GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Declared as Deemed to be University u/s 3 of UGC Act. 1956)

Visakhapatnam | Hyderabad | Bengaluru

Accredited by NAAC with A+ Grade

REGULATIONS AND SYLLABUS

of

Master of Architecture (Sustainable Architecture)

(w.e.f. Academic Year 2018-19)

Website: www.gitam.edu

SCHOOL OF ARCHITECTURE
GITAM (Deemed to be University)
REGULATIONS
Master of Architecture (Sustainable Architecture)
(w.e.f. 2018-19 Academic Year)

1.0 ADMISSIONS

1.1 Admissions into 2 year Master of Architecture (Sustainable Architecture) programme of GITAM (Deemed to be University) are governed by GITAM (Deemed to be University) admission regulations and as per norms of Council of Architecture (CoA), New Delhi.

2.0 ELIGIBILITY CRITERIA

2.1 The candidate with a minimum of 50% marks in aggregate in a Bachelor of Architecture degree course recognized by the Council of Architecture shall be admitted to the post graduate course in architecture.

3.0 CHOICE BASED CREDIT SYSTEM

3.1 Choice Based Credit System (CBCS) is introduced with effect from the admitted batch of 2017-18 based on UGC guidelines in order to promote:

(i) Student centered learning
(ii) Cafeteria approach
(iii) Students to learn courses of their choice
(iv) Learning at their own pace
(v) Interdisciplinary learning

3.2 Learning goals/objectives and outcomes are specified, focusing on what a student should be able to do at the end of the program.

4.0 STRUCTURE OF THE PROGRAMME

4.1 The Programme of instruction consists of:

- Core Courses (compulsory) which give general exposure to a Student in Architecture and Sustainable Architecture and subject related area.
- Programme Electives which are supportive to the discipline and gives expanded scope of the course.
- Open Electives are of general nature either related or unrelated to the discipline.
- Carryout design thesis approved by the faculty of architecture and submits a portfolio.

4.2 Each academic year consists of two semesters. The curriculum and course content (syllabi) for the M.Arch. (Sustainable Architecture) programme is recommended by the Board of Studies in Architecture and approved by Academic Council.

4.3 Each course is assigned certain number of credits which will depend upon the number of contact hours (lectures/tutorials) per week.

4.4 The curriculum of M.Arch. (Sustainable Architecture) programme is designed to have a total of 79 credits for the award of M.Arch. (Sustainable Architecture) degree.

5.0 MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6.0 REGISTRATION

Every student has to register himself/herself for each semester individually at the time specified by the School / University.

7.0 ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/She has to repeat the semester along with his/her juniors.

7.2 However, the Vice Chancellor on the recommendation of the Principal/Director of the Institute/School may condone the shortage of attendance of the students whose attendance is between 66% and 74% on genuine grounds and on payment of prescribed fee.

8.0 EVALUATION

8.1 The assessment of the student's performance in theory courses will be based on two components: Continuous Evaluation (50 marks) and Semester-end Examination (50 marks).

8.2 A student has to secure an aggregate of 45% in the two components of the course put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 45% in the Semester-end Examination component of the respective course.

8.3 Practical Courses, Design Studios (I, II & III Semesters) and Design Thesis (IV Semester) are completely assessed under Continuous Evaluation. A student has to secure a minimum of 45% marks in each course to be declared to have passed the course.

8.4 The pass percentage shall not be less than 45% in any subject and shall not be less than 50 % in the aggregate.

Details of assessment procedure are furnished below in Table 1.

Table 1: Assessment Procedure

S.No.	Component of assessment	Marks allotted	Type of Assessment	Scheme of Examination
1	**Theory Course**	50	Continuous Evaluation	(i) Two mid semester examinations shall be conducted for fifteen (15) marks each. (ii) Fifteen (15) marks are allotted for assignments. (iii) Five (5) marks are allotted for attendance.
		50	Semester-end Examination	Fifty (50) marks are allotted for the semester-end examination.
	Total	**100**		
2	**Practical Course**	**100**	Continuous Evaluation	(i) Ninety (90) marks are allotted for course work. (ii) Ten (10) marks are allotted for attendance.
3	**Design Studio (I, II & III Semesters)**	**400**	Continuous Evaluation	(i) Two Hundred (200) marks are allotted for course work. (ii) One Hundred and Sixty (160) marks are allotted for the external viva-voce.

				(iii) Forty (40) marks are allotted for attendance.
4	**Design Thesis (IV Semester)**	**800**	Continuous Evaluation	(i) Four Hundred and Eighty (480) marks are allotted for course work. (ii) Three Hundred and Twenty (320) marks are allotted for the external viva-voce.

9.0 REAPPEARANCE

9.1 A student who has secured 'F' Grade in a theory course shall have to reappear at the subsequent semester-end examination held for that course.

9.2 A student who has secured less than 45% of the maximum marks in the continuous evaluation component of any course is eligible to attend Special Instruction classes held during summer vacation, by paying the prescribed fee. However a student is permitted to attend **"only once"** in that particular course during his/her entire program of study.

