Semester- 1

	DIGITAL DESIGN STUDIO -1			
	Course Code	22DAC11	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:08:00	Viva Marks	50
	Total Hours of Pedagogy	10	Total Marks	100
	Credits	10	Exam Hours	-

Course Learning objectives:

- To explore the inter-relationships between the contemporary mediums of digital design to digital production
- To use digital tools in creating the required outcome
- To understand the relation between the tools , process and the final product

	Module-1	
	INTRODUCTION 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 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* ***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 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* ***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 Advanced digital fabrication tools would be engaged to test 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 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 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. 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. (DA)

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	22DAC12	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	03:01:00	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 - power point*

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 - mapping,

Teaching-Learning Process	***Collaborative and Cooperative learning**: students can present their research and findings to class* ***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. Excel quantitative analysis is introduced to understand and sieve information , cleaning up the- data , data analysis

Teaching-Learning Process	***ICT and Digital support**: introduce the excel tool for data and statistical analysis* ***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 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

- Lankow, Jason (2012), Inforgraphics: The Power of Visual Stroytelling, 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. (DA)

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	22DAC13	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
	Total Hours of Pedagogy	4	Total Marks	100
	Credits	3	Exam Hours	3

Course Learning objectives:

- To develop a conceptual orientation for the historic trajectory and trace current process influences impact of digital technologies in architectural design
- To understand and trace the works of different architects , computationally
- 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 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 power point presentation* ***Collaborative and Cooperative learning-*** *discussion and analysis based on the lecture*

Module-2

Introduction to research and analysis of Post modernism and DE constructivist 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* ***ICT and Digital support****: Lecture will be conducted , through the use of power point 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 power point presentation* ***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 concept and works of Marcos Novak, Lars spyubroek .

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

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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. (DA)

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 -1			
	Course Code	22DAS14	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:01:02	Viva Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	2	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 power point presentation* ***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 power point presentation* ***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

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* ***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 power point presentation* ***Collaborative and Cooperative learning****: students can do a fabrication model based on the same*

Assessment Details (both CIE and SEE)

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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. (DA)

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

	PARAMETRIC SOFTWARE			
	Course Code	22DAS 15	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:01:02	Viva Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	2	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

The new modelling technique called Associative modelling will be taught as one of the approach for design development. Demonstrating the significantly associative role of the software as against its assumed role as a representative tool. Elements of parametric design and design patterns The structure of parametric design processes, their characteristics and reusable parametric design approaches

Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***Collaborative and Cooperative learning-** discussion and analysis based on the lecture*

Module-2

The subject will become the base to develop digital concepts through parametric skill sets
. • Basic Interface – of 3D modelling and its parametric interface
• Capacity determination of the designing agency
• Geometry types - Points, Vectors, Lines,

Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***Collaborative and Cooperative learning**: students will be given exercises to do in class*

Module-3

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

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

Module-4

Parametric modeling techniques and tools: Tools that are available to model design parametrically will be introduced in this class to illustrate the construction of geometrical relationships among complex shapes, plug - ins grasshopper/ weaverbird/ kangaroo solver/ fologram/lunchbox

	Teaching-Learning Process	***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation* ***Collaborative and Cooperative learning****: students can do a fabrication model based on the same*
	Module-5	
	To help students better understand in organizing data - Decoding geometrical logic -Extracting information for fabrication - Common pitfalls and how to avoid them - An introduction to physical simulation -Tips, tricks and shortcuts	
	Teaching-Learning Process	***ICT and Digital support****: Lecture will be conducted , through the use of power point presentation* ***Collaborative and Cooperative learning****: students can do a fabrication model based on the same*

Assessment Details (both CIE and SEE)

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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. Robert Woodbury Parametric; Design for Architecture
2. Arturo Tedeschi ; Algorithmic aided design
3. Andy Payne; The Grasshopper Primer_Second Edition.
4. Zubin khabazi; Generative Algorithms series with grasshopper.
5. RajaaIssa; Essentid modelling and mathematics.
6. FreyerC ; Digital By Design : Crafting Technology For Products And Environments. 7. Burry J ; New Mathematics Of Architecture.

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=uSEzWfGgP2Y

https://www.youtube.com/watch?v=3GQHaYdmULs

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 parametric 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. (DA)

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

	RESEARCH METHODS & IPR			
	Course Code	22DAS 16	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	01:00:02	SEE Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	2	Exam Hours	3

Course Learning objectives:

To introduce the methods and the process of research within the realm of Digital architecture and to understand the significance of the same in contemporary architectural practice.

Module-1

Introduction to the types of research and the process of formulating a research project. Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research

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

Module-2

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

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

Module-3

Data collection and analysis -Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies

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

Module-4

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

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

Module-5

	Interpretation and report writing - Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of power point 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:

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

- Creswell, J. W; Research Design: Qualitative, quantitative and mixed methods approaches, 2nd Ed., Thousand Oaks: Sage. 2003.
- De Vaus, D. A; Surveys in Social Research, Jaipur :Rawat Publications. 2003. .
- Kothari, C.R; Research Methodology: Methods and Techniques, New Delhi: WishwaPrakashan. 2005. 5. Sanoff, H; Methods of Architectural Programming, Dowden Hutchinson and Ross, Inc. Vol. 29, Community Development Series. 1977.
- Sanoff, H; Visual research methods in design, USA: Van Nostrand Reinhold. 1991.udio.

Web links and Video Lectures (e-Resources):

- https://www.scribbr.com/category/research-paper/
- https://writing.ku.edu/writing-process

Skill Development Activities Suggested

To undertake a focused study based upon a research question and to present it in the form of a research paper, compilation of study material, along with brief assignments demonstrating the steps in the research process.

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 choose their research aims and objectives	L2
CO2	Enable students to Understand the limitations of particular research methods	L2
CO3	To Develop skills in qualitative and quantitative data analysis and presentation	L3
CO4	To Develop advanced critical thinking skills	L3
CO5	To Demonstrate enhanced writing skills	L3

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	To Demonstrate the ability to choose methods appropriate to research aims and objectives	PO1
2	To Understand the limitations of particular research methods	PO2
3	Should be able to Develop skills in qualitative and quantitative data analysis and presentation	PO3
4	Develop advanced critical thinking skills	PO4
5	Demonstrate enhanced writing skills	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

	BOS RECOMMENDED ONLINE COURSE			
	Course Code	22AUD17	CIE Marks	
	Teaching Hours/Week (L:P:SDA)	00:02:00	Viva Marks	
	Total Hours of Pedagogy	2	Total Marks	pp
	Credits	PP	Exam Hours	

Semester- 1

	DIGITAL MATERIALITY AND TECTONICS			
	Course Code	22DAE 181	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:02:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	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 power point 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 power point 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 power point 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. (DA)

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	22DAE 182	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:02:00	SEE Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

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)

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://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. (DA)

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	22 DAE 183	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	01:01:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	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*

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):

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. (DA)

