# SAVITRIBAI PHULE PUNE UNIVERSITY

## (FORMERLY UNIVERSITY OF PUNE)


**SYLLABUS FOR**

# MASTERS IN ARCHITECTURE
# M.ARCH. (COMPUTERAPPLICATIONS)

**(To be implemented w.e.f. A.Y. 2019-20)**

**BOARD OF STUDIES IN ARCHITECTURE**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**PREAMBLE-**

Digital design is an emerging area in Architecture and the M.Arch Computer Applications program is designed to prepare students to specialize in this area which has a high potential in future architectural career. Concepts from computation and contemporary sciences and their impact in the domain of architecture and urban design are investigated. This course encourages inquiries into methods and representations for design, the development of design tools, applications of digital technologies to design practice, the impacts of these technologies on the built environment and their social and cultural implications. Students enrolled in Computer Applications take subjects and do research in theory and applications of computation and computer technology including computer graphics, digital modeling and rendering, generative design, CAD/CAM and rapid prototyping technologies, remote collaborative design, and the design processes and management systems. It will probe concepts such as behavioural, parametric and generative design, algorithmic logic and key ideas from quantum physics, biology and systems theory as a knowledge resource and means of production. A productive dialogue will be initiated with experts from other fields, including mathematics, computer science and engineering, under the larger collaborative platform of Computational design. Students are exposed to various new concepts like: Digital Tectonics , Digital Morphogenesis, Parametric design , Generative architecture , Performative Design ,Parametric Urbanism , Hypertecture and Evolutionary prototyping. The program has a main digital design studio which runs through three semesters culminating in the thesis. Students undertake professional training during the course too.

**Digital Design Studio** :-

• Basic concept formulation, non-linear geometry and parametric thinking

• Sustainable design concepts and design based on data streaming

• Parametric Urbanism design projects using information mapping and research paper

• Research paper and Computer Applications project

**Supporting Technical Subjects are** :-

• Visualization and animation – advance 3D software and programming

• Advance building construction concepts through digital fabrication and automated design

• Building Information Modelling – simulation and analytical methods using software

• Management Information Systems – Management at all stages from design development to execution

• Geographic Information Systems – information Mapping and querying

**Skill Development Classes are** :- in software training, programming, colloquium, academic writing and research methods.

**OBJECTIVES** :-

Architecture as a built reality maintains a close relationship to the mode and techniques of representation. The advent of digital software has released a unique potential that can lead to a significant rethinking, re-imaging and reconfiguration of the built environment. This course offers the opportunity to be at the forefront of interrogation in this field.

**SCOPE AND OPPORTUNITIES:**-

This course offers an opportunity to be at the forefront of the emergent practice of digital architecture. The graduates of this course can be absorbed in the mainstream Architecture or many related fields like Architectural Visualization, Building Management Systems, Software Development, etc.

**PROGRAM EDUCATIONAL OBJECTIVES [PEO]**

PEO1 - Concepts from computation and contemporary sciences and their impact in the domain of Architecture and urban design are investigated.

PEO2 – Innovative open exchange programs and dialogue between faculty, students, experts of allied field and practicing professionals to encourage the practice in the field of Digital Architecture.

PEO3 – Contribution to the design profession around the globe through modern tools and technologies.

PEO4 – Understanding the impact on environment and crucial role of an architect towards sustainable methods, an integral part of the curriculum.

PEO5 -Crafting well-educated, responsible, sensible and motivated architects equipped with ultra-modern skills, who can contribute towards building a humane society for the future.

## PROGRAM OUTCOMES [PO]

PO1 –
Investigating Computational tools for computer modelling, rendering, simulation, analysis and parametric thinking process in Architectural Design.

PO2 –
Broadly understand the established and ongoing developments and research work in the domain of emerging technologies e.g. digital media and computational design.

PO3 –
Understanding of different digital design theories in Architecture and its application in different scales of Design.

PO4 –
Exploring building and its applications with respect to energy efficiency, climate control, light, sound and noise controls.

