**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **Computational & Parametric Design Studio** | | | |
| | Course Code | MDAC101 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 01:05:01 | Viva Marks | 50 |
| | Total Hours of Pedagogy | 7 | Total Marks | 100 |
| | Credits | 6 | Exam Hours | - |
| | **Course Learning objectives:**<br>• To explore the inter-relationships between the contemporary mediums of digital design to digital production<br>• To use digital tools in creating the required outcome<br>• To understand the relation between the tools , process and the final product | | | |
| | **Module-1** | | | |
| | INTRODUCTION<br>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 product design within an Architectural domain that will augment the character of a specific built environment | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: To introduce the advanced Digital tools, to make them understand the process and approach to computational design - Rhino* | | |
| | **Module-2** | | | |
| | ANALYSIS OF DATA<br>Investigation into the inter-dependencies amongst definite factors like human ergonomics, explicit site information, specific programmatic data and the immediate environment and their analysis and synthesis. | | | |
| | **Teaching-Learning Process** | ***Collaborative and Cooperative learning****: physical case studies*<br>***ICT and Digital support****: To introduce and understand different parameters and constraints to incorporate into the analysis and study of the project . power presentation for relevant studies and analysis* | | |
| | **Module-3** | | | |
| | PRODUCT MORPHOLOGIES<br>Detailed digitized resultants of this analysis to be used as input parameters whose permutations and combinations that will facilitate the generation of different iterations for Product morphologies | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: To introduce the advanced Digital tools, to make them understand the process and approach to computational design - Rhino*<br>***Collaborative and Cooperative learning****: Analyse the digitized results and consider the input parameters for different iterations . to study the optimized result which further, facilitate the generation of different iterations for Product morphologies.* | | |
| | **Module-4** | | | |
| | DIGITAL FABRICATION<br>To enhance digital fabrication skill set to engage the performative capabilities of one specific selection generated through the iterative process. | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: introduction to different fabrication tools .* | | |

| | Module-5 | |
|---|---|---|
| | FINAL DESIGN<br>The methodologies engaged in the program will necessarily explore the inter-relationships between performative designs, solid modelling and computer numerically controlled fabrication. | |
| | **Teaching-Learning Process** | ***Collaborative and Cooperative learning***: *Students should work on final design portfolio* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

CIE marks shall be awarded by a committee composed of Principal/Dean, PG Course Coordinator/HOD and Guide/Co-guide of the department. The CIE marks awarded for PSC (professional supportive course), shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the report

### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
- The Viva-voce will be evaluated by external examiners appointed by the University along with PG Course coordinator/ guide/ co-guide or an internal examiner..
- The viva-voce marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

**Suggested Learning Resources:**

**Books**

1. Mark Burry; Scripting Cultures
2. Casey Reas and Chandler McWilliams; Form+Code in Design, Art, and Architecture, Kostas Terzidis ; Algorithmic Architecture
3. John Frazer; Evolutionary architecture
4. Tomoko Sakamoto; From control to Design

**Web links and Video Lectures (e-Resources):**

- https://www.danieldavis.com/a-history-of-parametric/
- https://vdoc.pub/download/scripting-cultures-architectural-design-and-programming-53g6jiss52r0
- https://davidfrico.com/evolutionary-architecture-principles.pdf
- https://www.perlego.com/book/2388244/from-control-to-design-pdf

**Skill Development Activities Suggested**

Students will work on analytical and design projects of product design scale and produce the work in the following form Complete documentation with all necessary design abstracts, process trajectory, digital models, diagrams, drawings, illustrations & text in a printed format as well as a soft digital. Scaled model of the complete project.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Interpret the understanding of digital tools , process and outcome | L2 |
| CO2 | Understand the interdependency of different parameters | L2 |
| CO3 | Develop the different parameters , and apply them computationally | L3 |
| CO4 | To engage to test the performative capabilities of one specific selection generated through the iterative process. | L4 |
| CO5 | To understand solid modelling and fabrication process | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Acquire outstanding fundamental knowledge in the field of computational design | PO1 |
| 2 | Encompass the ability to work in collaboration with interdisciplinary teams. | PO2 |
| 3 | Demonstrate creativity in the problem-solving process through professional quality graphic presentations and technical drawings. | PO3 |
| 4 | Acquire outstanding knowledge & software skills for design and construction | PO4 |
| 5 | Demonstrate design solutions that integrate contextual, social, economic, cultural, ethical, environmental concerns. | PO5 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| **CO1** | **0** | **M** | **M** | **H** | **H** |
| **CO2** | **L** | **M** | **H** | **M** | **L** |
| **CO3** | **0** | **M** | **M** | **H** | **H** |
| **CO4** | **0** | **M** | **M** | **L** | **H** |
| **CO5** | **L** | **L** | **M** | **M** | **H** |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **ANALYTICAL DIAGRAMMING AND ARCHITECTURAL REPRESENTATION** | | | |
| | Course Code | MDAC102 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 02:02:00 | Viva Marks | 50 |
| | Total Hours of Pedagogy | 4 | Total Marks | 100 |
| | Credits | 4 | Exam Hours | - |