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

Semester- II

	DIGITAL DESIGN STUDIO -II			
	Course Code	22 DAC 21	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:08:00	Viva Marks	50
	Total Hours of Pedagogy	10	Total Marks	100
	Credits	10	Exam Hours	-
	Course Learning objectives: This unit of study introduces explorative and creative thinking expressed through the application of digital software to design propositions. Students will develop the ability to use digital software for the development and execution of parametrically designed building typology			
	Module-1			
	Decoding the architectural design process as a collaborative, iterative and evolutionary vector framework - collaborative- spatial design & parameters, iterative - to understand the parameters and form a complex system- vector framework			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*		
	Module-2			
	Role of diagramming in analysis, data mapping and their translation to parametric platforms - data mapping to relevant parameters , parametric analysis. computational tools and skills , Produce creative design outcomes in a digital environment with reference to appropriate parametric software use for designing a building typology			
	Teaching-Learning Process	***Collaborative and Cooperative learning**: physical case studies* ***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			
	Identifying and defining the role of parametric platforms as a powerful design tool that augments the design and execution process - introduction to different tools like			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation , software tools will be taught*		
	Module-4			
	Develop and document individual visual communication concepts and outcomes framed by a project brief -Identify and use appropriate digital software to execute intended design outcomes			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of power point presentation ,software tools will be taught*		
	Module-5			

	Apply vector oriented design software as design tools to achieve design objectives -Produce creative design outcomes in a digital environment with reference to appropriate parametric software use for designing a building typology
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of power point 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

- Tschumi, Bernard ; Notations: Diagrams and Sequences
- Koolhaas, Rem ; Delirious New York: A Retroactive Manifesto for Manhattan,
- Fenton, Joseph , Pamphlet Architecture 11: Hybrid Buildings
- Woodbury, Robert ; Elements of Parametric Design, Routledge New York
- Oxman, Rivka and Robert ; Theories of the Digital in Architecture, Routledge New York.

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 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

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	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.	L4

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	Decoding the architectural design process as a collaborative, iterative and evolutionary vector framework	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	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- II

	DIGITAL ARCHITECTURE PROCESS THEORIES AND HISTORY -II			
	Course Code	22 DAC 22	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	03:00:02	SEE Marks	50
	Total Hours of Pedagogy	5	Total Marks	100
	Credits	4	Exam Hours	3

Course Learning objectives:

To develop a focused inquiry into a specific area of algorithmic dynamics through formal content and theories with regards to emergent behaviours those exhibit a dynamic interaction of diverse forces.

Module-1

The subject focuses on the concepts and convergent interdisciplinary effects of evolutionary design processes on design and production technologies in architecture, the focus is on developing these as creative inputs to new architectural design processes.

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

Module-2

The Subject Course is designed to familiarise students with these instruments, their associated conceptual fields and with their application to architectural design research.

Teaching-Learning Process	***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

Course content includes theories of Generative algorithms within the realm of Emergence (swarm Behaviour, Fractals, L systems, cellular Automata, genetic algorithms). The concept ,various tools, building egs should be analysed and studied

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

Module-4

The course is meant to develop vocabulary and critical understanding of a wide array of algorithms, thus developing a critical stance towards algorithmic tooling. ’

	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of power point presentation*
	Module-5	
	Research based theoretical investigations will also include works of architects who recursively use algorithmic tooling in their structural form finding and generative design processes.	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of power point 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:

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

- Tschumi, Bernard ; Notations: Diagrams and Sequences
  Koolhaas, Rem ; Delirious New York: A Retroactive Manifesto for Manhattan,
  Fenton, Joseph , Pamphlet Architecture 11: Hybrid Buildings
- Woodbury, Robert ; Elements of Parametric Design, Routledge New York
- T schumi, Bernard ; Event Cities

Web links and Video Lectures (e-Resources):

- https://www.researchgate.net/publication/282813761_Emergence_in_Architectu
- https://www.youtube.com/watch?v=f6ra024-ASY
- https://www.techtarget.com/searchenterprisedesktop/definition/cellular-automaton#:~:text=A%20cellular%20automaton%20(CA)%20is,the%20states%20of%20neighboring%20cells.
- https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a7137-fractal-geometry-in-architecture/
- https://www.sciencedirect.com/topics/engineering/swarm-intelligence#:~:text=Swarm%20intelligence%20(SI)%20is%20a,movement%20of%20birds%20and%20fish.

Skill Development Activities Suggested

The sessional work will be in the form of exercises that are based on generative processes using algorithmic tools available in grasshopper plugins and to understand its use in architectural design. The submission will also include research reports and theoretical presentations to explore the systematic investigation in design processes using algorithmic tools.

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	The students will be familiar with associated concepts of algorithmic architecture and its application to architectural designresearch	L3
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.	L4

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	Decoding the architectural design process as a collaborative, iterative and evolutionary vector framework	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	**M**	**M**	**H**	**H**	**M**
CO2	**M**	**M**	**L**	**H**	**M**
CO3	**M**	**M**	**M**	**H**	**M**
CO4	**L**	**M**	**M**	**H**	**L**
CO5	**M**	**M**	**L**	**H**	**M**

H – High , M – Medium, L - Low

Semester- II

	APPLICATION OF DIGITAL ARCHITECTURE STUDY ON REAL-TIME PROJECT I			
	Course Code	22 DAC 23	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:00:02	Viva Marks	50
	Total Hours of Pedagogy	-	Total Marks	100
	Credits	1	Exam Hours	-

Course Learning objectives:

To give an opportunity for learning and for development of skills related to practical aspects of the discipline of Digital Architecture, by working in a professional firm. Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently.
Internship/Professional practice:

Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcome

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

- Gain practical experience within the industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions ofprofessionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

Assessment Details (both CIE and SEE)

Assessment Details (SEE only) Weekly work logs by the students will be filed and marked for 50 Semester End Examination marks for the internship report (50 marks), seminar (25 marks) and question and answer session (15 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question-and-answer session) by the examiners appointed by the University. The total marks will be then reduced to 50 marks

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.

Skill Development Activities Suggested

- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.

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 practicalities of professional practice	L2
CO2	Expand thinking and broaden the knowledge and skills acquired through course work in the field.	L3
CO3	Interact with and learn from current professionals in the field..	L3
CO4	Insight into professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.	L3
CO5	Understand the duties and responsibilities of a professional.	L4

program Outcome of this program. (DA)

Sl. No.	Description	POs
1	Acquire outstanding fundamental knowledge in the field of Digital 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	The individual student must show an increase in the particular skills/knowledge offered and in the field of architecture in general	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	**M**	**M**	**H**	**H**	**M**
CO2	**M**	**M**	**L**	**H**	**M**
CO3	**M**	**M**	**M**	**H**	**M**
CO4	**L**	**M**	**M**	**H**	**L**
CO5	**M**	**M**	**L**	**H**	**M**

H – High , M – Medium, L - Low

Semester- II

	INTERNET OF THINGS (IOT)			
	Course Code	22 DAC 24	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	01:01:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

To introduce the terminology, technology and its applications,introduce the Python Scripting Language which is used in many IoT devices ,introduce the implementation of web based services on IoT devices

	Module- 1
	Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-2
	Arduino Simulation Environment Arduino Uno Architecture Setup the IDE, Writing Arduino Software Arduino Libraries Basics of Embedded C programming for Arduino Interfacing LED, push button and buzzer with Arduino Interfacing Arduino with LCD
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-3
	Sensor & Actuators with Arduino Overview of Sensors working Analog and Digital Sensors Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino Interfacing of Actuators with Arduino. Interfacing of Relay Switch and Servo Motor with Arduino
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-4
	IoT Physical Devices and Endpoints – Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5

	IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API
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

- Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015
- Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,
- Make sensors: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.

Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
- https://www.youtube.com/watch?v=LlhmzVL5bm8
- https://www.youtube.com/watch?v=Fj02iTrWUx0

Skill Development Activities Suggested

Students will be able to configure basic protocols in sensor networks. Program and configure Arduino boards for various designs.Python programming and interfacing , Design IoT applications in different domains

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	The students will be familiar with associated concepts of basic protocols in sensor networks	L3
CO3	Advanced their knowledge on Program and configure Arduino boards for various designs.	L3
CO4	Python programming and interfacing for Raspberry Pi	L4
CO5	Design Iot applications in different domains	L4

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	Interpret the impact and challenges posed by IoT networks leading to new architectural models	PO1
2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.	PO2
3	Appraise the role of IoT protocols for efficient network communication.	PO3
4	Elaborate the need for Data Analytics and Security in IoT	PO4
5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- II

	ANALYSIS SOFTWARE			
	Course Code	22 DAS 25	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:02:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

To establish performance analysis as a major driver to architectural design decisions. Emphasis is to achieve a feed-back loop between the design ambitions and the physical simulations within the domain of performance based digital architecture.

Module- 1

Introduction of contemporary software that are capable of inducing physical parameters into the digitally generated model to evaluate its performance for various factors necessary for the performance of the buildings.

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

Module-2

This is done through testing the digitally generated models for their structural, environmental, thermal and material properties.

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

Module-3

To facilitate this students are introduced to contemporary softwares that are capable of inducing physical parameters into the digitally generated model to evaluate its performance for various factors. These software's aid the students to perform structural stability checks, computational fluid dynamics (CFD) analysis, thermal analysis, etc.

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

Module-4

These softwares are taught to them as short seminars and relevant industrial expertise from different faculties, practices or establishments are invited to delve deeper into specifics of any particular software : ladybug, firefly, butterfly, ghowl, puffer fish, mosquito, dragon fly, termite nest, honeybee , space

	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5	
	Application of the gained knowledge to design problems- to find the optimized solution / understanding of the parameters- using the different tools/ plugins to drive an optimized solution/ to understand the core structure - workflow of parametric modelling	
	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

- Peter Brandon; Emerging Paradigms and Models in Digital Design – Performance-Based Architectural Design
- Michael Hensel ; Performance-Oriented Architecture: Rethinking Architectural Design and the Built Environment
- Stanney K M ; Handbook Of Virtual Environments : Design Implementation And Applications
- Braun ; Masterpieces: Performance Architecture +Design
- IncPadt; Introduction to the Ansys Parametric Design Language : A Guide to the Ansys Parametric Design Language

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=6meHDZMJp-I
- https://www.youtube.com/watch?v=WgvGv8OceLA
- https://www.youtube.com/watch?v=if8verABo2g

Skill Development Activities Suggested

The students will be asked to make presentations about the role of performance based design using a specific simulation tool that they have learnt in the due course introduced to them. Through small exercises the students will apply their parametric knowledge and performance assessment to a building typology. Students are expected to submit detailed reports of the tutorials they undertook with appropriate analysis of the results.

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	The students will be familiar with associated concepts of basic protocols in sensor networks	L3
CO3	Understand the core structures and workflows of parametric modeling	L3
CO4	Manipulate complex data flows toward desired design outcomes	L4
CO5	Become familiar with program flow and geometry manipulation in Rhino	L4

Program Outcome of this program. (DA)

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- II

	DIGITAL FABRICATION-II			
	Course Code	22 DAS 26	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:02:00	SEE Marks	50
	Total Hours of Pedagogy	4	Total Marks	100
	Credits	4	Exam Hours	3

Course Learning objectives:

To augment the Contemporary developments in the building & construction domain which display capacities to facilitate experimentation & investigation in material informed design. The focus is to explore several intrinsic properties of materials, which can prove beneficial for iterative morphological design developments.

Module- 1

Experimentation & investigation into a chosen building material wherein in-depth study of the material & its intrinsic properties are studied and recorded

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

Module-2

These documented material properties and its behavior are extracted into numerical parameters which are later used to perform iterative digital operations.

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

Module-3

A feed-back loop thus established between the digital & analogue experiments is further used to augment design developments based on specific properties & behaviors of the materials that are investigated during the course of the studio.

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

Module-4

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

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

Module-5

	Parametric modeling techniques and tools: Tools that are available to model design parametrically will be introduced in this class to illustrate the construction of geometrical relationships among complex shapes. The lectures will focus on hands-on techniques that can be applied to the design process, to extend the efficiency and productivity of work during the process.	
	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:

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

- Peter Brandon; Emerging Paradigms and Models in Digital Design – Performance-Based Architectural Design
- Michael Hensel ; Performance-Oriented Architecture: Rethinking Architectural Design and the Built Environment
- Stanney K M ; Handbook Of Virtual Environments : Design Implementation And Applications
- Braun ; Masterpieces: Performance Architecture +Design
- IncPadt; Introduction to the Ansys Parametric Design Language : A Guide to the Ansys Parametric Design Language

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=6meHDZMJp-I**
- **https://www.youtube.com/watch?v=WgvGv8OceLA**
- **https://www.youtube.com/watch?v=if8verABo2g**

Skill Development Activities Suggested

The sessional work will include in-depth documentation of material experimentation that will specifically include intrinsic material properties documentation through demonstrative results, conversion of material properties into the digital medium and iterative digital explorations with reductive material parameters. The documentation will have material experimentation and prototypical models.

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. (DA)

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
5	Assess what type or combinations of types of digital fabrication technologies that are appropriate for the task at hand.	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- II

	BIOMIMETIC ARCHITECTURE			
	Course Code	22 DAE 271	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

This course examines how biomimicry and parametric design can address environmental challenges. to understand the concepts and analysis of bio- mimcry - applications using, computational tools

Module- 1

This class will examine how natural organisms can be models for architectural design using Biomimicry principles and morphogenetic parametric design. Starting from the beauty of nature as inspiration, students will study ways that architects and designers are examining nature's forms, mechanisms and systems to discover principles for approaching design problems.

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

Module-2

Design approaches will include processes of observation, description, analysis, metaphor and abstraction.Biomimicry and systems thinking provide a framework for looking at skins, bones and growth as paradigms for designing static structures and dynamic systems.

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

Module-3

Students will study how designers have used natural models to generate building designs, architectural systems and kinetic constructions. Examples will span scales from landscapes, architecture and product design.

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

Module-4

Students will study and analyse in detail, different buildings that have been modelled under bio mimicry egs- Beijing National Stadium, National Aquatic Centre, Council House2 , Milwaukee Art Muesem , The Gherkin , Eastgate Centre .