9.3 A student who has secured 'F' Grade in Design Thesis (AAR922) shall have to improve his/her port-folio and reappear for viva-voce at the time of special examination to be conducted in the summer vacation.

10.0 SPECIAL EXAMINATION

10.1 A student who has completed his/her period of study and still has "F" Grade in a maximum of three theory courses, is eligible to appear for the special examination, which shall be conducted in the summer vacation.

11.0 BETTERMENT OF GRADES

11.1 A student who has secured only a pass or second class and desires to improve his/her grades can appear for betterment examination only in theory courses of any semester of his/her choice, conducted in summer vacation along with the special examination. Betterment of Grades is permitted **"only once"** immediately after completion of the program of study.

12.0 GRADING SYSTEM

12.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades & Grade Points

SL No	Grade	Grade points	Absolute Marks
1	O (Outstanding)	10	90 and above
2	A+(Excellent)	9	80 – 89
3	A (Very good)	8	70 – 79
4	B+ (Good)	7	60 – 69
5	B (Above Average)	6	55 – 59
6	C (Average)	5	50 – 54
7	P (Pass)	4	45 – 49
8	F (Fail)	0	Less than 45
9	Ab (Absent)	0	---

12.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5 for a Pass in the semester.

13.0 GRADE POINT AVERAGE

13.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma [CxG]}{\Sigma C}$$

Where

C = number of credits for the course,

G = grade points obtained by the student in the course.

13.2 Semester Grade Point Average (SGPA) is awarded to those candidates who pass in all the courses of the semester.

13.3 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time.

13.4 CGPA required for classification of class after the successful completion of the programme is shown in Table 3.

Table 3: CGPA required for award of Degree

Class	CGPA Required
First Class with Distinction	≥ 8.0*
First Class	≥ 7.0
Second Class	≥ 6.0
Pass	≥ 5.0

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses of every semester in **first attempt**.

14.0 ELIGIBILITY FOR AWARD OF THE M. ARCH. (SUSTAINABLE ARCHITECTURE) DEGREE

14.1 **Duration of the programme**:
A student is ordinarily expected to complete the M. Arch. (Sustainable Architecture) programme in four semesters of two years. However, a student may complete the programme in not more than four years including study period.

14.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

14.3 A student shall be eligible for award of the M. Arch. (Sustainable Architecture) degree if he/she fulfills all the following conditions.

a) Registered and successfully completed all the courses and projects.
b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.
c) Has no dues to the School, Hostels, Libraries, NCC, NSS etc, and
d) No disciplinary action is pending against him/her.

15.0 DISCRETIONARY POWER

Not withstanding anything contained in the above sections, the Vice-Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

RULES

1. In respect of all theory examinations, the paper setting shall be done by an external paper setter having a minimum of three years of teaching experience. The panel of paper setters for each course is to be prepared by the Board of Studies of the school concerned and approved by the Academic Council. The paper setters are to be appointed by the Vice Chancellor on the basis of recommendation of Director of Evaluation / Controller of Examinations.

2. The theory papers of end-semester examination will be evaluated by internal/external examiner.

3. Panel of examiners of evaluation for each course is to be prepared by the Board of Studies of the department concerned and approved by the Academic Council.

4. The examiner for evaluation should have a minimum of three years teaching experience.

5. The appointment of examiners for evaluation of theory papers will be done by the Vice Chancellor on the basis of recommendation of Director of Evaluation / Controller of Examinations from a panel of examiners approved by the Academic Council.

6. The attendance marks for each course shall be allotted as follows:

Percentage of Attendance	**Marks for Attendance**		
	50 Marks Continuous Evaluation Component Course	**100 Marks Continuous Evaluation Component Course**	**400 Marks Continuous Evaluation Component Course**
76% to 80%	1	2	4
81% to 85%	2	4	8
86% to 90%	3	6	12
91% to 95%	4	8	16
96% to 100%	5	10	20

SYLLABUS

I - SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR801	Sustainable Development & Environmental Management	3	0	0	3	50	50	100	3
2	AAR803	Sustainable and Green Building Design	3	0	0	3	50	50	100	3
3	AAR805	Sustainable, Energy Efficient Building Materials & Technologies	3	0	0	3	50	50	100	3
4	AAR807	Solar Passive Architecture	3	0	0	3	50	50	100	3
5	AAR809	Sustainability and Energy Conservation in Landscape Architecture	3	0	0	3	50	50	100	3
6	AAR821	Design Studio - I	0	9	0	6	400	-	400	Viva-Voce
Total			**15**	**9**	**0**	**21**	**650**	**250**	**900**	
Total Hrs. per week			**24**							

II – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR802	Sustainable Urban Design	3	0	0	3	50	50	100	3
2	AAR804	Research Methodology in Architecture	3	0	0	3	50	50	100	3
3	AAR806	Performance Evaluation of Buildings	2	0	2	3	50	50	100	3
4	AAR808	Sustainable Infrastructure & Services	3	0	0	3	50	50	100	3
5	AAR822	Design Studio - II	0	9	0	6	400	-	400	Viva-Voce
6	AARxxx	Program Elective - I	3	0	0	3	50	50	100	3
Total			**14**	**9**	**2**	**21**	**650**	**250**	**900**	
Total Hrs. per week			**25**							

III – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR901	Low Cost Housing	3	0	0	3	50	50	100	3
2	AAR903	Disaster Management	3	0	0	3	50	50	100	3
3	AAR905	Remote Sensing & Geographical Information Systems	2	0	2	3	50	50	100	3
4	AAR921	Design Studio - III	0	9	0	6	400	-	400	Viva-Voce
5	AAR923	Research Seminar	0	0	3	2	100	-	100	-
6	AARxxx	Program Elective - II	3	0	0	3	50	50	100	3
Total			**11**	**9**	**5**	**20**	**700**	**200**	**900**	
Total Hrs. per week			**25**							

IV – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR922	Design Thesis	0	21	0	14	800	-	800	Viva-Voce
2	AOExxx	Open Elective - I	3	0	0	3	50	50	100	3
Total			**3**	**21**	**0**	**17**	**850**	**50**	**900**	
Total Hrs. per week			**24**							

Program Elective – I

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR842	Tall Buildings	3	0	0	3	50	50	100	3
2	AAR844	Intelligent Buildings	3	0	0	3	50	50	100	3
3	AAR846	Project Management	3	0	0	3	50	50	100	3

Program Elective – II

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR941	Real Estate Management	L	3	0	3	50	50	100	3
2	AAR943	Adaptive Reuse & Retrofit of Buildings	L	3	0	3	50	50	100	3
3	AAR945	Urban Planning: Principles and Techniques	L	3	0	3	50	50	100	3

Open Elective – I

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AOE202	German for Beginners	L	3	0	3	50	50	100	3
2	AOE204	French for Beginners	L	3	0	3	50	50	100	3

I - SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR801	Sustainable Development & Environmental Management	3	0	0	3	50	50	100	3
2	AAR803	Sustainable and Green Building Design	3	0	0	3	50	50	100	3
3	AAR805	Sustainable, Energy Efficient Building Materials & Technologies	3	0	0	3	50	50	100	3
4	AAR807	Solar Passive Architecture	3	0	0	3	50	50	100	3
5	AAR809	Sustainability and Energy Conservation in Landscape Architecture	3	0	0	3	50	50	100	3
6	AAR821	Design Studio - I	0	9	0	6	400	-	400	Viva-Voce
Total			**15**	**9**	**0**	**21**	**650**	**250**	**900**	
Total Hrs. per week			**24**							

AAR 801	SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarize the strategies and concepts of sustainable development.
- To create awareness about the legislative mechanisms for environmental protection and Environmental Impact Assessment (EIA) methods and procedures.

UNIT I

OVERVIEW OF SUSTAINABLE DEVELOPMENT

Genesis and Principles of Sustainable Development, Overview of International and National policies and programmes- Stockholm Conference, Bruntland Commission, Earth Summit, Agenda21, Kyoto protocol and other emerging issues,.

UNIT II

SUSTAINABLE DEVELOPMENT FOR RESOURCE CONSERVATION

Strategies and concepts of Sustainable Development for resource conservation as relevant to settlement planning and design.

UNIT III

ENVIRONMENTAL PLANNING TECHNIQUES

Definition of environmental planning terms, Environmental Planning techniques: analysis and carrying capacity, ecological footprint and land suitability, vulnerability assessment and microzonation, pollution modeling, eco-city development, etc.

UNIT IV

CASE STUDIES AND APPLICATION OF CONCEPTS

Case studies of application of concepts at various scales: regional, settlement and buildings with emphasis on urban ecosystems, green buildings, pollution control, energy use, water harvesting, waste treatment and waste management, etc.

UNIT V

STATUTORY ACTS, REGULATIONS AND ENVIRONMENTAL IMPACT ASSESMENT

Statutory Acts, Regulations and Notifications (Coastal Zone regulations, Pollution Control Act, etc.), Definition of Environmental Impact Assessment (EIA), Methods of EIA, procedures and formats, important clearances, time frame, legal framework of EIA, Case studies of EIA as relevant to urban design projects

OUTCOMES

- The student will develop a concern for the protection of the natural environment and gain an understanding of techniques for sustainable development applied to urban design, planning and architecture.

- The student will become aware of legislative mechanisms for environmental protection.

REFERENCES

1. Bob Doppelt. The Power of Sustainable Thinking, Earthscan, 2010
2. Paul Appleby, Integrated Sustainable Design of Buildings, Earthscan, 2010
3. Tillman Lyle, J. Regenerative Design for Sustainable Development, John Wiley and Sons, 1966.
4. Van der Ryn, S. Ecological Design, Island Press, 1995.
5. Kirkby J, O, Keefe P and Timberlake, Sustainable Development, Earthscan Publications.
6. Singh O P. Environment and natural resources, Regency Publications, New Delhi, 2006.
7. Carter, L. Environmental Impact Assessment, McGraw Hill, New Delhi, 1966.
8. Rana SVS. Essentials of Ecology and Envronmental Science, Prentice Hall of India, New Delhi, 2005.

AAR 803	SUSTAINABLE AND GREEN BUILDING DESIGN	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To sensitize about the various aspects of sustainable and green building design in the context of global warming and climate change.
- To study the building materials for its impact on environment.

