use energy efficiency, influence of the micro climate through urban landscaping, agriculture and green spaces

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. Clarke, J.A., “Energy simulation in building design”, Adam Hilger Ltd, Bristol, 1985
2. Energy Audit of Building Systems – MoneefKranti (Ph. D) – CRC Press 2000
3. ESRU. “ESP – A Building Energy Simulation Environment; User Guide Version 9 Series. “ESRU Manual U 96/1, University of Starthclyde, Energy Systems Research Unit, Glasgow, 1996.
4. Kabele, K., “Modeling and analyses of passive solar systems with computer simulation”, in Proc. Renewable energy sources, PP. 39 – 44, Czech Society for Energetics Kromeriz 1998 (in Czech)
5. Robert B. Bechtel and Arza Churchman “Handbook of Environmental Psychology”, John Wiley & Sons Inc., New York 2002

E - Resources:

1. https://www.coursera.org/learn/sustainable-architecture
2. https://www.ibpsa.org/
3. https://www.autodesk.com/solutions/bim
4. https://www.unhabitat.org/

DG25303	Dissertation	L	T	P	C
		0	0	4	4

Each student is required to prepare a dissertation on a subject concerning Digital Architecture and design media, under the guidance of an advisor, approved by the department.

Course Objectives:

- To expose the students to the various thrust areas in Digital architecture.
- To inculcate the spirit in the students to research in the field of Digital architecture by providing opportunities to read on various issues.
- To help students enhance their technical writing and interdisciplinary research skills.

Process

The primary objective of the dissertation is to provide an opportunity to each student to undertake in-depth and original study research in the field of their interest. It also provides an opportunity to synthesize knowledge and skill-sets, acquired through theory courses and digital architecture studios.

Dissertation is a self-directed exploration of any topic of the students' choice – a written document of the student's findings in a chosen specific area of interest within the realm of digital architecture through a rigorous process of original research. The subject of the dissertation may be theoretical, analytical, computational, comparative or interdisciplinary research concerning digital processes in the architectural domain (topic to be approved by departmental jury). The process would consist of choosing of an area of interest/challenge, phasing out primary studies, clarifying intent, identifying
methodologies to approach and achieve the intent, exploring ways of primary data collection (reading, first hand studies, experimentation, documentation, computation, programming, digital analysis tools, interviews and so on), structuring the information, analyzing and interpreting it, and finally concluding with well-argued inferences. The dissertation should serve to concretize notions and ideas relating to digital architecture and/or the concerns and challenges of architecture and design in today's digital world.

The study must comprise of an aim, the objectives, the scope and limitations of their dissertation, hypothesis (if any), methodology followed by extensive review of literature and case studies through references and documentation. The analysis of the work must be substantiated either parametrically, empirically or through extensive arguments. A dissertation could serve as a prelude to the Thesis preparation and gives the student scope for independent study and opportunity to explore specific area of interest which will form the basis of his/ her design thesis project in the next semester. The topic will have to be approved at the start of the semester and the progress of work will be reviewed periodically, culminating in a viva-voce to a jury at the end of the semester.

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

Assessment Methodology:

Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively.

Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

References:

1. Borden, Ian and Kaaterina Rue diRay. The Dissertation: An Architecture Student's Handbook. Oxford: The Architectural Press; 2006
2. JA Smith, P Flowers, M Larkin. Interpretative Phenomenological Analysis: Theory, Method and Research (English) FIR Edition. New Delhi: Sage Publication, 2009.
3. W Creswell, John. Research design: Qualitative, Quantitative and Mixed Methods Approaches. New Delhi: Sage Publications, 2011.
4. Groat, Linda and Wang, David. Architectural Research Methods – 2nd edition. Hoboken: John Wiley & Sons Inc., 2013.
5. Ranjith Kumar, Ranjit. Research Methodology- A step by step guide for beginners-3rd Edition. New Delhi: Sage Publications, 2011

E - Resources:

1. https://www.coursera.org/learn/digital-transformation-in-architecture
2. https://ocw.mit.edu/courses/architecture/4-251-architecture-and-digital-culture-spring-2014/
3. https://www.e-architect.com/
4. https://scholar.google.com/

DG25304	Digital Studio III: Urban Computational Design	L	T	P	C
		0	0	10	10

Course Objectives:

- To facilitate students towards exploring new limits and possibilities of urban interventions and place making in the digital age.
- To analyze technology-society transect and corresponding shifts in place-realm and identity, resource based and infrastructural urbanism, new typologies etc.
- To employ data analysis, visualization and flexible-scalable frameworks of generative design to augment multi-layered and collaborative urban design process

Course Content

Students will explore the transect of technology, society and cities, in flux and the multifold prospects that arise from contemporary urban condition and aspirations. They will study global and local urban design parameters and their effect on a selected area of study.

Students will employ cartography data mapping, analysis and visualization as basis for a layered collaborative design and analysis framework. They will combine ground mapping with stakeholder's analysis, demographic study, climate studies, socio-economic analysis and wide range of urban design parameters. They will develop a system based approach for generating, evaluating and evolving multiple design solutions and development scenarios. They will employ generative and algorithmic models that might include (but not limited to) voronoi, cellular automata, fractals and L systems, neural networks, genetic algorithm etc.,

Probable projects might include place making in the digital era, urban networks and resources, eco urbanism, big data, IoT and urban form, digital and virtual urban experience, social media and the city, virtual public participation platforms and 'up-stream' public engagement with technology.

Weightage: Continuous 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. Stimmel, Carol. Building Smart Cities: Analytics, ICT, and Design Thinking. Abingdon-On-Thames: Auerbach Publications 2015
2. Calthorpe, Peter. Urbanism in the age of Climate Change. Washington DC: Island Press, 2011
   Long, To introduce the challenges of Digital architectural practice.
3. To enable Ying and Zhang, Enjia. Data Augmented Design: Embracing New Data for Sustainable Urban Planning and Design (Strategies for Sustainability). Springer, 2020
4. Maibritt Pedersen Zari, Regenerative Urban Design and Ecosystem Biomimicry. New York: Routledge Research in Sustainable Urbanism, 2019
5. Verebes, Tom (2014); Master planning the Adaptive City: Computational Urbanism in the , Routledge; Twenty-First Century

E - Resources:

1. https://www.autodesk.com/solutions/generative-design
2. https://www.coursera.org/learn/data-driven-urban-design
3. https://ocw.mit.edu/courses/urban-studies-and-planning/11-190-urban-design-and-digital-tools-fall-2008/
4. https://www.urbanobservatory.ac.uk/

DG25305	Internship Training	L	T	P	C
		0	0	0	2

Course Objective:

Overall understanding of different stages in real life Digital architectural projects in practice.

- To create involvement in these stages as much as possible within the scope of contemporary architectural practice - initiation of project, development of concepts into schematic drawings, approval process, presentations and working drawings, involvement in office discussions and client meetings, integrating structural and service concerns, estimation and tendering processes, site supervision and coordination in the construction process.