	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5	
	Students can observe and document natural patterns, 3d patterns ,solar adjustable module , solar responsive surface etc . This will familiarise the students to analyse and document buildings within these parameters .	
	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

- Biomimetics: Biologically InspiredTechnologies Ed. Yoseph Bar-Cohen,2005
- Biomimicry and Architecture Michael Pawlyn, 2011
- Bionics in Action: The Design Work of Franco Lodato, Motorola Jens Bernsen, 2004
- Cat's Paws and Catapults: Mechanical Worlds of Nature and People
  Steven Vogel, 1998
- The Gecko's Foot: Bio-inspiration, Engineering New Materials and Devices from Nature.
  Peter Forbes, 2005

Web links and Video Lectures (e-Resources):

- https://www.greenbiz.com/vid
- https://www.youtube.com/wat
- https://cei.ece.cornell.edu/new
- http://algorithmicbotany.org/

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	Ability to address an environmental design problem by using a natural analogy, natural processes, or natural material properties.	L2
CO2	Understanding of bio-inspired methods for sustainable design	L3
CO3	Ability to use parametric design software to generate form variants	L3
CO4	Understanding of emergent possibilities in digital design, analysis and fabrication	L4
CO5	students will be able to better understand the concepts , for tool aided design	L4

Program Outcome of this program. (DA)

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 biomimetic design	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- II

	PRODUCT DESIGN+ ROBOTICS			
	Course Code	22 DAE 272	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

It will focus on the understanding of the basics behind programming and robotics. These topics will be explored by designing an interactive product according to the studio design intent. Dedicated time for working with programmes like Python for grasshopper, Arduino etc will be allotted since the students have to learn the underworking of any adaptive design.

Module- 1

PRODUCT DEVELOPMENT FUNDAMENTALS AND PROCESS LEARNING RESULTS-Analyzes, evaluates and recommends the opportunities of market that could be turn into potential ideas for successful products launching that allow companies to lever up their growth strategies. Designs and develop in detail a plan and the process that an idea for a product have to follow to turn it into a winning concept, analyzing carefully each of its stages. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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

Module-2

CONCEPTCREATIONANDCUSTOMERVALIDATIONSLEARNINGRESULTS:Functioneffectivelyonateamwhose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. Formulates and presents clearly how to develop a differential concept from a product idea and a better comprehension of the needs of the target audience. Designs, analyzes and interprets research and products or concepts tests.

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

Module-3

To provide the students an introductory understanding and appreciation of robotics. It covers the fundamentals of kinematics, dynamics, and control of robot manipulators, robotic vision, and sensing. Evolution of robots and robotics, Laws of robotics, Progressive advancement in robots, Robot anatomy, Human arm characteristics, Design and control issues, Manipulation and control, Sensors and vision, Programming robots

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

Module-4

	Robot Dynamics: Langrangian mechanics, Two degree of freedom manipulator-dynamic model, Langrange-Euler formation, Control of manipulators: Open and close loop control, The manipulator control problem, linear control schemes, Characteristics of second-order linear systems, Linear second-order SISO model of a manipulator joint, Joint actuators	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5	
	Robot Applications: The meaning of sensing, Sensors in robotics, Kinds of sensors used in robotics, Robotic vision, Industrial applications of vision-controlled robotic systems, Process of imaging, Architecture of robotic vision systems, Image acquisition, Description of other components of vision systems, Image representation, Image processing.	
	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

- DNagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003
- Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008
- Fu. K.S, Gonzalez, R.C., Lee, C.S.G, Robotics, control, sensing, Vision and Intelligence, McGraw Hill International, 1987
- Harry Asada &Slottine "Robot Analysis& Control" , Wiley Publications, 2014

Web links and Video Lectures (e-Resources):

- https://www.researchgate.net/publication/329132291_Product_Design_Process_and_Methods
- https://nzifst.org.nz/resources/creatingnewfoods/documents/CreatingNewFoodsCh5.pdf
- **https://www.researchgate.net/publication/283452773_Introduction_to_Robot_Design**

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	Explain the evolution of robotic systems	L2
CO2	Understand robot configuration, structures, basic components, workspace and generations of robots	L2
CO3	Associate the relation between kinematic linkages and robot kinematics	L2
CO4	Understand robot dynamics	L2
CO5	Understand robot characteristics with their control systems /application of robots in the industry	L4

Program Outcome of this program. (DA)

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 product design+robotics	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- II

	OPTIMIZING BUILT STRUCTURES			
	Course Code	22 DAE 273	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

This subject focuses on the study of building typologies and its optimization techniques using Grasshopper for Rhino, This project extends the system logics to a larger and more complex piece of the city where parameters like the microclimate, social and typological organizations of an urban context will be studied

Module- 1

Problem Formulation and Setup- System characterization:

1. Identification of objectives, design variables, constraints, subsystems
2. System-level coupling and interactions
3. Examples of MSDO in practice
4. Visualization techniques in design optimization

Subsystem model development

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

Module-2

Optimization and Search Methods- Optimization and exploration techniques:

1. Review of linear and nonlinear programming
2. Heuristic techniques: genetic algorithms simulated annealing, Tabu search
3. Design Space Exploration: Design of Experiments (DOE): Full factorial search, parameter study, Taguchi/orthogonal arrays, latin hypercubes
4. Mixed integer programming (application to hub spoke / network problems)

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

Module-3

Multiobjective and Stochastic Challenges

1. Multiobjective optimization:
    1. Weighted sum optimization
    2. Weak and strong dominance
    3. Pareto front computation
    4. Goal programming and isoperformance
    5. Physical Programming
    6. Multiattribute Utility Theory

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

	Module-4	
	Implementation Issues and Real World Applicationsn System assessment and extensions: 1. What is optimality? 2. Design for value: including lifecycle costing 3. Optimizing product families and platforms	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5	
	Implementation issues: 1. Model reduction 2. Approximation techniques: response surfaces, kriging, neural networks 3. Concurrent design Reference studies of buildings of students choice is encouraged - to better understand the architectural aspect	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*

Assessment Details (both CIE and SEE)

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Semester End Examination:

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- Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008
- Fu. K.S, Gonzalez, R.C., Lee, C.S.G, Robotics, control, sensing, Vision and Intelligence, McGraw Hill International, 1987
- Harry Asada &Slottine "Robot Analysis& Control" , Wiley Publications, 2014

Web links and Video Lectures (e-Resources):

- https://www.researchgate.net/publication/329132291_Product_Design_Process_and_Methods
- https://nzifst.org.nz/resources/creatingnewfoods/documents/CreatingNewFoodsCh5.pdf
- **https://www.researchgate.net/publication/283452773_Introduction_to_Robot_Design**

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	To analyse area of analysis and optimization of multidisciplinary systems during the "conceive" and "design" phases	L2
CO2	Develops and codifies a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures	L2
CO3	Rationalize and quantify a system architecture or product design problem by selecting appropriate objective functions, design parameters and constraints	L2
CO4	Subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model	L3
CO5	To analyse and study buildings to understand the different generations / survival of the fittest / optimised results	L3

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	perform a critical evaluation and interpretation of analysis and optimization results, including sensitivity analysis and exploration of performance, cost and risk tradeoffs	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	be familiar with the basic concepts of multiobjective optimization, including the conditions for optimality	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	DIGITAL DESIGN STUDIO-III			
	Course Code	22 DAC 31	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:08:00	Viva Marks	50
	Total Hours of Pedagogy	10	Total Marks	100
	Credits	10	Exam Hours	-

Course Learning objectives:

To explore new limits and possibilities of urban interventions that are assisted by parametric design principles. The aim is to hone and utilize parametric capacities and use them as a powerful tool that augments the multi-layered and collaborative urban design process and helps produce design solutions of greater resilience.