PO5 –
Exposure to the practical work of digital fabrication and latest technologies in fabrication.

**MATRIX OF PROGRAM EDUCATIONAL OBJECTIVES AND PROGRAM OUTCOMES**

| PEO | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| PE01 | √ | √ | √ | | |
| PEO2 | √ | √ | | | √ |
| PEO3 | √ | | | | √ |
| PEO4 | √ | | | √ | |
| PEO5 | √ | | √ | √ | |

| Sr.No. | Program Outcomes | Subjects in curriculum |
|---|---|---|
| 1 | PO1- | Digital tools and techniques, Elective II |
| 2 | PO2- | Elective I |
| 3 | PO3- | Digital Design theory |
| 4 | PO4- | Automated Design |
| 5 | PO5- | Digital Fabrication, Digital Practices and Professional Training |

| Sr.No. | Electives | Tentative Subjects of Electives |
|---|---|---|
| 01 | Elective I [First Year] | Colloquium |
| 02 | Elective II [First Year] | Robotics and Embedded Systems |
| 03 | Elective III [Second Year] | Open Elective |

**M-Arch (Computer Applications)** **For Semesters I**

| Course Code | Course Title | Course Type | Contact Periods (60 mins) | Teaching Scheme | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory/ week | Studio/ week | Credits | SS | SV | Theory | | Marks |
| | | | | | | | | | In semester | End semester | |
| 2019CA101 | Digital Design Studio I | **C1** | 10 | 2 | 8 | 10 | | 400 | Nil | Nil | **400** |
| | | | | | | | | | | | |
| 2019CA102 | Elective I | **EL** | 3 | 2 | 1 | 3 | 100 | Nil | Nil | Nil | **100** |
| | | | | | | | | | | | |
| 2019CA103 | Digital Tools and Techniques I | **C2** | 4 | 2 | 2 | 4 | 200 | Nil | Nil | Nil | **200** |
| | | | | | | | | | | | |
| 2019CA104 | Digital Design Theory I | **SP1** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| | | | | | | | | | | | |
| 2019CA105 | Automated Design | **SP2** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| | | | | | | | | | | | |
| 2019CA106 | Digital Fabrication | **L** | 2 | 1 | 1 | 2 | 100 | Nil | Nil | Nil | **100** |
| | | | | | | | | | | | |
| | | | **25** | 11 | 14 | 25 | | | | | **1000** |

**M-Arch (Computer Applications)** **For Semesters II**

| Course Code | Course Title | Course Type | Contact Periods (60 mins) | Teaching Scheme | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory/ week | Studio/ week | Credits | SS | SV | Theory | | Marks |
| | | | | | | | | | Insemester | End semester | |
| 2019CA201 | Digital Design Studio II | **C1** | 10 | 2 | 8 | 10 | | 400 | Nil | Nil | **400** |
| | | | | | | | | | | | |
| 2019CA202 | Elective II | **EL** | 3 | 2 | 1 | 3 | 100 | Nil | Nil | Nil | **100** |
| | | | | | | | | | | | |
| 2019CA203 | Digital Tools and Techniques II | **C2** | 4 | 2 | 2 | 4 | 200 | Nil | Nil | Nil | **200** |
| | | | | | | | | | | | |
| 2019CA204 | Digital Design Theory II | **SP1** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| | | | | | | | | | | | |
| 2019CA205 | Research I | **SP2** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| | | | | | | | | | | | |
| 2019CA206 | Computer Graphics | **L** | 2 | 1 | 1 | 2 | 100 | Nil | Nil | Nil | **100** |
| | | | | | | | | | | | |
| | | | **25** | 11 | 14 | 25 | | | | | **1000** |

