SAVITRIBAI PHULE PUNE UNIVERSITY

SYLLABUS FOR

MASTER IN ARCHITECTURE
M.ARCH (DIGITAL)

(To be implemented w.e.f. A.Y. 2015-16)

BOARD OF STUDIES IN ARCHITECTURE

FACULTY OF ENGINEERING

PREAMBLE

Digital technologies with its applications have been a catalyst in changing the way we live and aspire and have significantly changed the way architecture is practiced and produced. The focus of the curriculum is to prepare architectural academics for future aspirations. The intent is to reconfigure learning patterns that are inspired by a desire to harness increasingly sophisticated digital technologies in architectural design and construction.

Digital architecture covers the entire gamut of digital tools, software's and technologies as and when they are applied to architectural design and execution process and thus relates to the entire span of the built environment based on digital technologies ranging from analysis, mapping to computational design, services, information modelling and construction management.

At the heart of the curriculum are the parametric design processes that are used for generation of different formal expressions of a design concept. The term parametric design implies the representation of a design with a series of associative operations, controlled by constraints and parameters. These are defined in parametric software's that are able to generate interactive forms in the three dimensional (3D) space. The realization of such designs is facilitated by CAM processes essentially known as digital fabrication. With the use of parametric design tools, students/practitioners can study the interactive relationships of architectural designs in the early steps. By enabling the enlarged set of performances assessed impact choices at an early stage, parametric tools enhance interdisciplinarity, and creates a visual link between form and numeric performance evaluations, which in turn reduce the investment in poor performing solutions. Furthermore, they can revise basic aspects of the actual construction, including material, manufacturing technologies and structural components. This understanding and formulation of a procedural symbiotic relationship between conception, generation, and production is the crux of the digital architecture curriculum. The gamut of functional and formal knowledge includes parametric design methodologies, digital fabrication, parametric process theories, parametric software proficiencies, Interactive architecture through embedded systems, parametric urbanism as its core intent and are supported by a variety of subjects like, analytical diagramming and parametric thinking, evolutionary processes and morphogenetic strategies, performance based studies through analysis software's, parametric urbanism and research methodologies Experimental leanings in the field are explored through subjects like digital tectonics and materiality, parametric processes in allied fields, generative urbanism and responsive design in the form of electives.

COURSE OBJECTIVES:

1. To introduce designing in a parametric environment as a major change in conception of architectural designing approach where process is means to an end.
2. To equip architects towards procedural symbiotic relationship between conception, generation and production of architectural spaces using digital tools.
3. To provide an academic base wherein integration of technological content using digital tools with that of conceptual content of formal digital design processes is a formative process of learning.

SEMESTER WISE LEARNING OUTCOMES:

SEMESTER 1:

At the end of the semester the students would have learnt the application of parametric design principles at a product design scale

The focus of this semester is to equip the students with the following

- Parametric software skill sets.
- Concept generation and development of a parametric thought through analytical diagramming
- Conception, generation and production of a product design within the Architectural premise like furniture, installation etc wherein the students learn parametric design as a symbiotic process between conception, generation and production using digital tools and fabrication machinery.

SEMESTER 2:

By the end of the semester the students would have learnt the application of parametric design principles at a building typology scale

The semester focuses on performance based design by inculcating simulation tools as a driving parameter for the design of a building typology.

With the objective of initiating the students into research the second semester focuses on understanding generative and process based theories within the new epistemology of Digital architecture. Within the premise of digital architecture performance based design, fabrication intensive design and morphological processes are introduced and are tested by linking them to generative capacities of the digital tools.

SEMESTER 3:

This semester will enhance the student's comprehension of application of parametric principles at an urban design scale

The semester aims at exploring new limits and possibilities of urban interventions that are assisted by parametric design principles and theory.

The intent is to hone parametric software capabilities and utilize them as a powerful tool that augments the multi-layered and collaborative urban design process through theories of parametric urbanism and a design studio of an urban design scale.

SEMESTER 4:

The semester aims at directing students to pursue research in a field of digital architecture where their digital skillsets and parametric design thinking are tested through written documentation in the form of post graduate dissertation. The dissertation will evolve around an argument that will be validated through the rigorous process of research, questions or hypotheses, review of the literature, methodology, results and discussion.

25% of the total teaching hours are reserved for reflecting the institute's philosophy and its reflection in the design studio.

RULES OF COURSE STRUCTURE FOR
MASTER OF ARCHITECTURE, M. ARCH. (DIGITAL)

PROVISION OF INFRASTRUCTURE

Course shall be conducted as per the guide lines laid down by the Council of Architecture, New Delhi, with respect to intake of students, class rooms, studios, laboratories, seminar rooms, library facilities, students' amenities and all the appurtenant requirements to carry out teaching activity effectively.

APPOINTMENT OF TEACHING AND SUPPORTING STAFF

The appointment of teaching staff shall be made as per the norms laid down by C.O.A., New Delhi and other statutory bodies as applicable.

RULE NO. 1 : ELIGIBILITY CRITERIA

A student seeking admission to Master of Architecture Course must have secured minimum 50% marks in aggregate in a Bachelor of Architecture degree course or equivalent courses recognized by the apex body with / without valid GATE score. The students with valid GATE score shall be given preference and the students without GATE score shall be considered subject to the vacancy.

RULE NO. 2 : SCHEME OF ASSESSMENT:

A candidate, to be eligible for the Master's Degree in Architecture, will be required to appear for and pass examinations as under
1. First Year M. Arch: SEM I AND SEM II
2. Second Year M. Arch. : SEM II AND SEM IV

University will declare combined result of
• SEM I + SEM II at the end of First Year and
• SEM III + SEM IV at the end of Second Year

RULE NO. 3 : GRANTING OF TERM

Academic year will consist of TWO SEMESTERS of 90 teaching days each. Sessional work/ assignments prepared by the students shall be continuously assessed by the Internal Teacher throughout the semester.

The candidate will be permitted to appear for the examinations at the end of each semester only if he/she keeps term at a college affiliated to the university and produces testimonials from the Principal for

1. 75% attendance in each head of passing of Theory and /or Sessional work as prescribed by the University.
2. Satisfactory completion of the Sessional Work prescribed for each subject and secured at least 50 % marks in the Internal Assessment for the same.
3. Good conduct.