UNIT I

INTRODUCTION

A historical perspective. General premises and strategies for sustainable and green design, objectives and basis. Bio-mimicry as a design tool based on ecosystem analogy.

UNIT II

GREEN CONSTRUCTION AND ENVIRONMENTAL QUALITY

Sustainable architecture and Green Building: Definition, Green building evaluation systems; LEED Certification; Green Globe Certification; Case studies which look at the environmental approach; Renewable Energy; Controlling the water cycle, Impact of materials on environment; Optimizing construction; Site management; Environmental management of buildings.

UNIT III

PASSIVE DESIGN IN MATERIALS

Passive Design and Material Choice – Traditional Building Materials – Importance of envelope material in internal temperature control – Specification for walls and roofs in different climate – Material and Humidity Control.

UNIT IV

ECO HOUSE

The form of the house, the building as an analogy. Building concepts: energy loss, insulation, passive solar gain, active solar gain, health benefits, sustainable materials. Small scale wind and hydro power systems. Case study of eco house.

UNIT V

SUSTAINABLE AND GREEN BUILDING DESIGN STUDIO

This studio will explore collaborative learning to explore, investigate and apply various parameters of sustainability for design development of projected building/ urban scenarios.

OUTCOMES

- An understanding on sustainability.
- Knowledge on renewable energy conservation through material usage.
- A thorough understanding on designing green buildings.

REFERENCES

1. Ken Yeang: Eco Design- A manual for Ecological design; Wiley Academy, 2006.
2. Sue Roaf et all: Ecohouse, A design guide; Elsevier Architectural Press, 2007.
3. Thomas E Glavinich: Green Building Construction; Wiley, 2008.
4. Brenda and Robert Vale: Green Architecture, Design for a Sustainable Future; Thames and Hudson, 1996.
5. Daniel Vallero and Chris Brasier: Sustainable Design - The science of sustainability and Green Engineering; Wiley, 2008.

		L	P	S	Credits	Total Marks
AAR 805	**SUSTAINABLE, ENERGY EFFICIENT BUILIDING MATERIALS AND TECHNOLOGIES**	3	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of Energy.
- To study the building materials and its impact on environment.
- To provide an insight into various Energy Efficient Materials and Sustainable Construction Technology

UNIT I

Energy Efficiency – Energy Conservation – Recourse Consumption – Introduction – Distribution of Energy use in India – Factors affecting the Energy use in Buildings – Pre Building Stage, Construction Stage & Post Occupancy stages – Concept of Embodied Energy – Energy needs in Production of Materials – Transportation Energy – Concept of light footprint on Environment

UNIT II

ENVIRONMENTAL IMPACT OF BUILDING MATERIALS

Measuring the impact of building materials; calculating embodied energy, recycling and embodied energy, processing and embodied energy, time and embodied energy, embodied energy of different building materials, low energy building and masonry materials, life cycle and analysis (life cycle analysis can be after embodied energy); Case studies and analysis.

UNIT III

RECYCLABLE AND RENEWABLE MATERIALS

Concept of Recyclable materials – Sustainable Building Materials – Life Cycle Design of Materials – Biodegradable & Non-Biodegradable Materials – Green rating and Building Materials — Concept of Resource reuse, Recycled content, Regional materials, Rapidly renewable materials – Fly ash bricks, Cement – Recycled Steel, Bamboo based products

UNIT IV

SUSTAINABLE CONSTRUCTION

Design issues relating to sustainable development including site and ecology, community and culture, health, materials, energy, and water- Domestic and Community buildings using self-help techniques of construction; adaptation, repair and management.-.portable architecture

UNIT V

ENERGY EFFICIENT TECHNOLOGIES

Energy Efficient Construction Technology – Filler Slab – Rat trap Bond – Technologies developed by CBRI

Traditional Building Construction Technologies – Introduction to other Technological interventions to save Energy – Intelligent Buildings – Energy Conservation through Technological intervention – Saving Energy used for lighting by design innovation – Case studies.

OUTCOMES

- Insight on environmental impact of building materials.
- Understanding of building materials and construction techniques that are sustainable and energy efficient.

REFERENCES

1. Koenigsberger O.H, T.G. Inger Soll, "Manual of tropical Housing and Building" Longman Group United Kingdom, 2012.
2. Bansal Naveendra K., Hauser Gerd and Minke Gernot, "Passive Buildings Designs : Handbook of Natural Climatic Control", Elsevier Science, Amsterdam, 1997.
3. Givonji B., "Man, Climate and Architecture", Elsevier, Amsterdam, 1986.
4. Watson Donald, 'Climatic Design: Energy Efficient Building Principles & Practices", Mc Graw Hill Book company, New York, 1993.

AAR 807	SOLAR PASSIVE ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To study the principles of solar passive architecture.
- To understand the concept of thermal energy flow.
- To study various solar passive techniques used in different climatic conditions.