**M-Arch (Computer Applications) For Semesters III**

| Course Code | Course Title | Course Type | Contact Periods (60 mins) | Teaching Scheme | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory/ week | Studio/ week | Credits | SS | SV | Theory | | Marks |
| | | | | | | | | | Insemester | End semester | |
| 2019CA301 | Digital Design Studio III | **C1** | 10 | 2 | 8 | 10 | | 400 | Nil | Nil | **400** |
| 2019CA302 | Research II | **C2** | 3 | 2 | 1 | 3 | 100 | Nil | Nil | Nil | **100** |
| 2019CA303 | Digital Practices and Professional Training** | **C3** | 4 | 2 | 2 | 4 | | 200 | Nil | Nil | **200** |
| 2019CA304 | Interaction Design | **SP1** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| 2019CA305 | Smart Materials and Advanced Construction | **SP2** | 3 | 2 | 1 | 3 | Nil | Nil | 30 | 70 | **100** |
| 2019CA306 | Computational Design Skills | **L** | 2 | 1 | 1 | 2 | 100 | Nil | Nil | Nil | **100** |
| | | | **25** | 11 | 14 | 25 | | | | | **1000** |

**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. The subject is included as core subject and will have both sessional and viva assessment.

**M-Arch (Computer Applications)** **For Semesters IV**

| Course Code | Course Title | Course Type | Contact Periods (60 mins) | Teaching Scheme | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory/ week | Studio/ week | Credits | SS | SV | Theory | | Marks |
| | | | | | | | | | In semester | End semester | |
| 2019CA401 | Project | **C** | 20 | 4 | 16 | 20 | | 800 | Nil | Nil | **800** |
| | | | | | | | | | | | |
| 2019CA402 | Elective III* | **EL** | 5 | 1 | 4 | 5 | 200 | Nil | Nil | Nil | **200** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | **25** | | | 25 | | | | | **1000** |

*Elective III can be offered as an open elective. In case it is not possible to offer open elective, colleges should offer any elective from the list of electives which the student has not undertaken in any previous semester.

# DETAIL SYLLABUS

# SEM - I

| SUBJECT TITLE:<br>**DIGITAL DESIGN STUDIO–I** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA101** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 300 | |
| Studio Periods per week | 8 | Viva/Oral | 100 | |
| **Total Contact Periods ( 60 min period) per week** | **10** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **10** | **Total Marks** | **400** | |

**COURSE OBJECTIVES**:

Objective of this studio is to introduce the integration of Parametric tools in Architectural Design .To inculcate the parametric thinking process in design and explore the different fabrication techniques.

**COURSE CONTENT** :

Students will take up two independent design projects during the course of this semester. The project shall be specifically designed and approved by the faculty, to fulfill the objectives. The scope of the project should be limited to a small project. The source of this may be an existing Architectural project, onto which the Visualization and parametric tools could be integrated and redefined in two separate projects. One project shall go on for no longer than 8 weeks.

Unit I: - Introduction of the first project
Unit II: - Using Parametric tools on the given project
Unit III: - Presentation of the project
Unit IV: - Introduction of the second project
Unit V: - Parametric design project
Unit VI: - Presentation of the project

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

Each student shall be judged on individual performance as well as his/her contribution to the group
work. Students are expected to produce complete documentation with all the required content such as design concepts, design process, digital explorations, models, diagrams and drawings, along with text in a presentation format (soft copy) as well as printed format (hard copy).

**OUTCOME** :

Students will learn the applications of Parametric tools and parametric thinking process in Architectural Design.

**RECOMMENDED READINGS :**

- Advanced Technologies : Building in the Computer Age (The Information Technology Revolution in Architecture) by Valerio Travi
- Animate Form by Greg Lynn
- Blobitecture: Waveform Architecture and Digital Design by John K. Waters
- CAD Principles of Design, An Analytical Approach to the Computational Representation of Architectural Form by Peter Szalapaj
- Digital Tectonics by Neil Leach (Editor), David Turnbull (Editor), Chris Williams (Editor)
- Gramazio Fabio, Matthias Kohler, Silvan Oesterle, Encoding Material, architectural Design Special Issue: The New Structuralism: Design, Engineering and Architectural
- HyperArchitecture : Spaces in the Electronic Age ( The Information Technology Revolution in Architecture ) by Luigi Prestinenza Puglisi, L. Byatt ( Translator )
- Hyperbodies by Kas Oosterhuis
- Next Generation Architecture : Folds, Blobs, and Boxes by JOSEPH ROSA

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| SUBJECT TITLE:<br>**ELECTIVE –I** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA102** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 100 | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **3** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

**Colloquium**

Student should be able to do extensive research on the pioneers of this field and present with audio-visual aids. The presentation should be open house and followed by discussion, which will be guided by the faculty member/s. Faculty shall guide the students for the topics, research methods and writing techniques.

