



**BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY)
COLLEGE OF ARCHITECTURE, PUNE-43
NAAC A ++ Accredited (Fourth Cycle)**

CBCS 2025 PATTERN

FOR

POST GRADUATE DEGREE

PROGRAMME

M. ARCH. (Sustainable Architecture)

Under Faculty of Engineering

VISION OF BV (DU) UNIVERSITY

“To be a world class University for Social Transformation through Dynamic Education”

MISSION OF BV (DU) UNIVERSITY

- To provide quality technical education with advanced equipment, qualified faculty members, and infrastructure to meet the needs of the profession and society.
- To provide an environment conducive to innovation, research and entrepreneurial leadership.
- To practice and promote professional ethics, transparency, and accountability for social community, economic and environmental conditions.

VISION OF BV (DU) COA, PUNE

“Inculcate Sensitivity towards Sustainable Built Environment through Architectural Education”

MISSION OF BV (DU) COA, PUNE

The institution shall strive:

- To inculcate knowledge, skills, values and ethics to create ‘**socially responsible**’, ‘**environmentally sensitive**’, ‘**economically conscious**’, architecture professionals.
- To promote innovations and research for a sustainable built environment.

PROGRAM OUTCOMES (POS) – M. ARCH. IN SUSTAINABLE ARCHITECTURE

Knowledge

- Demonstrate the ability to integrate sustainable design principles—including energy efficiency, low-impact materials, water conservation, and ecological sensitivity—into design and development of architectural solutions at all scales.
- Apply advanced knowledge of passive and active environmental control systems, green building technologies, and climate-responsive design in architectural projects.
- Evaluate site, context, and user needs to develop environmentally responsible and contextually appropriate design solutions.
- Use advanced tools, simulation software (e.g., energy modelling, daylighting analysis) to evaluate, analyze and enhance building performance and environmental impact.

Competency

- Conduct independent research to explore, analyze, and address complex environmental and socio-economic challenges through innovative sustainable architecture practices.
- Demonstrate ethical decision-making and a commitment to the social, economic, and environmental responsibilities of architects in a rapidly changing world.

Skills

- Understand and apply national and international policies, codes, standards, acts and rating systems (such as IGBC, GRIHA, LEED) related to sustainable design and construction.
- Engage effectively in multidisciplinary teams involving architects, engineers, planners, and sustainability consultants to develop holistic and integrated solutions.
- Communicate sustainable design concepts clearly and persuasively through drawings, reports, presentations, and community engagement.
- Recognize the need for lifelong learning and stay updated with emerging trends, technologies, and challenges in sustainable architecture.

Rules Regarding Passing, Continuous Assessment and Award of Class:

Rule 1: Eligibility Criteria:

A student seeking admission to **Master of Sustainable Architecture** must have passed B.Arch. from a recognized university securing a minimum 50% or above, aggregate marks. Admission process and eligibility as per rules and regulations of Bharati Vidyapeeth (Deemed to be) University, Pune and Council of Architecture, New Delhi.

Rule No. 2: Scheme of Assessment

The candidate eligible for master's degree shall appear for and pass examinations as under: First

Year Masters: Semester I and II

Second Year Masters: Semester III and IV

Rule No. 3: Granting of Term

The academic year shall consist of two semesters of 18 weeks each (15 weeks teaching +3 weeks internal assessment work).

The student shall be permitted to appear for examinations at the end of each semester only if he/she meets the following:

A. 75% attendance in each head of passing of as prescribed by the university.

B. Satisfactory completion of Sessional Work prescribed in the syllabus.

C. Good Conduct.

1. For all courses there shall be Internal Assessment (IA) conducted by the institution and at the end of term University Examination (UE) for the courses specified in the structure. UE and IA constitute two separate heads of passing.

2. In order to pass and to earn the assigned credits:

- a) The candidate must obtain a minimum grade point of 6.0 (50% marks) at UE and also a minimum of 6.0 (50% marks) at IA.

Or

If he/she fails in IA, the student passes in the course provided he/she obtains a minimum of 25% in IA and the grade point average (GPA) for course is at least 6.0 (50% in aggregate). The GPA for a course will be calculated only if a student passes at UE.

- b) A candidate who fails in UE in a course must reappear only at UE as a backlog candidate and clear head of passing. Similarly, a candidate who fails in a course in IA has to reappear only at IA as a backlog candidate and clear head of passing.

Rule No. 4: Examinations

Evaluation Criteria for University Examination (UE) and Internal Assessment (IA)

Contact Hours and Credits assigned under various heads are as follows:

For lectures	1 hour of lecture	1 credit
For studio	1 hour of studio	1 credit
For course with Internal Assessment	15 hours of lectures	1 credit
<ul style="list-style-type: none">• Total number of credits for four semesters M.Arch. Course will be: 80		
<ul style="list-style-type: none">• Total Marks for all semesters together = 2000		
<ul style="list-style-type: none">• Additional Credits: 05 (These are over and above total credits for the marks and will appear separately in the mark list)		

Bharati Vidyapeeth (Deemed to Be University) College of Architecture, Pune-43

- a. Internal Assessment (IA):** The performance of the students shall be assessed progressively by an internal teacher for IA during the semester. The distribution under Internal Assessment is as follows:

Sr. No	Parameter considered	Marks awarded for IA 40 marks	Marks awarded for IA 100 marks
1	Unit Tests / Research or Design Proposals/Report	20	50
2	Tutorials / Assignments / Case- Studies/ Climatic Analysis	15	45
3	Attendance	05	05
	Distribution for internal assessment: $20 + 15 + 05 = 40$		$50+45+05=100$

- b. University Examination (Viva Voce):**

For university examinations of all semesters, assessment shall be done jointly by internal and external examiners in equal weightage.

- c. University Examination (Theory):**

The question paper for the theory course will carry **60 marks** and will be **2.5 hours** based on all 6 units.

- d. University Examination (Sessional):**

For university examinations of all semesters, Sessional assessment shall be done jointly by internal and external examiners in equal weightage of the work done during the semester.

Evaluation criteria for additional credits:

Participation in activities such as research publications, conferences, seminars, workshops, etc. or professional development (passing GRIHA, ECBC, IGBC, Accredited Professional exam) can be claimed to earn a maximum 5 extra credits which are over and above the minimum number of credits (total 80 credits) the student must complete for award of the degree. These credits would be awarded for the type of activity undertaken from the joining of course till the end of course as mentioned in the table below. Students must submit the necessary documents at the end of semester IV.

Award of extra credits

Sr. No	Type of Activity	Maximum Credits awarded per participation
1	Publication in Scopus/Web of Science/UGC-CARELIST indexed Journals.	02
2	Registering for a patent with the Institute as co-applicant.	02
3	Registering for Copyright /Publication in International/ national Journal (for 1st or 2nd author only)/Conference Proceedings/ Passing professional exams like LEED-IGBC, GRIHA – Trainer, Energy Manager, ECBC-Master Trainer, etc./ Winning award at various National /International Competitions.	01
4	MOOC Courses for period of minimum 4 weeks with certificate/any program of 30 hrs. Training.	01
5	Participation in seminars, workshop, conferences, etc. (national/ international /state/ local) /volunteering for organizing professional events-Greentech Fest/Conferences/Seminars/ Sending entry to design competition held at state / national / international level.	0.5

The student must accumulate and submit the respective documents to the PG academic coordinator, to become eligible for getting the credits as mentioned above.

Rule no. 5: Performances and grading system

Award of Grades (Ten-point Grading systems):

The assignment of score obtained by the candidate (out of maximum 100) to a grade may be done as follows:

Range of Marks (Out of 100)	Grade Letter	Grade Point
$80 \leq \text{Marks} = 100$	O	10
$70 \leq \text{Marks} < 80$	A+	9
$60 \leq \text{Marks} < 70$	A	8
$55 \leq \text{Marks} < 60$	B+	7
$50 \leq \text{Marks} < 55$	B	6
Marks < 50	D	0

Eligibility for Passing:

The University rules and standards define the result (Pass/Fail) of a candidate. It is in the form of obtaining a minimum CGPA (Cumulative Grade Point Average) calculated across all the semesters at the end of the course. Also, the SGPA (Semester Grade Point Average) is calculated separately after every end-semester examination which is reflected in the grade card issued to the student after the completion of the course.

Span for completion of Program:

The candidate must clear all the examination heads within five years from the date of registration of the program. If he/she fails to complete the program in the stipulated time span extension of one year will be provided to the candidate on his/her request for which he/she has to apply for the same to the University office through proper channel.

Course Code (9-Digit Code)

Type of Course	Faculty Code	Programme Number	Sem/Year	Course Number	Course Code
MI	11	01	1	01	MI1101101

Programme Code (9-Digit Code)

Commencement Year	Faculty Code	Programme Type	Programme Number	Programme Code
2025	11	1	01	2511101

Award of Honors at the End of the Course (CGPA):

Range of CGPA	Final Grade	Performance Descriptor
$9.50 \leq \text{CGPA} \leq 10.00$	O	Outstanding
$9.00 \leq \text{CGPA} \leq 9.49$	A+	Excellent
$8.00 \leq \text{CGPA} \leq 8.99$	A	Very Good
$7.00 \leq \text{CGPA} \leq 7.99$	B+	Good
$6.00 \leq \text{CGPA} \leq 6.99$	B	Average
$5.00 \leq \text{CGPA} \leq 5.99$	C	Satisfactory
CGPA Below 6.00	F	Fail

Grade Card:

The grade cards shall be issued to the students in a uniform format given by the University. The grade card will reflect the marks obtained by the student, Credit points of the individual paper as well as Semester, conversion of marks into grades, calculation of SGPA for each individual semester and the CGPA for the complete course at the end of the final semester.