UNIT I

INTRODUCTION

PRINCIPLES OF SOLAR PASSIVE ARCHITECTURE

Simple Techniques which can be incorporated in a building without any additional cost such as: Site condition, building orientation, plan form and building envelope

UNIT II

ADVANCED SOLAR PASSIVE TECHNIQUES

Direct gain, Thermal storage wall, trombe wall, water wall, solar chimney, Transwall, Thermal storage / Roof Pond/ Skytherm, Roof radiation trap, Solarium, Isolated Gain

UNIT III

PASSIVE COOLING CONCEPTS

Evaporative cooling, Nocturnal radiative cooling, Passive descant cooling, Induced ventilation, Earth sheltering/berming, Wind tower, Earth-air tunnels, Insulation, Varytherm wall.

UNIT IV

DESIGN GUIDELINES

Design guidelines for Hot and Dry Climate, Warm and Humid Climate and Moderate climate with reference to resisting heat gain, orientation and planform, building envelope, fenestraration, color and texture of walls and daylighting.

UNIT V

TECHNIQUES FOR ESTIMATING THERMAL PERFORMANCE

Building thermal simulation flow path, simplified method for performance evaluation, Heat gain in conditioned and non-conditioned buildings. Mathematical models of heat transfer phenomenon through building components: transfer function methods and numerical methods – Models of radiative and convective heat transfer phenomena with buildings.

OUTCOMES

- Insight on various methods of passive heating and passive cooling techniques without use of mechanical or electrical devices.
- Understanding on various methods to calculate heat transfer through various components of buildings.

REFERENCES

1. Givoni Baruch, Passive and Low Energy Cooling of Buildings, Van Nostrand Reinhold, New York, 1994.
2. Sodha, M., Bansal, N. K., Bansal, P. K., KuMEB, A., and Malik, M. A. S., Solar Passive Buildings, Pergamon Press, Oxford, 1986.
3. Bansal Narendra, K., Hauser Gerd and Minke Gernot, Passive Buildings Design: A Hand book of Natural Climatic Control, Elsevier Science, Amsterdam, 1994.
4. Goulding, John, R., Lewis, Owen, J., and Steemers, Theo, C., Energy in Architecture, Bastford Ltd., London, 1986

		L	P	S	Credits	Total Marks
AAR 809	**SUSTAINABILITY AND ENERGY CONSERVATION IN LANDSCAPE ARCHTECTURE**	3	0	0	3	100

COURSE OBJECTIVES

- To understand how landscaping can be used in a sustainable manner for modifying microclimate reducing energy and resource use.

UNIT I

PARADIGM SHIFT IN LANDSCAPING THOUGHT

Paradigm shift in landscaping thought, the present day energy crisis, Paradigm shift in landscaping significance of energy conservation, landscaping as a passive tool for energy conservation.

UNIT II

SUSTAINABLE SITE

Sustainable site – LEEDS, BREAM,GRIHA rating, soil erosion and sedimentation control, natural topography and vegetation, preservation or transplantation of trees, heat island reduction through vegetation urban development, landscape and exterior design etc., Green landscaping in the context of sustainability, Ecology and sustainability.

UNIT III

LANDSCAPE DESIGN FOR MICROCLIMATE MODIFICATION

Role of trees, shrubs and groundcover in reducing the impact of direct and reflected radiation, shading of walls and roofs with trees and vines, green roofs, shelter belts and plantations for mitigating adverse winds, noise reduction in highways through tree plantation, and planting for pollution control.

UNIT IV

LANDSCAPE ISSUES AND SUSTAINABILITY ISSUES

Use of Vegetation, Water, Earth and Stones in Landscape designs, Concept of Native Plants, Principles of Xeriscaping, Organic Gardening, Bio-Filtering, Bio-Swales, Rain Gardens, Green Roofs and Walls, Vertical landscaping and living walls.

UNIT V

SUSTAINABLE LANDSCAPE PRACTICES

Sustainable landscape, low cost maintenance and management of landscapes, Sustainable planning and city form. Sustainable urban landscape, landscape sustainability at the national and regional level.

OUTCOMES

- Understanding of Sustainable Landscaping from macro to micro level.
- Knowledge on Energy conscious Landscape design

REFERENCES

1. John.F.Benson and Maggie.H.Roe, Landscape and sustainability, John Wiley Publication, Newyork, 2000.
2. O.R.Gray, Landscape Planning for energy conservation, Van Nostrand Reinhold, 1983.
3. Anne simon Moffat and Marc Schiler, Landscape design that saves energy, William Monow and Co.,Inc., New York, 1981.
4. Publications of Centre for Science and Environments, New Delhi and TERI. 5. Grady Clay, Water and the Landscape McGraw-Hill Inc.,US; First Edition edition 1979.

AAR 821	DESIGN STUDIO - I	L	P	S	Credits	Total Marks
		0	0	9	6	400

COURSE OBJECTIVES

- To enable the student to understand the underlying concepts of Sustainable Architecture, to experiment and utilize them in various aspects of building design.
- To train the student to derive sustainable solutions at an individual building level.

DESIGN PROBLEM

The design studio is focused on to explore the role of Site Planning, spatial design, building materials, construction technology, landscape and other components in achieving sustainability. The Studio work includes both, the quantitative and qualitative analysis of buildings and the role of each of the above components in achieving sustainability. Passive design strategies are to be explored in contemporary architecture.