**COURSE CONTENT** :

Unit I: **Paraphrasing**- Introduction to the colloquium format. Research on potential topics through books, magazines, internet and other sources.

Unit II: **Literature review** - Selection of the topic and colloquium on the literature.

Unit III: **Analytical presentation** - Colloquium presentation based on the selected topic with the understanding of analytical reading.

Unit IV: **Drawing inferences** - Reading and analysis of the topic and drawing inferences based on the focus of the study.

Unit V: **Writing** - Writing papers/articles on the presented and discussed topics.Students should be able to write about own understanding and views.

Unit VI: **Concluding** - Student should be able to write own conclusions, generate research questions
and study further based on those research questions. Students should be able to write with technical understanding of 'writing'

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

The sessional work shall be assessed by the internal faculty member on the basis of A/V presentation
and report/paper/article etc. A/V presentation should be made by individual student.
The assessment shall be based on the following factors:
i. Student's understanding of the topic
ii. Presentation techniques
iii. Technical Writing

**OUTCOME** :

Emerging technologies e.g. digital media and computational design, students will gain the global perspective of the current research and developments. This format of the coursework helps to broadly understand the established and ongoing developments and research work in this domain.

**RECOMMENDED READINGS :**


- Hartkopf, Volk, [et al], (1993), Designing the office for the future: the Japanese approach to tomorrows workplace, John Wiley & sons
- Ruck, Nancy, C. 1989, Building Design and Human performance, Van Nostrand Rheingold

| SUBJECT TITLE:<br>**DIGITAL TOOLS AND TECHNIQUES –I** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA103** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 200 | |
| Studio Periods per week | 2 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **4** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **4** | **Total Marks** | **200** | |

**COURSE OBJECTIVES**:

The focus of this subject would be on various digital tools and their applications in Architectural projects. Opening up new horizons of technological advancements in the field of computational technology through the use of computer modeling, rendering, Parametric modeling, Simulation, analysis, BIM software etc. The focus would be on the exploration of space and place making through use of various computer modelling tools.

**COURSE CONTENT** :

Each of the below mentioned topics shall be introduced in lecture periods and is to be dealt with subsequently in the design studios in detail. The focus of teaching in this subject shall be as following:

Unit I **- Architectural geometry:** Introduction to basic Architectural 2D & 3D geometry.

Unit II **- Visualization:** Introduction to Visualization tools in Architecture such as 3D software, Nurbs
modeling, Parametric modeling, BIM.

Unit III **- Rendering:** Introduction to rendering techniques including Material mapping, Lighting,
Perspective.

Unit IV **- Presentation:** Introduction to presentation tools & techniques for print and digital medium.

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

The assessment will be done on the progressive work in the studios and a final seminar presentation by
the student for the various tools. Submission should be in form of a report and presentation of the progressive work done in the studios throughout the semester.

**OUTCOME** :

Students will learn different Computational tools for computer modelling, rendering, simulation, analysis
etc.

**RECOMMENDED READINGS :**


- Alexander, C. (1964). Goodness of fit. In *Notes on the Synthesis* (pp. 15-28).Cambridge: Harvard University Press.
- Cecil Balmond, Geometry, Algorithm, Pattern: The Serpentine Pavillion 2002, *Digital Tectonics*, ed Neil Leach, London ,Wiley-Academy, 2004. 132 Print
- Helmut Pottmann, Michael Hofer and Axel Kilian (eds), *Advances in Architectural Geometry*, Vienna,2008
- TerzidisKostas ,*Algorithmic Architecture*, Architectural Press , Oxford , 2006


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| SUBJECT TITLE:<br>**DIGITAL DESIGN THEORY –I** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA104** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | **Duration** |
| Theory Periods per week | 2 | Sessional | Nil | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | 30 | |
| | | End-semester Examination | 70 | 150min |
| **Total Credits** | **3** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

The objective of this class is to develop an understanding and a theoretical underpinning for digital
mediation in architecture.