**Course Learning objectives:**

- To understand the potential of diagramming as an analytical as well as a representational tool inherent to parametric design process
- To use digital tools in creating the required outcome
- To understand the relation between the tools , process and the final product

**Module-1**

Understanding diagramming as an analytical and representational tool . User centric design ,New methods to understand and observe tangible and intangible elements of behaviour, design of building and organisation

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support****: To enhance the students' understanding of representation in architecture. To enable them to diagrammatically represent data - powerpoint* |

**Module-2**

The history and evolution of diagramming in architecture. Design, technology and prototyping
It focuses on advance skills of industry, ideation and processes using design analytics principles- architectural representation, data analysis (qualitative & quantitative - mapping,

| | |
|---|---|
| **Teaching-Learning Process** | ***Collaborative and Cooperative learning****: students can present their research and findings to class*<br>***ICT and Digital support****: To introduce and understand different parameters and constraints to incorporate into the analysis and study of the project . power presentation for relevant studies and analysis* |

**Module-3**

DATA ANALYSIS

Developing the ability to sieve information and build effective and meaningful information on diagrams. to understand data and process information diagrammatically

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support****: introduce the excel tool for data and statistical analysis*<br>***Collaborative and Cooperative learning****: Analyse the digitized results and consider the input parameters for different iterations . to study the optimized result which further, facilitate the clean up of data* |

**Module-4**

DIAGRAMMING REPRESENTATION

Exploring the usage of diagramming in professional international practices • Use of program diagrams in the design process. To understand architecture in terms of diagrammatic representation - Bernard Tschumi

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support****:To introduce them to strategies and tools enabling integrated design analytics.* |

**Module-5**

| | | |
|---|---|---|
| | Introduction to Architectural representation platforms, post-production techniques and tools. | |
| | **Teaching-Learning Process** | ***Collaborative and Cooperative learning***: *Students can research and present their works to class* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

CIE marks shall be awarded by a committee composed of Principal/Dean, PG Course Coordinator/HOD and Guide/Co-guide of the department. The CIE marks awarded for PSC (professional supportive course), shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the report

### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
- The Viva-voce will be evaluated by external examiners appointed by the University along with PG Course coordinator/ guide/ co-guide or an internal examiner..
- The viva-voce marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

**Suggested Learning Resources:**

**Books**

Lankow, Jason (2012), Infographics: The Power of Visual Storytelling, Wiley & Sons Hoboken

- MVRDV (1999); Metacity/Datatown
- Tschumi, Bernard (2014); Notations: Diagrams and Sequences
- McCandless; David (2014), Knowledge is Beautiful
- Koolhaas, Rem (1999);Content

**Web links and Video Lectures (e-Resources):**

· https://www.pinterest.com/pin/25543922871651198/

· https://www.pinterest.com/pin/615867317762664564/

· https://openlab.citytech.cuny.edu/arch-1210-spring-2013/files/2011/06/Precedents-in-Architecture-Analytic-Diagrams-Formative-Ideas-and-Partis.pdf

· https://www.researchgate.net/publication/297699713_Bernard_Tschumi_Draws_Architecture

**Skill Development Activities Suggested**

· Assignment will be in the form of notes/ assignments covering all the topics mentioned above with suitable examples, sketches and supportive material.

· Students will work on at least one project taken up in the design studio- I and work on conceptual evolution of design strategy through diagramming.