The studio will experiment on designing an individual building, like, a residence, primary school, health center, small office, etc. situated in one of the climatic zones in India. In-depth analysis of the local climate, site conditions, usage characteristics of the premises, user-groups' functional and physiological needs, and aspirations should guide the student in deriving appropriate building geometry, orientation, blending of built, semi-open and open spaces, and usage of suitable building elements to achieve a sustainable building design solution.

PRESENTATIONS & VIVA VOCE

Stage-wise progress of student's approach to design is continually evaluated by the Studio-In-charges at various internal juries, followed by a final presentation at the Semester-end Design-Jury.

Viva-Voce on the project would be conducted by an external jury to examine the prudence of the student in deriving the design solution, reviewing the complete work done during the design studio.

II – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR802	Sustainable Urban Design	3	0	0	3	50	50	100	3
2	AAR804	Research Methodology in Architecture	3	0	0	3	50	50	100	3
3	AAR806	Performance Evaluation of Buildings	2	0	2	3	50	50	100	3
4	AAR808	Sustainable Infrastructure & Services	3	0	0	3	50	50	100	3
5	AAR822	Design Studio - II	0	9	0	6	400	-	400	Viva-Voce
6	AARxxx	Program Elective - I	3	0	0	3	50	50	100	3
Total			**14**	**9**	**2**	**21**	**650**	**250**	**900**	
Total Hrs. per week			**25**							

Program Elective – I

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR842	Tall Buildings	3	0	0	3	50	50	100	3
2	AAR844	Intelligent Buildings	3	0	0	3	50	50	100	3
3	AAR846	Project Management	3	0	0	3	50	50	100	3

AAR 802	SUSTAINABLE URBAN DESIGN	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce concepts of sustainability related to urban design

UNIT I

CLIMATE CONSIDERATIONS IN URBAN DESIGN

Urban Climatology

General characteristics of the urban climate, the Urban Temperature, The Heat Island Phenomenon, Heat Island models, Impact of the Nocturnal Urban Heat Island Phenomenon on Human Comfort, Health and Energy Use in Different Climates, Urban Radiation and Sunshine, the Urban Wind Field.

UNIT II

URBAN DESIGN EFFECTS ON THE URBAN CLIMATE

Effect of size of cities on the Urban Heat Island, Climatic effects of Density of the Built-Up Area, Climatic impacts of Density on Energy Demand and Potential for Solar Energy Utilization, Urban Density and the Urban Wind Field, Pedestrian Reactions to Excessively Windy Environments, Wind Environment in the vicinity of Tall Buildings.

UNIT III

NEIGHBOURHOOD PLANNING AND URBAN DESIGN STRATEGIES

Impact of built density, building footprint urban form including height and geometry, transport planning, land-use zoning strategies, landscape planning etc.

UNIT IV

URBAN RENEWAL AND INNER CITY REGENERATION

Concepts related to urban renewal namely inner city regeneration, revitalization of "townships" and informal settlement /slum upgrading.

UNIT V

SOLAR CITIES AND SMART CITIES

Objectives and approaches of Solar Cities Programme under MNRE(Ministry of New and Renewable Energy Programmme, and ISCI (International Solar Cities Initiative), and Concepts and Principles relating to Smart Cities Mission under MUD (Ministry of Urban Development) including waste management, water management, energy management, urban mobility, etc.

OUTCOMES

- The students will acquire necessary skills to work on urban design projects to make them sustainable.

REFERENCES

1. Alexander, C. Pattern Language, Oxford University Press, 1977.
2. Farr, D. Sustainable Urbanism: Urban Design with Nature, John Wiley & Sons Inc, 2007
3. Gallion, A. The Urban Pattern, CBS Publishers & Distributors, India, 2003.
4. Lynch, K. Image of the city. MIT Press, London, 2000.
5. Watson, D; et al. Time Saver Standards for Urban Design, McGraw Hill, New York, 2003.
6. Emmanuel., R., An urban approach to climate sensitive design: strategies for the tropics, Span Press, Taylor and Francis Group, 2005.
7. UDPFI Guidelines, Part I and Part II. Ministry of Urban development and Poverty Alleviation, Government of India, 1996.

AAR 804	RESEARCH METHODOLOGY IN ARCHITECTURE	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enhance the understanding of role of research in Architecture
- To increase the student's abilities to interpret, evaluate and conduct research

UNIT I

INTRODUCTION

Basic research issues and concepts, Orientation to research process, Types of research: quantitative, qualitative, co-relational, experimental, simulation and modeling, logical argumentation, case study and mixed methods

UNIT II

RESEARCH PROCESS

Elements of research process: Finding topic- Writing and introduction- Stating a purpose of study identifying key research questions and hypotheses- Reviewing literature using theory, defining and stating the significance of the study, methods and procedures for data collection and analysis.

UNIT III

RESEARCHING AND DATA COLLECTION

Library and archives- The role of Internet, finding and evaluating sources of misuse, Test for reliability ethics- Methods of data collection- From primary sources: observation and recording, interviews: structured and unstructured, questionnaire, open ended and close ended questions, Problems encountered in collections data from secondary sources.