**COURSE CONTENT** :

Unit I: - Introduction

Unit II: - Concepts in Critical Theory

Unit III: - Digital culture

Unit IV: - Curvilinearity in architecture

Unit V: - Architecture and science

Unit VI: - Architecture and cybernetics

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

This being an individual project, each student shall be judged on their individual performance, through
essays and presentations on readings in the class.

**OUTCOME** :

Students will develop an understanding for different digital design theories in Architecture.

**RECOMMENDED READINGS :**


- Architecture and Disjunction by Bernard Tschumi
- Architecture's Appeal, How Theory Informs Architectural Praxis Edited by Marc J. Neveu, NeginDjavaherian
- Architectural Theory Edited by Harry Francis Mallgrave
- Architectural Theories of the Environment, Posthuman Territory Edited by Ariane Lourie Harrison
- G Lynn (ed) Folding in architecture, AD pp 8-15 Profile no. 102
- Hensel, M. and Menges, A (2008): 'Morpho-Ecologies', London: Architectural Association.

- Intersections, Architectural Histories and Critical Theories Edited by Iain Borden, Jane Rendell
- Kotnik Toni, *Digital Architectural Design as Exploration of Computable Functions,* international journal of architectural computing issue 01, (2006) volume 08,(3)
- Lina Bo Bardi, The Theory of Architectural Practice ByCathrineVeikos
- Rethinking Technology, A Reader in Architectural Theory Edited by William W. Braham, Jonathan A.Hale
- The Production of Space by Henri Lefebvre
- Theories of the Digital in Architecture Edited by Rivka Oxman, Robert Oxman
- Thinking Architecture by Peter Zumthor


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| SUBJECT TITLE:<br>**AUTOMATED DESIGN** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA105** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | **Duration** |
| Theory Periods per week | 2 | Sessional | Nil | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | 30 | |
| | | End-semester Examination | 70 | 150 min |
| **Total Credits** | **3** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

The objective of this class is to study in detail Building automation for various building typologies.

**COURSE CONTENT** :

Study of the systems and their applicability in the following areas:

Unit I :**Introduction -** Theory of automation design

Unit II :**Theory -** Theory of automation for energy efficiency

Unit III :**Project work -** Simulation for climate control

Unit IV :**Project work -** Simulation for light and noise control

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

Student should be able to generate designs and models based on the building automation technique.

**OUTCOME** :

Students will learn building automation and its applications in the project with respect to energy efficiency, climate control, light, sound and noise controls.

**RECOMMENDED READINGS :**


- Applied Illumination Engineering by L.Lindsey. FIES
- Building Control Systems by Vaughn Bradshaw
- Dr.M.K.Murlidhara, luminous environments.Heat and Mass Transfer
- Fry et al. Noise control in building services. Pergammon Press 1988
- Home Automation and wiring – James Gerhart
- L. Cremer and H. Muller (trnsschults). Principles and applications of room acoustics (vol 1) applied science 1982
- Lighting Design + Applicatiob Published by IESNA (Illumination Engineering Society)
- Ronald N.Helms and M.Clay Belcher, lighting for energy efficient


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| SUBJECT TITLE:<br>**DIGITAL FABRICATION** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA106** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 1 | Sessional | 100 | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **2** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **2** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

This studio will explore fabrication process in architecture with non-linear geometries and the material
techniques which is useful to bring the software models into reality. It gives hands on experience of working with the machines.