Content

The Practical Training would be done in offices / firms practising Digital techniques/processes in India empanelled by the Institution in which the principal architect is registered with the Council of Architecture if the firm is in India or in an internationally reputed firm established abroad. The progress of practical training shall be assessed periodically internally through submission of log books along with work done by the students in terms of drawings, reports, etc., along with the regular progress report from the employers.
The students would be evaluated based on the criteria related to their contribution in the office some of which are given below.

- Understanding and involvement in the Contemporary process of architectural practice as mentioned in the objectives within the scope of the specific office in which training is undertaken.
- Adherence to time schedule, overall responsibility and professional conduct.
- Ability to carry out the instructions on preparation of schematic drawings, presentation drawings, working drawings and skill in this regard.
- Ability to work as part of a team in an office and contribute to related activities.
- Ability to participate in client meetings and discussions.
- Involvement in supervision at project site.
- Involvement/ initiative/ participation in any other aspects during the course of the training.

At the end of the Practical Training, a portfolio of work done during the period of internship along with certification from the office has to be submitted for evaluation through a viva voce examination.

Weightage: End Semester Examinations: 100%.

Semester IV

DG25401	Thesis Project	L	T	P	C
		0	0	20	20

Course Objectives:

- To integrate knowledge gained in previous semesters with respect to issues/ tools of Digital Architecture.
- To understand and identify issues appropriate to a particular project or area of concern, through independent thinking and digital tools.
- To enable students project design solutions through computational, parametric, generative and/or algorithmic methodology.

Content

The students will synthesize the areas of knowledge, skills and techniques acquired in the various courses of the previous semesters through a thesis project of their choice. This thesis project would be concerned in the realm of digital explorations of architectural design with a strong research component. The project would desirably extend the critical position and computational theories and tools developed within the theory and studio projects as well as dissertation. Thesis projects can include but are not limited to research and application of computational models, prototyping, audit tools for building performance, generative systems for design automation, parametric design application in the realm of architecture, BIM, workflows, embedding computational design in practice, advanced algorithmic frameworks, additive manufacturing, IOT building systems and management. The process would culminate in design interventions at scales appropriate to the topic. The project shall desirably have the potential to serve as a starting point for practice and/ or further research.

Students will submit a detailed proposal on their topic of interest(s). The Proposal shall be approved by the thesis review committee. The thesis project will be reviewed periodically by the review committee. At the end of the semester, the final thesis will be submitted and presented through a viva voce examination before a jury.

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

Assessment Methodology: Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively. Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

References

1. Contemporary Architecture and the Digital Design Process, Peter Szalapaj, Architectural Press.
2. From control to design: Parametric/algorithmic architecture. Barcelona, Spain: Actar. Meredith, M., Aranda, B., Lasch, C. &Sasaki, M. (Eds.). (2008).
3. Techniques and technologies in morphogenetic design (Architectural Design). Hoboken, NJ: John Wiley & Sons, Inc.
4. 4D space Interactive Architecture, Architectural Design, Lucy Bullivant, John Wiley & Sons, Inc.
5. Phylogenesis: FOA's Ark, Foreign Office Architects, FarshidMoussavi, Alejandro Zaera, Sanford Kwinter, Foreign Office Architects, Albert FerreLosa and Michael Kubo.
6. The Autopoiesis of Architecture, Volume I: A New Framework for Architecture, Patrick Schumacher, Wiley

Professional Elective Courses

UR25C03	Culture of Public Spaces	L	T	P/S	C
		3	0	0	3

Objective

- To understand the role of art in articulating city culture.
- To understand Cultural memory and art form associations in cities
- To understand the way public spaces in Indian cities have been used, appropriated and conceived.
- To understand the role of art in altering meanings and perceptions of public spaces

Production of Spaces – Public Space:
Space: relative and absolute space, production of space in books, movies and literature. Definitions of public spaces, history of public spaces, typologies and characteristics of public spaces: parks, streets, plazas, Indian bazaars, etc.

City, Meanings and Memory:
Regeneration, culture and the city. Understanding urban popular cultural influences: Traditions –folklore - histogenesis. Urban landscape as public history. Formation of public space: power, resistance and meaning.

Performativity and Temporality in Spaces:
Everyday activities in the city: space, body, signs, rituals. Art and the city: role of art festivals in cultural shifts. Religion, ritual space, festival and spectacle in the city. Case studies of Kala ghoda festival, Pongal fairs and festivals, arupathumoovar, santhanakoodu and velankanni

Activism and Public Spaces:
Theory of democratic public spaces: democratic theory, democratic performances. Theorizing and evaluating public spaces: place and politics, democratic assemblies, protests and the public sphere, city and its representative space. Global case studies of urban space, protests and activism

Consumption of Urban Spaces:
Visual, sensory and experimental consumption of urban spaces. Digital culture and virtual consumption of spaces. Branding of cities and their urban spaces. Case studies of Shanghai, Time Square, Paris, Marina beach, George Town, Chennai

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. Ritzer, George. Postmodern Social Theory. Beijing: Beijing da xuechu ban she. 2004
2. Sadler, Simon. Situationist City. Cambridge: MIT PRESS,1998.
3. Storey, John. Cultural Theory and Popular Culture: An Introduction. Abingdon-On-Thames: Routledge, 2018.
4. Neal, Zachary “Locating Public Space” in Antony Orum and Zachary Neal, Eds. Common Ground? Readings and Reflections on Public Space, New York: Routledge, 2010
5. Lefebvre, Henri. Toward an Architecture of Enjoyment. Minneapolis: University of Minnesota Press, 2014.
6. Harvey, David. Spaces of Hope (California Studies in Critical Human Geography). Berkeley: University of California a Press, 2000

E resources

1.https://www.projectforpublicspaces.org/
2. https://www.urbanomnibus.net/
3. https://thefunambulist.net/
4.https://www.ted.com/playlists/394/the_urban_landscape

DG25001	Advanced Graphics and Interface Architecture	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide students with the knowledge on user interface and graphics design.
- To enable understanding of human interface, digital imagining and production

Introduction to Advanced Graphics and Interface Architecture

The fundamentals of user experience and user interface design, with an emphasis on: the design of interactive user experiences and interface systems for effective and meaningful computer-human interaction: and the use of digital tools for asset creation. Projects focus on the structural, informational, and psychological aspects of interactive design, as well as asset design and creation.

Graphics Design and Illustration

Advanced work with images, headlines, text and graphs in single and multi-page publications as well as three dimensional layouts. a. Advanced problem solving methods b. Corporate and commercial graphics c. Advanced use of layout design software. Advanced layout methods. Illustrations in design work and criteria for selecting the most effective style. Students plan and work up rough concept drawings before executing the final work. a. Advanced use of vector based illustration program b. Package design c. Digital illustration

Measuring Systems

Measuring methods used in the graphic arts and printing industries. a. Picas, Points and Agates review b. Halftones measurements review c. Scaling d. Aspect ratios e. Pagination and in-position.