UNIT IV

REPORT WRITING

Writing and publishing the research works in journals- Research writing in general- Components: Referencing- Writing the Bibliography- Developing the outline, presentation, etc.

UNIT V

CASE STUDIES

Case studies illustrating how good research can be used from project inception to completion- review of research publications

OUTCOMES

- The student will develop necessary skills to identify and interpret issues relating to Sustainable Architecture, based on research inquiry methods.
- The student will learn how to write and publish research work in journals

REFERENCES

1. Iain Borden and Kaaterina Ruedi, The Dissertation: An Architecture Student's Handbook, Architectural Press, 2000
2. Linda Grant and David Wang, Architectural Research Methods, John Wiley Sons,2001.
3. John W.Creswell, Research Design: Qualitative, Quantitative and Mixed Methods and Approaches, Sage Publications, 2002.
4. Ranjitth Kumar, Research Methodology- A step by step guide for beginners, Sage Publications, 2005.

AAR 806	PERFORMANCE EVALUATION OF BUILDINGS	L	P	S	Credits	Total Marks
		2	2	0	3	100

COURSE OBJECTIVES

- To investigate the simulation and audit techniques for assessing the energy performance, environmental response and impact of built form.

UNIT I

INTRODUCTION TO BUILDING PERFORMANCE EVALUATION

Emerging role of performance evaluation in building design and Master Planning. E's of sustainability – Integrated approach to environmental design – Case studies – Cognitive, analytical and simulated modeling and design of buildings. Net Zero Energy Building.

UNIT II

ENVIRONMENTAL ASSESSMENT METHODS AND MODELLING FOR PASSIVE SYSTEMS

Modelling and experimental techniques for building assessment/ evaluation and design – Basics of thermal comfort, solar shading/access/control, day lighting, acoustics air movement etc. – issues and opportunities with current assessment modes/evaluation tools – Evaluation assessment based on building type/function and program

UNIT III

ENERGY MODELLING

Computer based simulation. Building performance with respect to function, program, micro climate, urban planning, envelope design, material –.Energy Modelling and performance simulation of existing buildings – residential – institutional – design of a new residential building.

UNIT IV

POST OCCUPANCY EVALUATION OF BUILDINGS

Building performance benchmarks – rating and comparison of buildings. Techniques, methods and procedures of post occupancy evaluation. Students are required to carry out post occupancy evaluation of a building and document the relationship between building design, energy use, occupant satisfaction, and environmental impact and report their observations. Assessing existing buildings on their energy use, environmental impact and occupant satisfaction.

UNIT V

SEMINAR AND CASE STUDY PRESENTATION

Case study presentation of students on performance evaluation of a building identified by them and. approved by the course faculty – Seminar on topics approved by the course faculty.

OUTCOMES

- The students will gain knowledge on environmental assessment methods, audit and simulation techniques.
- Add value to architectural design processes and equip students with energy modeling skills.

REFERENCES

1. Energy Audit of Building Systems – Moneef Kranti (Ph. D) – CRC Press 2000
2. Clarke, J.A., Energy Simulation in building design, Adam Hilger Ltd, Bristol, 1985
3. ESRU., "ESP – A Building Energy Simulation Environment; User Guide Version 9 Series. "ESRU Manual U 96/1, University of Starthclyde, Energy Systems Research Unit, Glasgow, 1996.
4. Kabele, K., Modeling and analyses of Passive solar systems with computer simulation, in Proc. Renewable energy sources, PP. 39 – 44, Czech Society for Energetics Kromeriz 1998.
5. James Douglas "Building Adaptation", Elsevier, Oxford 2002.

AAR 808	SUSTAINABLE INFRASTRUCTURE AND SERVICES	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To expose the students to the norms and standards for designing of the infrastructure services required for housing.
- To enable the students to have a sound knowledge about the current/innovative practices in water supply, sewerage system and solid waste management.
- To expose the students to the services required for multistoried buildings.

UNIT I

STANDARDS AND GUIDELINES

Norms and standards for infrastructure planning, National and local guidelines.

UNIT II

WATER SUPPLY SYSTEMS

Quality and quantity requirements; sources; collection and conveyance of water; treatment methods; treatment plant location; planning distribution systems and their zoning with respect to urban structure, rain water harvesting, water recycling with special reference to Housing disposal.

UNIT III

WASTE WATER DISPOSAL SYSTEMS

Separate and combined systems; characteristics of waste water; Industrial pollutants and their effects; waste water treatment methods; planning and location of treatment plants; disposal of municipal and industrial effluents, effects on rivers and water bodies; legal aspects. Innovative approach to optimal use of waste and separations of waste water and Grey water for disposal / recycling.

UNIT IV

SOLID WASTE MANAGEMENT SYSTEM

Elements of solid wastes management; classification and properties of solid wastes; on site collection, storage, transportation and disposal of solid wastes; processing and treatment of solid wastes; various social aspects of the solid waste management, source segregation and dispersal.

UNIT V

SPECIAL SERVICES FOR MULTISTOREYED BUILDINGS

Planning for elevators, standby electrical supply, planning for emergency escape, garbage disposal system for high rise buildings, firefighting services, piped gas supply, methods for energy efficient systems in renewable and non-conventional energy resources.