RULE NO.4 : EXAMINATIONS

At each examinations Theory Paper Sessional and Sessional and viva – voce based on Sessional Work, as prescribed in the syllabus for the Examination at the end of each semester, shall constitute separate heads of passing.

RULE NO. 5 : SESSIONAL WORK ASSESSMENT:

In respect of Sessional work in First, Second, Third and Fourth semesters, target date shall be fixed for the completion of each assignment. All assignments shall be continuously assessed by the Internal Teacher during each semester.
b) For the First, Second, and Third Semester examinations, Sessional and Viva assessment will be done by an External Examiner, who is external to the college i.e. teacher from college other than one, whose students are being examined.
c) For Fourth Semester examination, external assessment shall be carried out by a professional not teaching in any of the Colleges under University of Pune.
d) An examiner for any of the subjects of examination shall have a minimum of 5 years of teaching / professional experience in his/her specific field of study.

RULE NO. 6: PRE REQUISITES AND RULES OF A.T.K.T. FOR ADMISSION TO HIGHER CLASSES

This course has been considered as an integrated on and students will be allowed to take admission to second, third and fourth semesters irrespective of number of subjects in which they are failing.

RULE NO. 7 : CRITERIA FOR PASSING

To pass the First and Second Year Examination, a candidate must obtain minimum 50 % marks in each paper, 50% in Sessional/Viva voce and 50% in aggregate.

RULE NO. 8 : GRADING SYSTEM

Assessment and Grade Point Average

R-8.1 Marks/Grade/Grade Point
A grade is assigned based on the total marks obtained by a student in all the heads of examination of the course. These grades, their equivalent grade points are given in Table 3.

The guidelines for conversion of marks to grades are given below.

Grade	Grade	Percentage of	Remarks
O	10	90-100	Outstanding
A	9	80-89	Very Good
B	8	70-79	Good
C	7	60-69	Fair
D	6	50-59	Average
E	0	Below 50	Fail

R-8.2 Passing Grade
The grades **O, A, B, C**, **D**, are passing grades. A candidate acquiring any one of these grades in a course shall be declared as pass. And student shall earn the credits for a course only if the student gets passing grade in that course.

R-8.3 E Grade
The grade E shall be treated as a failure grade. The student with E grade will have to pass the concerned course by re-appearing for the examination. The student with E grade for any stage of the Project Work will have to carry out additional work/ improvement as suggested by the examiners and re-appear for the examination.

Rule No. 9. PERFORMANCE INDICES:

R-9.1 SGPA
The performance of a student in a semester is indicated by a number called the Semester Grade Point Average (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses, seminars and projects registered by the student during the semester.

(i) Semester Grade Point Average (SGPA) =

$$SGPA = \frac{\sum_{i=1}^{p} Ci\,Gi}{\sum_{i=1}^{p} Ci}$$

$$SGPA = \frac{\sum \text{Grade Points Earned} \times \text{Credits for each course}}{\text{Total Credits}}$$

For Example: suppose in a given semester a student has registered for five courses having credits C1, C2, C3, C4, C5 and his / her grade points in those courses are G1, G2, G3, G4, G5 respectively. Then students

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

SGPA is calculated up to two decimal places by rounding off.

R-9.2 CGPA
The CGPA is the weighted average of the grade points obtained in all the courses, seminars and projects registered by the student since student is admitted to the college. It is calculated in the same manner as the SGPA.

R-9.3 ln case of a student clearing a failed course or improvement, the earlier grade would be replaced by the new grade in calculation of the SGPA and CGPA.

Rule No. 10. RESULT:

R-10.1 Based on the performance of the student in the semester examinations, the University of Pune will declare the results and issue the Semester Grade sheets.
The University of Pune will issue a Degree Certificate and the final grade sheet of Semester I, II, III & IV, to the student, who is otherwise eligible for the award of Degree of Master of Architecture.

R-10.2 The class shall be awarded to a student on the CGPA calculated based on all the four semesters. The award of the class shall be as per Table 4.

Sr. No.	**CGPA**	**Class of the Degree awarded**
1	7.75 or More than 7.75	First Class with Distinction
2	6.75 or more but less than 7.75	First Class
3	6.25 or more but less than 6.75	Higher Second Class
4	5.5 or more but less than 6.25	Second Class

RULE NO. 11 : EXEMPTIONS AND SUPPLEMENTARY EXAMINATION

In case a candidate fails and desires to appear again,
a) He/she will be exempted from appearing in the head/s of passing in which he/she has passed.
b) A candidate will have to appear for the examination of backlog subjects along with the examination of current semester.

RULE NO. 12 : OTHER RULES:

University/ affiliated colleges may frame additional rules and regulations or modify these regulations if required, and once approved by the University, they would be binding on the students.

UNIVERSITY OF PUNE
COURSE STRUCTURE MASTER IN ARCHITECTURE (Digital)
[TO BE IMPLEMENTED W.E.F.ACADEMIC YEAR 2015 - 2016]

Credit Structure for M.Arch Programme					
Course work	Semester I	Semester II	Semester III	Semester IV	Total
Core courses	16	16	16	-	48
Elective Courses	2	2	2	-	6
Lab Courses + Supportive courses	7	7	3	-	17
Seminar	-	-	-	5	5
Project work	-	-	4	20	24
Total	**25**	**25**	**25**	**25**	**100**

SEMESTER I M.ARCH (Digital)														
Sub. Code	SUBJECT	Course	Hrs /wk		TEACHIG SCHEME		EXAMINATION SCHEME							CREDITS
				period/ wk	Lect./ Wk	Studio /Wk	Paper	Term work	SESSIONAL		Oral		Total	
									Int	Ext	Int	Ext		
D1	Digital Design Studio I	Core	9	12	2	10	-	-	150	150	25	25	350	9
D2	Analytical diagramming and Architectural Representation	Core	4	5	2	3	-	-	75	75	-	-	150	4
D3	DA process theories and History-1	Core	3	3	2	1	100	25	-	-	-	-	125	3
D4	Elective –I	Elective	2	2	1	1	-	100	-	-	-	-	100	2
D5	Parametric Softwares	Lab/ Supportive	4	5	2	3	-	-	75	75	-	-	150	4
D6	Digital Fabrication I	Supportive	3	3	2	1	100	25	-	-	-	-	125	3
TOTAL (SEMESTER I)			25	30	11	19	200	150	300	300	25	25	1000	25