Typography

Typography as an essential component of any design project. Exploring creative ways to use typography in design work. a. Typographical poster design b. Signage c. Font design.

Digital Imaging and Production

Exploring creative ways to use the digital imaging software. a. Work in grey scale or sepia tone modes b. Product and portrait photography techniques c. Create special effects images d. Set up a digital portfolio e. Advanced use of digital imaging software. Production process involved in reproduction of a graphics file into a publication. a. Troubleshooting prepress files b. Printer's instructions c. interpreting printer's marks d. Evaluating proofs and print work e. Troubleshooting press operations

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. Wilbent. Galitz "The Essential Guide to User Interface Design", John Wiley &Sons, 2001.
2. James Craig, Designing with Type, 5th Edition: The Essential Guide to Typography, Watson-Guptill, 2006
3. Stephen Coles, The Anatomy of Type: A Graphic Guide to 100 Typefaces, Harper Design, 2012
4. Ellen Lupton, Thinking with Type, 2nd revised and expanded edition: A Critical Guide for Designers, Writers, Editors, & Students, Princeton Architectural Press, 2010
5. Adobe Creative Team, Adobe Creative Suite 6 Design & Web Premium Classroom in a Book, Adobe Press, 2012

E-Resources

1. https://helpx.adobe.com/creative-cloud/tutorials-explore.html
2. https://www.interaction-design.org/courses
3. https://www.canva.com/learn/design-school/

UR25C01	Quantitative Techniques and Data Representation	L	T	P/S	C
		3	0	0	3

Objectives

- To acquire knowledge in statistical and numerical techniques and to take up quantitative analysis and research
- To provide in-depth understanding of various research methods in the field of planning and urban design

Statistical Methods: Data: Statistical and Numerical data. Types of data measurement scale – Nominal, ordinal, interval, ratio, Variables. Discrete, continuous- Data collection, coding and decoding, methods, tabulation and graphic presentation of data. Frequency distribution. Measures of central tendency: mean, median, mode. Measures of dispersion, Correlation and Regression. Introduction to spread sheets and statistical software – SPSS, Data Fit etc.

Hypothesis Testing:Sampling Distribution. Test based on Normal, t, Chi-square and F-Distributions. Discrete random variables, Completely Randomized Design. Randomized Block Design. Latin Square Design. ANOVA**.**

Quantitative Techniques in Planning & Demographic Analysis:
Elementary association models and decision making. Index numbers, weighted and un-weighted index numbers. Application of index number in spatial planning. Calculation techniques of vital events. Methods of demography and population studies, population projections, introduction to Census data and sampling Techniques**.**

Forecasting and Time Series Analysis:
Time series forecasting- line chart, curve fitting. Function approximation – approximation theory and numerical analysis, interpolation, extrapolation, pattern recognition, econometrics, segmentation, Uni-variate linear and nonlinear measures and bi-variate measures. Visualization Charts, Braided graphs, Line charts, Slope graphs, Gap Chart, Horizon graphs, reduced line chart (small multiples), Silhouette graph, Circular silhouette graph etc.

Data Representation:
Data Ideograms and the Language of Symbols- Braille, Morse Code, Sign, and Gesture Data Abstraction, Task Abstraction, Common Visualization Idioms such as Bar Chart, Pie Chart and Coxcomb Plot, Line Chart, Area Chart etc., -Spatial data, networks, trees - Making Maps-encoding, Stacked & Grouped data, Manipulate View, Facet into Multiple Views, Case Studies in Visualization and Information tools

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. Agarwal B L. Programmed Statistics. New Delhi: New Age International Publishers, 2007
2. C. Acock, Alan. A Gentle Introduction to STATA. Revised Third Edition. 2012
3. Wooldridge. Introductory Econometrics: A Modern Approach. Noida: Thomson Press, 2011
4. F. Punch, Keith. Introduction to Social research: Qualitative and Quantitative Approaches. London: Sage Publications, 2013
5. 3. W Creswell, John. Research design: Qualitative, Quantitative and Mixed Methods Approaches. New Delhi: Sage Publications, 2011.
6. Evergreen, Stephanie DH. *Effective data visualization: The right chart for the right data*. New Delhi: Sage Publications, 2019.

E resources

1. https://www.khanacademy.org/math/statistics-probability
2. https://www.gapminder.org/tools/
3. https://flowingdata.com/\
4. https://owl.purdue.edu/owl/research_and_citation/using_research/statistics_in_research.html

DG25002	Digital Media	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable students to understand the integration of Art with Technology
- To give students a perspective on the history of interactive and digital art.

History of Art and Technology

The use of tools, new materials, processes of production, mass communication, new products, inventions, and applications that were originally envisioned to be utilized in an industrial society and how they are now applied in the creation of artwork. Impact that artists have made on the technical world, particularly through the disciplines of printmaking, photography, film, and digital visualization

Contemporary Art in Context

Digital art culture, present and happening. Case Studies of Artists and designers who are actively working with the latest technologies.

Interactive Art and Installation

Interactive art and its meaning. Theoretical and practical perspective of interactive art. Purpose and language of art, creative practices, the appropriation of new technologies, social relevance, common artistic themes, and the response and involvement of audiences

Components of an interactive installation

Introduction to hardware and software components of an installation. Sensors and mobile devices as Input. Microcontrollers for processing. Digital Media as Output

Beyond Installations

The emergence of Collaborative Design. Encounter and engagement around Urban Installations. Behavior Pattern and social interaction

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. Agarwal B L. Programmed Statistics. New Delhi: New Age International Publishers, 2007
2. C. Acock, Alan. A Gentle Introduction to STATA. Revised Third Edition. 2012
3. Wooldridge. Introductory Econometrics: A Modern Approach. Noida: Thomson Press, 2011
4. F. Punch, Keith. Introduction to Social research: Qualitative and Quantitative Approaches. London: Sage Publications, 2013
5. W Creswell, John. Research design: Qualitative, Quantitative and Mixed Methods Approaches. New Delhi: Sage Publications, 2011.
6. Evergreen, Stephanie DH. *Effective data visualization: The right chart for the right data*. New Delhi: Sage Publications, 2019.

E-Resources

1. https://rhizome.org/
2. https://ars.electronica.art/center/en/
3. https://processing.org/ and https://www.arduino.cc/

MH25C06 **Soft Skills** L T P/S C
2 0 1 3

Objectives:

- To give introduction to the soft skills and personality
- To give understanding of and enable better interpersonal communication.
- To apprise of aspects of organisational communication and develop skill in it.
- To enable skill in reading and writing.