Details of the project relating to all the above-mentioned topics will be submitted in the form of sheets and/or report and /or presentation

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | To understand spaces through, notations and diagrams | L2 |
| CO2 | Interpret the history and evolution of diagramming architecture | L2 |
| CO3 | To sieve information and build effective and meaningful information on diagram | L3 |
| CO4 | To demonstrate the use of design programs in representation | L4 |
| CO5 | students will be able to diagrammatically represent data and spaces . | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Acquire outstanding fundamental knowledge in the aspect of diagramming | PO1 |
| 2 | Encompass the ability to work in collaboration with interdisciplinary teams. | PO2 |
| 3 | Demonstrate creativity in the problem-solving process through professional quality graphic presentations and technical drawings. | PO3 |
| 4 | Students should be able to represent notationally architectural concepts | PO4 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 |
|---|---|---|---|---|
| CO1 | M | M | L | H |
| CO2 | M | L | 0 | M |
| CO3 | L | M | M | H |
| CO4 | L | M | H | M |
| CO5 | M | L | L | H |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **DIGITAL ARCHITECTURE PROCESS THEORIES AND HISTORY -1** | | | |
| | Course Code | MDAC103 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 03:00:01 | SEE Marks | 50 |
| | Total Hours of Pedagogy | 4 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | 3 |
| | **Course Learning objectives:**<br>• To develop a conceptual orientation for the historic trajectory and trace current process influences impact of digital technologies in architectural design<br>• To understand and trace the works of different architects , computationally<br>• To better understand the concept of parametric design | | | |
| | **Module-1** | | | |
| | Introduction to readings and discussions that trace the sociocultural and technological ferment of renaissance and neo- classical architecture. To understand the planning process of Marcus Vitruvius, Antonio Palladio , Leon Battista Alberti . This trajectory will trace the background of the past 20 years that was crucial for the formation of Digital Culture in architecture. | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning-** discussion and analysis based on the lecture* | | |
| | **Module-2** | | | |
| | Introduction to research and analysis of Postmodernism and DEconstructivism movement. To understand the planning process, technical capabilities that brought a radical departure from traditional planning in architecture. Tracing the works of Peter Eisenman, Robert Venturi, Frank Gehry | | | |
| | **Teaching-Learning Process** | ***Collaborative and Cooperative learning**: students can present their research and findings to class*<br>***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* | | |
| | **Module-3** | | | |
| | To trace the historical aspect and analysis of the following architects , for a better understanding of the generative and algorithmic approach to computational design . Daniel Libeskind , Mario Botto, Tadao Ando , Herzog de Mueron , Bernard Tschumi, patrick schumacher , zaha hadid | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning**: Analyse the different works-concepts of architects and discuss on the same* | | |
| | **Module-4** | | | |
| | Introduction to the term- trans architecture , the meaning relevance and analysis in today's scenario , detailed study of concepts and works of Marcos Novak, Lars Spyubroek . | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning**: Analyse the different works-concepts of architects and discuss on the same* | | |
| | **Module-5** | | | |

| | | |
|---|---|---|
| | Understanding and analysis of the virtual world, cyber space , virtual reality . to understand different computational installations and simulations . to understand the virtual world , possibilities and limitations | |
| | **Teaching-Learning Process** | ***Collaborative and Cooperative learning***: *Students can research and present their works to class* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

Continuous Internal Evaluation will be based on Assignments, Tests and Term Paper submission

### Semester End Examination:

Theory Examination shall be held for 3-hour duration, students are expected to answer FIVE full questions, one question from each module

**Suggested Learning Resources:**

**Books**

1. Antoine Picon ; Digital Culture in Architecture
2. Ali Rahim; Contemporary Processes in Architecture
3. Rivka Oxman, Robert Oxman; Theories of the Digital in Architecture
4. Lise Anne Couture , Hani Rashid; Asymptote Architecture: Actualizations

**Web links and Video Lectures (e-Resources):**

- https://v2.nl/
- https://v2.nl/archive/people/marcos-novak
- https://www.nox-art-architecture.com/
- https://www.researchgate.net/publication/30873726_Parametric_Variations_of_Palladio's_Villa_Rotonda
- https://issuu.com/birkhauser.ch/docs/herzog-de-meuron-complete-works
- https://www.researchgate.net/publication/277899530_The_Parametric_Design_Genealogy_of_Zaha_Hadid