SEMESTER II M.ARCH (Digital)														
Sub. Code	SUBJECT	Course	Hrs /wk		TEACHIG SCHEME		EXAMINATION SCHEME							CREDITS
				period/ wk	Lect./ Wk	Studio /Wk	Paper	Term Work	SESSIONAL		Oral		Total	
									Int	Ext	Int	Ext		
D7	Digital Design Studio II	Core	9	12	2	10	-	-	150	150	25	25	350	9
D8	Digital Fabrication II	Core	4	5	2	3	-	-	75	75	-	-	150	4
D9	DA process theories and History II	Core	3	3	2	1	100	25	-	-	-	-	125	3
D10	Elective-II	Elective	2	2	1	1	-	100	-	-	-	-	100	2
D11	Analysis Software	Lab/ Supportive	4	5	2	3	-	-	75	75	-	-	150	4
D12	Research Methodologies -I	Supportive	3	3	2	1	100	25	-	-	-	-	125	3
TOTAL (SEMESTER II)			25	30	11	19	200	150	300	300	25	25	1000	25

SEMESTER III M.ARCH (Digital)														
Sub. Code	SUBJECT	Course	Hrs /wk		TEACHIG SCHEME		EXAMINATION SCHEME							CREDITS
				period/ wk	Lect./ Wk	Studio /Wk	Paper	Term Work	SESSIONAL		Oral		Total	
									Int	Ext	Int	Ext		
D13	Digital Design III	Core	9	12	2	10	-	-	150	150	25	25	350	9
D14	Parametric Urban Mapping	Core	4	5	2	3	-	-	75	75	-	-	150	4
D15	Parametric Urbanism	Core	3	3	2	1	100	25	-	-	-	-	125	3
D16	Elective-III	Elective	2	2	1	1	-	100	-	-	-	-	100	2
D17	Digital Professional Practice (Training*)	Lab	4	-	-	-	-	-	50	50	25	25	150	4
D18	Digital Fabrication III	Supportive	3	3	2	1	100	25	-	-	-	-	125	3
TOTAL (SEMESTER III)			25	25	9	16	200	150	275	275	50	50	1000	25

*****This includes Professional Training (40 full working days) to be undertaken during intermediate time between II & III Semester, details of which are mentioned in the detailed syllabus. The Oral Assessment of the same will be held at the end of Semester III.

SEMESTER IV M.ARCH (Digital)														
Sub. Code	SUBJECT	Course	Hrs /wk		TEACHING SCHEME		EXAMINATION SCHEME							CREDITS
				period/ wk	Lect./ Wk	Studio /Wk	Paper	TW	SESSIONAL		Oral		Total	
									Int	Ext	Int	Ext		
D19	Digital Architectural Project	Project Work	20	22	5	17	-	-	300	300	100	100	800	20
D20	Research-II	Seminar	5	8	1	7	-	-	100	100	-	-	200	5
TOTAL (SEMESTER IV)			25	30	6	24	-	-	400	400	100	100	1000	25

DIGITAL DESIGN STUDIO–I			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	9	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	10	Sessional (Internal)	150
		Sessional (external)	150
Total Contact Periods/ week	**12**	Oral (Internal)	25
		Oral (External)	25
Total Credits	**9**	**Total Marks**	**350**

Objective: - To explore the inter-relationships between the contemporary mediums of digital design to digital production

Course Content:-

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.

- 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.
- 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.
- Advanced digital fabrication tools would be engaged to test the performative capabilities of one specific selection generated through the iterative process.
- The methodologies engaged in the program will necessarily explore the inter-relationships between performative designs, solid modelling and computer numerically controlled fabrication.

Sessional Work
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

Readings:-

1. Mark Burry; *Scripting Cultures*
2. Casey Reas and Chandler McWilliams; *Form+Code in Design, Art, and Architecture*
3. Kostas Terzidis **;** *Algorithmic Architecture*
4. D-Arcy Wentworth; *On growth and form*
5. John Frazer; *Evolutionary architecture*

6. Philip Ball ; *Shapes: Nature's Patterns; A Tapestry in Three Parts*
7. Tomoko Sakomato ; *From control to Design*
8. Mark Burry and Jane Burry ; *Mathematics of Architecture*
9. Ji-Seong J *; International Architecture Competition: Parameter and Process*
10. Szalapaj P ; *Contemporary Architecture And The Digital Design Process*
11. Neil Leach ; *Digital Tectonics*

ANALYTICAL DIAGRAMMING AND REPRESENTATION			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	3	Sessional (Internal)	75
		Sessional (external)	75
Total Contact Periods/ week	**5**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**4**	**Total Marks**	**150**

Objective: - To understand the potential of diagramming as an analytical as well as a representational tool inherent to parametric design process

Course Contents:

- Understanding diagramming as an analytical and representational tool
- The history and evolution of diagramming in architecture
- Developing the ability to sieve information and build effective and meaningful information diagrams
- Exploring the usage of diagramming in professional international practices
- Use of program diagrams in the design process
- Introduction to Architectural representation platforms
- Post-production techniques and tools
- Understanding architectural representation techniques

Sessional Work

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.

Readings

1. Lankow, Jason (2012), *Inforgraphics: The Power of Visual Stroytelling, Wiley & Sons Hoboken*
2. McCandless; David *(2014), Knowledge is Beautiful*
3. Mau, Bruce and Koolhaas; Rem (1998), *S,M,L,XL,* The Monacelli Press
4. MVRDV (1999); *Metacity/Datatown*
5. Koolhaas, Rem (1999);*Content*
6. Tschumi, Bernard (2014); *Notations: Diagrams and Sequences*
7. Ingells, Bjarke (2009); *Yes Is More*

8. Steele J; *Architecture And Computers : Action And Reaction In The Digital Design Revolution*
9. Ji-Seong J; *International Architecture Competition : Parameter And Process*
10. Szalapaj P; *Contemporary Architecture And The Digital Design Process*
11. Padgham L; *Developing Intelligent Agent Systems : A Practical Guide*
12. Young P M ; *Conceptual Representations : Architectural Diagrams 1*
13. Young P M ; *Conceptual Representations : Architectural Diagrams 2*

DIGITAL ARCHITECTURE PROCESS THEORIES AND HISTORY –I			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

Objective/Preamble:-

To develop a conceptual orientation for the historic trajectory and trace current process influences impact of digital technologies in architectural design.