Introduction to Soft Skills and Personality

Introduction to Soft Skills. Understanding of self. Self-awareness, self- management and Self Development. Values. Attitude. Positive Thinking and optimism. Confidence and excellence. Developing perception. Patience, persistence and flexibility. Empathy and Emotional Intelligence. Types of stress and stress management. Time Management and overcoming procrastination. Career planning.

Exercises and case studies for the various topics.

Interpersonal Communication

Classification and types of Communication. Verbal and non-verbal communication. Formal and informal communication. Barriers in communication.

Listening Skills, Types of Listening. Enhancing listening. Understanding context of words. Responding. Speaking. Self development through speaking.

Nonverbal Communication. Body language and etiquette. Proxemics. Understanding of cultural, social and economic diversity and adapting to others.

Exercises and case studies for the various topics.

Organisational Communication

Group Communication. Organisational Communication. Communication Breakdown. Conflict Management. Negotiation Skills. Meeting Management. Team Building and Team work. Leadership Skills. Emotional intelligence. Critical Thinking.

Speeches and debates, Combating nervousness and anxiety, Patterns and Methods of Presentation, Oral presentation- Planning and preparation, Making effective presentation. Speaking for various occasions at different scales. Public speaking. Group Discussions.

Exercises for the various topics.

Advanced Reading and Writing Skills

Critical reading and understanding. Reviewing articles and books. Technical explanatory writing. Report writing for project. Structure of scientific/ technical papers. Writing papers for journals and conferences.

Assignments for the various topics.

Course Outcome

CO1 Awareness of importance of soft skills.
CO2 Knowledge and skill in interpersonal communication.
CO3 Knowledge and skill in organisational communication.
CO4 Competency in reading and writing.

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

.**Assessment Methodology:** Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively. Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

References

1. Soft Skills, K.Alex, S.Chand, 2010
2. Soft Skills, Hariharan S, Sundararajan N, Shanmugapriya S.P, MJB Publishers 2010.
3. The ACE of Soft Skills, Gopalaswamy Ramesh, Mahadevan Ramesh, Pearson 2010.
4. Understanding Interpersonal Communication, Richard West and Lynn H.Turner, Cengage Learning, 2010.
5. Interpersonal Communication, Steven A. Beebe, Susan J. Beebe, Mark V. Redmond, Pearson 2011.
6. Business Correspondence & Report Writing, R. C. Sharma , Krishna Mohan,Tata McGraw Hill, 5th Edition 2017
7. How to Research and write a scientific paper, Robert A. Day, Barbara GasteCambridge University Press 2012.

DG25003	User interface and User Experience Design (UI / UX)	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire knowledge in User interface and user experience design and techniques and able to develop wire frames and prototypes.
- To provide in-depth understanding of role of human computer interactions.
- To gain basic design thinking knowledge into UX design and its research methods.

Introduction to UXD

What is UX design, History and evolution of UX, connection between cognitive psychology and UX design, concept of human centered design process, components of UX design, difference between UX, UI and interaction design, introduction to basic laws in UX design, difference between web-based UI and phone-based UI.

Understanding and Defining a Problem

Example of global UX projects worked and problems addressed, Practical exercise on Establishing design thinking into UX design, UX research methods (Contextual enquiries, ethnographic study, cultural probe, behavioral study, benchmarking etc.). Active immersion exercises reading a brief, problem identification and deriving of a problem statement basic overview of processes in UX design processes, conducting heuristic analysis

Analysing And Establishing User Empathy

Understanding human systems and Practical exercises on collaborative thinking (brainstorming, role-play etc.) Deriving practical user centric scenarios of existing problem and possible solutions to the problem through story boarding. Understanding user mind-set and establishing empathy (empathy mapping, user journey mapping etc). Deriving a strategic direction and plan of intervention areas, scope of interventions etc.

Introduction to Ideation Processes in Context With Usability

Practical exercises on deriving of insights and conversion into user flows, Information architecture, wireframes and paper prototypes Introduction of Ui software (Figma / Adobe XD etc) Usability in interaction design, Introductions to Laws of UX design (Fitt's law, Law of proximity, Gestalt laws etc), Golden rules of usability in UI design, schneiderman's Eight golden rules, psychology and UX.

Visual Design and Prototyping

Practical exercises in basics of Ui colour themes, Psychology behind colour themes, establishing aesthetic identity and theme relevant to context of the product, mood board generation and analysis. Incorporation of branding/ strategy theme into visual design. Generation of completed hi-fidelity prototypes.

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. Norman, D.A.: The Psychology of Everyday Things. Basic books, New York (1988)
2. Weinschenk, S. (2015). 100 more things every designer needs to know about people. New Riders.
3. User Interface Design: Bridging the Gap from User Requirements to Design. (2018). United States: CRC Press.
4. Hartson, R., Pyla, P. S. (2018). The UX Book: Agile UX Design for a Quality User Experience. Netherlands: Elsevier Science.
5. Quesenbery, W., Brooks, K. (2010). Storytelling for User Experience: Crafting Stories for Better Design. United States: Rosenfeld Media.
6. Szabo, P. W. (2017). User Experience Mapping. United Kingdom: Packt Publishing.

E - Resources:

1. https://www.interaction-design.org/courses/user-experience-the-beginner's-guide
2. https://www.coursera.org/learn/user-experience-design
3. https://www.adobe.com/products/xd.html
4. https://www.figma.com/resources/learn-design/

DG25004	Advanced BIM and Building Services	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable students to understand HVAC strategies, building services, building management and building automation & networking.
- To provide knowledge on the BIM Software in design development, project and building management.

HVAC

Major Factors in HVAC Design – Ventilation, Duct Design, Heat Losses - Heat Gains. Methods of heating buildings, General procedure for sizing a heating plant. Methods of cooling and air conditioning, Sizing an Air-Conditioning Plant, Refrigeration. Cycles - Air-Distribution Temperature for Cooling, Condensers, Compressor-Motor Units. Cooling Equipment - Central Plant Packaged Units, Zoning, Packaged Air-Conditioning Units, Absorption Units for Cooling. Ducts for Air Conditioning, Built-Up Air-Conditioning Units. Variable Air Volume (VAV) Systems, Air-Water Systems. Control Systems for Air Conditioning. Heating and Air Conditioning. Industrial -Air Conditioning. Chemical Cooling, Year-Round Air Conditioning. Energy efficiency techniques in air conditioning. Air conditioning in IT environments, hospitals etc. Air conditioning for green buildings.

Electrical Services

Electrical power – DC / Ac system, electrical load and emergency power, electrical conductors and raceways. Electrical distribution in buildings – Substations, substation equipment's. Power distribution system, standby and alternate power supply system. Light and sight – quality of light, lighting methods, daylight, system design of lighting. Measuring Light and Illumination –selection of recommended Illuminance, Zonal Cavity Method of Calculating Illumination. Lamp characteristics and Selection Guide. Impact of light on color. Integration of services. Electrical power monitoring– IBMS system.