Module- 1

Introduction to analytical diagramming/information graphics post mapping for analysis and data representation tool acting at local and urban scale Stakeholder analysis, demographic study, climate studies, socio-economic analysis and related analysis of a wide range of urban forces

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

Module-2

Inferences from analysis in terms of Variables, Constraints & Opportunities followed by 'problematization'(identification of key urban issues that need resolution wrt to design brief

Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-3

Development of design agenda and an urban concept that addresses the macro issues followed by a more specific strategy for the site that addresses micro issues/opportunities. Introduction of parametric platform as a vector field for site formulation -tools used elk, decoding spaces, urbano, pedism.

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

Module-4

	Design evolution and refinement through selection and iteration within the parametric platform . Refinement and detailing in 3d and Detailing in 2d digital environment modelling environment and Post production and design representation techniques	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-5	
	Students to place all the parametric analysis/ computational tools onto the given site and come up with analysis, inference , identify the problem and provide the solution	
	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

- Jacobs, Jane (1961), The Death and Life of Great American Cities, Random House
- Maas, Winy (2013), MVRDV: Agenda for Urbanism, O10 Publishers
- Schumacher, Patrick (2011), Total Fluidity, University of Applied Arts Vienna

Web links and Video Lectures (e-Resources):

- **https://www.researchgate.net/publication/255670004_Parametric_Design_in_Urban_Design**
- **https://www.sciencedirect.com/science/article/pii/S209526351830044X**
- **https://otp.uni-weimar.de/courses/parametric-urban-design-analysis-puda-19-2/**

Skill Development Activities Suggested

Rhino - parametric / urban plug-ins

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To analyse area of analysis and optimization of multidisciplinary systems during the "conceive" and "design" phases	L2
CO2	Develops and codifies a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures	L2
CO3	Rationalize and quantify a system architecture problem by selecting appropriate objective functions, design parameters and constraints	L2
CO4	Subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model	L3
CO5	To analyse and study buildings to understand the different generations / survival of the fittest / optimised results	L3

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	perform a critical evaluation and interpretation of analysis and optimization results, including sensitivity analysis and exploration of performance, cost and risk tradeoffs	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	be familiar with the basic concepts of multiobjective optimization, including the conditions for optimality	PO5

Mapping of COS and POS

	PO1	PO2	PO3	PO4	PO5
CO1	L	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- III

	PARAMETRIC URBAN MAPPING			
	Course Code	22 DAC 32	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	01:02:00	Viva Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	3	Exam Hours	-

Course Learning objectives:

To define the role of information in parametric urban design.This studio focuses on imparting skill set through different mapping techniques of parametric urban mapping where the emphasis is placed on data collection, pattern analysis, visualization, parametric spatial modelling, and physical representation.

Module- 1

Introduction to statistics and Data science- The studio explores spatial diagramming, through digital modelling and documentation, showcases how the urban phenomenon and its geospatial pattern can be interpolated into parametrically controlled forms which can later be translated into design solutions

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

Module-2

Data preprocessing using R programming- The students will investigate programmatic and formal precedents through readings, discussions, field trips which will be in support of the subject research. The goal will be to understand current urban conditions and practices, and reveal underlying patterns of the fields of research within the domain of parametric designing.

Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-3

Geospatial and GIS technique for Mapping- The research conducted by students will cover mapping of different aspects of urban phenomena and their relation with physical cityscape using the appropriate tools.

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

Module-4

	Modelling methods using Python Programming -The process of creating Data Models using the syntax and environment of the Python programming language is called Data Modelling in Python. The Data Model is the building block of Python. Internally Data Model has its design and code blocks for its implementation. identity of an object/ type of an object/ value of an object/ mutable objects	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-5	
	Data science project using above tool and technology- The course syllabus assumes preparing students to best practice the urban planner profession in the conditions of information society. Another objective is to provide them with the tools for influencing the dominant discourses.	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

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Semester End Examination:

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- 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

- MVRDV: Agendas on Urbanism
- JernejVidmar University of Ljubljana, Faculty of Architecture, SloveniaA lateral method for 3D urban design
- José Beirão, NunoMontenegro, PedroArrobas; City Information Modelling: parametric urban models including design Support data Campus and the City
- Kerstin Hoeger and KeesChristianse ; Urban Design for the Knowledge Society

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=X_XpOk1miIY
- https://www.youtube.com/watch?v=vnLc_3VnVcw
- https://towardsdatascience.com/develop-a-nlp-model-in-python-deploy-it-with-flask-step-by-step-744f3bdd7776

Skill Development Activities Suggested

Ability to understand the different mapping parameters , the relation between parameters , variations and spaces-tools that can be used for mapping .

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To analyse area of analysis and optimization of multidisciplinary systems during the “conceive” and “design” phases	L2
CO2	Develops and codifies a prescriptive approach to multidisciplinary modeling and quantitative assessment of new or existing system/product architectures	L2
CO3	Rationalize and quantify a system architecture problem by selecting appropriate objective functions, design parameters and constraints	L2
CO4	Subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model	L3
CO5	To analyse and study buildings to understand the different generations / survival of the fittest / optimised results	L3

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	perform a critical evaluation and interpretation of analysis and optimization results, including sensitivity analysis and exploration of performance, cost and risk tradeoffs	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	be familiar with the basic concepts of multiobjective optimization, including the conditions for optimality	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	PARAMETRIC URBANISM			
	Course Code	22 DAC 33	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
	Total Hours of Pedagogy	4	Total Marks	100
	Credits	3	Exam Hours	3
	Course Learning objectives: To trace the theoretical developments in use of parametric techniques in the urban design process and investigate formal design approaches to the parametric urban morphology. The subject intends to trace the development concerned with the deliberation on the genesis and the development of parametric urban models through theoretical research.			
	Module- 1			
	The subject will examine architectural vision of the city from emergence of the metropolis to the contemporary city. to understand the urbanics and the various parameters that govern these factors .Historical urban approach can be studied, archigram/ syncity			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*		
	Module-2			
	Emphasizing the concepts of form, movement, infrastructure, network, pattern and landscape, the seminar will investigate different agendas, strategies, manipulations that were employed in relation to the city, forcing a new understanding of the urban realm to emerge. meta design-concept/ context egs , relevance in today's world			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-3			
	It specifically will delve into the theoretical development of use of parametric tools in urban design where their utilization augments the multi-layered and collaborative urban design process. cellular automata - terms of generative design, cellular automata on urban growth.			
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*		
	Module-4			