SUMMARY OF M. ARCH (SA) -2025 CBCS COURSE

Semester I	
Course Code	Courses
MJ1101101	Sustainable Design Studio-I
MJ1101102	Energy Conservation I (Responding to Thermal and Aqueous Environment)
ID1101103	Climate Action, Sustainability and Governance
ID1101104	Integrated Energy Systems and Technologies
SE1101105	Simulation and Modelling I
AE1101106	Elective I

Semester II	
Course Code	Courses
MJ1101201	Sustainable Design Studio-II
MJ1101202	Energy Conservation II (Responding to Luminous and Acoustic Environment)
RP1101203	Research Methodology
SE1101204	Green Building Standards and Certification
SE1101205	Sustainable Materials and Technology
AE1101206	Elective II

Semester III	
Course Code	Courses
MJ1101301	Sustainable Design Studio-III
MJ1101302	Capstone Project
RP1101303	Dissertation I
ID1101304	Innovation and Entrepreneurship
SE1101305	Simulation and Modeling-II
AE1101306	Elective III

Semester IV	
Course Code	Courses
MJ1101401	Dissertation -II
SE1101402	Internship

M.ARCH (SA) -2025 CBCS COURSE Semester I		Total Duration: 20 Hrs./Week Total Marks: 600 Total Credits: 20										
Course Code	Courses	Examination Scheme					Teaching Scheme			Credits		Total Credits
		UE			IA	Total	Lecture per week	Studios per week	Total no. of classes / Semester (week x 15)	Lecture	Studio	
		Theory	Oral	Sessional								
MJ1101101	Sustainable Design and Studio-I	-	60	-	40	100	02	04	90	2	4	6
MJ1101102	Energy Conservation I (Thermal and Aqueous)	60	-	-	40	100	06	00	90	6	0	6
ID1101103	Climate Action, Sustainability and Governance	-	-	60	40	100	02	00	30	2	0	2
ID1101104	Integrated Energy Systems and Technologies	60	-	-	40	100	02	00	30	2	0	2
SE1101105	Simulation and Modelling I	-	-	60	40	100	00	02	30	0	2	2
AE1101106	Elective I	-	-	60	40	100	02	00	30	2	0	2
	Lectures/ week					600	14	06				20

M.ARCH (SA) -2025 CBCS COURSE Semester II		Total Duration: 20 Hrs./Week Total Marks: 600 Total Credits:20										
Course Code	Courses	Examination Scheme					Teaching Scheme			Credits		Total Credits
		UE			IA	Total	Lecture per week	Studios per week	Total no. of classes / Semester (week x 15)	Lecture	Studio	
		Theory	Oral	Sessional								
MJ1101201	Sustainable Design and Studio-II	-	60	-	40	100	02	04	90	2	4	6
MJ1101202	Energy Conservation II (Luminous and Aqueous)	60	-	-	40	100	06	00	90	6	0	6
RP1101203	Research Methodology	60	-	-	40	100	02	00	30	2	0	2
SE1101204	Green Building Standards and Certification	-	60	-	40	100	02	00	30	2	0	2
SE1101205	Sustainable Materials and Technology	-	-	60	40	100	02	00	30	2	0	2
AE1101206	Elective II	-	-	60	40	100	02	00	30	2	0	2
	Lectures/ week					600	16	04				20

M.ARCH (SA) -2025 CBCS COURSE Semester III		Total Duration: 20 Hrs./Week Total Marks: 600 Total Credits: 20										
		Examination Scheme					Teaching Scheme				Credits	
Course Code	Courses	UE			IA	Total	Lecture per week	Studios per week	Total no. of classes / Semester (week x 15)	Lecture	Studio	Total Credits
		Theory	Oral	Sessional								
MJ1101303	Sustainable Design Studio-III	-	60	-	40	100	02	04	90	2	4	6
MJ1101304	Capstone Project	-	-	60	40	100	01	03	60	1	3	4
RP1101305	Dissertation-I	-	60	-	40	100	00	04	60	0	4	4
ID1101302	Innovation and Entrepreneurship	-	-	60	40	100	00	02	30	0	2	2
SE1101301	Simulation Modeling-II	-	-	60	40	100	00	02	60	0	2	2
AE1101306	Elective III	-	-	60	40	100	02	00	30	2	0	2
	Lectures/ week					600	05	15				20

M.ARCH (SA) -2025 CBCS COURSE Semester IV		Total Duration: 20 Hrs./Week Total Marks: 400 Total Credits: 20										
		Examination Scheme					Teaching Scheme				Credits	
Course Code	Courses	UE			IA	Total	Lecture per week	Studios per week	Total no. of classes / Semester (week x 15)	Lecture	Studio	Total Credits
		Theory	Oral	Sessional								
MJ1101401	Dissertation-II	-	60	-	40	100	04	10	270	4	14	14
SE1101402	Internship	-	60	-	40	100	*	6		0	6	6
	Lectures/ week					200	04	16				20
<p align="center">*Internship of min. 40 working days to be undertaken during Semester IV, details of which are mentioned in the contents. The Assessment of the same will be held during Semester IV.</p>												

Annexure

A. Guidelines for Sessional work and Internal assessment

Sessional work prepared by students shall be continuously assessed by internal faculty members throughout the semester. Individual faculty members shall have flexibility to design the continuous assignments in a manner to evaluate students' capabilities across knowledge, skill and attitude.

Theory Courses (UE-Theory)

Internal Assessment shall be done on the basis of performance in the unit tests and assignments as follows.

a. Unit Tests

A minimum of 3-unit tests will be conducted of 20 marks each for the theory course in the assessment week, preferably one test per two Units. The schedule for the same will be declared in the teaching schedule of that course. To calculate final marks of the unit test for IA the following procedure is followed:

- Out of the three-unit tests conducted during the semester, the marks of only two-unit tests in which the candidate has shown his/her best performance shall be considered. These marks will be averaged to convert out of 20 marks for IA.
- If the candidate appears only for two-unit tests conducted during the semester, he/she will not be given the benefit of the best performance in the tests.
- If the candidate appears only for one-unit test conducted during the semester, to calculate the marks obtained in the unit tests it will be considered that the candidate has got 0(zero) marks in other unit tests.

b. Awards for Tutorials / Assignments

Minimum two assignments in the form of tutorials/case-studies/ literature review/climatic analysis, etc. should be submitted under the respective courses. The assignments should be designed to apply theory and explore the thinking and research ability of the student.

c. Awards for Attendance

The student will be eligible to acquire the marks under this criterion, a course to fulfill the minimum attendance in the respective courses required to grant the term.

d. Studio Courses (Design and other subjects) (Oral and Sessional)

Internal Assessment shall be done based on presentations and interim making done throughout the semester.

Three (3) nos. of intermediate juries and presentations shall be conducted throughout the semester at three stages for design development and review.

Stage 1: Climate data collection, site selection and analysis

Stage 2: Design review and building strategies

Stage 3: Performance assessment with the help of manual calculations and simulation software

e. Design or research proposal

Work produced by the student should be assessed based on the performance to arrive at the final design solution or research output.

f. Awards for Assignments / Case-Studies/ Climatic analysis/ Program analysis

Minimum numbers of assignments as prescribed in the content like case-studies/ literature review/climatic analysis, etc. should be submitted.

g. Awards for Attendance

The student will be eligible to acquire the marks under this criterion, a course to fulfill the minimum attendance in the respective courses required to grant the term.

Allied courses (Electives)

Internal Assessment shall be done based on presentations done throughout the semester and final report submitted.

h. List of Electives

The course of electives is being introduced with an intention of an in-depth study of a particular course of students' liking in greater detail but in larger context of overall scope of the course. It also helps the student to acquire expertise in his choice of course.

Following is the list of topics from which the students would have an option to choose a topic and undertake study. Every semester student can opt from only one group. As far as possible the topics are limited to below mentioned topics only. However, under exceptional circumstances, if deemed necessary and opted for by minimum stipulated number of students and agreed to by the principal and the coordinator, any additional topic may also be chosen and undertaken for study. To accommodate the relevant topics, various Swayam Courses are listed below. Any additional courses can be opted with prior approval from the coordinator and Principal. On receipt of MOOCs completion certificate from Host Institute, the University will give equivalent credit weight (up to 40%) for the credits earned through SWAYAM.

The strength of any preferred course to be minimum 10 per topic chosen.

Core Electives	Allied Electives	Open Electives
Bioclimatic Architecture: Future proofing with Simple and Advanced Passive Strategies	Building Energy Systems and Auditing	Introduction to User Experience Design
Design of Ventilation& Air conditioning System for Buildings Specialization	Structure, Form and Architecture: The Synergy	Business and Sustainable Development
Sustainable thinking for green buildings	Urban Services Planning	Sustainable Happiness
Psychrometry and green building	Sustainable Engineering Concepts and Life cycle analysis	Psychology of Stress, Health and Well-Being
Daylight design guidelines	Sustainable power generation systems	Development of Online Courses for SWAYAM
Learn how to tackle today's urban challenges: Inclusive and Sustainable Cities	Sustainable through landscape Design	Foreign Languages

i. Guidelines for structure of Dissertation report

The report should be submitted to the course coordinator in A4 size portrait format as a hardbound copy (red color for internship and black for design dissertation) with title page embossed on Front cover and only title on the edge. The report must be accompanied by a CD containing full text pdf and MS word. All images should be saved in jpeg format in a separate folder. Use **Times New Roman 12 fonts** for main body and 14 bold for headings with 1.5 spacing. All references, quotes, images, graphs, tables should be cited properly and duly acknowledged. Permission should be taken for copyright material. Two copies should be submitted. Publication of Research papers will be done as per format of Journal.