Building Automation and Networking

Introduction to building automation systems: components of BAS, HVAC, Lighting, electrical systems, water supply and sanitary systems, fire safety, security, communication and office automation system. Concept of Intelligent buildings. Integration of services, water pump monitoring & control. Control of Computerized HVAC Systems: Direct Digital Control, chillers, pumps, BTU monitoring & control. Data networking: IBMS system and its components, centralized control equipment's, substation and field controllers, field sensors.

Work Flows and Project Management

Introduction to softwares like spreadsheets, excel, etc. to determine workflow, materials inventory, human resource management, finance management, Primavera-P6/MS Project/Sure track-For schedule development and tracking of it; Prolog-Data Management-RFI's *Request for Information], Submittals-Product Data, Punch list etc.; JDE [JD Edwards]. Financial Management: For use of tracking and developing the cost reports and issuing the change orders, etc.; Navis works-In this software 3D Auto CAD/Revit model can be imported with a project schedule to review the progress of the Project.

Introduction to BIM Software application to simulate and analyze anticipation and ease of project delivery, the overall safety, etc. and to enhance efficiency during and post construction phases, and facility management. Applications like determination of quantities of items and material inventory, to build a building virtually prior to building it physically, work out problems,

and simulate and analyze potential impacts, anticipation & ease of project delivery, overall safety of the project, etc.

Building Information Modelling (BIM)

Use of computers, Building information management of energy with environment aspects. Building information modelling (BIM): Facilitates documentation, design exploration, model-based quantity take off and estimating, interference checking, construction coordination and sequencing, digital fabrication and 3- D building information capture and visualization. Examine geometry, spatial relationships, building information, quantities and properties of building components. Integrating people, systems, business structures and practices for maximizes efficiency through all phases of design, fabrication, construction and life cycle of the structure.

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. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013
2. BIS, National Building Code 2005, New Delhi, 2005
3. Shan Wang, Handbook of Air Conditioning and Refrigeration, 2n d Edition, McGraw Hill, 2000
4. Krieder, J. F., Handbook of Heating Ventilation and Air Conditioning, Taylor & Francis, 2005
5. Barrie Rigby, Design of Electrical Services for Buildings, 4th Edition, Routledge, 2013

E - Resources:

1. https://www.coursera.org/learn/hvac-design-and-system
2. https://www.energy.gov/eere/buildings/articles/introduction-building-automation-systems
3. https://www.autodesk.com/bim
4. https://www.pluralsight.com/paths/project-management-software-primer

DG25005	Materials And Tectonics in DA	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce students to emerging innovative building materials.
- To enable understanding of production of SMART materials, their uses and its application.

Introduction

Introduction: Innovative Materials, Smart materials in Nature, Current Trends and Developments.

Smart Materials and Technologies I

Introduce students to smart materials for use in architectural design: materials and products that have changeable properties and that are able to reversibly change their shape or color in response to physical elements like light, temperature etc. ; Property Changing Smart Materials Photochromic, Thermochromics, Electro chromics – Photo adhesives, Electro active Polymers, Shape Memory Alloys

Smart Materials and Technologies II

Examine in depth, materials and technologies such as Energy-exchanging smart materials - Phase change Materials (PCM) – Photo-luminescents, Photovoltaics, LED's, and Photoelectric, thermoelectric, Piezoelectric, smart glazing, displays and interactive surfaces; and their contemporary application in architecture.

Smart Materials and Technologies III

Matter-exchanging smart materials, Gas/Water storing Smart Materials - Absorbent/Super absorbent Polymers- Bio plastics

Case Studies

Case Studies by Students on the innovative applications of Smart Materials in Design, to discuss the methods of fabrication, production and construction for innovation in design.

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. Axel Ritter, *Smart Materials: In Architecture, Interior Architecture and Design*, Birkhauser, 2007
2. Michelle Addington and Daniel L.Schodek, *Smart Materials and Technologies in Architecture*, Architectural Press, Elsevier, 2004
3. Marinella Ferrara and Murat Bengisu*, Materials that Change Color: Smart Materials, Intelligent Design*, Springer, 2013

E - Resources:

1. https://www.materialdistrict.com/
2. https://smart-materials.org/
3. https://www.sciencedirect.com/topics/engineering/smart-materials
4. https://www.archdaily.com/tag/smart-materials

DG25006	Advanced Coding for Urban Design	L	T	P	C
		1	0	2	3

Course Objectives:

- To train students in using simulation and coding, to understand and re-imagine urban scenarios
- To familiarize students with complex automation algorithms in big data crunching and urban projections

Urban Design Practices

Introduction to various issues and aspects that impinge on contemporary urban condition: globalization, digital revolution, contemporary processes, sustainability, splintering urbanism through changes in information and communication networks and transportation. Contemporary Processes in Urban Design. Place making in the Digital Age. Reconfiguring Public realm. Urbanization and Excursions on density. Case study / appraisal of an urban center / central business district / Town center in view of the above issues related to urban design.

Analytical Techniques, Computer programming and Information Systems

Introduction to computers, concept of data management, flow-chart, introduction of programming languages. Delphi, Trade off-game, simulation models, gravity analysis, Lowry model, Threshold analysis, Multivariate analysis. Techniques of delineation of planning areas and planning regions. LanD use models. Optimization and economic analysis methods in project formulation and implementation- Project management software- Goal achievement matrix, Introduction to Cost-Benefit analysis - Application of computer in planning.

Parametric Modelling

Parametric modelling for adaptive topographies, modularity, visualization of development codes, urban environmental modelling. Scripts for parametric algorithms. Interactive web applications. Additional functions for land use, FSI and density, plot coverage, optimization of building footprint.GIS appilcations

BIM Datasets

BIM datasets manipulation. Automate processes. Create links between multiple applications.

Case Studies

Case Studies by Students on the innovative applications of Smart Materials in Design, to discuss the methods of fabrication, production and construction for innovation in design.

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. Ayeni, Bola. Concepts and Techniques in Urban Analysis (Volume 17). Abingdon-On-Thames: Routledge, 2017
2. Tedeschi, Aruturo. AAD Algorithms-Aided Design: Parametric Strategies using Grasshopper. Paris: Le Penseur, 2014
3. Charytonowicz, Jerzy and Falcão, Christianne. Advances in Human Factors, Sustainable Urban Planning and Infrastructure: Proceedings of the AHFE 2018 International Conference on Human Factorsin Intelligent Systems and Computing). New York: Springer, 2018
4. William J. Mitchell, City of Bits: Space, Place and the infobahn,Cambridge: MIT PRESS, 1996.
5. Portmann Edy, Designing Cognitive Cities (Studies in Systems, Decision and Control Book 176) .New York: Springer, 2018

E - Resources:

1. https://ocw.mit.edu/courses/urban-studies-and-planning/
2. https://www.coursera.org/learn/urban-planning-and-design
3. https://grasshopperdocs.com/ (Parametric modelling with Grasshopper)
4. https://www.autodesk.com/bim (BIM datasets and integration)

MH25C05 **Psychology of Learning and Development** L T P/S C
3 0 0 3

Course Objectives

- To introduce general concepts of learning theory.
- To help understand research related to theories of learning.
- To enable opportunity to engage in critical analysis of theories through discussions.