**Skill Development Activities Suggested**

- To enable students to research and submit in the form of reports, discussions and debates. The outcome will also be in the form of individual perceptions on process theories
- through documentation and critical appraisals.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | To understand historically the parametric relevance | L2 |
| CO2 | Interpret the history and evolution of parametric architecture | L3 |
| CO3 | To sieve information and build effective and meaningful information | L2 |
| CO4 | To demonstrate the use of design programs in representation | L4 |
| CO5 | students will be able to better understand the concepts , for tool aided design | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Acquire outstanding fundamental knowledge in history | PO1 |
| 2 | Encompass the ability to work in collaboration with interdisciplinary teams. | PO2 |
| 3 | Demonstrate creativity in the problem-solving process through professional quality graphic presentations and technical drawings. | PO3 |
| 4 | Students should be able to these architectural concepts on to their design | PO4 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 |
|---|---|---|---|---|
| **CO1** | **M** | **M** | **H** | **H** |
| **CO2** | **M** | **M** | **L** | **H** |
| **CO3** | **M** | **M** | **M** | **H** |
| **CO4** | **L** | **M** | **M** | **H** |
| **CO5** | **M** | **M** | **L** | **H** |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **DIGITAL FABRICATION & CONSTRUCTION-1** | | | |
| | Course Code | MDAC104 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 02:00:01 | Term work | 50 |
| | Total Hours of Pedagogy | 3 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | - |

**Course Learning objectives:**

- The primary learning objective of this subject is systems application of existing modes of production using digital fabrication
- Aims towards the development of new thinking that results from invented systems wherein design is constrained and informed by CAD/CAM manufacturing and real materials

| | | |
|---|---|---|
| | **Module-1** | |
| | Introduction to whats digital fabrication, the different manufacturing process of fabrication , additive manufacturing- subtractive manufacturing | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning-*** *discussion and analysis based on the lecture* |
| | **Module-2** | |
| | CNC CUTTING - introduction ,concept and process of cnc cutting , applications of cnc cutting , different materials used , examples of cnc cutting - pros- cons | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning****: students can do a fabrication model based on the same* |
| | **Module-3** | |
| | CNC MILLING- introduction ,concept and process of cnc milling , applications of cnc milling , different materials used , examples of cnc milling - pros- cons | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation* |
| | **Module-4** | |
| | LASER CUTTING - introduction ,concept and process of laser cutting , applications of laser cutting , different materials used , examples of laser - pros- cons<br>3D Printing (SLS & FDM) - introduction, concept and process - applications and the materials used- examples - pros - cons | |

| | | |
|---|---|---|
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation*<br>***Collaborative and Cooperative learning***: *students can do a fabrication model based on the same* |
| | **Module-5** | |
| | 3 Axis CNC cutting & milling on non-planar surfaces- introduction, concept and process - applications and the materials used-examples - pros - cons | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning***: *students can do a fabrication model based on the same* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

CIE marks shall be awarded by a committee comprising of Principal/Dean, PG Course Coordinator/HOD and Guide/Co-guide of the department. The CIE marks awarded for PSC (professional supportive course), shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the report

### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
- The Viva-voce will be evaluated by external examiners appointed by the University along with PG Course coordinator/ guide/ co-guide or an internal examiner.
- The viva-voce marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

**Suggested Learning Resources:**

**Books**

1. Lisa Iwamoto ; Digital Fabrications: Architectural and Material Techniques
2. Luca Caneparo; Digital Fabrication in Architecture, Engineering and Construction
3. Christopher Breorkram ; Material Strategies in Digital Fabrication
4. Sophia Vyozviti; Soft Shells: Porous and Deployable Architectural Screens
5. Sophia V -yozviti; Folding Architecture
6. Mark Burry Jordi BonetiArmengol, Jos Tomlow, Antoni Gaudi ; Gaudi: Unseen

**Web links and Video Lectures (e-Resources):**

- https://www.researchgate.net/publication/257314849_Digital_Fabrication
- https://www.researchgate.net/publication/242259668_Laser_Cutting_Machines_for_3-D_Thin_Sheet_Parts
- https://www.youtube.com/watch?v=Ev-MM9cGKiQ
- https://www.youtube.com/watch?v=FNYEXjRmDtI
- https://www.youtube.com/watch?v=SIjUVCho_xU

**Skill Development Activities Suggested**

Students will demonstrate their proficiency through Model making Students will submit reports related to their process of fabrication and research in the related domain will be presented through documentation.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | To characterize central technology in fabrication | L2 |
| CO2 | Interpret the different concepts and transfer to models | L3 |
| CO3 | To Critically review and assess the introduction and shift to digital fabrication in manufacturing organizations. | L3 |
| CO4 | To demonstrate the use of fabrication in computational design | L4 |
| CO5 | students will be able to better understand the concepts , for tool aided design | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Assess what type or combinations of types of digital fabrication technologies that are appropriate for the task at hand. | PO1 |
| 2 | Encompass the ability to work in collaboration with interdisciplinary teams. | PO2 |
| 3 | Critically review and assess the introduction and shift to digital fabrication | PO3 |
| 4 | Analyze organizational implications of digital fabrication. | PO4 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 |
|---|---|---|---|---|
| CO1 | L | M | M | H |
| CO2 | L | L | M | M |
| CO3 | L | M | M | M |
| CO4 | M | M | L | H |
| CO5 | M | M | M | H |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **BIM FUNDAMENTALS** | | | |
| | Course Code | MDACL10 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 02:00:02 | Viva marks | 50 |
| | Total Hours of Pedagogy | 4 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | - |

**Course Learning objectives:**

The subject aims to introduce students to associative parametric design software, both as an aid to an iterative design process, a method of design exploration through the introduction of parametric modeling softwares

| | |
|---|---|
| | **Module-1** |
| | Introduction to BIM key concepts - **Overview -**Definition and principles of BIM,Evolution and adoption in the architecture, engineering, and construction (AEC) industry . **Key Concepts** BIM dimensions: 3D, 4D, 5D, and beyond, BIM levels of maturity (LOD) , **Benefits of BIM-** Improved collaboration and communication, Enhanced project visualization and analysis, **Case Studies -** Examples of successful BIM implementation in real-world projects, Challenges and lessons learned |
| **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning-*** *discussion and analysis based on the lecture* |
| | **Module-2** |
| | Bim software tools and technologies - **Popular BIM Software-** Overview of major BIM software (e.g., Autodesk Revit, ArchiCAD or any suitable software ), Comparison of features and capabilities<br>**BIM Workflow-** Understanding the BIM workflow process, Integrating different BIM software tools,introduction to basic modeling techniques using BIM software |
| **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*<br>***Collaborative and Cooperative learning****: students will be given exercises to do in class* |
| | **Module-3** |
| | **Data Management in BIM-** Managing BIM data: models, families, and libraries, BIM data standards ,**Collaborative BIm-** Collaborative workflows in BIM projects, BIM coordination and clash detection ,BIM for facility operations and maintenance, Lifecycle management using BIM data **Case Study-** Analyzing a complex project using collaborative BIM tools |
| **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation* |
| | **Module-4** |

| | | |
|---|---|---|
| | **Advanced Modeling Techniques-** Parametric modeling and scripting in BIM, Creating geometries and adaptive components. **BIM for Sustainability -** Energy analysis and sustainable design using BIM ,**Case Study-** Applying advanced BIM techniques to optimize project outcomes | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation* ***Collaborative and Cooperative learning***: *students can do a fabrication model based on the same* |
| | **Module-5** | |
| | **Emerging Technologies-** Augmented Reality (AR) and Virtual Reality (VR) in BIM, Artificial Intelligence (AI) and Machine Learning (ML) in BIM applications,Collaborative platforms and interoperable workflows,BIM applications in urban planning and infrastructure projects, Future directions and challenges in BIM adoption | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation* ***Collaborative and Cooperative learning***: *students can do a fabrication model based on the same* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

CIE marks shall be awarded by a committee comprising of Principal/Dean, PG Course Coordinator/HOD and Guide/Co-guide of the department. The CIE marks awarded for PSC (professional supportive course), shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the report

### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
- The Viva-voce will be evaluated by external examiners appointed by the University along with PG Course coordinator/ guide/ co-guide or an internal examiner.
- The viva-voce marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

**Suggested Learning Resources:**

**Books**

. Textbooks and readings on BIM fundamentals and advanced topics, Online resources and journals specific to BIM and construction technology, Software tools for BIM modeling and analysis practice