CONTENTS OF THE REPORT:

1. Cover page: It should contain title of the course, name of the institute, title of the project, student's name, year of submission and guide's name
2. Certificate from the Institute
3. Declaration for authenticity
4. Acknowledgements
5. Abstract: A summary of report (not more than 150 words)
6. Table of contents- A numbered list of headings and subheadings with page numbers
7. List of figures and tables with page numbers
8. Main body of report arranged in various sections
 - a. Introduction and Problem Statement
 - b. Aim and objectives
 - c. Scope and limitations
 - d. Methodology
 - e. Literature review
 - f. Case studies and data presentation
 - g. Analysis and conclusions
 - h. Program brief and analysis
 - i. Site analysis: for all four environments namely thermal, aqueous, luminous and acoustic
 - j. Design solution with validation using simulation software for various environments
 - k. References (use APA 6)
9. Annexure

Contents

CBCS 2025 COURSE
FOR
POST GRADUATE DEGREE PROGRAMME
IN
M. ARCH. (Sustainable Architecture)

SEMESTER I
SYLLABUS CONTENTS
POST GRADUATE DEGREE PROGRAMME
IN
M. ARCH. (Sustainable Architecture)

Sustainable Design Studio I

Course Code: MJ1101101			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	6
Teaching hours/ semester	90 hours	University examination (UE- Oral)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To translate sustainable passive design principles and water conservation techniques into architectural design and the application of environmental modeling and simulation tools and techniques for building design.

Course Learning Outcome:

Co1	Remember- Concepts of passive design principles and integration in design.
Co2	Understand- Design program formulation and program analysis.
Co3	Apply- Analysis techniques of Thermal and Aqueous Environment.
Co4	Analyze- Heat transfer in buildings and water requirements for resource management.
Co5	Evaluate- Design strategies for Thermal and Aqueous Environment.
Co6	Create- Sustainable passive design responding to thermal and aqueous environment.

Unit I	Detailed theoretical study.	30 hours
	<p>Introduction to strategies for sustainable practices, design, theoretical and/or technological issues that focus on proper scientific architectural thought and practice to lead to climate responsive energy efficient and sustainable solutions. Introduction ECBC Compliance.</p> <ul style="list-style-type: none"> ○ Site Planning principles ○ Site Selection ○ Site Analysis ○ Site Development ○ Analysis techniques for aqueous environment 	
Unit-II	Studio: Project Description	60 hours
	<p>The studio will experiment on designing an individual building, situated in various climatic zones in India.</p> <p>Design project of Area between a range of 3000-5000 sq.m. built up to respond to Thermal & Aqueous Environments using scientific methods of design namely analysis techniques, design strategies and system integration and evaluation procedures.</p> <ul style="list-style-type: none"> ○ Evaluation and Quantification to be done for the following aspects: ○ Microclimatic analysis - Bio climatic and psychometric 	

	<p>analysis.</p> <ul style="list-style-type: none"> ○ Solar Analysis for optimizing Orientation, Shading and glazing areas using simulation tools. ○ Whole building Analysis for Climatic Comfort & ECBC Compliance. ○ Passive energy conservation measures. ○ Indoor & Outdoor thermal comfort. ○ Passive Design evaluation and simulation. ○ Site Planning, Site contour analysis, Net previous area, annual runoff calculations & Water Management. ○ Solid Waste Management. ○ Application of Sustainable materials and Analysis on Life cycle assessment/ Embodied energy. 	
Sessional Work: The project submission should be in the form of Drawings, calculations, models and reports.		
IA: Please refer to the guidelines given in the annexure		
	<p>References:</p> <ul style="list-style-type: none"> ● IS:3362-1977, Indian Standard, code of practice For Ventilation of Residential Building ● Rea, M., 2000. The Lighting Handbook. 9th ed. Illuminating Engineering Society of North America, SP 41 (1987) Handbook On Functional Requirements Of Non-Industrial Buildings (Lighting And Ventilation), BIS ● Steven V Szokolay, 2008, Introduction to architectural science. Taylor & Francis group ● Givoni Baruch, “Passive and Low Energy Cooling of Buildings”, Van Nostrand Reinhold, New York, 1994 ● Man, climate and architecture – B. Givoni, Applied science pub. Ltd., U.K. ● Manual of tropical housing and building – Koenigsberger et al, Orient Longman, 1973. ● Climate Design: Energy Efficient building principles and practices by Watson Donald ● Climate responsive architecture- a design handbook for energy efficient buildings, Tata McGraw-Hill Publishing Company Limited -2000 ● Sun, Wind & Light – G.Z. Brown, Mark Dekay, John Wiley & Sons, 2001. 	

Energy Conservation I (Thermal Environment and Aqueous Environment)

Course Code: MJ1101102			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	6
Teaching hours/ semester	90 hours	University examination (UE-Theory)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To enable students with knowledge and understanding the effects of thermal environment (climate) on comfort conditions in built spaces, water management and waste management.

Course Learning Outcome:

Co1	Remember- parameters, climates zones, thermal comfort parameters and water conservation measures.
Co2	Understand-To understand Building physics and water budgeting.
Co3	To illustrate the ways of applying passive design strategies and water management strategies in design.
Co4	To analyze the impact of a project and suggest measures for passive design and water conservation.
Co5	To evaluate various strategies proposed for thermal and aqueous environments.
Co6	To integrate passive design strategies and water management for resource conservation.

Unit I	Introduction to Climate and Building Physics	20 hours
	Introduction to Climate elements, characteristics of climate zones, need Passive design and Energy Conservation. Building Physics and Heat transfer. Thermal Quantities, Heat exchange of Buildings, Periodic Heat Flow, Psychrometric charts Thermal comfort factors, indices Bioclimatic charts and their applications, Thermal resistance, thermal transmittance, thermal performance index, thermal lag, periodic heat flow calculations	
Unit-II	Analysis Techniques to understand thermal behavior of buildings: Building Program and use, Building form and Envelope	20 hours
	Building program and use: occupancy heat gain, electric lighting heat gain, equipment heat gain Form and envelope: skin heat flow, window solar gain, ventilation/infiltration gains and losses Combining Climate, program and form: Building bioclimatic chart, Shading calendar, Total heat gains and losses, balance point temperatures and balance point profiles.	
Unit III	Thermal Design Strategies at Site, Building Scale and Component Scale	20 hours

	Analysis, selection, formulation, evaluation and validation of thermal design strategies at various scales. Strategies by Climate type and Energy Intentions: Making strategy bundles for neighborhoods, buildings and rooms for (heating, cooling, lighting, ventilation or energy) High performance Buildings: Net zero and peak zero buildings, net positive buildings, carbon neutral buildings etc.	
Unit IV	Introduction to Fundamentals of Water Management and Water recycling	10 hours
	Methods of Water Treatment, Systems for water management, recycling, reuse, conservation. Sustainable Urban Drainage systems Design principles of water conservation and water efficiency Design for water conservation – building and products Ground water management and Artificial Recharge Systems Roof and non-roof Rain water harvesting techniques. Integrated Water Management - key aspects, components, benefits and challenges.	
Unit V	Efficient Wastewater Treatment	10 hours
	Onsite individual and multiple Building Sewage treatment, Large scale sewage treatment systems, recycling and gray water, storm water treatment. Integrated Wastewater Management - key aspects, components, benefits and challenges.	
Unit VI	Solid Waste Management, Recycling and Waste to Energy	10 hours
	Introduction to Solid Waste management, Municipal Solid Waste Management, Waste as a Resource, Energy from Waste. Wastes generated by Human Habitat – Solid, liquid and Gaseous Types of Wastes- Municipal, Industrial, Agricultural, Toxic, Bio-Medical, Hazardous, Electronic, Radioactive etc., Overview of laws /rules governing waste management in India, Importance of Community participation in waste management Impact on health and sanitation Integrated Solid Waste Management.	

Sessional work: Unit tests and assignments based on the above content.

IA: Please refer to the guidelines given in the annexure.

Textbooks and References:

- Inside out – G. Z. Brown et al – John Wiley & sons Inc., New York.
- Environmental systems – H. J. Cowan, P. R. Smith, VNR Co., New York.
- Environmental Acoustics – Leslie L. Doelle, Canada.
- Architectural Acoustics – Eagan, M. David, McGraw Hill Co., 1988.
- MEEB – Stain, Benjamin et al, John Wiley & sons Inc. 2000.
- Sun, Wind & Light, Second edition, G. Z. Brown & Mark DeKay, John Wiley&Sons.
- Sustainable building technical manual: green building design, construction and operations, Abraham L.E. et al, 1996, Washington D.C. U.S. Green building council and Public Technology, Inc.
- Composting and Vermi-composting, Agarwal S. K. and Saxena L.M. 2001.
- Watershed Protection, Athens L and Ferguson B.K. 1996
- Climatic zones and rural housing in India, Bansal N. K. and Minke G. 1988

- Directory of Indian building materials, BMTPC, 2003, LHM publication
- CPCB publication, 1989 and 2000 on air quality and root zone method
- Beyond growth: The economics of sustainable development, Daly H. E. , 1997, Boston, Deacon press
- Energy recovery from Municipal solid waste: Potential and possibility, Dhussa A.K. and Varshney A.K., 2000, Bio-Energy news 4

Climate Action, Sustainability and Governance

Course Code: ID1101103			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE-Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

Sensitizing the built environment professionals on their affirmative role in Climate Action, Sustainability and Governance.

Course Learning Outcome:

Co1	To understand the fundamentals of sustainability, climate change and governance
Co2	To comprehend the role of ecosystem services and legislative frameworks.
Co3	To assess the key challenges for adaptation to climate change and mitigation measures.
Co4	To analyze ESG Frameworks and study its application
Co5	To develop skills to conduct comprehensive carbon footprint assessments and Environmental Impact Assessment.
Co6	To use ESG framework and write ESG report.