Introduction

Introduction to learning. Behaviourism - Classical and Operant. Social Learning Theory. Taxonomies. Mastery Learning. Cognitive Information Processing. Problem Solving, Transfer. Meaningful Learning. Situated Cognition. Development and Learning. Interactional Theories of Learning. Nature and Meaning of Psychology. Methods and Scope Psychology.

Educational Psychology

Nature and Meaning of Educational Psychology. Functions Educational Psychology. Physical, Social, Emotional and Cognitive development patterns. Stage. Specific Characteristics of Infancy and Childhood and their developmental tasks. Characteristics and Problems of Adolescents. Needs, aspiration, attitudes and Self-concept of Adolescents. Guidance and Counselling for adolescents.

Understanding Learner Stages of Human Development

Cognitive Development. The Self, Social, and Moral Development. Learner Differences and Learning Needs. Language Development. Language Diversity and Immigrant Education. Culture and Diversity, Behavioural Views of Learning. Cognitive Views of Learning. Complex Cognitive Processes.

Learning and Motivation

Concept of learning and its nature. Factors influencing learning – Personal and Environmental. Motivation – Nature, Types. Techniques of enhancing learner's motivation. Theory of Learning. Operant Conditioning theory of learning. Gestalt theory of Learning. Learning goals with classroom activities, create motivating and inclusive environments, and integrating assessment into learning. Frameworks like Backward Design. Effective teaching and learning frameworks from psychological, cognitive, sociological, and educational research.

Appreciation And Criticism

Ability of Understanding– appreciation, advocatory, descriptive, evaluative, interpretative and other evaluation criteria and methodology. Development of Design Thoughts-understanding, developing and expressing a design thought in its right perspective purpose, manner and mode. Theories and models for experiencing architecture.

Course Outcomes

CO1 Knowledge about major social and psychological processes involved in learning and development in an educational setting.

CO2 Ability to engage in knowledgeable and productive dialogue with colleagues about human learning, development, and educational practice.

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. Ellen D. Gagne, Carol Walker Yekovich, Frank R. Yekovich,‘ The Cognitive Psychology of School Learning’ , Pearson, 1997.
2. Derville, Leonore, M.T ,’The use of Psychology in Teaching’, Longman London, 1982.
3. Biggs, Jhon B, ‘The Process of Learning’, Pearson Higher Education,1993.
4. McShane, J, ‘Cognitive Development, An Information Processing Approach Basic’, Black Well, Oxford, 1991.
5. Glover, J.A and Bruning,‘Educational Psychology Principles and Applications, Pearson, 1990.
6. Dececco J.P, ‘Psychology of Learning and Instruction: Educational Psychology’, Prentice Hall of India Ltd, NewDelhi, 1970.
7. Herbert J. Klausmeier, Richard E. Ripple, ‘Learning and Human Abilities: Educational Psychology’, Joanna Cotler Books, 1975.
8. Carol Davidson Cragoe, ’How to Read A Building’, Rizzoli, 2008.

DG25007	Advanced Structures and Modular Systems	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable students in understanding the advanced structural systems.
- To introduce students to the modular construction technique.

Introduction

Understanding various structural systems and structural mechanism of complex systems-Wind and earthquake resistant building design, Advanced structural systems and construction systems. Overview of design philosophy and selection of the structural systems for tall buildings; criteria and loadings; Gravity load resisting systems, Lateral load resisting systems.

Design Principles

Design criteria for structural members and foundation- Codal provisions. Earthquake resistant building design. Introduction and Importance of earthquake resistant design: Fundamentals of the earthquake resistant design of engineering structures. Structural modelling and analysis.

Advanced Structural Systems

Properties, Application, specifications and standards (Indian and International). Shell Structure, Domes, Space frames, shell barrel vault, folded plates, tensile structure and pneumatic structure – working details. Sequence of erection and facilitating maintenance of such structures. Understanding specialized equipment's.

Modular Coordination

Materials - Modular co-ordination, standardization and tolerances-system for prefabrication. Pre-cast concrete manufacturing techniques, Moulds –construction design, maintenance and repair. Pre-casting techniques - Planning, analysis and design considerations - Handling techniques -Transportation Storage.

Digital Fabrication

Study of various industrial mass production systems - CNC cutting and milling (for mass customization) - Laser Cutting - 3D printing (SLS & FDM) & 3D Scanning - 3Axis CNC cutting & milling on non-planar surfaces. Digital & analogue experiment on various materials and their challenges. Best practices on the same.

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. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

2. N.D. Kaushika, Energy, Ecology and Environment, Capital Publishing Company, New Delhi.
3. John Fernandez, Material Architecture, Architectural Press, UK.
4. Borden, G P. Matter: Material Processes in Architectural Production. Routledge, 2014.
5. Lindsey, B. Digital Gehry: Material Resistance Digital Construction. Birkhäuser Basel, 2001.

E - Resources:

1. https://www.sciencedirect.com/topics/engineering/advanced-structural-systems
2. https://www.archdaily.com/899481/modular-construction-the-complete-guide
3. https://www.engineeringcivil.com/earthquake-resistant-design.html
4. https://www.autodesk.com/redshift/digital-fabrication-in-architecture/

DG25008	Metaverse	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the foundational concepts of the Metaverse and its implications for architecture.
- To explore technological frameworks that power immersive virtual environments.
- To analyze design principles and case studies related to architectural interventions in the Metaverse.
- To examine the socio-cultural, ethical, and economic challenges of spatial computing.
- To critically envision future directions of architecture in hybrid physical-virtual urban environments.

Introduction to the Metaverse

Definition and evolution of the Metaverse - Historical context: cyberspace, virtual worlds, simulation theory - Key components and architecture of the Metaverse - Major platforms: Decentraland, Sandbox, Spatial.io, Meta Horizons - Role of architects in immersive environments.

Hands on exercises:

- Explore a Metaverse platform such as Decentraland or Sandbox and observe its architectural features.
- Reflect on how virtual architecture differs from physical spaces.
- Create a simple virtual structure or pavilion using the platform's tools or compatible 3D software.

Technologies Enabling the Metaverse

Extended Reality (XR): AR, VR, MR – devices and implications for space - Game engines and

spatial computing: Unity, Unreal Engine - BIM and Digital Twins in virtual ecosystems - Blockchain, NFTs, smart contracts, and decentralization - AI and real-time rendering in architecture.