**Web links and Video Lectures (e-Resources):**

Introduction to BIM Fundamentals and ISO 19650 Standards

Fundamentals of BIM

**Skill Development Activities Suggested**

- Specific software submissions in the form of process tutorial output will be submitted individually by every student.
- Students will develop their BIM understanding through different exercises and also students will work on at least one project taken up in the design studio- I and work on digital details of the project relating to all the above mentioned topics in the form of sheets and /or report.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Understand the core structures and workflows of parametric modeling | L2 |
| CO2 | Manipulate complex data flows toward desired design outcomes | L3 |
| CO3 | Apply elementary algorithmic thinking to design problems | L3 |
| CO4 | Model complex forms and relationships using geometric concepts and parametric tools | L4 |
| CO5 | Become familiar with program flow and geometry manipulation in Rhino | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Possess the critical skills necessary to question the limits and biases of a software interface. | PO1 |
| 2 | Encompass the ability to work in collaboration with interdisciplinary teams. | PO2 |
| 3 | Critically review and assess the software interface and apply to design | PO3 |
| 4 | To develop a sensibility for generative modeling uniquely | PO4 |
| 5 | To able the students in the better understanding of tools that aid in computational design | PO5 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| CO1 | M | M | H | H | M |
| CO2 | M | M | L | M | H |
| CO3 | H | H | M | L | H |
| CO4 | M | M | M | M | H |
| CO5 | L | L | L | M | H |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **DIGITAL MATERIALITY AND TECTONICS** | | | |
| | Course Code | MDAE115A | CIE Marks | 100 |
| | Teaching Hours/Week (L:P:SDA) | 02:00:01 | Term work | - |
| | Total Hours of Pedagogy | 3 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | - |

**Course Learning objectives:**

The objective of this elective course is to allow the students to cover a varied spectrum of domains of investigation within the premise of digital architecture. This course seeks to posit the role of different experimental threads within the broader context of digital practice.

**Module-1**

The Tradition of Tectonics in Architecture- The focus on the structural clarity, materiality, and attention to detail in the assemblage of buildings components in architecture is commonly termed architectural tectonics- crystal palace- london , mies van der rohe , german pavilion - barcelona , seagram building- new york ,digital tools allowed a more accurate translation of architectural ideas into built artifacts

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

**Module-2**

The Shift to Digital Tectonics- Frank Gehry disney concert hall ,The topological, curvilinear geometries are produced with the same ease as Euclidean geometries of planar shapes and cylindrical, spherical, or conical forms

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

**Module-3**

| | | |
|---|---|---|
| | The role of education - the digital revolution is firmly rooted in the educational process.CAD-CAM machinery- procedural / computational process - materiality analysis , intersection of the physical and virtual . | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |
| | **Module-4** | |
| | Building and interconnecting analog constructions/To expose issues of tectonics,criteria required for interconnecting..Building and interconnecting digital constructions . the limitations- to critically investigate the process and durability of materials | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |
| | **Module-5** | |
| | Physical-Virtual-Physical: Scanning, modeling, rationalizing, and fabricating , importance and the substitution / analog and digital scale | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

CIE marks shall be awarded by a committee comprising of Principal/Dean, PG Course Coordinator/HOD and Guide/Co-guide of the department. The CIE marks awarded for PSC (professional supportive course), shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the report

### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
- The Viva-voce will be evaluated by external examiners appointed by the University along with PG Course coordinator/ guide/ co-guide or an internal examiner..
- The viva-voce marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

**Suggested Learning Resources:**

**Books**

- BrankoKolarevic; Performative Architecture: Beyond Instrumentality
- AchimMenges; Emergence: Morphogenetic Design Strategies
- AD Wiley publications; Material Computation
- Robert Corser ; Fabricating Architecture: Selected Readings in Digital Design and Manufacturing
- Toshiko Mori; Textile/Tectonic: Architecture, Material, and Fabrication
- NeriOxman ; Towards a Material Ecology