Unit I	Environment and sustainability	4 hours
	Concept of Ecological Footprint, Urban Ecology -Need, Principles, Urban Ecosystem Services, Biodiversity and habitat provisioning - Biogeographic regions of India. The Importance of Urban Green Spaces for Biodiversity, Environmental Degradation & Need for sustainable development, Key aspects of Sustainability, sustainability Index, Sustainable Development Goals- targets and measures, Approaches and strategies to achieve sustainability – COP, The Paris and Post-Paris Convention on Climate Change, India’s commitment to sustainable development.	
Unit-II	Climate change, resilience and mitigation	5 hours
	Understanding planetary boundaries and the impacts of natural and anthropogenic interventions on these planetary boundaries, causes and consequences of climate change, Climate risk & vulnerability assessment, Physical vulnerability, economic vulnerability, social vulnerability, vulnerability of resources to climate change Impact of climate change on the built environment, Climate change mitigation- concept, strategies, Carbon Sequestration and challenges Climate change adaptation – concept, need, examples	
Unit III	Environmental Laws, Impact Assessment and Management	6 hours

	Introduction to Environmental Management System, Environmental Impact Assessment – Characteristics, methodologies and process, Tools, Environmental clearance process in India Introduction to laws, policies and rules related to environment and resource protection*-Environmental Protection Act 1986, Biological diversity (Amendment Act 2023), National Green Tribunal Act 2010, Protection and preservation of trees rules 2009, Solid waste management and handling rules 2016, MOEFCC guidelines for Eco sensitive zones, etc. *The latest mandate available should be considered.	
Unit IV	Carbon Accounting	4 hours
	Concept of carbon footprint, decarbonization, & carbon neutrality, Methodologies and practices, Framework of carbon accounting and carbon sink estimation, Carbon footprint assessment and emission reduction strategies and related tools, Determine the baseline GHG emissions profile and the way forward towards low carbon/zero carbon operation.	
Unit V	Introduction to Environmental, Social and Governance (ESG)	4 hours
	Potential and Barriers to Sustainable Business, Principles of Responsible Business conduct, Socially and Environmentally Responsible Business Management, Relevance of Green Growth Green Business paradigms, Environmental Values of Business Corporate Social Responsibility and Environmental Impacts	
Unit VI	ESG rating systems and reporting	7 hours
	Need for Sustainability Reporting, Environmental and Social Impact Assessment (ESIA) guidelines, Reporting Frameworks-BRSR, CDP, GRI, etc., Key Principles of ESG Frameworks and Performance Indicators, Tools for reporting and case studies, Format for reporting, Writing a simple ESG report.	
Sessional work: Unit tests and assignments based on the above content.		
IA: Please refer to the guidelines given in the annexure.		
Textbooks and References: <ul style="list-style-type: none"> ● UN (2013) World Economic and Social Survey 2013 ● Global Sustainable Development Report 2015 ● Understanding Sustainable Development-John Blewitt ● Bert Metz, 2010. Controlling climate change, Cambridge University Press. ● Canter L.W. (1996) <i>Environmental Impact Assessment</i>, 2nd Edn. New York, McGraw Hill ● Trivedy R.K., Handbook of Environmental Law, Acts, Guidelines, Compliances and Standards, Volume Environment Media, 1996. ● Mohanty S. K., Environment and Pollution Law Manual, Universal Law Publishing Company Ltd., 3rd edition, 2002 ● Pollution Control Acts, Rules and Notifications, Pollution Control Law Series – V ● volume – I, Central Pollution Control Board, 1992 ● Dr. P. Khanna, Premier on Environment Management, 2001, multi- tech publishing co. ● ESG report templates. 		

Integrated Energy Systems and Technologies

Course Code: ID1101104			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE- Theory)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks
Course Objective: Introduction and integration of various Aspects of Energy Management – Audit, Electrical Systems and Renewable Energy to improve the energy performance of buildings.			
Course Learning Outcome:			
Co1	Remember-To describe the General aspects of energy management, energy systems and renewable energy.		
Co2	Understand-To understand types of energy systems and renewable energy options.		
Co3	Apply-To understand various types of Energy Audits and illustrate the application for buildings.		
Co4	Analyze-To explain and compare energy management opportunities and renewable energy integration.		
Co5	Evaluate- To judge various energy saving opportunities with financial analysis.		
Co6	Create-To plan various energy saving opportunities for Audit Project and renewable energy opportunities.		
Unit I	General Aspects of Energy and Energy Management		4 hours
	Classification of Energy, Primary and Secondary Energy, Commercial and Non-commercial Energy, Renewable and Non-Renewable Energy, Global Primary Energy Reserves and Commercial. Energy Scenario Coal, Oil, Natural Gas, Electrical Energy Supply, Energy Needs of Growing Economy, Energy Intensity, Energy Security and Energy Independence, Energy Performance Index Key Elements and Principles of Energy Management, energy action Planning, top management commitment and support, Energy Policy & Planning, Introduction of tools for effective implementation of energy management systems		
Unit-II	Energy Audit		6 hours
	Definition & Objectives of Energy Audit and Management, Need for Energy Audit, Types of Energy Audit & Approach, Technical and Financial Feasibility of ENCON Measures, Energy Audit Report, Energy Costs, Benchmarking, Energy Performance, Fuel and Energy Substitution, Need for measurement parameters and Instruments, Scope and Coverage of Energy Audit of Buildings. Methodology of Energy Audit and opportunities for ENCON of Buildings		

Unit III	Electrical Systems	4 hours
	Introduction to Electrical Power Supply Systems - Generation, Transmission, Transmission & Distribution System losses and Efficiency, Industrial Consumer and Typical Industrial Distribution System, Electricity billing, Concept of Maximum Demand, Electrical load management and Maximum Demand Control, Power factor Improvement and benefits, Automatic Power Factor Controller.	
Unit IV	Air Conditioning & Refrigeration Systems and Cooling Towers	6 hours
	Introduction, Types of Refrigeration systems, Vapor Compression, Radiant Cooling Systems, Solar Air Conditioning Systems, Commonly used Refrigerants, Compressor Types and Applications, Selection of Refrigeration system. Energy Efficiency Ratio, COP, Performance assessment, Factors affecting Performance and Energy Efficiency of AC / Refrigeration Plants, Standards and Energy Labeling of Room Air Conditioners, Energy Saving Opportunities. Cooling tower introduction, Types of Cooling Tower, Energy Conservation Opportunities in motors, pumps, blowers and compressors	
Unit V	Fundamentals of Renewable Energy Technologies	4 hours
	Principles and Fundamentals of Different types of Renewable Energy Sources, Present Status of Sector wise Renewable Energy Capacity Development in India, Targets for RE Development in the Country, Rural Renewable Energy, Renewable Energy Policies, Present Incentives & Subsidies	
Unit VI	Solar Energy and Wind Energy	6 hours
	Fundamentals of Solar Energy, Solar Heating and Solar Power, Flat Plate Collector Technology, Evacuated Tube Collectors Technology, Solar Concentrators for Steam Generation, Solar Water Heating Systems for Commercial, Residential and Industrial Sectors, Thermal Storage Systems Jawaharlal Nehru National Solar Mission, Solar Energy Systems integration for Buildings, Sizing, Selection Criteria and Feasibility. Basics of Wind Energy and Wind Power Generation, Variability of Wind Speed and its Effect, Types of Wind Turbines, Operating Characteristics of Wind Turbines and Generators, Wind energy Calculations, Capacity factor, Grid connected Wind Generators, Future of Wind power Generation in India, Issues related to Wind power Generation, Small size Wind Energy Systems for Buildings, Selection Criteria and Feasibility	
	Sessional Work: Unit tests and assignments based on contents above	
	IA: Please refer to the guidelines given in the annexure	
	Textbooks and References: <ul style="list-style-type: none"> ● General Aspects of Energy Management and Energy Audit Book – 1 Published by Bureau of Energy Efficiency, New Delhi ● Energy Conservation Building Code – 2017 Document Issued by Bureau of Energy Efficiency, New Delhi ● The Energy Conservation Act 2001 and The Energy Conservation (Amendment) 	

	<p>Act 2010</p> <ul style="list-style-type: none">● The Indian Electricity Act 2003 and The Electricity (Amendment) Bill 2010● Alternate Energy Sources – T. H. Taylor, Adam Higlal Ltd., Bristol.● Renewable Energy Sources for rural areas in Asia and Pacific- APO, Tokyo 2000.● Energy Technology – S. Rao, Dr. B. B. Parulekar – Khanna Publications.● Non-conventional Energy Sources – G. D. Rai – Khanna Publications.● Websites – www.ireda.org, www.windenergy.com Kumar, Amitkumar Tyagi,● TERI, New Delhi, 2002. Technology Menu for Energy Efficiency – NPC.● ASHRAE Handbook.
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Simulation and Modelling-I

Subject Code: SE1101105			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE- Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To facilitate students through a pool of software programs which provide analytical skills of energy performance, lighting performance, water and material performance for selection of appropriate strategies for energy conservation

Course Learning Outcome:

Co1	To know Simulation tools and advance digital assessing tools.
Co2	To understand Calculations of Building physics and heat transfer in buildings.
Co3	To illustrate the ways of assessing passive design strategies and energy demand in buildings
Co4	To analyze the impact of a project and suggest measures using simulation tools
Co5	To evaluate various optimization measures proposed for thermal and acoustic, aqueous lighting environments.
Co6	To integrate passive and active design strategies and energy efficiency for resource conservation.

Unit I	Introduction to Simulation Tools	8 hours
	<p>Introduction to advanced tools for thermal, air flow and lighting simulation and their application to building design and design research.</p> <ul style="list-style-type: none"> ○ Understanding Building Thermal Performance ○ Understanding Shadow patterns and analysis ○ Understanding shading devices and calculations ○ Understanding Wind Movement at Macro and Micro Level ○ Understanding Daylight Availability and Optimization ○ Understanding Artificial Lighting and optimization ○ Understanding Simulation reports and optimization 	
Unit-II	Performances Assessment and Inference	22 hours
	<p>Application of Simulation tools to optimize building performance and efficiency of resources. Following will be covered through various building simulation software's.</p> <ul style="list-style-type: none"> ○ Assessing Building Thermal Performance ○ Assessing Shadow patterns and analysis ○ Assessing shading devices and calculations ○ Assessing Wind Movement at Macro and Micro Level ○ Assessing Daylight Availability and Optimization ○ Assessing Artificial Lighting and optimization 	Module based distribution of teaching hours.