Architectural Spatial Experience in the Metaverse

Nature of space and spatial perception in digital environments - Interaction, embodiment, and
avatar-based navigation - Narrative architecture and world-building in virtual design - Architectural language in the Metaverse: form, structure, materiality - Case Studies: Mars
House, ZHA Cyber Urbanism, Metaverse pavilions.

Ethical, Social and Cultural Dimensions

Identity, presence, and digital embodiment - Issues of privacy, surveillance, and data ownership
- Inclusion and accessibility in virtual architecture - Digital colonization, cultural representation,
and copyright - Governance, spatial justice, and ethics in virtual development.

Future of Architecture and Urbanism in the Metaverse

Virtual real estate and economy of virtual space - Energy use, sustainability and carbon cost of virtual worlds - Hybrid urbanism: physical-digital integration - Role of architects in shaping digital communities - Speculative design: what comes after the Metaverse!

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. Matthew Ball – The Metaverse: And How It Will Revolutionize Everything
2. Jeremy Bailenson – Experience on Demand
3. Stephen Graham – The Cybercities Reader
4. Michel Rojkind, Patrik Schumacher (Eds.) – Virtual Architectures
5. Architectural Design (AD) – Architecture and the Metaverse issue
6. IJAC – International Journal of Architectural Computing
7. CAAD Futures, ACADIA, CAADRIA papers on immersive tech

E - Resources:

1. https://www.archdaily.com/981386/metaverse-in-architecture-what-is-it-and-why-it-matters
2. https://learn.unrealengine.com/course/5f27f732ed9178001f29b1c7/introduction-to-the-metaverse
3. https://www.autodesk.com/redshift/metaverse-architecture/
4. https://www.decentraland.org/developers/

DG25009	Generative Design For Fabrication	L	T	P	C
		1	0	2	3

Course Objectives:

- To teach students how to produce detailed and accurate shop drawings from generative design models.
- To understand the logic of materials, joints, and assembly as they relate to drawing outputs.
- To explore parametric workflows that automate drawing production for fabrication and construction.
- To integrate digital tools into professional documentation standards for architectural components.

Introduction to Shop Drawings in Architecture

Purpose and scope of shop drawings – Differences between schematic drawings, working drawings, and shop drawings – Types of shop drawings (wood, metal, panels, facades, components) – Industry standards for fabrication documentation – Overview of digital tools used for shop drawing automation.

Geometry to Documentation Workflows

Developing parametric components using Grasshopper or Dynamo – Embedding material and dimensional data into design logic – Sectioning, unfolding, and annotation techniques – Extracting drawing sets (plans, sections, elevations) from generative models – Layer management and scale settings.

Detailing For Fabrication

Generating fabrication-ready details – Joinery, notching, and assembly conditions for CNC or manual fabrication – Incorporating tolerances, kerf, material thickness, and edge conditions – Detailing systems for flatpack, interlocking, and layered assemblies – Representing exploded views and part labels.

Automated Drawing Outputs

Workflow for producing shop drawings directly from generative scripts – Using plugins like FabTools, Human, Elefront for automated layouting – Page composition: title blocks, tags, dimensions, and legends – Batch exporting to DXF, PDF, and fabrication formats – BOM (Bill of Materials) and cut list generation.

Drawing Management & Industry Readiness

Organizing multi-part drawing sets – Shop drawing checklist and quality control – Real-world examples from façade systems, pavilions, and modular structures – Coordinating with fabricators and vendors – Final portfolio submission: end-to-end workflow from parametric model to shop drawing package.

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. 1. Iwamoto, L. (2009). *Digital Fabrications: Architectural and Material Techniques*. Princeton Architectural Press.
2. Kolarevic, B. (2003). *Architecture in the Digital Age: Design and Manufacturing*. Taylor & Francis.
3. Friedman, D. (2010). *Shop Drawings for Craftsman Interiors*. Dover Publications.
4. Rhino + Grasshopper + FabTools / Elefront Plugin Documentation.
5. Fabrication industry guides and CAD/CAM shop drawing samples.

E - Resources:

1. https://www.grasshopper3d.com/page/shop-drawings
2. https://www.autodesk.com/redshift/generative-design-architecture/
3. https://fabtools.cc/
4. https://www.rhino3d.com/learn/

DG25010	Ecology and Digital Architecture	L	T	P	C
		3	0	0	3

Course Objectives:

- To enable students to understand nature inspired designs.
- To give students knowledge on bio mimicry architecture.
- To introduce students about the use of digital platforms for design development.

Introduction

Introduction to nature inspired design thinking principles and philosophies. Understanding earth operating condition. Patterns in nature, reconnect with nature. Biophilia. Life's unifying principles. Bio mimicry and architecture. Works and philosophies of Antoni Gaudi, Norman Foster, Michael Pawlyn.

Dynamics in Ecology

Introduction to Urban Eco-systems. Basis of environmental science. Ecology, Ecosystems, Habitat, structure of the ecosystem, major ecosystems, productivity of ecosystems adaptation Understanding ecological concept, regulation, carrying capacity, stability and resilience of ecosystem. Introduction to emergence in nature - self organization and complex systems in nature. Concept of Boids, understanding bionics and its implications in design.

Biomimicry

Introduction to bio mimicry architecture – principles. Understanding Space creating, conditioning, structure, Energy and form. Understanding Natural form. Ecological systems. Biological strategies. Natural systems. Understanding Challenges and issues in Biology to Design.

Biomorphism

Emerging technologies and designs- towards a biological paradigm. Dynamics in biological systems. Environmental dynamics and computation. Understanding Fibers, Textiles, Nets, Lattices, Branches, Cells, Mass components and implications in design.

Visual Scripting

Evolve concepts of Biomimicry and Biomorphism in architecture, simple scripting, visual coding and parametric design using BIM and other computational software.

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. Pawlyn, Michael. Biomimicry in Architecture, 2011.
2. Pérez, Eliezer, Amador. Biomimicry/Biomimetics in Architecture, 2014.
3. Ginatta, Carlos. Architecture without Architecture, 2010.
4. Cervera, Maria, Rosa, and Javier Gómez-Pioz. Bionic Architecture, 2015.

E-Resources

1. https://biomimicry.org/
2. https://natureofcode.com/
3. https://www.grasshopper3d.com/
4. https://hypar.io/

UR25C02	Social Theory and The City	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To give critical understanding of the city and its underlying forces though various social theories
- To give awareness of urban processes through political, economic, social and cultural lenses.
- To give knowledge about the role of people and culture in city identity.

City, Culture and Its Identity

Understanding city culture. Theories of Socio-cultural memory. Understanding visual culture. Urban and cultural anthropology. Contemporary Urban issues. City and Identity. Theories of Margaret Mead, Levi Strauss, Saskia Sassen, Claire Cooper Marcus, MSS Pandian, Malcom Adiseshaiah and Arjun Appadurai.

Historiography and the City

Understanding authorized and subaltern histories of cities - society and cities in vernacular literature, folk tradition and popular art - post-colonial theories and histories of Indian Cities.