**COURSE CONTENT** :

Architectural and material techniques in architecturally innovative projects realize through digital design
and constructive process. It has become possible because of the collaboration of software and machines.
Introduction to various tools and different techniques of digital fabrication will be taught in this subject. Introduction about digital fabrication, different methods of digital fabrication and their advantages, various fabrication machines.

Unit I: Introduction to various fabrication techniques like sectioning, tessellating, folding, its use.

Unit II: Introduction to various fabrication techniques like of contouring, forming, its use.

Unit III: introduction to various advanced technologies and latest trends like robotics etc.

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

Students will be introduced to the types of digital fabrication and machines. The student will take individual project of architectural design and workout the joinery, select the material and technique to be used for individual model.

**OUTCOME** :

Students will be exposed to the practical work of digital fabrication on machines.

**RECOMMENDED READINGS :**


- Biosensor principles and Application – by LoicJ.Blum, Pierre R.Coulet
- Digital Fabrications architectural and material techniques – by Lisa Iwamoto


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# DETAIL SYLLABUS

# SEM - II

| SUBJECT TITLE:<br>**DIGITAL DESIGN STUDIO–II** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA201** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 300 | |
| Studio Periods per week | 8 | Viva/Oral | 100 | |
| **Total Contact Periods ( 60 min period) per week** | **10** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **10** | **Total Marks** | **400** | |

**COURSE OBJECTIVES**:

Objective of this studio is towards learning digital design processes and their application in Design
studio in architectural projects. Another focus will be on sustainability through Automated design and
construction.

**COURSE CONTENT** :

Students will take up two independent design projects. One in a group of four, specifically designed to
fulfill the requirement for integration of above-mentioned specializations. The scope of the project should be limited to a medium sized project. The source of this may be an existing Architectural project, onto which the automation tools could be integrated and redefined. The second project shall be an individual one based on parametric design processes.

Unit I: - Introduction of the first project
Unit II: - Using Parametric tools on the given project
Unit III: - Presentation of the project
Unit IV: - Introduction of the second project
Unit V:- Parametric design project
Unit VI: - Presentation of the project

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

This shall be a group-work, distributing specific duties to each of the member. Each student shall be
judged on individual performance as well as his/her contribution to the group work. Students are expected to produce complete documentation with all the required content such as design concepts, design process, digital explorations, models, diagrams and drawings, along with text in a presentation format (soft copy) as well as printed format (hard copy).

**OUTCOME** :

Students will learn digital design processes and their application in Design studio in architectural projects with focus on sustainability through Automated design and construction.

**RECOMMENDED READINGS :**


- Atkin, Brian, 1993, Intelligent Buildings: Applications of IT and building automation to high
  technology construction projects, Aldershot: Avebury Technical
- Berry John, 1995, Integrated design-building Services
- Building Control Systems by Vaughn Bradshaw
- DBMS by Date
- Fundamentals of Database Systems by Remez Elmasri, Shamkant B. Navathe
- George B. Korte, " The GIS Book ", Onword Press (Thomson learning), 5th Edition.
- M Anji Reddi, " Remote sensing & Geographical Information Systems ",BS Publication, Second
  Edition.
- Modern Control Engineering by Katsuhilo Ogata, University of Minnesota
- Peter A. Burrough and McDonell, "Principles of Geographical Information Systems", Oxford
  University Press, 1998.


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| SUBJECT TITLE:<br>**ELECTIVE –II** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA202** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 100 | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **3** | **Total Marks** | **100** | |

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**COURSE OBJECTIVES**:

**Robotics and Embedded systems**

The course will facilitate understanding of various methods of automation into construction with respect torobotics.

**COURSE CONTENT** :

Unit I: **Embedded systems -** Embedded systems for intelligent buildings
Unit II: **Self assembly-** Self-assembly systems
Unit III: **Robotics-** manufacturing Introduction to robotics in manufacturing and assembly
Unit IV: **Robotics -** construction Robotics in construction
Unit V: **Mass Customisation -** Concepts in mass customisation

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

Student / group of students should be able to generate 3D models based on the technique of mass customisation/robotics/ automated construction.