	○ Assessing Simulation reports and optimization.	
	Sessional Work: Students must model and simulate a design project with a detailed report of inferences and solutions drawn from the simulation study.	
	IA: Please refer to the guidelines given in the annexure	
	Textbooks and References:	

Elective -I

Course Code: AE1101106			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE- Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To facilitate the students' ability to learn out of a pool of specialized Courses, which provides extended scope, or which enables exposure to discipline-centric' Courses as well as cross-disciplinary Courses.

Learning Outcome:

At the end of semester, the students will understand:

- Application of knowledge in solving a real-life problem in an analytical and scientific way
- MOOC Courses for period of minimum 4 weeks with certificate/any program of 30 hrs.
- Training is accepted for extra credits and completion of Elective Course.

	Description	30 hours
	The student can select any one Course in semester I from the list of Courses prepared by the department. A comprehensive list of Courses to be included under three broad areas of study namely; Core, Allied and Open Electives A selected Course expertise course be arranged to provide for necessary syllabus formulation and guidance to students.	
	Sessional Work: The students are expected to study the selected topic in depth under the guidance of the expertise, undertake case-studies and necessary site visits, and collect all the relevant information and present an exhaustive study report in a group.	
	IA: Please refer to the guidelines given in the annexure	

SEMESTER II
SYLLABUS CONTENTS

POST GRADUATE DEGREE PROGRAMME
IN
M. ARCH. (Sustainable Architecture)

Sustainable Design Studio II

Course Code: MJ1101201			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	6
Teaching hours/ semester	90 hours	University examination (UE- Oral)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To translate sustainable design principles into the Application Procedure of the relevant Analysis Techniques, Design Strategies, and Evaluation Procedures for Thermal and Luminous Environment, into Architectural Design, and the application of environmental modeling and simulation tools and techniques for building design.

Course Learning Outcome:

Co1	Remember- Learn and refine their architectural design skills, required to incorporate the knowledge gained from theory courses into the design solutions.
Co2	Understand- Energy conservation through site selection, planning and design; siting and orientation.
Co3	Apply- Exposure to sustainable building design in the context, building physics, and energy efficiency.
Co4	Analyze- Carrying out thermal and lighting design of buildings and predicting their performance.
Co5	Evaluate- Daylighting and artificial lighting concepts, energy-efficient illumination and mechanical systems for heating and cooling.
Co6	Create- Pre-certification report of the selected project.

Unit I	Detailed theoretical study.	18 hours
	Sustainable design principles into the Application Procedure of relevant Analysis Techniques, Design Strategies and Evaluation Procedures for Luminous and Acoustic Environment, into Architectural Design Problem and application of environmental modeling and simulation tools and techniques to building design.	
Unit-II	Studio: Project Description	72 hours
	A large-scale project of area from 5000 -20,000 sq.m. built up to respond to Thermal, Luminous and Aqueous Environment using scientific methods of design, namely analysis techniques, design strategies, and system integration and evaluation procedures. Students should select project sites with different orientations, ground conditions, urban infrastructure, and vegetation, along with five different climates of the Indian subcontinent. Students shall also perform Simulation for daylighting, and artificial lighting, mechanical cooling and heating exercises for their design solution using software tools. Design Methodology:	

	<ol style="list-style-type: none"> 1. Completion of data collection related to climate, site, and daylighting and water. 2. Analysis of the building Programme and use for all environments. 3. Database & data processing, analysis, projection & graphic presentation of climate, site, and day lighting 4. Formulating Approach / parameters for proposed design / plan / model – Schematic Design 5. Design/plan/model proposals and details 6. Implementation/application of thermal, lighting & aqueous calculations, both manual and simulation 7. Pre-certification for selected national or international rating system. 	
<p>Sessional Work: The project submission should be in the form of Drawings, calculations, models, and reports.</p>		
<p>IA: Please refer to the guidelines given in the annexure</p>		
<p>Textbooks & References:</p> <ul style="list-style-type: none"> ● IS:3362-1977, Indian Standard, code of practice For Ventilation of Residential Building ● Rea, M., 2000. The Lighting Handbook. 9th ed. Illuminating Engineering Society of North America, SP 41 (1987) Handbook on Functional Requirements of Non-industrial Buildings (Lighting and Ventilation), BIS ● Steven V Szokolay, 2008, Introduction to architectural science. Taylor & Francis group ● Givoni Baruch, “Passive and Low Energy Cooling of Buildings”, Van Nostrand Reinhold, New York, 1994 ● Man, climate and architecture – B. Givoni, Applied science pub. Ltd., U.K. ● Manual of tropical housing and building – Koenigsberger et al, Orient Longman, 1973. ● Climate Design: Energy Efficient building principles and practices by Watson Donald ● Climate responsive architecture- a design handbook for energy efficient buildings, Tata McGraw-Hill Publishing Company Limited -2000 ● Sun, Wind & Light – G.Z. Brown, Mark Dekay, John Wiley & Sons, 2001. ● Bureau of Energy Efficiency, “Energy Conservation Building Code 2017”, Ministry of Power, Govt. of India. ● Bureau of Indian Standards, “SP 41: Handbook on Functional Requirements of Buildings (Other than Industrial Buildings)”, Bureau of Indian Standards, New Delhi 		

Energy Conservation II (Luminous and Acoustic Environment)

Course Code: MJ1101202			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	4
Teaching hours/ semester	90 hours	University examination (UE- Theory)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To enable students with knowledge and understanding the effects of Luminous and Acoustic environment on comfort condition in built spaces.

Course Learning Outcome:

Co1	Remember- Parameters affecting daylight and acoustics.
Co2	Understand-To understand integration of daylighting and artificial lighting.
Co3	Apply- To illustrate the ways of applying Luminous design strategies and acoustic zoning strategies in design
Co4	Analyze-To analyze the availability of daylight and suggest measures for daylighting in deeper spaces
Co5	Evaluate-To evaluate various strategies proposed for Luminous and Acoustic environment
Co6	Create- To integrate Luminous and acoustic design strategies for resource conservation

Unit I	Lighting Fundamentals and Light Sources	20 hours
	Physics of light, Light and sight, Quantity of Light, Quality of Light, Fundamentals of Color. Daylight sources, Electric light sources	
Unit-II	Day lighting Design and Electrical Lighting Design	20 hours
	Day lighting opportunities, Strategies for day lighting buildings, Aperture Sizing- side lighting and top lighting, specialized daylighting strategies, daylight factor, components of day lighting, guidelines for preliminary day lighting design, design analysis method and physical modeling, Luminaires, lighting control, Detailed Design procedures, evaluation.	
Unit III	Lighting Design Process and Electrical Lighting Applications	20 hours
	Goals of Lighting Design, Cost Factors, power budgets, tasks analysis, preliminary design, luminaries, detailed design and evaluation. Lighting application, lighting control. Residential occupancies, educational facilities, Commercial Interiors, industrial lighting. Special lighting applications, emergency lighting, floodlighting, street lighting, light pollution, remote source lighting, fiber optic lighting and light pipes and light guides.	
Unit IV	Fundamentals of Architectural Acoustics	10 hours

	Sound Theory and Hearing Phenomenon, Noise Sound, Hearing, Sound Sources, Expressing Sound Magnitude, Noise, Vibration.	
Unit V	Sound in Enclosed Spaces	10 hours
	Sound in enclosures, Absorption, Room Acoustics, Room Design, Sound Reinforcement Systems.	
Unit VI	Building Noise Control	10 hours
	Noise Reduction, Absorption, Sound Isolation, Airborne Sound, Speech Privacy, Structure Borne Sound, Mechanical System of Noise Control, STC and IIC Recommendations and criteria, Outdoor Acoustic Considerations.	
Sessional work: Unit tests and assignments based on above content		
IA: Please refer to the guidelines given in the annexure		
	<p>Textbooks and References:</p> <ul style="list-style-type: none"> ● Inside out – G. Z. Brown et al – John Wiley & sons Inc., New York. ● Environmental systems – H. J. Cowan, P. R. Smith, VNR Co., New York. ● Environmental Acoustics – Leslie L. Doelle, Canada. ● Architectural Acoustics – Eagan, M. David, McGraw Hill Co., 1988. ● MEEB – Stain, Benjamin et al, John Wiley & sons Inc. 2000. ● Sun, Wind & Light, Second edition, G. Z. Brown & Mark DeKay, John Wiley & sons ● Sustainable building technical manual: Green building design, construction and operations, Abraham L.E. et al, 1996, Washington D.C. U.S. Green building council ● and Public Technology, Inc. ● Composting and Vermi-composting, Agarwal S. K. and Saxena L.M. 2001. ● Watershed protection, Athens L and Ferguson B.K. 1996 ● Climatic zones and rural housing in India, Bansal N. K. and Minke G. 1988 ● Directory of Indian building materials, BMTPC, 2003, LHM publication ● CPCB publication, 1989 and 2000 on air quality and root zone method ● Beyond growth: The economics of sustainable development, Daly H. E. 1997, Boston, Deacon press ● Energy recovery from Municipal solid waste: Potential and possibility, Dhussa A.K. and Varshney A.K., 2000, Bio-Energy news 4 	

Research Methodology

Course Code: RP1101203			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective: To induce research attitude in students by introducing them to research methodology with a focus on sustainable architecture.

Course Learning Outcome:

Co1	Remember- To know the fundamental concepts of research, research types and approaches.
Co2	Understand- To develop a skill of searching and reviewing literature and comprehend various referencing styles.
Co3	Apply- To illustrate an appropriate research design.
Co4	Analyze- To select the techniques, tools for data collection and analysis.
Co5	Evaluate- To analyze data using statistical tools.
Co6	Create- To write a research proposal.