Subject Content:-

The focus of the content will be on Readings and discussions that trace the sociocultural and technological ferment of Post modernism and DE constructivist movement, along with advancement in technical capabilities brought about a radical departure from traditional planning in architecture. The trajectory will trace the background of past 20 years that was crucial for the formation of Digital Culture in architecture.

The subject will also include Process based theoretical investigations through works of practitioners to understand their radical processes and parametric process trajectories which enabled architects to design and construct innovative buildings with more exacting qualitative and quantitative conditions.

SESSIONAL WORK:

Submission will be 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.

Readings:-

1. Antoine Picon ; *Digital Culture in Architecture*
2. Ali Rahim; *Contemporary Processes in Architecture*
3. Branko Kolarevic; *Architecture in the Digital Age: Design and Manufacturing*
4. Rivka Oxman**,** Robert Oxman; *Theories of the Digital in Architecture*
5. Lise Anne Couture , Hani Rashid; *Asymptote: Flux Hardcover*
6. Lise Anne Couture , Hani Rashid; *Asymptote Architecture: Actualizations*
7. Ban Van Berkel and Caroline Bos; *UNStudio UN Fold*
8. Foreign Office Architects Farshid Moussavi; *Phylogenesis: FOA's Ark*
9. Ban Van Berkel *Digitale Un Studio*

10. Lars Spuybroek *NOX - Machining Architecture*
11. Mark Burry, Jane Burry; *The new mathematics of architecture*
12. Jordi Bonet i Armengol, Jos Tomlow, Antoni Gaudi; *Gaudi Unseen by Mark Burry*
13. Kostas Terzidis ;*Algorithmic architecture*
14. D-Arcy wentworth ;*On growth and form*
15. John Frazer ;*Evolutionary architecture*
16. Philip Ball ;*Shapes: Nature's Patterns: A Tapestry in Three Parts*
17. Tomoko Sakomato ; *From control to Design*
18. Ali Rahim; *Catalytic Formations Architecture And Digital Design*
19. Castle H ;*New Structuralism: Design Engineering And Architectural Technologies*
20. Leach N; *Digital Tectonics*

ELECTIVE- I			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	2	Paper	Nil
Lectures/ week	1	Term work	100
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**2**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**2**	**Total Marks**	**100**

Objective

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.

Course Content

With the aim of imparting core theoretical literacy in different experimental leanings of digital architecture electives are offered in the disciplines of **Digital Materiality and Tectonics, Performative design and Techniques and Technologies in Morphogenetic Design**

The choice of the electives to be offered to the students will depend upon each individual College and the availability of resource persons. In such a case detailed syllabus for all other Elective Topics will be finalized by individual College in consultation with expert Faculty, considering the time and marks allotted to the subject.

Digital Materiality and Tectonics:-

The subject elective investigates the emerging new synthesis of material in design which is resulting in the formulation of conceptual principles of digital architecture. This emphasizes the need for integration of design with fabrication and production. Through the comparative analysis of selected case studies of material-based design in research and practice, conceptual models processes and principles will be identified and documented.

Performative design;-

This elective course will investigate the theoretical basis for understanding the current shift in performance-based, termed performative design. In the theoretical introduction the terms performative design and performative architecture will be defined and discussed. Topics related to the current movement towards performance-based design in architecture, such as the role of parametric design, associative geometry, and generative processes will be discussed and documented through case studies presented, and their implications for, and influence upon, performative design will be discussed.

Techniques and Technologies in Morphogenetic Design

Digital morphogenesis as a process of shape development enabled by computation is investigated through formal theoretical research and all the genres of morphogenetic design are explored within this premise.

Investigations of group of methods that employ digital media for form-making and adaptation rather than for representation, often to respond to contextual processes will be studied through case studies.

Sessional Work

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.

Readings:-

1. Branko Kolarevic; *Performative Architecture: Beyond Instrumentality*
2. Achim Menges; *Emergence: Morphogenetic Design Strategies*
3. AD Wiley publications; *Material Computation*
4. Robert Corser ; *Fabricating Architecture: Selected Readings in Digital Design and Manufacturing*
5. Toshiko Mori; *Textile/Tectonic: Architecture, Material, and Fabrication*
6. Neri Oxman ; *Towards a Material Ecology*
7. Kostas Terzidis ;*Algorithmic architecture*
8. D-Arcy wentworth; *On growth and form*
9. John Frazer; *Evolutionary architecture*
10. Philip Ball; *Shapes: Nature's Patterns: A Tapestry in Three Parts*
11. Tomoko sakomato ; *From control to Design*
12. Mark Burry and Jane Burry ; *New Mathematics of Architecture*

PARAMETRIC DESIGN SOFTWARES			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	3	Sessional (Internal)	75
		Sessional (external)	75
Total Contact Periods/ week	**5**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**4**	**Total Marks**	**150**

Objective

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.

Studio content

The new modelling technique called as 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. The subject will become the base to develop digital concepts through parametric skill sets. Students will be introduced to different exercises to familiarize thoroughly with the parametric software fundamentals which help them in precision modelling and to create and edit free-form 3d models.

This studio aims to cover all the essentials needed

- Basic Interface – of 3D modelling and its parametric interface
- Capacity determination of the designing agency
- Geometry types - Points, Vectors, Lines,
- Curves, Surfaces and Meshes.
- 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

Sessional work

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. The merit of submissions will be assessed on the basis of digital concept development, variations and specific design negotiations through parameters

Readings

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. Rajaa Issa; *Essentid modelling and mathematics.*
6. Freyer C *; Digital By Design : Crafting Technology For Products And Environments*
7. Burry J ; *New Mathematics Of Architecture*
8. Sakamoto T ; *From Control To Design : Parametric Algorithmic Architecture*
9. Schulitz H C ; *Form Follows Performance*

DIGITAL FABRICATION–I			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

Objective: -

The primary learning objective of this subject is systems application of existing modes of production using digital fabrication. The subject 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

Course content:-

Different manufacturing processes like Additive, Subtractive & Consolidatory processes will be introduced to the students as under

• CNC cutting
• CNC milling
• Laser Cutting
• 3D Printing (SLS & FDM)
• 3D Scanning
• 3 Axis CNC cutting & milling on non-planar surfaces

Data conversion for design production will be emphasised upon details for file Conversions, Meshing, etc. that is required for realising the proto-types from digital files of the models will be emphasized upon. Students will be exposed to emerging theories pertaining to smart materials and alloys.