Power and Resistance In the City Spaces

Understanding the concept of power and its space manifestation in cities. Historic Indian Treatises: Chanakya Neeti, Harshacharitra, Ula, Uthirmerur inscriptions, Baburnama, Ain-i-Akbari. Theories of Giddens, Aldo Rossi, Corbusier, Oscar Niemeyer, Foucault. Case studies from New Delhi, Istanbul, Los Angeles, Jerusalem, Shenzen.

Urban Politics

City and its people. Cities and social theory: Marxism, public realm theory, difference theory, critical theory. Spatial-social justice in the city. Spatial inequalities and urban form. Neoliberalism and the city. Globalization and urban spatial politics. Theories of Jane Jacobs, Pyatok, Newmann, Saskia Sassen. Case studies of Belfast, Berlin, Curitiba city, Caracas, Scandinavian cities, Mumbai -Lokhandwala region.

Gaze in the City

Space and body: The Flâneur, gaze and urban public spaces. Tourist gaze, gender gaze, colonial gaze. Sexuality in urban space: feminista, queer, transgender, etc.

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. Ritzer, George. Postmodern Social Theory. Beijing: Beijing da xuechu ban she. 2004
2. Sharp, Kristen, and Elizabeth Grierson. Re-Imagining the City: Art, Globalisation and Public space. Bristol: Bristol: Intellect Books, 2013
3. Phadke, Shilpa and Khan, Sameera. Why Loiter? New Delhi: Penguin India, 2011
4. Montgomery, Charles. Happy City: Transforming our lives through Urban Design. London: Penguin, 2015
5. Said, Edward. Orientalism: Western Conceptions of the Orient. London: Penguin Publication, 1978
6. Rapoport, Amos. The meaning of the built environment. Tucson: The University of Arizona Press, 1982

7. Rapoport, Amos. House, Form and Culture. London: Pearson Education, 1969
8. Srivastava A.R.N. Essentials of Cultural Anthropology. New Delhi: Prentice Hall India Private Ltd, 2005

E-Resources:

1. https://www.marxists.org/reference/subject/philosophy/works/ge/baudelaire.htm
2. https://www.researchgate.net/publication/228339061_The_Tourist_Gaze
3. https://www.tandfonline.com/doi/abs/10.1080/0042098042000326213
4. https://www.escholar.manchester.ac.uk/api/datastream?publicationPid=uk-ac-man-scw:2m1746&datastreamId=FULL-TEXT.PDF

MH25C07	Theory of Architectural Education	L T P/S C 3 0 0 3

Course Objectives

- To give familiarity about theories of architectural education.
- To introduce the idea of cognition development.
- To give familiarity about ways of thinking and learning with respect to architecture.

Introduction

Overview of the important aspects of the discipline of architecture. Nature of Architectural Education based on the nature of the discipline of architecture.

Tools/ Techniques to Teach Architecture

Models and methods of Teaching. Teaching Aids In Architecture Education. Types of Teaching Aids- Visual, Audio, etc., Learning by Doing, reflection, exploring, arguing, incidentally. Case-Based Teaching. Advanced Organizer, Concept attainment model, Simulations.

Synectics as a Model of Teaching.

The essence of creativity in synectics. Use of synectics in the design studio. Techniques of teaching-learning: Maxims of teaching and its application to subjects of architecture. Concept mapping, creating concept maps. Basic aspects of classroom management.

Student Development

Need of development. Cognitive Development. Connection between seeing and remembering. Memory Retention. Attention Span. Organizing Communication. Comprehension. Create a Focal Point. Evolution of technology in education. Testing of module/ survey conducted.

Learning In Architecture Design Studio

Development of Critical, Creative and Pragmatic Thinking in Architectural Design Studio. Bloom Taxonomy in Design Studio. Qualities which can be attained at various stages in Architectural Design Studio.

Course Outcome

CO1 Awareness of the importance of contextual excellence in architectural design and methods for the same.

CO2 Knowledge about and ability to integrate interdisciplinary and cognitive aspects of learning, teaching and development.

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. S. K. Mangal, ‘Essential of Educational Technology’, PHI Learning Pvt. Ltd., 2009.
2. Bruce Joyce, Emily Calhoun, Marsha Weils, ‘Models of Teaching’, Pearson, 2014.
3. Klausmier, Ripple,’Learning and Human Abilities’ Harper and Row, New York, 1971.
4. Eames Charles, Ray, ‘An Eames Anthology’, Yale University Press, 2015.

DG25011	Ethics and Policy in Digital Architecture	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce ethical frameworks applicable to digital design tools and processes in architecture.
- To examine emerging policy, legal, and regulatory issues related to digital practices in the built environment.
- To explore the social, environmental, and cultural implications of algorithmic and data-driven design.
- To prepare students to practice architecture responsibly in an AI-augmented, digitally networked world.

Ethical Foundations in Digital Design

Definition of ethics in the context of architecture and digital systems – Design responsibility in the digital age – The ethics of automation and authorship – Moral implications of generative tools and AI – The architect's agency in digital production ecosystems

Intellectual Property & Design Authorship

IP rights in computational and AI-generated design – Copyright, patent, and licensing frameworks – Open-source design culture vs proprietary systems – Ownership of parametric scripts, generative models, and fabrication logic – Case studies in design plagiarism and digital forensics.

Data, Privacy, And Surveillance in Architecture

Architectural implications of sensor data, IoT, and user tracking – Smart cities and ethical concerns over surveillance – Data collection in buildings and public spaces – GDPR and Indian data protection laws – Consent, transparency, and accountability in digital systems

Policy Frameworks & Professional Guidelines

Overview of digital policies: national (India's DPDP Act, Smart Cities Mission) and international (EU AI Act, ISO standards) – Regulatory norms for AI, BIM, and automation in construction – Professional codes of conduct for digital practice – Digital equity and access in architecture.

Case Studies & Future Directions

\Analysis of real-world case studies: algorithmic bias in urban systems, digital exclusion, and ethical challenges in smart housing – Emerging debates: climate justice in computational design, ethics of digital twins – Towards a responsible digital practice: frameworks, charters, and manifestos.

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. Benjamin, R. (2019). *Race After Technology: Abolitionist Tools for the New Jim Code*. Polity.

2. Fry, T. (2014). *Design Futuring: Sustainability, Ethics and New Practice*. Bloomsbury.
3. UNESCO (2021). *Recommendation on the Ethics of Artificial Intelligence*.
4. Picon, A. (2010). *Digital Culture in Architecture*. Birkhäuser.
5. Indian Digital Personal Data Protection Act (DPDP), 2023 – Government of India.
6. Selected case studies and whitepapers on AI ethics, BIM regulation, and smart cities.

E-Resources

https://archleague.org/

https://creativecommons.org/

https://www.wipo.int/portal/en/index.html