	It will analyse the diverse design ideals that influence cities and settlements, and investigate how urban designers use parametric technologies to shape urban form. Quantitative / qualitative analysis - Jane Jacobs/mvrv design/ urban cinematics / urban mapping
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation* ***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-5
	To understand the concept of parametric urban planning through works of Zaha Hadid/ Patrick Schumacher/ china's urbanscape(old to new), generative urban design Pattern Language , Charles Correa /Aldo Rossi
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:

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

- Patrick Schumacher; Parametric Urbanism
- Toni Oosterland; The Digital Design in Sustainable Urbanism – Explorations in computational design strategies
- EVOLO ; Digital and parametric architecture
- Michael Weinstock; Architecture of Emergence

Web links and Video Lectures (e-Resources):

- https://www.grasshopper3d.com/profiles/blogs/parametric-urbanism-15-basic-parameters-in-urban-design
- https://www.researchgate.net/publication/261439394_Parametric_Maps_for_Performance_Based_Urban_Design
- https://www.sciencedirect.com/science/article/pii/S209526351830044X

Skill Development Activities Suggested

Better understanding of the theories / concepts and tools used for urbanism and mapping

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Acquire outstanding fundamental knowledge in history	L2
CO2	Encompass the ability to work in collaboration with interdisciplinary teams.	L2
CO3	Demonstrate creativity in the problem-solving process through professional quality graphic presentations and technical drawings.	L2
CO4	Students should be able to these architectural concepts on to their design	L3
CO5	Acquire outstanding fundamental knowledge in urbanism through parametric means	L3

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	perform a critical evaluation and interpretation of analysis and optimization results, including sensitivity analysis and exploration of performance, cost and risk tradeoffs	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	be familiar with the basic concepts of multiobjective optimization, including the conditions for optimality	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	APPLICATION OF DIGITAL ARCHITECTURE ON REAL -TIME PROJECT II			
	Course Code	22 DAC 34	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:00:04	Viva Marks	50
	Total Hours of Pedagogy	-	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

. To give an opportunity for learning and for development of skills related to practical aspects of the discipline of Digital Architecture, by working in a professional firm. Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently.
Internship/Professional practice:

Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcome

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

- Gain practical experience within the industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions ofprofessionals.
- Develop and refine oral and written communication skills.

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.

Skill Development Activities Suggested

- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.

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 practicalities of professional practice	L2
CO2	Expand thinking and broaden the knowledge and skills acquired through course work in the field.	L3
CO3	Interact with and learn from current professionals in the field..	L3
CO4	Insight into professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.	L3
CO5	Understand the duties and responsibilities of a professional.	L4

Program Outcome of this program. (CPM)

Sl. No.	Description	POs
1	Acquire outstanding fundamental knowledge in the field of Digital 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	The individual student must show an increase in the particular skills/knowledge offered and in the field of architecture in general	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	**M**	**M**	**H**	**H**	**M**
CO2	**M**	**M**	**L**	**H**	**M**
CO3	**M**	**M**	**M**	**H**	**M**
CO4	**L**	**M**	**M**	**H**	**L**
CO5	**M**	**M**	**L**	**H**	**M**

H – High , M – Medium, L - Low

Semester- III

	DISSERTATION PHASE- I (THESIS)PRE- THESIS			
	Course Code	22 DAS 35	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:01	Viva Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

- The objective of the dissertation is to provide an opportunity to the students to prepare independent and original study of a special project of his/her own choice
- The project provides students an opportunity for academic research to cultivate specialization in the areas of their own interest under the overall guidance of the faculty
- The objective of the seminar work is to train the students to prepare state of art report by assimilation of concepts / ideas on a chosen topic in the area of Building Engineering and Management.

COURSE CONTENT

Research Content: The dissertation/ thesis is an individual research project that is a major piece of work undertaken by the students. It is a continuation of the Dissertation phase-1 of the previous semester. They are expected to select a topic on a live problem in the industry or a macro-issue having a bearing on performance of the real estate, construction or urban infrastructure industry. The topic should be researchable and involve scientific design of a study, collection and analysis. The aim is to prepare a state of art report on the chosen topic and develop hypotheses to be tested through the research methodology designed for the purpose.

The thesis proposal should include an overview of the proposed plan of work, including the general scope of your project, your basic research questions, research methodology, and the overall significance of your study. In short, the proposal should explain what to study, how to study this topic, why this topic needs to be studied.

Thesis proposals are designed to

- Justify and plan (or contract for) a research project.
- Show how your project contributes to existing research.
- Demonstrate to your advisor and committee that you understand how to conduct discipline specific research within an acceptable time-frame.
- Recommend future study areas for research.

Research Process: Students are required to test their outcome proposals through various methods, including questionnaire surveys and case studies. Students must create an innovative insight on the specific issues.

Thesis work includes processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology; field study planning; survey data collection, analysis and result presentation; literature study; conceptual an empirical :compilation and inference drawing; research study validation through case studies, field application and simulation models; discussion of findings of research findings; study conclusion and recommendation formulations. The progress of the Thesis work is presented and discussed by the student periodically in the classroom environment and progress monitored continuously. This work develops the comprehension and presentation skills of the students. The students are provided guidance from the faculty to channelize their thoughts.

Area of Research: The subject for special study may be conceptual or practical but pertaining to Building Engineering and Management in areas like Building Engineering, Construction technology ,Structural systems , Energy efficient building materials & techniques , Construction project management, Time management, Cost

	management, Quality management, Safety management, Contract Administration, Design management, Construction financial management, Human resource management, Quantitative techniques, Energy management, Building services, Building management systems, Infrastructure services , Management information systems , Project planning and feasibility and Disaster management **Presentation**: The dissertation Project shall be submitted in the form of drawings, project report, models, slides etc. Relevant details/codes, schematic charts, reports and photographs.	
	Teaching-Learning Process	*Critical review with constructive suggestions / feed backs has to be provided by the Guide/ co-guide during the progress of the dissertation*

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 Dissertation Stage -2, shall be based on the progress of the student throughout the semester, presentation skills in seminars and submission of the Dissertation 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

- Creswell, J. W; Research Design: Qualitative, quantitative and mixed methods approaches, 2nd Ed., Thousand Oaks: Sage. 2003.
- Kothari, C.R; Research Methodology: Methods and Techniques, New Delhi: WishwaPrakashan. 2005
- Sanoff, H; Visual research methods in design, USA: Van Nostrand Reinhold. 1991

Web links and Video Lectures (e-Resources):

- Thesis Format | Dissertation Format | Paper, Structure, Sample | Leverage Edu

Skill Development Activities Suggested

- Guest lecture
- Review of researchpapers
- Workshops / seminars by industry experts
- Site visits / case studies

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Prepare an extensive literature study and data collection from the field and presentation in the form of drawings, relevant details/codes, schematic charts, reports and photographs	L3
CO2	Develop a hypothesis to be tested through the research methodology designed for the purpose with innovative insight on specific issues thereby undertaking academic research independently.	L3
CO3	Experiment with research processes.	L4
CO4	Propose areas for further research and development	L5