Sessional work:-

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.

Readings:-

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 Vyozviti; *Folding Architecture*
6. Blikstein, P; *Digital fabrication and 'Making' in education: the democratization of invention*
7. Mark Burry Jordi Bonet i Armengol, Jos Tomlow, Antoni Gaudi ; *Gaudi: Unseen*
8. Kolarevic B; *Manufacturing Material Effects : Rethinking Design And Making In Architecture*
9. Lorenzo-Eiro ; *Architecture In Formation : On The Nature Of Information In Digital Architecture*
10. Cerrato A; *Digital Fabrication In Architecture, Engineering And Construction*
11. Peters S; *Material Revolution : Sustainable And Multi Purpose Materials For Design And Architecture*
12. Haeusler M H ; *Media Facades : History Technology Content*
13. Hensel M ; *Emergent Technologies And Design : Towards A Biological Paradigm For Architecture*
14. Borden G P ; *Matter : Material Processes In Architectural Production*
15. Lindsey B ; *Digital Gehry : Material Resistance Digital Construction*
16. Borden G P; Matter : *Material Processes In Architectural Production*

Semester II

DIGITAL DESIGN STUDIO-II			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	9	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	10	Sessional (Internal)	150
		Sessional (external)	150
Total Contact Periods/ week	**12**	Oral (Internal)	25
		Oral (External)	25
Total Credits	**9**	**Total Marks**	**350**

Objective:

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

Course content:

- Decoding the architectural design process as a collaborative, iterative and evolutionary vector framework
- Role of diagramming in analysis, data mapping and their translation to parametric platforms
- Identifying and defining the role of parametric platforms as a powerful design tool that augments the design and execution process
- 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
- 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

Sessional Work

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.

Readings

1. Tschumi, Bernard ; *Notations: Diagrams and Sequences*
2. Koolhaas, Rem ; *Delirious New York: A Retroactive Manifesto for Manhattan,*
3. Fenton, Joseph , *Pamphlet Architecture 11: Hybrid Buildings*
4. Woodbury, Robert ; *Elements of Parametric Design*, Routledge New York
5. Tschumi, Bernard ; *Event Cities*
6. Di Mari, Anthiny & Yoo, Nora ; *Operative Design: A catalogue of spatial verbs*

7. Barios, Carlos ; *Parametric Design in Architecture: Fundamentals, Methods*, Applications
8. Oxman, Rivka and Robert ; *Theories of the Digital in Architecture*, Routledge New York
9. Maas, Winy ; *MVRDV:FARMAX*
10. Fortmeyer, Russell ; *Kinetic Architecture: Design for Active Envelopes*
11. Yeang Ken ; Eco Skyscrapers

DIGITAL FABRICATION –II			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	3	Sessional (Internal)	75
		Sessional (external)	75
Total Contact Periods/ week	**5**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**4**	**Total Marks**	**150**

Objective:-

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.

Course Content:-

- Experimentation & investigation into a chosen building material wherein in-depth study of the material & its intrinsic properties are studied and recorded
- These documented material properties and its behaviour are extracted into numerical parameters which are later used to perform iterative digital operations.
- A feed-back loop thus established between the digital &analogue experiments is further used to augment design developments based on specific properties & behaviours of the materials that are investigated during the course of the studio.

Sessional Work

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

Readings

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 Vyozviti ; *Folding Architecture*
6. Mark Burry, Jane Burry ; *Digital fabrication and 'Making' in education: the democratization of invention by The new mathematics of architecture*
7. Mark Burry, Jordi Bonet i Armengol, Jos Tomlow, Antoni Gaudi ; *Gaudi Unseen*

8. Howes P *; Material Matters* : *New Materials In Design*
9. Iwamoto L; *Digital Fabrications : Architectural And Material Techniques*
10. Bechthold M ; *Innovative Surface Structures : Technologies And Applications*
11. Hensel M *; Emergent Technologies And Design : Towards A Biological Paradigm For Architecture*
12. Kolarevic B ; *Manufacturing Material Effects : Rethinking Design And Making In Architecture*
13. Borden G P ; *Matter : Material Processes In Architectural Production*
14. Reiser J ; *Atlas Of Novel Tectonics*
15. Moussavi F; *Function Of Form*
16. Elconsorci Pub; *Media ICT*

DA PROCESS THEORIES AND HISTORY–II			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

Objective:-

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.

Course Content:-

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. The Subject Course is designed to familiarise students with these instruments, their associated conceptual fields and with their application to architectural design research. Course content includes theories of Generative algorithms within the realm of Emergence (swarm Behaviour, Fractals, L systems, cellular Automata, genetic algorithms). The course is meant to develop vocabulary and critical understanding of a wide array of algorithms, thus developing a critical stance towards algorithmic 'tooling. '

Research based theoretical investigations will also include works of architects who recursively use algorithmic tooling in their structural form finding and generative design processes.

SESSIONAL WORK:

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.

Theory examination based on the aforesaid course outline for this subject will be conducted for 100 marks

Readings-

1. Casey Reas and Chandler McWilliams; *Form+Code in Design, Art, and Architecture*
2. Kostas Terzidis ; *Algorithmic architecture*
3. D-Arcy Wentworth ; *On growth and form*
4. John Frazer; *Evolutionary architecture*
5. Philip Ball; *Shapes: Nature's Patterns: A Tapestry in Three Parts*
6. Tomoko sakomato ; *From control to Design*

7. Mark Burry and Jane Burry ; *New Mathematics of Architecture*
8. Clegg C J ; *Advanced Biology Principles And Applications*
9. Ball P ; *Flow : Nature's Patterns A Tapestry In Three Parts*
10. Ball P ; *Branches : Nature's Patterns A Tapestry In Three Parts*
11. Leach N ; *Digital Tectonics*
12. Castle H ; *Emergence : Morphogenetic Design Strategies*
13. Douglis E ; *Autogenic Structures*
14. Grobman Y J ; *Performalism : Form And Performance In Digital Architecture*
15. Watanabe M S; *Induction Design : A Method For Evolutionary Design*
16. Kwinter S ; *Phylogenesis : Foas Ark Foreign Office Architects*

ELECTIVE-II			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	2	Paper	Nil
Lectures/ week	1	Term work	100
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**2**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**2**	**Total Marks**	**100**

Objective:

To introduce the students to parametric developments in allied fields and to observe adjacencies specifically in the use of parametric tools.