**Web links and Video Lectures (e-Resources):**

**http://papers.cumincad.org/data/works/att/acadia04_256.content.pdf**

**https://www.youtube.com/watch?v=5Vkm2QIoSeI**

**https://www.youtube.com/watch?v=UlKwdgnMu9g**

**Skill Development Activities Suggested**

Assignment will be in the form of in depth documentation subsequent to the study of a topic related to any one of the subject based on availability of experts, which will be presented by the student in the form of a documented report , and a presentation on the same.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Demonstrate the ability to understand tectonics in architecture | L2 |
| CO2 | Enable students to Understand the limitations in shift from traditional architecture to digital | L2 |
| CO3 | To Develop skills in qualitative and quantitative data analysis and presentation | L3 |
| CO4 | To Develop advanced understanding of materiality and tectonics | L3 |
| CO5 | To critically interpret and understand the tectonics - materiality /application and the need. | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | To understand the relevance of tectonics in architecture | PO1 |
| 2 | To gauge the limitations in the shift from tradition to digital | PO2 |
| 3 | To understand the qualitative and quantitative data analysis and presentation | PO3 |
| 4 | To develop the understanding of materiality , strength, durability/accessibility and its application to architecture | PO4 |
| 5 | Critically interpret and understand the tectonics - materiality | PO5 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| **CO1** | **H** | **M** | **L** | **M** | **H** |
| **CO2** | **L** | **H** | **M** | **M** | **H** |
| **CO3** | **L** | **M** | **M** | **M** | **H** |
| **CO4** | **M** | **L** | **M** | **M** | **M** |
| **CO5** | **L** | **L** | **M** | **M** | **H** |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **PERFORMATIVE DESIGN** | | | |
| | Course Code | MDAE115B | CIE Marks | 100 |
| | Teaching Hours/Week (L:P:SDA) | 02:00:01 | Term Work | - |
| | Total Hours of Pedagogy | 3 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | - |
| | **Course Learning objectives:**<br><br>To actively engage the technological and affective potentials of performative design in architecture. Performance can be understood as the incorporation of contingencies or parameters (material, technical, geometric, programmatic, social and economic) that inform the design process | | | |
| | **Module-1** | | | |
| | To understand the theoretical basis for understanding the current shift in performance-based design and proposes a model of performance-based design in architecture, termed performative design- impact of environmental forces on form generation in digital design are the content of experimental processes | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* | | |
| | **Module-2** | | | |
| | Topics related to the current movement towards performance-based design in architecture, such as the role of topology, parametric design, associative geometry, and generative processes, are presented, and their implications for, and influence upon, performative design | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* | | |
| | **Module-3** | | | |
| | Performance-based design and the Design Prototype- simulation process, virtual prototyping, digital tools for analysis and evaluation of performance aspects- In such an approach the desired performance can be selected and activated as a performative-mechanism that can generate and modify designs. | | | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of power point presentation* | | |
| | **Module-4** | | | |
| | Performance-based architectural design-Performance-based design is currently recognized as one of the most significant and productive design models in digital design- take building egs and do in- depth analysis , building performance is regarded as a guiding design principle and one which is morpho-genetic while being essentially formally neutral in the sense that form generation is the result of performative simulation process | | | |

| | | |
|---|---|---|
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation* |
| | **Module-5** | |
| | The 'Performative Design Prototype' - Performative prototyping is fundamentally different from conventional CAD simulation processes. Traditional CAD tools are based on performance evaluation of the object itself. Students can explore one performative design pattern and apply to their design studio | |
| | **Teaching-Learning Process** | ***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation* |

## Assessment Details (both CIE and SEE)

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### Continuous Internal Evaluation:

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### Semester End Examination:

- The student needs to submit his/her report done throughout the semester, including the data collection for the Viva examination, at least one day prior to the Viva examination to the PG course coordinator/HOD.
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**Suggested Learning Resources:**

**Books**


- BrankoKolarevic; Performative Architecture: Beyond Instrumentality
- AchimMenges; Emergence: Morphogenetic Design Strategies
- AD Wiley publications; Material Computation
- Robert Corser ; Fabricating Architecture: Selected Readings in Digital Design and Manufacturing
- Toshiko Mori; Textile/Tectonic: Architecture, Material, and Fabrication
- NeriOxman ; Towards a Material Ecology

**Web links and Video Lectures (e-Resources):**

http://cumincad.scix.net/data/works/att/ecaade2007_198.content.pdf

https://www.youtube.com/watch?v=0fuE2_Qg8_w

**https://www.youtube.com/watch?v=V17Lp1X0_ao**

**Skill Development Activities Suggested**

Assignment will be in the form of in depth documentation subsequent to the study of a topic related to any one of the subject based on availability of experts, which will be presented by the student in the form of a documented report , and a presentation on the same.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | students should be able to synthesize the knowledge they have acquired throughout the year. | L2 |
| CO2 | gained an understanding of the impact of digital design and digital fabrication on a building scale as well as on a scale that begins to address more extensive urban ecologies | L2 |
| CO3 | advanced their knowledge on contemporary architectural discourse in close relation to the design task. | L3 |
| CO4 | To understand the comprehensive design , of a design project | L4 |
| CO5 | to establish new ways of thinking about design and fabrication, professional practice and its cultural impact. | L3 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | The generation of digital tools makes it possible to use parametric design as a way of evolving new information systems, new ways of producing building components and architecture. | PO1 |
| 2 | The course/project goal is to increase the student's knowledge in this area/field and skills/knowledge in the field of architecture in general | PO2 |
| 3 | The students will enter the project with varying degrees of knowledge/skills and will subsequently end up at different levels at the end of the course/project. | PO3 |
| 4 | The individual student must show an increase in the particular skills/knowledge offered and in the field of architecture in general | PO4 |
| 5 | To critically interpret and understand performative design | PO5 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| CO1 | L | M | M | M | H |
| CO2 | H | M | H | M | M |
| CO3 | L | M | M | M | H |
| CO4 | L | M | M | L | H |
| CO5 | M | M | M | M | L |