Unit I	Introduction to Research	4 hours
	Meaning, need and significance of research, Objectives and characteristics of research, Criteria for good research, Areas of research in sustainable architecture, Ethics in research, Difference between research methods and methodology. Research Types -Historic, Descriptive, Case study, Experimental, Applied and Causal, etc., Research Approaches-Qualitative, Quantitative, Mixed, Advantages and disadvantages of various approaches.	
Unit-II	Literature Review	4 hours
	Need for literature review, conducting a Literature Search, Sources for literature and online databases, Citation and Referencing Styles.	
Unit III	Research Design	6 hours
	Process of conducting research: Overview of research process and design, Steps in conducting research, formulating research problems, Framing Hypothesis and understanding variables, Preparing Research Proposal. Sampling design: Need for sampling, Types of sampling design, Criteria for sample selections, Sampling error	
Unit IV	Data Collection and Analysis	6 hours
	Measurements and scaling techniques, Data collection techniques and tools, Survey, observation, FGD, interviews, questionnaires, instruments, etc., Data presentation techniques (Tables, figures, behavior maps, charts, graphs, etc)	

	Interpreting and analyzing data (content analysis, visual analysis, simulation analysis)	
Unit V	Statistical Tools and Techniques	6 hours
	Hypotheses testing and measures of association, Descriptive and inferential statistics, Measures of central tendencies, Parametric and non-parametric tests, Statistical tools , Interpreting results.	
Unit VI	Reporting Research	4 hours
	Need for reporting research, Ways of Reporting-research report, paper, Presenting Insights and findings, Structure of report and research paper.	
Sessional work: Unit tests and assignments based on above content		
IA: Please refer to the guidelines given in the annexure		
Textbooks and References: <ul style="list-style-type: none"> ● Kothari, C. R. (2004). <i>Research Methodology Methods & Techniques</i> (Second Edition ed.). New Delhi: New Age international publisher. ● Sanoff, H. (1991). <i>Visual Research Methods in Design</i>. New York: VNR. ● Bechtel, R., Marans, R., & Michelson, W. (Eds.). (1990). <i>Methods in environmental and behavioral research</i> (second ed.). Florida: Robert E. Krieger ● Groat, L., & Wang, D. (Eds.). (2002). <i>Architectural Research Methods</i>: John Wiley and Son. ● Zeisel, J. (2006). <i>Inquiry by Design</i> (Revised ed.). New York W.W. Norton & Company 		

Green Building Standards and Certification

Course Code: SE1101204			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To acquaint students with the concepts of green buildings and green building certification systems.

Course Learning Outcome:

Co1	Remember- The principles of green building, sustainable development, and the benefits of environmentally responsible construction.
Co2	Understand- Core principles of Green Building Certification
Co3	Apply- Green Standards and codes to evaluate and comply buildings based on their environmental performance.
Co4	Analyze- Analyze buildings for green rating and certification.
Co5	Evaluate- Evaluating the environmental performance of green buildings.
Co6	Create- Integrate green building rating systems and their processes for a project.

Unit I	Foundational Concepts of Green Building Certification	4 hours
	Understanding of Basic Concepts of Sustainable Development and Green Building Principles, Energy Efficiency and Conservation, Water Conservation and Management, Material Selection and Resource Efficiency, Life Cycle Assessment, Indoor Environmental Quality (IEQ)	
Unit-II	Green Building Standards and Codes	4 hours
	Compliance requirements, compliance documents, and calculation of energy consumption of the proposed and standard design. International Standards and Codes - International Green Construction Code (IgCC), ASHRAE Standards, Energy Star etc. Indian Standards and Codes- National Building Code of India, Energy Conservation Building Code (ECBC) ECBC compliance and approach	
Unit III	Green Building Technologies and Practices	4 hours
	Passive and Active Design Strategies, Sustainable Materials and Construction Techniques, Green Roofs and Walls, Waste Management and Recycling, etc.	
Unit IV	International green building rating systems	6 hours
	Focus areas, rating systems for different types of Buildings, registration and certification process, details of credits, process to achieve rating of prominent international green building rating systems like LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment	

	Environmental Assessment Method) , WELL Building Standard etc.	
Unit V	National Green building rating systems	6 hours
	Focus areas, rating systems for different types of Buildings, registration and certification process, details of credits, process to achieve the rating of national green building rating systems like GRIHA (Green Rating for Integrated Habitat Assessment), Indian Green Building Council (IGBC) etc.	
Unit VI	Analyzing and Evaluating the Performance of Green Building Projects	6 hours
	Studying and exploring compliance of successful green building projects and identifying best practices. Evaluating and Assessing the environmental, economic, and social performance of green buildings.	
	Sessional Work: Assignments based on the contents above.	
	IA: Please refer to the guidelines given in the annexure.	
	Textbooks and References: <ul style="list-style-type: none"> ● Mili Majumdar, "Energy-efficient buildings in India," Tata Energy Research Institute, 2002. ● TERI "Sustainable Building Design Manual- Volume & II" Tata Energy Research Institute, 2009 ● HarharaIyer G, Green Building Fundamentals, Notion Press ● Dr. Adv. Harshul Savla, Green Building: Principles & Practices ● Relevant Code Books. ● National Building Code India. ● Handbooks and Manuals of International & National Green Rating Systems 	

Sustainable Materials and Technologies

Course Code: SE1101205			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To study various contemporary and traditional materials, assess their performance and methods of sustainable construction for energy efficiency.

Course Learning Outcome:

Co1	Remember- General aspects of sustainable building materials and technology.
Co2	Understand- Types traditional and contemporary sustainable materials and technology in construction.
Co3	Apply- Apply knowledge of sustainable materials in buildings.
Co4	Analyze- Selected materials for its life Cycle Analysis
Co5	Evaluate- Compare and evaluate materials and technologies for application in appropriate climate zone.
Co6	Create- Create reports of Life cycle Analysis of selected materials and technologies with required details and sections

Unit I	Traditional and Contemporary Sustainable Materials	4 hours
	Environmental impact of building materials, examples of “green” materials, issues related to “sustainable” materials, future of “sustainable” materials, characteristics of sustainable materials and energy efficiency in materials. Traditional Sustainable construction materials (e.g. walling, roofing, finishing), their properties, thermal/acoustic/aqueous performances. Contemporary Sustainable construction materials, (e.g. walling, roofing, finishing), their properties, thermal/acoustic/aqueous performances. Traditional and contemporary Insulating materials, finishing materials with costing and performance	
Unit-II	Traditional and Contemporary Sustainable Construction Technology	4 hours
	Traditional Technology of Construction with examples and relevance with typology of construction. (feasibility, economics, scale and applicability) Contemporary Technology of Construction with examples and relevance with typology of construction. (feasibility, economics, scale and applicability)	
Unit III	LCA - LCCA and Green Certified materials	4 hours

	LCA and LCCA calculations and online tools Market Study and analysis of Green rated construction materials Integration of LCCA and green rated construction products for a small interior design project.	
Unit IV	Integration of Sustainable materials in Building	8 hours
	Detail analysis of any two Sustainable Materials, costing, performance, strategies integration in design (envelope) Comparative Analysis of alternative materials used in strategies in design Detail analysis of any two Sustainable Materials, costing, performance, strategies integration in SDS I (Roofing) Comparative Analysis of alternative materials used in strategies in design Detail analysis of any two Sustainable Materials, costing, performance, strategies integration in design (Finishing material) Comparative Analysis of alternative materials used in strategies in design	
Unit V	Integration of Sustainable construction techniques in Building	8 hours
	Detail analysis of any two Sustainable construction techniques, performance, strategies integration in design. (envelope) Comparative Analysis of alternative construction techniques used in strategies in design. Detail analysis of any two Sustainable construction techniques, performance, strategies integration in design. (Roofing) Comparative Analysis of alternative construction techniques used in strategies in design. Detail analysis of any two Sustainable construction techniques, performance, strategies integration in design. (Finishing material) Comparative Analysis of alternative construction techniques used in strategies in design.	
Unit VI	New Construction materials and construction Techniques	2 hours
	Green certifications: labels or marks, Common Green Certifications for construction materials, Examples of Green-Certified Materials. New and upcoming Sustainable construction materials and innovative design. Their performance, economy and impact.	
	Sessional Work: Assignments based on contents above	
	IA: Please refer to the guidelines given in the annexure	
	Text book and References: <ul style="list-style-type: none"> ● Sustainable Materials, Processes, and Production – Rob Thompson ● Materials for Sustainable Sites – Meg Calkins ● Green Building Materials: A Guide to Product Selection and Specification – Ross Spiegel & Dru Meadows ● Sustainable Construction: Green Building Design and Delivery – Charles Kibert ● Building Materials: Principles and Applications – Harold Rosen & John Wiley ● Earth Construction: A Comprehensive Guide – Hugo Houben & Hubert Guillaud 	

Elective -II

Course Code: AE1101206			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective: To facilitate the students learning out of a pool of specialized Courses, which provides extended scope or which enables exposure to discipline-centric' Courses as well as cross-disciplinary Courses.		
Course Learning Outcome: At the end of semester, the students will understand:		
<ul style="list-style-type: none"> • Application of knowledge in solving real-life problems in an analytical and scientific way. • MOOC Courses for a period of minimum 4 weeks with certificate/any program of 30 hrs. • Training is accepted for extra credits and completion of Elective Course 		
	Description	30 hours
	The student can select any one Course in semester I from the list of Courses prepared by the department. A comprehensive list of Courses to be included under three broad areas of study namely; Core, Allied and Open Electives A selected expertise course be arranged to provide necessary syllabus formulation and guidance for students.	
	Sessional Work: The students are expected to study the selected topic in depth under the guidance of the expertise, undertake case-studies and necessary site visits, and collect all the relevant information and present an exhaustive study report in a group.	
	IA: Please refer to the guidelines given in the annexure	

SEMESTER III
SYLLABUS CONTENTS

POST GRADUATE DEGREE PROGRAMME
IN
M. ARCH. (Sustainable Architecture)

Sustainable Design Studio III

Course Code: MJ1101304			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	6
Teaching hours/ semester	90 hours	University examination (UE- Oral)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To address complex environmental issues beyond building scale using a sustainable approach as a team.