Course content:

Allied fields of designing along with their design agencies will be investigated. The focus will be on the design variables, constraints and other related key parameters within the design premise and subsequent negotiations by the design agency.

The allied electives will be offered in the field of Product design, Furniture Design, Automotive design and styling and Fashion technology.

The choice of the electives to be offered to the students will depend upon each individual College and the availability of resource persons. In such a case detailed syllabus for all other Elective Topics will be finalized by individual College in consultation with expert Faculty, considering the time and marks allotted to the subject.

SESSIONAL WORK:

The students will be asked to make presentations about the role of parametric tool in the particular field of design introduced to them. Through small exercises the students will apply their parametric knowledge to the design process specific to the chosen field through which a final design will be achieved.

Readings:-

1. Robert Woodbury; *Elements of Parametric Design*
2. Rhino 3d .com ; *Simply Rhino Generative Design for Jewellers*
3. Elîania Rosetti ; *Designing Jewelry with Rhinoceros*
4. Issey Miyake; *Making Things*

5. Midori Kitamura; *Issey Miyake Pleats Please*
6. Kan Hu,Chi Di; *Addendum Surface Design Based on the Parametric Method*
7. Jackson P; *Folding Techniques For Designers : From Sheet to Form*
8. Freyer C ; *Digital By Design : Crafting Technology For Products And Environments*
9. Taylor M ; *Surface Consciousness*
10. Liu Y T ; *Diversifying Digital Architecture : 2003 FEIDAD Award*
11. Freyer C ; *Digital By Design : Crafting Technology For Products And Environments*

ANALYSIS SOFTWARES			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	3	Sessional (Internal)	75
		Sessional (external)	75
Total Contact Periods/ week	**5**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**4**	**Total Marks**	**150**

Objective:-

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.

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Course Content:-

Introduction of contemporary software's those 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.

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

SESSIONAL WORK:

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.

Readings

1. Peter Brandon; *Emerging Paradigms and Models in Digital Design – Performance-Based Architectural Design*
2. Michael Hensel ; *Performance-Oriented Architecture: Rethinking Architectural Design and the Built Environment*
3. Braun ; *Masterpieces: Performance Architecture + Design*
4. Branko Kolarevic; *Performative Architecture: Beyond Instrumentality*

5. M. Hensel, A. Menges*; Performance in Morpho-Ecological Design*
6. Inc Padt; Introduction to the Ansys Parametric Design Language : A Guide to the Ansys Parametric Design Language
7. Stanney K M ; Handbook Of Virtual Environments : Design Implementation And Applications
8. Castle H ;New Structuralism : Desing Engineering And Architectural Technologies
9. Lally S ; Softspace : From Representation Of Form To A Simulation Of Space
10. Elconsorci Pub.;Media ICT
11. Grobman Y J ; Performalism : Form And Performance In Digital Architecture

RESEARCH METHODOLOGY			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

Objective

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

Course contents

1. Introduction to the types of research and the process of formulating a research project
2. Introduction to various methods of research, their relative advantages and disadvantages and their applications
3. Introduction to technical writing and presenting a research paper
4. Development of skills

Sessional Work

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

Sessional Assessment

The term work in the form of notes/ assignments, as stipulated above will be assessed internally with weightage of 25 marks. Theory examination based on the aforesaid course outline for this subject will be conducted for 100 marks.

Readings

1. Creswell, J. W; *Research Design: Qualitaitve, quantitative and mixed methods approaches*, 2nd Ed., Thousand Oaks: Sage. 2003.
2. De Vaus, D. A; *Surveys in Social Research*, Jaipur : Rawat Publications. 2003
3. Groat, L. & Wang; D. *Architectural Research Methods*, NY: John Wiley and Sons Inc. 2002.
4. Kothari, C.R; *Research Methodology: Methods and Techniques*, New Delhi: Wishwa Prakashan. 2005.
5. Sanoff, H; *Methods of Architectural Programming*, Dowden Hutchinson and Ross, Inc. Vol. 29, Community Development Series. 1977.
6. Sanoff, H; *Visual research methods in design*, USA: Van Nostrand Reinhold. 1991

SEMESTER III

DIGITAL DESIGN III			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	9	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	10	Sessional (Internal)	150
		Sessional (external)	150
Total Contact Periods/ week	**12**	Oral (Internal)	25
		Oral (External)	25
Total Credits	**9**	**Total Marks**	**350**

Objective: - 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.

Course Content

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

Sessional Work

Students will work on above mentioned in detail and will submit the work in the form of drawings and/ models that will elaborately explain the complex layering of information post strategizing and the design resolution.

Readings

1. Jacobs, Jane (1961), *The Death and Life of Great American Cities, Random House*
2. Maas, Winy (2013*),* MVRDV: *Agenda for Urbanism, O10 Publishers*
3. Mau, Bruce and Koolhaas, *Rem (1998), S,M,L,XL, The Monacelli Press*
4. Schumacher, Patrick (2011), *Total Fluidity, University of Applied Arts Vienna*
5. Maas, Winy (2010), *Visionary Cities*
6. Farley, Lorraine (2011); *Drawing for Urban Design, Lawrence King Publishing London*

7. Lynch, Kevin (1960); *Image of the City, MIT press*
8. Tschumi, Bernard (2005); *Event Cities, MIT Press*
9. Barnett, Jonathan (1974); *Urban Design as Public Policy*
10. Duany, Andres, Speck, Jeff and Lydon, Mike (2009); *The Smart Growth Manual*, McGraw Hill
11. Leach, Neil (2009); *AD Digital Cities*
12. Verebes, Tom (2014); *Masterplanning the Adaptive City: Computational Urbanism in the* , Routledge; *Twenty-First Century*
13. National Association of City Transportation Officials (2013), *Urban Street Design Guide*

PARAMETRIC URBAN MAPPING			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	2	Term work	Nil
Studio Periods/ week	3	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**5**	Oral (Internal)	75
		Oral (External)	75
Total Credits	**4**	**Total Marks**	**150**

Objective

To define the role of information in parametric urban design.This studio focuses on imparting skillset 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.