Program Outcome of this program. (DA)

Sl. No.	Description	POs
1	Acquire outstanding fundamental knowledge in the field of Construction Project Management.	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, construction, resources management and scheduling & Monitoring of projects	PO4
5	Understanding the diverse needs of values and systems of society and providing sustainable solutions	PO5
6	Demonstrate design solutions that integrate contextual, social, economic, cultural, ethical, environmental concerns	PO6
7	Ability to do independent/option-based research and exploration of advanced and emerging topics.	PO7
8	Appraise professional standards and ethical responsibilities as a team member	PO8

Mapping of COS and POS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	H	H	H	H	H	H	H
CO2	H	M	H	H	H	M	H	H
CO3	M	H	H	H	H	H	H	H
CO4	M	H	H	H	H	H	H	H

H – High , M – Medium, L - Low

Semester- III

	DIGITAL FABRICATION-III			
	Course Code	22 DAS 36	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	00:03:00	Viva Marks	50
	Total Hours of Pedagogy	3	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

The objective is to delve into the Digital fabrication via embedded systems explored with respect to the domain of Interactive/Responsive design environments.

Module- 1

This studio explores theoretical and practical potentials of fabrication following a speculative methodology which gets empirically implemented via robotically built scale models

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

Module-2

Studies include a wide range of activities from theoretical discourse and mostly digital explorations of interactivity to hands-on experiments using sensors, actuators, and related scripting environments.

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

Module-3

Students will learn a full stack of prototyping skills ranging from web development and version control to CAD modelling and electronics production. In-depth understanding of how the machines work and their limitations will lead to better digital design strategies for manufacturing which can reduce project time in the case of teamwork

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

Module-4

Design premise for implementation would be within a palette of augmented spaces on an urban level or a building scale, interactive networks, interactive media towards responsive environments, and interactive components and products that will be explored in the due course of the studio.

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

Module-5

	This studio we'll be focusing on new hardware and software prototyping techniques; primarily focusing on a wide range of sensing and actuation modalities in order to build novel interactive panel devices, Using remote sensors, microcontrollers (Arduino), and actuators.
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

Viva- Voce 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

- Andrew Payne; The firefly premiersecond edition
- Rodolphe el-Khoury,ChristosMarcopoulos Carol Moukheiber; The Living, Breathing, Thinking, Responsive Buildings of the Future
- Wes Mc Gee; Robotic Fabrication in Architecture, Art and Design

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=6meHDZMJp-I**
- **https://www.youtube.com/watch?v=WgvGv8OceLA**
- **https://www.youtube.com/watch?v=if8verABo2g**

Skill Development Activities Suggested

The sessional work will include in-depth documentation of material experimentation that will specifically include intrinsic material properties documentation through demonstrative results, conversion of material properties into the digital medium and iterative digital explorations with reductive material parameters. The documentation will have material experimentation and prototypical models.

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. (DA)

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
5	Assess what type or combinations of types of digital fabrication technologies that are appropriate for the task at hand.	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	PARAMETRIC LANDSCAPE URBANISM			
	Course Code	22 DAE 371	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

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

Module- 1	
To provide students with the necessary theoretical knowledge and technical skills for analysing, documenting and interpreting urban landscape.to make students understand through ecological awareness, different methods have been investigated to explore the relationship between nature and design. Additionally, digital techniques and methods have begun to dominate all elds of professions, including design disciplines.	
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
Module-2	
To familiarize the students with 'landscape urbanism' interventions. aims to construct a new logic to interrelate multiple urban systems, including fabric modulation, street systems, and a system of open spaces. Patrick Schumacher	
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
Module-3	
Landscape Urbanism - to produce new open-space morphol-ogies by generating, integrating and mediating ecological systems with a well-developed understanding of the ground as well as deploying a built form that incorporates a new in-frastructural sensibility	
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
Module-4	
Algorithmic approach- Computation obtains an algorithmic logic that is deterministically rational,decisive and systematized. students should explore methodology, site constraints, generation of the computational geometry ,optimization process	
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*

	Module-5
	To integrate the sub-systems into the masterplan including the infrastructure, water and waste management of the landscape. It is possible to assess the NURBS-based surface model of the landscape as a 3D terrain by integrating issues related to the ground.
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

Viva- Voce 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

- Patrick Schumacher; Parametric Urbanism
- Toni Oosterland; The Digital Design in Sustainable Urbanism – Explorations in computational design strategies
- EVOLO ; Digital and parametric architecture
- Tomas Michael; Hybrid architecture for future urbanism

Web links and Video Lectures (e-Resources):

- https://www.researchgate.net/publication/312061212_A_parametric_landscape_urbanism_method_The_search_for_an_optimal_solution
- https://etd.lib.metu.edu.tr/upload/12621258/index.pdf
- http://papers.cumincad.org/data/works/att/ecaade2017_143.pdf

Skill Development Activities Suggested -

- Students will be aware of the tools and methodology needed to analyse urbanism

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Build the tools to thrive in rigorous intellectual and practice environments, where questions about the site and the environment are investigated through design research and design thinking.	L2
CO2	Learn to work collaboratively and in an interdisciplinary manner across scales integrating the understanding of programmatic needs, contextual/environmental conditions, technological challenges, social structures and historical/theoretical meaning.	L3
CO3	To think like a native of a place, understanding of the ecologies of this region, its historical and cultural context and the equitable opportunities and value of urban life	L3
CO4	To understand the cultural stability of the city	L4
CO5	To understand the tools and methodologies to understand urbanism	L4

Program Outcome of this program. (DA)

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 product design+robotics	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	SUSTAINABLE URBAN DESIGN			
	Course Code	22 DAE 372	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

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

	Module- 1	
	To develop architectural, urban design skills and awareness through the design of architectural and urban interventions at an appropriate scale and resolution, in response to a brief. To adopt novel approaches to the generation of design concepts, and to develop these in detail in response to the circumstances of both the physical, cultural and intellectual context	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-2	
	To introduce and analyse contemporary urban design theories and practice including their evolution from historical practice to develop a critical understanding of the contemporary city and how people engage with it. This will include an analysis of the visual, social, functional, perceptual and environmental dimensions of the practice of urban design.	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-3	
	Sustainable Cities - introduces the key theories of how a city works and its impact on the environment.It makes the students aware that sustainable cities are a product of both spatial patterns and social realities. The module examines a range of issues and challenges with a particular focus on environmental impact (local -global integration).	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-4	
	Towards Sustainable Design Principle- futurity ,environmental diversity, carrying capacity, the precautionary principle, equity/quality of life / local empowerment - concept of sustainable cities - 3 key systems-	
	Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-5	
	The theory of sustainable development, solutions to a sustainable city, understanding the concepts through detailed understanding of urban examples	
	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:

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Suggested Learning Resources:
Books

- Patrick Schumacher; Parametric Urbanism
- Toni Oosterland; The Digital Design in Sustainable Urbanism – Explorations in computational design strategies
- EVOLO ; Digital and parametric architecture
- Tomas Michael; Hybrid architecture for future urbanism