**OUTCOME** :

The students shall be able to execute small scale components of design with the help of emerging technology of automation into construction. This course shall facilitate the practical implementation of mass customisation.

**RECOMMENDED READINGS :**


- Date P. P., "Introduction to Manufacturing Technology, Principles and Practices", , Jayco Publishers, Mumbai
- G. Boothroyd , C. Poli, L. Murch, "Automatic Assembly", Marcel Dekker Inc. 1982.
- Histand B.H., Alciatore D.G., "Introduction to Mechatronics and Measurement Systems", ISBN 0-07-052910-8


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| SUBJECT TITLE:<br>**DIGITAL TOOLS AND TECHNIQUES –II** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA203** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 2 | Sessional | 200 | |
| Studio Periods per week | 2 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **4** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **4** | **Total Marks** | **200** | |

**COURSE OBJECTIVES**:

The focus of this subject would be on various digital tools and their applications in Architecturalprojects. Opening up new horizons of technological advancements in the field of computational technologythrough the use of computer modeling, rendering, Parametric modeling, Simulation, analysis, BIM software etc. The focus would be on the exploration of space and place making through use of variouscomputermodellingtools.

**COURSE CONTENT** :

Each of the below mentioned topics shall be introduced in lecture periods and is to be dealt with subsequently in the design studios in detail. The focus of teaching in this subject shall be as following:

Unit I **- Relational geometry:** Introduction to Relational geometry and its applications in Architecture.

Unit II **- NurbsModeling:** Introduction to Nurbsmodeling and its application in Architecture.

Unit III **- Parametric modeling:** Introduction to Parametric modeling& its application in Architecture.

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

The assessment will be done on the progressive work in the studios and a final seminar presentation by
the student for the various tools. Submission should be in form of a report and presentation of the progressive work done in the studios throughout the semester.

**OUTCOME** :

Students will learn different Computational tools for computer modelling, rendering, simulation, analysis
and its application in architectural geometries and architectural design.

**RECOMMENDED READINGS :**

- Architectural Geometry by Helmut Pottmann
- Architectural Representation Handbook: Traditional and Digital Techniques for Graphic Communication by Paul Laseau
- Helmut Pottmann, Michael Hofer and Axel Kilian (eds), *Advances in Architectural Geometry*, Vienna,2008
- TerzidisKostas ,*Algorithmic Architecture*, Architectural Press , Oxford , 2006

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| SUBJECT TITLE:<br>**DIGITAL DESIGN THEORY –II** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA204** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | Duration |
| Theory Periods per week | 2 | Sessional | Nil | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | 30 | |
| | | End-semester Examination | 70 | 150 min |
| **Total Credits** | **3** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

Specific theoretical issues dealing with form generation using the generative potential of software's
unique ability to deploy geometric entities. Introduction of Shape grammars and its potential uses for the
Architectural Design and analysis.

**COURSE CONTENT** :

The focus of teaching shall be on:

Unit I- Digital Architecture design processes and diagrams

Unit II- Morphogenetic design processes, etc

Unit III-Shape grammar

Unit IV-Other similar theoretical issues

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

The sessional work shall be in form of the experiments with above mentioned topics and research papers
based on those experiments.

**OUTCOME** :

Students will develop an understanding for different digital design theories in Architecture.

**RECOMMENDED READINGS :**


- Defining Digital Architecture: 2001 FEIDAD Award by Yu Tung Liu (Editor)
- Demonstrating Digital Architecture: 2004 Feidad Award by Yu-Tung Liu (Editor)
- Developing Digital Architecture by Yu-Tung Liu (Editor), Yu Tung Liu
- Digital Architecture by M. Saleh Uddin
- Digital Eisenman (The Information Technology Revolution in Architecture) by Luca Galofaro, Luca Galofaro (Translator)
- Hybrid Space : Generative Form and Digital Architecture by PETER ZELLNER
- Mathematics of Space by George Legendre
- MORPHOGENESIS OF FLUX STRUCTURE. by Mutsuro; Ito, Toyoo; Isozaki, Arata Sasaki
- Narrative Architecture by Nigel Coates
- New Flatness : Surface Tension in Digital Architecture by Alicia Imperiale
- Patterns of Architecture: No 6 by Mark Garcia
- Programming Cultures: Architecture, Art and Science in the Age of Software Development
  (Architectural Design) by Mike Silver
- The Autopoiesis of Architecture by Patrik Schumacher
- The Function of Ornament by Farshid Moussavi