Studio content

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. 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. The research conducted by students will cover mapping of different aspects of urban phenomena and their relation with physical city scape. 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.

Sessional work

The studio includes group work; Students will map the site (design premises) documenting and visualizing the data then translating it to design strategies.

Readings

1. MVRDV: *Agendas on Urbanism*
2. MVRDV: *MetaCity/Datatown*
3. *Jernej Vidmar University of Ljubljana, Faculty of Architecture, Slovenia*A lateral method for 3D urban design
4. José Beirão, NunoMontenegro, PedroArrobas*;* City Information Modelling: parametric urban models including design Support data Campus and the City
5. Kerstin Hoeger and Kees Christianse ; Urban Design for the Knowledge Society
6. Campbell T; Beyond Smart Cities : How Cities Network, Learn And Innovate

PARAMETRIC URBANISM			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

Objective: - 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.

Course content:-

The subject will examine architectural vision of the city from emergence of the metropolis to the contemporary city. 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.

This course focuses on relationship between urban design ideals, urban design action, and the built environment through readings, discussions, presentations, and papers. It specifically will delve in the theoretical development of use of parametric tools in urban design where their utilization augments the multi-layered and collaborative urban design process. It will analyse the diverse design ideals that influence cities and settlements, and investigates how urban designers use parametric technologies to shape urban form.

Sessional work: - Students will examine a contemporary and seminal text in parametric city-building through research in academic proliferations and practice centric theories that are necessarily situated in parametric interventions in urban design. Assignment will be in the form of individual in-depth study of the topics related to above said context.

Required readings:-

1. Patrick Schumacher; Parametric Urbanism
2. Toni Oosterland; The *Digital Design in Sustainable Urbanism – Explorations in computational design strategies*
3. Tom Verebes ;Masterplanning the Adaptive City: Parametric Urbanism in the Twenty-first Century
4. Michael Hensel Tom Verebes; *Architecture & Urbanism 3 - .urbanisations*
5. EVOLO ; Digital and parametric architecture

6. Tomas Michael; Hybrid architecture for future urbanism
7. Michael Weinstock; *Architecture of Emergence*
8. Aldo Rossi ; *Architecture of the city*
9. Bernard Tschumi; *Event cities I*
10. Bernard Tschumi ; *Event citiesII*
11. Bernard Tschumi ; *Event cities III*
12. Theodore Spyropoulos AADRL publications*; Adaptive Ecologies: Correlated Systems of Living*
13. A Joint publication by the University of Texas, and Placemaking Studio *; Emergent Urbanism: Evolution in Urban Form, Texas,*
14. Di Mari, Anthiny & Yoo, Nora (2012), *Operative Design: A catalogue of spatial verbs*, BIS Publishers, Notterdam
15. Barios, Carlos (2014); *Parametric Design in Architecture: Fundamentals, Methods*, *Applications*
16. Oxman, Rivka and Robert (2014); *Theories of the Digital in Architecture*, Routledge NewYork
17. Maas, Winy (2013); *MVRDV: FARMAX*, O10 Publishers
18. Mau, Bruce and Koolhaas, Rem (1998);*The Monacelli Press*
19. Fortmeyer, Russell (2014); *Kinetic Architecture: Design for Active Envelopes*, Images Publishing
20. Hillier B; *Social Logic Of Space*
21. Duany A ;Suburban Nation : *The Rise Of Sprawl And The Decline Of American Dream*
22. Jacobs J ; *Death And Life Of Great American Cities*
23. Campbell T ; *Beyond Smart Cities : How Cities Network, Learn And Innovate*

Elective III			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	2	Paper	Nil
Lectures/ week	1	Term work	100
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**2**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**2**	**Total Marks**	**100**

Objective: - The objective of this elective course is to allow the 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.

Course content:-

These electives explore the role of thinking about those processes specific to parametric urbanism and the built environment in a broad range of contexts including history/theory, and necessary processes of parametric intervention in urbanism and new conceptions for the making and display of architecture. The elective begins with the premise that making architecture is governed by a critical perspective and practice of those processes that reflect on-going changes in technology, contemporary urban environment and society.

Parametric Landscape urbanism:-

Parametric Landscape is a forum for the investigation, experimentation, and application of parametric modeling in the field of Landscape Architecture. This elective course will specifically investigate various parametric strategies that are used for digital mediation in Landscape design using parametric softwares.

Sustainable Urban Design:-

Investigations are directed towards parametric urbanism and correlating it with environmental approach from a quantitative point of view, through deducing the main physical parameters of the urban morphology and how these parameters can be associated with the environmental aspects to create a parametric assessment/generation for supporting design decision making. This course elective integrates the role of digital technologies and performance based parametric strategies to analyse urban data and discover new relationships between the form of the city and its performance.

Generative Urban Design:-

This subject delves into the new field of generative design, as applied to urbanism. Its purpose is to formulate a concept of parametric urbanism and data-driven urban design, and how it departs from existing concepts of urban analysis and resulting design methods. It highlights the description of the

notion of generative urban design, and its relevance to current the practice of architecture and global political, sociological and economic developments. The difference between dogmatic forms of urban design and new parametric research methods will be explored

Sessional Work

Assignment will be in the form of individual 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 an audio-visual presentation and a report on the same.