Web links and Video Lectures (e-Resources):

- https://www.researchgate.net/publication/322617880_Sustainable_urban_design_with_an_approach_in_sustainable_urban_development
- https://www.archdaily.com/964460/6-urban-design-projects-with-nature-based-solutions
- https://discovery.ucl.ac.uk/92934/7/Carmona_Sustainabilitypaper1.pdf

Skill Development Activities Suggested -

- Students will be aware of the tools and methodology needed to analyse urbanism

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Build the tools to thrive in rigorous intellectual and practice environments, where questions about the site and the environment are investigated through design research and design thinking.	L2
CO2	Learn to work collaboratively and in an interdisciplinary manner across scales integrating the understanding of programmatic needs, contextual/environmental conditions, technological challenges, social structures and historical/theoretical meaning.	L3
CO3	To think like a native of a place, understanding of the ecologies of this region, its historical and cultural context and the equitable opportunities and value of urban life	L3
CO4	To understand the cultural stability of the city	L4
CO5	To understand the tools and methodologies to understand urbanism	L4

Program Outcome of this program. (DA)

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 product design+robotics	PO5

Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- III

	GENERATIVE URBAN DESIGN			
	Course Code	22 DAE 373	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:00:00	Viva Marks	50
	Total Hours of Pedagogy	2	Total Marks	100
	Credits	2	Exam Hours	-

Course Learning objectives:

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

	Module- 1
	On generation – rule based approach- Design support systems for sustainable development ,"Smart Solutions for Spatial Planning,A designer-centered shape grammar editor and interpreter-Cities as diachronic models: The spatial logic of growth and its role as a generative design component-City Induction Generation Module - Structuring a generative model for urban design: linking GIS to shape grammars
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*

	Module-2
	On the urban program formulation- City Induction Formulation Module - Towards a Computational Description of Urban Patterns
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-3
	On evaluation- CityZoom: A Visualization Tool for the Assessment of Planning Regulations-City Induction Evaluation Module - Integrating spatial analysis techniques in the parametric urban design process
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*
	Module-4
	Static networks, dynamic networks,- evolutionary algorithms, and multi-objective algorithm for simultaneously optimizing more than one criterion-infrastructure- different ways of moving
Teaching-Learning Process	***ICT and Digital support**: Lecture will be conducted , through the use of powerpoint presentation*

	Module-5	
	Cities are centers of integration, and urban infrastructure evolves to maximize integration. Multi-objective optimization allows us to create a set of designs for infrastructure that seek to minimize cost while maximizing integration, with varying tradeoffs- genetic algorithms , curvelinear forms	
	Teaching-Learning Process	***ICT and Digital support****: Lecture will be conducted , through the use of powerpoint presentation*

Assessment Details (both CIE and SEE)

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Books

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- EVOLO ; Digital and parametric architecture
- Tomas Michael; Hybrid architecture for future urbanism

Web links and Video Lectures (e-Resources):

- http://home.fa.utl.pt/~jduarte/dcc08_workshop/notes/2008_Proceedings_Workshop_1_DCC08.pdf
- https://journals.sagepub.com/doi/10.1177/2399808319894986
- https://www.youtube.com/watch?v=pHZA_xioyb8

Skill Development Activities Suggested -

- Students will be aware of the tools and methodology needed to analyse urbanism

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Build the tools to thrive in rigorous intellectual and practice environments, where questions about the site and the environment are investigated through design research and design thinking.	L2
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CO4	To understand the cultural stability of the city	L4
CO5	To understand the tools and methodologies to understand urbanism	L4

Program Outcome of this program. (DA)

Sl. No.	Description	POs
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Mapping of COS and POS

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

H – High , M – Medium, L - Low

Semester- IV

	DISSERTATION PHASE- II (THESIS)			
	Course Code	22 DAC 41	CIE Marks	50
	Teaching Hours/Week (L:P:SDA)	02:16:04	Viva Marks	50
	Total Hours of Pedagogy	22	Total Marks	100
	Credits	20	Exam Hours	-

Course Learning objectives:

- The objective of the dissertation is to provide an opportunity to the students to prepare independent and original study of a special project of his/her own choice.
- The project provides students an opportunity for academic research to cultivate specialization in the areas of their own interest under the overall guidance of the faculty.
- The objective of the seminar work is to train the students to prepare state of art report by assimilation of concepts / ideas on a chosen topic in the area of Digital Architecture

COURSE CONTENT

Research Content: The dissertation/ thesis is an individual research project that is a major piece of work undertaken by the students. It is a continuation of the Dissertation phase-1 of the previous semester. They are expected to select a topic on a live problem in the industry or a macro-issue having a bearing on performance of the real estate, construction or urban infrastructure industry. The topic should be researchable and involve scientific design of a study, collection and analysis. The aim is to prepare a state of art report on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose.

The thesis proposal should include an overview of the proposed plan of work, including the general scope of your project, your basic research questions, research methodology, and the overall significance of your study. In short, the proposal should explain what to study, how to study this topic, why this topic needs to be studied.

Thesis proposals are designed to

- Justify and plan (or contract for) a research project.
- Show how your project contributes to existing research.
- Demonstrate to your advisor and committee that you understand how to conduct discipline specific research within an acceptable time-frame.
- Recommend future study areas for research.

Research Process: Students are required to test their outcome proposals through various methods, including questionnaire surveys and case studies. Students must create an innovative insight on the specific issues.

Thesis work includes processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology; field study planning; survey data collection, analysis and result presentation; literature study; conceptual an empirical :compilation and inference drawing; research study validation through case studies, field application and simulation models; discussion of findings of research findings; study conclusion and recommendation formulations. The progress of the Thesis work is presented and discussed by the student periodically in the classroom environment and progress monitored continuously. This work develops the comprehension and presentation skills of the students. The students are provided guidance from the faculty to channelize their thoughts.

Area of Research: The subject for special study may be conceptual or practical but pertaining to parametric field , computational design , virtual realtor robotics

Presentation: The dissertation Project shall be submitted in the form of drawings, project report, models, slides

	etc. Relevant details/, schematic charts, reports and simulations	
	Teaching-Learning Process	*Critical review with constructive suggestions / feed backs has to be provided by the Guide/ co-guide during the progress of the dissertation.*

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Suggested Learning Resources:

Books

- Creswell, J. W; Research Design: Qualitative, quantitative and mixed methods approaches, 2nd Ed., Thousand Oaks: Sage. 2003.
- Kothari, C.R; Research Methodology: Methods and Techniques, New Delhi: WishwaPrakashan. 2005
- Sanoff, H; Visual research methods in design, USA: Van Nostrand Reinhold. 1991

Web links and Video Lectures (e-Resources):

- Thesis Format | Dissertation Format | Paper, Structure, Sample | Leverage Edu

Skill Development Activities Suggested -

- Guest lecture
- Review of researchpapers
- Workshops / seminars by industry experts
- Site visits / case studies

Course outcome (Course Skill Set)

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

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