Course Learning Outcome:

Co1	Remember- To understand Environmental Issues faced by the urban or rural communities
Co2	Understand-To identify the causes or factors contributing to these problems
Co3	Apply- To apply sustainable strategies to comprehend the environmental issues identified.
Co4	Analyze- To analyse the problem in relation to the context, resources and factors.
Co5	Evaluate- To evaluate possible solutions
Co6	Create- To provide design solutions or policy recommendations for the problem identified.

Unit I	Detailed theoretical study	15 hours
	Understanding various environmental issues faced by the urban or rural community by taking a live case. These issues can include but not limited to scarcity of basic resources and services, waste management, depletion of natural resources, traffic issues, UHI, loss of green cover, pollution, climate mitigation, etc.	
Unit-II	Studio: Project Description	75 hours
	<p>Understanding the issue, context, and identifying causes The scale of the project can vary from site scale, to campus to community or neighbourhood in an urban or rural context.</p> <p>1. Collect field data using appropriate methods to identify the causes/factors contributing to the issue.</p> <p>Analysis, synthesis and solution (Students will work in a team to understand the complexity of problem, analyze and provide solution)</p> <p>2. Analyze the collected data in light of resources, context and factors using appropriate tools. Incorporate community perspectives. Students will address the issue considering the multiple perspectives involving stakeholder.</p> <p>3. Provide solutions in the form of design or policies. Students will provide the solution as a team or individually based on the scale of the project.</p>	
	Sessional Work: The project submission should be in the form of drawings, calculations, simulations and reports.	

	IA: Please refer to the guidelines given in the annexure	
	<p>Textbooks & References:</p> <ul style="list-style-type: none"> ● IS:3362-1977, Indian Standard, code of practice For Ventilation of Residential Building ● Givoni Baruch, “Passive and Low Energy Cooling of Buildings”, Van Nostrand Reinhold, New York, 1994 ● Man climate and architecture – B. Givoni, Applied science pub. Ltd., U.K. ● Manual of tropical housing and building – Koenigsberger et al, Orient Longman, 1973. ● Climate responsive architecture- a design handbook for energy efficient buildings, Tata McGraw-Hill Publishing Company Limited - 2000 ● Sun, Wind & Light – G.Z. Brown, Mark Dekay, John Wiley & Sons, 2001. ● Bureau of Indian Standards, “SP 41: Handbook on Functional Requirements of Buildings (Other than Industrial Buildings)’, Bureau of Indian Standards, New Delhi ● Climate Design: Energy Efficient building principles and practices by Watson Donalt ● Climate responsive architecture- a design handbook for energy efficient buildings, Tata McGraw-hill Publishing Company Limited - 2000 ● The Sustainable Urban Design Handbook by Nico Larco and Kaarin Knudsen 	

Capstone Project

Course Code: MJ1101303			
Teaching Scheme		Examination Scheme	
Teaching	4 hours/week	Credits	4
Teaching hours/ semester	60 hours	University examination (UE- Sessional)	60 marks
Hours for Internal Assessment	12 hours	Internal Assessment (IA)	40 marks

Course Objective:

To study the interrelationship of all Courses that a student has learned in the curriculum of Sustainable Architecture.

Course Learning Outcome:

Co1	Remember- To understand a green building consultant's role of coordinating various documentation, legal and prescribed communication methods involved in green certified project's execution.
Co2	Understand- Interrelationship of all focus areas that a student has learned in the curriculum of the program.
Co3	Apply- Problem-Solving and Critical Thinking of Green Certification systems and practice in a holistic manner.
Co4	Analyze- Management and coordination involved in design and execution of a green certified project.
Co5	Evaluate- Green Building Principles , Sustainable Design, Construction and sustainability goals.
Co6	Create- Competence in transforming architectural projects to professional working documents for green certified projects.

Unit I	Detailed theoretical study.	15 hours
	A comprehensive understanding of green building concepts, including energy efficiency, water conservation, material selection, indoor environmental quality, and site selection.	
Unit-II	Studio: Project Description	45 hours
	<p>Students should select any existing academic or professional project that aligns with the course outcomes.</p> <p>A capstone project focused on green certified projects to evaluated and documented as:</p> <p>Green Building Certification: Develop project details, certification documentation and compliance requirements with a recognized rating agency involving Application and Documentation, Assessment and Audit</p> <p>Energy Efficiency and Renewable Energy: Develop a detailed energy model incorporating renewable energy sources and analyze the energy performance of different building designs.</p> <p>Investigate the effectiveness of different building envelope strategies Evaluate Optimization of Energy Performance through Passive Design Strategies.</p>	

	<p>Water Conservation Evaluate the performance of low-flow fixtures and appliances and assess its potential for reducing potable water demand.</p> <p>Material Selection and Life Cycle Analysis Develop a database of sustainable building materials based on their environmental performance and life cycle costs. Conduct a life cycle assessment (LCA) of different building materials to determine their environmental impact.</p> <p>Indoor Environmental Quality (IEQ) Investigate the impact of different ventilation strategies on indoor air quality. Evaluation, conclusion, including cost - benefit appraisal for relevance of the work.</p>	
	<p>Sessional Work: The project submission should be in the form of Drawings, calculations, models, and reports.</p>	
	<p>IA: Please refer to the guidelines given in the annexure</p>	
	<p>Textbooks and References:</p> <ul style="list-style-type: none"> ● Relevant Code Books. ● National Building Code India. ● Handbooks and Manuals of International & National Green Rating Systems 	

Dissertation -I

Course Code: RP1101305			
Teaching Scheme		Examination Scheme	
Teaching	4 hours/week	Credits	4
Teaching hours/ semester	60 hours	University examination (UE)	60 marks
Hours for Internal Assessment	12 hours	Internal Assessment (IA)	40 marks

Course Objective:

To apply the methods taught in **Research Methodology** to carry out research related to the field of Sustainable Architecture. This will help in developing research skills in terms of selecting appropriate methods to carry out research and writing paper.

Course Learning Outcome:

Co1	To remember the concepts of Research Methodology and apply them in by conducting research.
Co2	To carry out Literature Review
Co3	To formulate research design for selected research problem
Co4	To collect and analyze the data
Co5	To derive findings and discuss to arrive at conclusions
Co6	To write a research paper

Unit I	Selection of Research Topic	8 hours
	Identify area of research related to sustainable architecture & prepare a proposal, Justify the need for research.	
Unit-II	Literature Review	10 hours
	Search appropriate references from various databases Identify gaps in the literature Organize sources using a reference manager Write a literature review	
Unit III	Designing/planning research	12 hours
	Formulate a clear, concise, and researchable question and objectives If applicable, develop a hypothesis based on theoretical frameworks. Decide on qualitative, quantitative, or mixed methods based on research questions. Determine sampling strategies and data collection methods (e.g., surveys, experiments, interviews). Justify choice of methods in relation to research objectives	
Unit IV	Data Collection	12 hours
	Execute research plan systematically, develop tool to collect data, Carry out research (Field work) Maintain accurate records and organize data effectively	
Unit V	Data Analysis and validation	10 hours

	Use appropriate tools and software for qualitative and quantitative data analysis Interpret results in relation to research questions or objectives, Test hypothesis if applicable, Validate finding	
Unit VI	Reporting research	8 hours
	Present research findings, Write a research paper and publish it in a conference, journal, etc.	
Sessional Work: A research report of not more than 50 pages or a paper of approx. 3000 words on the selected area of research.		
IA: Please refer to the guidelines given in the annexure		
Textbooks and References: <ul style="list-style-type: none"> • Kothari, C. R. (2004). Research Methodology Methods & Techniques (Second Edition). New Delhi: New Age international publisher. • Sanoff, H. (1991). Visual Research Methods in Design. New York: VNR. • Bechtel, R., Marans, R., & Michelson, W. (Eds.). (1990). Methods in environmental and behavioral research (second ed.). Florida: Robert E. Krieger • Groat, L., & Wang, D. (Eds.). (2002). Architectural Research Methods: John Wiley and Son. • Yvonne N. B. (2013). How to Write a Master's Thesis (Second edition). Sage publications Inc. 		

Innovation and Entrepreneurship

Course Code: ID1101302			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE- Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

Introduction of various Aspects of Innovation and Entrepreneurship for initiating patents and startups.

Course Learning Outcome:

Co1	Remember-To describe the role of Entrepreneurs and process of Innovative thinking.
Co2	Understand-To understand opportunities for development of Business Model.
Co3	Apply-To apply techniques of Design Thinking for creating new start-ups.
Co4	Analyze-To analyze the potential of product or process for IPR.
Co5	Evaluate- To evaluate financial aspects for proposed start-up.
Co6	Create-To create a proposal for startup based on sustainable practices or products.