**H – High , M – Medium, L - Low**

**Semester- 1**

| | | | | |
|---|---|---|---|---|
| | **TECHNIQUES AND TECHNOLOGIES IN MORPHOGENETIC DESIGN** | | | |
| | Course Code | MDAE115C | CIE Marks | 100 |
| | Teaching Hours/Week (L:P:SDA) | 02:00:01 | Term work | - |
| | Total Hours of Pedagogy | 3 | Total Marks | 100 |
| | Credits | 3 | Exam Hours | - |

**Course Learning objectives:**

To propose a description of the architectural singularity for built environment professionals to visualise a route to their post singularity profession. To achieve this a self-organising building scenario is developed using science fiction prototyping (SFP) which has been used previously to explore future scenarios and their impact on intelligent environments

**Module-1**

Introduction - self - organisation , developmental biology morphogenesis describes how a single cell organism can self-organise and grow into a complex multicellular organism that is capable of a variety of functions, interdisciplinary implications of the SFP scenario a morphogenetic architecture framework (MAF) is proposed

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

**Module-2**

To learn to apply morphogenetic principles from biology in both architecture and engineering- eg Grey Lynn - embryological house, concept of phenotype - interaction with the genotype, to develop a taxonomy of morphogenetic approaches for use in the development of buildings.

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

**Module-3**

Drosophila melanogaster- organism to use as a basis for a morphogenetic architecture for IB because it is a complex organism- understand the characteristics , concept and translation to architecture

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* |

**Module-4**

The challenges of Morphogenetic Architecture- controlling Morphogenetic Architecture is the incongruity
between self-organising, bottom up processes and top down design human design approaches- building development stages, bownes development stages .

| | |
|---|---|
| **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of power point presentation* |

| | Module-5 | |
|---|---|---|
| | Morphogenetic Architecture scenario-Realising a Morphogenetic Architecture CONTROL, DRAW, BUILD . The Digital Fabrication continuum- role of an architect, engineer, system architect , user | |
| | **Teaching-Learning Process** | ***ICT and Digital support**: Lecture will be conducted , through the use of power point presentation* |

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**Books**


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- Toshiko Mori; Textile/Tectonic: Architecture, Material, and Fabrication
- NeriOxman ; Towards a Material Ecology

**Web links and Video Lectures (e-Resources):**

https://www.researchgate.net/publication/268449100_A_Morphogenetic_Architecture_for_Intelligent_Buildings

https://www.youtube.com/watch?v=n0KHPun5_70

**https://www.youtube.com/watch?v=-aIEbeb_3v8**

**Skill Development Activities Suggested**

Assignment will be in the form of in depth documentation subsequent to the study of a topic related to any one of the subject based on availability of experts, which will be presented by the student in the form of a documented report , and a presentation on the same.

**Course outcome (Course Skill Set)**

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

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Students should be able to synthesize the knowledge they have acquired throughout the year. | L2 |
| CO2 | To understand developments in BIM, parametric and generative design and digital fabrication in combination with the morphogenetic architecture framework | L2 |
| CO3 | Advance their knowledge on contemporary architectural discourse in close relation to the design task. | L3 |
| CO4 | To understand the comprehensive design , of a design project | L3 |
| CO5 | To establish new ways of thinking about design and fabrication, professional practice and its cultural impact. | L4 |

**Program Outcome of this program. (CPM)**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Morphogenetic approach to the design of buildings as we approach the architectural singularity | PO1 |
| 2 | The course/project goal is to increase the student's knowledge in this area/field and skills/knowledge in the field of architecture in general | PO2 |
| 3 | The students will enter the project with varying degrees of knowledge/skills and will subsequently end up at different levels at the end of the course/project. | PO3 |
| 4 | The individual student must show an increase in the particular skills/knowledge offered and in the field of architecture in general | PO4 |
| 5 | A framework is proposed as a disciplinary bridge to enable the team members to collaboratively identify and employ appropriate processes to implement morphogenetic IBs | PO5 |

**Mapping of COS and POS**

| | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| CO1 | L | M | M | M | H |
| CO2 | L | L | M | M | M |
| CO3 | L | L | M | M | H |
| CO4 | M | M | M | M | H |
| CO5 | L | L | M | M | H |

**H – High , M – Medium, L - Low**