Required readings :-

1. Patrick Schumacher; Parametric Urbanism
2. Toni Oosterland; The *Digital Design in Sustainable Urbanism – Explorations in computational design strategies*
3. Tom Verebes ;Masterplanning the Adaptive City: Parametric Urbanism in the Twenty-first Century
4. Michael Hensel Tom Verebes; *Architecture & Urbanism 3 - .urbanisations*
5. EVOLO ; Digital and parametric architecture
6. Tomas Michael; Hybrid architecture for future urbanism
7. Michael Weinstock; *Architecture of Emergence*
8. Aldo Rossi ; *Architecture of the city*
9. Bernard Tschumi; *Event cities I*
10. Bernard Tschumi ; *Event citiesII*
11. Bernard Tschumi ; *Event cities III*
12. Theodore Spyropoulos AADRL publications*; Adaptive Ecologies: Correlated Systems of Living*
13. A Joint publication by the University of Texas, and Placemaking Studio *; Emergent Urbanism: Evolution in Urban Form, Texas,*
14. Di Mari, Anthiny & Yoo, Nora (2012), *Operative Design: A catalogue of spatial verbs*, BIS Publishers, Notterdam
15. Barios, Carlos (2014); *Parametric Design in Architecture: Fundamentals, Methods*, *Applications*
16. Oxman, Rivka and Robert (2014); *Theories of the Digital in Architecture*, Routledge NewYork
17. Maas, Winy (2013); *MVRDV: FARMAX*, O10 Publishers
18. Mau, Bruce and Koolhaas, Rem (1998);*The Monacelli Press*
19. Fortmeyer, Russell (2014); *Kinetic Architecture: Design for Active Envelopes*, Images Publishing
20. Hillier B; *Social Logic Of Space*
21. Duany A ;Suburban Nation : *The Rise Of Sprawl And The Decline Of American Dream*
22. Jacobs J ; *Death And Life Of Great American Cities*
23. Campbell T ; *Beyond Smart Cities : How Cities Network, Learn And Innovate*

Digital Professional practice			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	4	Paper	Nil
Lectures/ week	4	Term work	100
Studio Periods/ week		Sessional (Internal)	50
		Sessional (external)	50
Total Contact Periods/ week		Oral (Internal)	25
		Oral (External)	25
Total Credits	**4**	**Total Marks**	**150**

Objective

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.

Course contents

- Debates in the digital architecture practice – Ethics, code of conduct and liabilities in collaborative practices
- Building information modeling as a design agency towards bringing in common design language in collaborative digital practices
- The students shall undergo professional Training (40 full working days) to be undertaken during intermediate time between II & III Semester. It involves working in a Architect's Firm in India or abroad that specifically engages in practices that incorporate digital tools. The student can also volunteer to work as an apprentice in the consultancy cell of the college and or engage in any research work done by a professional within the premise of digital architecture research
  The Oral Assessment of the same will be held at the end of Semester III.

Sessional/Term Work

Final submission will include compilation of the work done during the training in the form of A3 report. All hard copies need to be submitted with the signature of the head and the stamp of the firm, at the time of appearing for the viva-voce.

Readings

Websites of various professional organization associated with the profession of Landscape Architecture

Digital Fabrication (Robotics) III			
Subject Code -			
Teaching Scheme		**Examination Scheme**	
Hours / Week	3	Paper	100
Lectures/ week	2	Term work	25
Studio Periods/ week	1	Sessional (Internal)	Nil
		Sessional (external)	Nil
Total Contact Periods/ week	**3**	Oral (Internal)	Nil
		Oral (External)	Nil
Total Credits	**3**	**Total Marks**	**125**

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

Studio content: -

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

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. 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.

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.

Sessional work

Using both Grasshopper and the Firefly plug-in, students will create intelligent control strategies for interactive or responsive facades or environment. Students will build virtual and physical prototypes that can communicate/interact with humans and the world around them.

Readings and references

1. Andrew Payne; *The firefly premier second edition*
2. Rodolphe el-Khoury,Christos Marcopoulos Carol Moukheiber; *The Living, Breathing, Thinking, Responsive Buildings of the Future*
3. Wes Mc Gee; *Robotic Fabrication in Architecture, Art and Design*
4. Gramazio and Kohler; *The Robotic Touch – How Robots Change Architecture*
5. Gramazio and Kohler *; Flight Assembled Architecture*
6. Gramazio and Kohler; *Digital Materiality in Architecture*

SEMESTER IV

Digital Architectural project			
Subject Code -			
Teaching Scheme		Examination Scheme	
Hours / Week	20	Paper	Nil
Lectures/ week	5	Term work	Nil
Studio Periods/ week	17	Sessional (Internal)	300
		Sessional (external)	300
Total Contact Periods/ week	22	Oral (Internal)	100
		Oral (External)	100
Total Credits	20	Total Marks	800

OBJECTIVE:

To enable a student to independently conceptualize and develop a Digital architectural project with a design level/fabrication feasibility proposal for the same.

COURSE CONTENT:

The studio will emphasize design research that is collectively formulated through relationships among contemporary investigation into Parametric Designing. Different techniques and tools will be used to approach to the projects that engage mixtures of architecture, urbanism and landscape as well as contemporary design techniques and Digital Materiality and fabrication. Students work on the detailed design and presentation of an approved thesis subject that investigates from a theoretical or pragmatic position a subject of sufficient complexity and particular relevance to the thesis candidate's background and career orientation within the premise of Digital Architecture.

1. Each student is required to select an independent study, with reference to a special topic in Digital Architecture, before the end of third semester in consultation with the faculty members.
2. Identification of the project with its significance, scope and limitations
3. Programming research related to the project and evolving the project brief
4. Preparing a project proposal and presenting it in graphical and textual format supported with a model.

SESSIONAL WORK:

Students will work on analytical and design projects of a substantial scale and produce the work in the form of sheets, a report and a model produced with the help of Digital fabrication machinery and techniques.

Research II			
Subject Code -			
Teaching Scheme		Examination Scheme	
Hours / Week	5	Paper	Nil
Lectures/ week	1	Term work	Nil
Studio Periods/ week	7	Sessional (Internal)	100
		Sessional (external)	100
Total Contact Periods/ week	8	Oral (Internal)	100
		Oral (External)	Nil
Total Credits	5	Total Marks	200

Objective

To enable the student to undertake a methodical research on a topic in Digital architecture and to communicate it through technical writing

Course contents

The subject deals with selecting an appropriate topic (the topic for the research could be selected in a such way that it could help to develop an appropriate methodology and research approach related to the Digital Architectural Project taken up in semester-IV) from the field of Digital architecture or allied disciplines, for its theoretical exploration.

Sessional/Term Work

Research dissertation shall be prepared by each student, based upon the topic approved by the institute in around 5000 words, in a format specified by the university.

Assessment

The sessional work as stipulated above will be assessed internally and externally with equal weightage of 100 marks each for sessional work and a consolidated list of both will be submitted to the university.

Recommended Readings

All books/ Journals/ Magazines/ unpublished thesis related to the topic selected by the individual student.