Unit I	Introduction to Innovation and Entrepreneurship and Identifying Opportunities for developing Business Model	8 hours
	Understanding Innovation and its Types, Role of Entrepreneurship in Economic Growth, Characteristics of Successful Entrepreneurs , Case Studies of Innovative Startups, Brainstorming and Idea Generation Techniques Market Research and Trend Analysis, Problem Identification and Validation, Customer Discovery and Persona Creation, Business Model Generation, Feasibility Study and Risk Analysis	
Unit-II	Design Thinking and Idea Generation	10 hours
	Introduction to Design Thinking Process, Prototyping and Iteration Lean Startup Methodology, Minimum Viable Product (MVP) Concept, Rapid Experimentation and Feedback Loops	
Unit III	Intellectual Property Rights and Patents	12hours
	Introduction to Intellectual Property Rights (IPR), Types of Intellectual Property (Patents, Trademarks, Copyrights, Trade Secrets), Patent Search and Patentability Assessment, Patent Application Process and Documentation, Licensing and Commercialization of Patents, Case Studies of Patent Success Stories	
Unit IV	Building a Startup based on sustainable practices /products	8 hours

	Forming a Startup Team and Defining Roles, Legal and Regulatory Considerations, Product Development and Management, Marketing and Branding Strategies, Customer Acquisition and Retention Growth Strategies and Market Expansion, Partnerships and Collaborations, Managing Operations at Scale, Measuring and Optimizing Business Performance	
Unit V	Funding and Finance Management	10 hours
	Overview of Funding Sources: Bootstrapping, Angel Investors, Venture Capital, Pitching to Investors and Creating a Pitch Deck , Understanding Term Sheets and Valuation, Financial Management for Startups, Budgeting and Cash Flow Management	
Unit VI	Capstone Project and Case Studies	12 hours
	Develop a Business Idea and Create a Lean Canvas Model Perform a Patent Search and Draft a Preliminary Patent Application Present a Startup Pitch to a Panel of Experts Analyze and Discuss Real-world Startup and Patent Case Studies	
	Sessional Work: Assignments based on contents above Class Participation and Discussions Quizzes and Assignments Project Proposal for startup	
	IA: Please refer to the guidelines given in the annexure	
	Text book and References <ul style="list-style-type: none"> ● "The Lean Startup" by Eric Ries ● "Business Model Generation" by Alexander Osterwalder ● "Zero to One" by Peter Thiel ● WIPO and USPTO Patent Databases for Research 	

Simulation and Modelling-II

Course Code: SE1101301			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE-Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To facilitate students through a pool of software programs which provide analytical skills of energy performance, lighting performance, water and material performance for selection of appropriate strategies for energy conservation.

Course Learning Outcome:

Co1	To know Simulation tools and advance digital assessing tools.
Co2	To understand Calculations of Building physics and heat transfer in buildings.
Co3	To illustrate the ways of assessing passive design strategies and energy demand in buildings
Co4	To analyze the impact of a project and suggest measures using simulation tools
Co5	To evaluate various optimization measures proposed for thermal and acoustic, aqueous lighting environments.
Co6	To integrate passive and active design strategies and energy efficiency for resource conservation.

Unit I	Introduction to Simulation Tools	8 hours
	Introduction to advanced tools for thermal, air flow and lighting simulation and their application to building design and design research. Students have to focus on Efficient Facade Design, Energy Optimization in building, HVAC design and optimization., artificial lighting qualitative and quantitative approach to resolve various challenges in building design.	
Unit-II	Performances Assessment and Inference	22hours
	Environmental software's will be introduced for assessment and representation of thermal, airflow, lighting processes and energy simulation in and around a real or virtual building and outdoor spaces. The course will allow the students to generate and analyze climate data for any site, predict micro-climate conditions, perform shading, day lighting and thermal simulation studies, calculate energy requirements and assess environmental impacts of building.	Module based distribution of teaching hours.
	Sessional Work: Students have to model and simulate a design project with a detailed report of inferences and solutions drawn from the simulation study.	
	IA: Please refer to the guidelines given in the annexure	
	Text book and References	

Elective -III

Course Code: AE1101106			
Teaching Scheme		Examination Scheme	
Teaching	2 hours/week	Credits	2
Teaching hours/ semester	30 hours	University examination (UE- Sessional)	60 marks
Hours for Internal Assessment	06 hours	Internal Assessment (IA)	40 marks

Course Objective:

To facilitate the students to learn out of a pool of specialized Courses, which provides extended scope, or which enables exposure to discipline-centric' Courses as well as cross-disciplinary Courses

Course Learning Outcome:

At the end of semester, the student will understand:

- Application of knowledge in solving a real-life problem in an analytical and scientific way.
- MOOC Courses for period of minimum of 4 weeks with certificate/any program of 30 hrs.
- Training is accepted for extra credits and completion of Elective Course

	Description	
	The student can select any one Course in semester I from the list of Courses prepared by the department. A comprehensive list of Courses to be included under three broad areas of study namely; Core, Allied and Open Electives A selected Course expertise be arranged to provide for necessary syllabus formulation and guidance to students.	
	Sessional Work: The students are expected to study the selected topic in depth under the guidance of the expertise, undertake case-studies and necessary site visits, and collect all the relevant information and present an exhaustive study report in a group.	
	IA: Please refer to the guidelines given in the annexure	

SEMESTER IV
SYLLABUS CONTENTS

POST GRADUATE DEGREE PROGRAMME
IN
M. ARCH. (Sustainable Architecture)

Dissertation II

Course Code: MJ1101401			
Teaching Scheme		Examination Scheme	
Teaching	14 hours/week	Credits	14
Teaching hours/ semester	228 hours	University examination (UE- Oral)	60 marks
Hours for Internal Assessment	42 hours	Internal Assessment (IA)	40 marks

Course Objective:

To integrate the acquired knowledge in the previous semesters into design solution.

Course Learning Outcome:

Co1	Remember- Learn and refine their architectural design skills, required to incorporate the knowledge gained from theory courses into the design solutions.
Co2	Understand- Energy conservation through site selection, planning and design; siting and orientation.
Co3	Apply- Exposure to sustainable building design in the context, building physics, energy efficiency, Luminous environment.
Co4	Analyze- Responding to thermal, lighting, acoustic and aqueous design of buildings and predicting their performance.
Co5	Evaluate- Daylighting and artificial lighting concepts, energy-efficient illumination and mechanical systems for heating and cooling.
Co6	Create- Certification report of the selected project.

Unit I	Thesis Project
	<p>PREAMBLE</p> <p>The thesis gives student an opportunity to reflect on philosophy of Sustainable Architecture and integrate the knowledge, skills acquired from the course to apply for an individual selected topic. The thesis should reflect the philosophy of Sustainable Architecture with application of simulations and calculations required to prove resource conservation reflecting all four environments</p> <p>M. Arch. Dissertations shall include:</p> <ul style="list-style-type: none"> ○ Selection of topic and preparing proposal ○ Aim, Objectives and scope of work ○ Methodology ○ Literature Survey ○ Data collection and Case Studies ○ Findings/inferences/guidelines from literature survey and case studies ○ Program formulation and analysis ○ Site selection and analysis ○ Selection of appropriate strategies and techniques ○ Formulating Approach / parameters for proposed design ○ Design solution and details ○ Verification using simulation modeling <p>A progressive evaluation of the dissertation work done by the student will be made throughout semester by the departmental</p>

	<p>evaluation committee and concerned faculty as per the schedule declared at the beginning of the term.</p> <p>The final evaluation of the dissertation work and report will be done by the Dissertation Viva-Voce board at the end of the forth semester.</p> <p>The Thesis Project should consist of 2 parts:</p> <p>A. Technical Report: well documented report consisting of hypothesis formulation, data acquisition, verification, and analysis by following qualitative and quantitative research methods.</p> <p>B. Design Solution: Self-explanatory drawings, covering various aspects of form evolution, function sustainable construction methods and technology, services integrated in design and site planning etc</p> <p>Few suggested building types are institutional projects, civic amenities, commercial, industrial, sports and recreation, administrative, transportation facilities, specialized building, etc.</p>	
Unit II	Technical Report	
	<p>A hard bound copy of original report shall be submitted, which will be certified and signed by the college authorities as authentication of the work and by the guide who has guided the work.</p> <p>Size: Project Report size A4 Sized '120 Mm x 297 mm portrait with embossed title necessarily on the spine and front page.</p> <p>Total Pages: There Shall Be Maximum 50 Pages with double side printing excluding drawings.</p> <p>Printing: Font type like Arial/ Times New Roman With 12-point size shall be used for regular typing with 15- point size shall be used for captions. The typing shall be done with 1.5 lines spacing throughout. The presentation copy shall be necessarily a hard-bound copy. The number of copies shall be as prescribed by the college. (1 copy for the student, 1 original copy for the college library and soft copy on learning management program.)</p>	
Unit III	Design Solution	
	<p>Graphically presented design solution with minimum 5000 square meters Built up area shall be in form of a drawing portfolio. It shall consist sufficient number of architectural drawings (manually drawn / computerized) with models, etc. Since the architectural project is the culmination of two years of learning in various aspects of Sustainable Architecture, it is expected that student demonstrates an ability of holistic and comprehensive thinking in the areas of all four Environments namely; Thermal, Luminous, Aqueous and Acoustic Students should provide detailed calculations and simulations for all the environments with necessary detailing.</p> <p>The portfolio will consist of drawings (minimum of 10 -A2 sheets and maximum of 15) sufficiently in detail to demonstrate consideration given to above mentioned attributes. The emphasis shall be given to self-explanatory detail drawings.</p>	
	Sessional Work: Assignments based on contents above	
	IA: Please refer to the guidelines given in the annexure	

Internship

Course Code: SE1101402			
Teaching Scheme		Examination Scheme	
Teaching	6 hours/week	Credits	6
Teaching hours/ semester	90 hours	University examination (UE- Oral)	60 marks
Hours for Internal Assessment	18 hours	Internal Assessment (IA)	40 marks

Course Objective:

To give an opportunity for learning and for development of skills related to practical aspects of the discipline of Sustainable Architecture, by working in a firm/organization working in the field of Sustainability

Course Learning Outcome:

- To apply theoretical concepts in practical settings
- To develop professional and technical skills
- Exhibit problem-solving and critical thinking abilities in a professional context.
- Understand organizational culture, ethics, and professional conduct.

	Description	
	<p>The students will need to undertake internship to get acquainted with the procedures of the professional methods of consultancy. The students will have to complete internship under a professional/institute/NGO registered with respective bodies working in the field of sustainable architecture/environment/energy/resource management or consultancy. Student can also work as a research associate with doctoral candidate/ institute.</p> <p>During the course of their tenure, they will maintain a log book of their activities on a daily basis, which will be duly signed by the employer.</p> <p>At the end internship the candidate will have to submit a training report along the certificate by the employer to the effect that he / she has completed training satisfactorily for the stipulated period. Internal Assessment shall be done on the basis log book and training report which shall comprise of hard copies of the actual work done by the student, including reports on meetings attended, site visits performed and any work of special mention etc.</p>	