| SUBJECT TITLE:<br>**RESEARCH I** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA205** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | **Duration** |
| Theory Periods per week | 2 | Sessional | Nil | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **3** | In-semester Examination | 30 | |
| | | End-semester Examination | 70 | 150 min |
| **Total Credits** | **3** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

To develop an ability to research on any chosen topic, with systematic methodologies.

**COURSE CONTENT** :

The lectures will include presentations and discussions on the below mentioned topics.

Unit I: Introduction to research methods and methodology and types of Research Methods

Unit II: Research design and Literature review

Unit III: Data documentation and analysis

Unit IV:Components of the research paper

Unit V:Presentation of data and report

Unit VI:Theoretical research and Applied research

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

For this subject students will be assessed based on their process/es of documentation, methods of analysis and the judicious understanding of the research methods along with the content and research
design.

Minimum Assignment/s submissions towards Sessional Work shall include:
a. A report on understanding of various research methods
b. Comprehensive report of appropriate research design of their own paper on the chosen topic

**OUTCOME** :

Students will developability to research on any chosen topic, with systematic methodologies.

**RECOMMENDED READINGS :**

- Research Methodology: Methods and Techniques by C. R. Kothari
- Research Methodology: A Step-By-Step Guide for Beginners by Ranjit Kumar
- Research Methodology: A Handbook by R. P. Misra
- Research Methodology: Theory & Techniques by Jagadish R. Raiyani

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| SUBJECT TITLE:<br>**COMPUTER GRAPHICS** | | | | |
|---|---|---|---|---|
| Subject Code **: 2019CA206** | | | | |
| **Teaching Scheme** | | **Examination Scheme** | **Marks** | |
| Theory Periods per week | 1 | Sessional | 100 | |
| Studio Periods per week | 1 | Viva/Oral | Nil | |
| **Total Contact Periods ( 60 min period) per week** | **2** | In-semester Examination | Nil | |
| | | End-semester Examination | Nil | |
| **Total Credits** | **2** | **Total Marks** | **100** | |

**COURSE OBJECTIVES**:

This course aims at giving emphasis on the fundamentals of Graphics, scripts & programming related to architectural geometry.

**COURSE CONTENT** :

Unit I: Basic concepts: Introduction to computer graphics
Line, circle and polygon generation:
Unit II: Basics of Programming & scripting
Unit III: Generation of 2D, 3D geometry

Unit IV: All transformation rules for 2D, 3D geometry

Unit V: Curves and fractals: Curve generation, Interpolation, Interpolating, B-splines, Bezier curves,Fractals, Fractal surfaces and lines

Unit VI: Light, colour and shading: Diffused illumination, Point source illumination, Colour models RGB,HVS, CYM etc., Transparency, Reflection and shadows.

**SUBMISSION REQUIREMENT FOR SESSIONAL WORK** :

For this subject students will be assessed based on their small project which has scripts &itsgraphical output.

**OUTCOME** :

Students will be enabled to deal with varying site-based natural and ecological systems with reference to urban design projects and the city at large.

**RECOMMENDED READINGS :**


- Architectural Representation Handbook: Traditional and Digital Techniques for Graphic Communication by Paul Laseau
- Computer Graphics, Principles and Practice: Foley, Vandam, Feiner, Hughes, Addison Wesley
- Computer Graphics- A programming approach: McGraw Hill International Editions
- Demonstrating Digital Architecture: 2004 Feidad Award by Yu-Tung Liu (Editor)
- Procedural Elements for Computer Graphics: David F. Rogers, McGraw Hill International Editions


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