OUTCOMES

The students should be able to:

- Take a critical stand on the norms and recommendations provided by the guidelines
- Apply knowledge gained on implementation techniques in execution of projects
- Implement innovative disposal systems for multi storied housing including recycling methods

REFERENCES

1. T.P.Salvats, Environmental engineering and Sanitation, Wiley and Sons , New York,1972.
2. Steel E.W. Water supply and Sewerage , Mc Graw Hill Book Co.Inc., New York ,1984.
3. CPHEERI, M/c UA and e, Manual on Water Supply and Sewerage, New Delhi ,1991.
4. United Nations, Bureau of Solid waste Management, BSWM,Washington,DC,1970.

AAR 822	DESIGN STUDIO - II	L	P	S	Credits	Total Marks
		0	0	9	6	400

COURSE OBJECTIVES

- To enable the student to explore Sustainability principles, to experiment and utilize them in various aspects of neighborhood design at a Campus-level.
- To train the student to focus on the study and analysis of energy efficient principles, environmental regulations and use of innovative materials and techniques in deriving the design solutions.

DESIGN PROBLEM

This Studio explores the application of sustainable principles in projects of large-scale like, Group-housing project, residential school, Office or Shopping Complex, etc. at a Campus level. Relevance of environmental impact assessment as an evaluation tool in projects from micro to macro levels is to be studied. Study and analysis of existing mega projects and proposals is also to be made part of the studio work.

The approach to design is with a focus on integrated energy design of interdisciplinary nature. Emphasis shall be on building systems and services and their integration in architecture to derive comfortable micro- climate in a resource efficient manner, to ensure a successful functioning of these systems in architecture. Students will also get acquainted with Green Rating System and their application building performance appraisal.

Assessment will be based on breadth and depth of sustainability targets set in terms of LEED/GRIHA/BEE ratings and the degree to which these are met. Learning outcomes include the questioning of the traditional design process, the management of conflicts and tradeoffs, and the potential synergy between passive design principles, electro-mechanical systems and Green technologies.

PRESENTATIONS & VIVA VOCE

Stage-wise progress of student's approach to design is continually evaluated by the Studio-In-charges at various internal juries, followed by a final presentation at the Semester-end Design-Jury.

Viva-Voce on the project would be conducted by an external jury to examine the prudence of the student in deriving the design solution, reviewing the complete work done during the design studio.

AAR 842	TALL BUILDINGS	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To expose the students to various types of structural systems employed in tall buildings
- To enable the students to acquire knowledge on various building service systems required in tall buildings.

UNIT I

GENESIS OF TALL BUILDINGS

Definition of Tall Buildings, Evolution of Tall Buildings, Historical Background, Functional Requirements, Lateral load design philosophy, Concept of premium for height, relative structural cost, factors for reduction in the weight of structural frame.

UNIT II

STRUCTURAL SYSTEMS IN TALL BUILDINGS

Lateral load resisting systems, Examples, Shear wall systems, Core and outrigger systems, Bundle tube systems, Diagrid systems, Examples of Hybrid systems, Tall building aerodynamics, pedestrian comfort and safety in the vicinity of tall buildings, seismic effects of tall buildings.

UNIT III

SERVICES IN TALL BUILDINGS

Express Elevators, Sky lobbies, Local Elevators, service floors – water supply systems, skip stage pumping, Location and standardization of water tanks, Energy conservation methods, Electrical and communication systems, Disposal of Garbage, multi level parking.

UNIT IV

FIRE SAFETY AND MANAGEMENT

Wet risers, Sumps, Smoke detectors, Alarm, Sprinkler systems, Fire escape stairs, Fire resistant doors, Fire resistant rating of materials and Fire fighting equipment.

UNIT V

TALL BUILDINGS AND SUSTAINABILITY

Sustainability aspects in tall buildings, Ken Yeang and Ecological skyscraper, Emerging sustainable green technologies in tall buildings.

OUTCOMES

The student should be able to:

- Consciously choose the structural system for a particular project considering the need for consideration of building service requirements and fire safety.

REFERENCES

1. Robert Sinn, I.D. Bennetts, Max B. Kilmister Tall Building Structural Systems McGraw-Hill, 1995
2. Proceedings of the Council for Tall buildings – Vol 1 to 10, 1997
3. Bownass David, David A. Bownas, D. Bownass, Building Services Design Methodology, Routledge, 2001
4. K. Mittal, Electrical and Mechanical Service in High Rise Building CBS Publishers, 2009.

AAR 844	INTELLIGENT BUILDINGS	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand various intelligent building systems
- Application of these technologies to current building practices

UNIT I

BUILDING INTELLIGENCE

- Introduction to intelligent Buildings - history and development
- Intelligent Buildings- Features and definitions
- Use of artificial intelligence in building systems
- Developments in technology contributing to the intelligent buildings concept

UNIT II

BUILDING AUTOMATION AND CONTROLS

- Interfaces and components of Building Automation Systems
- Hardware and software requirements of Building Automation System

UNIT III

BUILDING AUTOMATION TECHNIQUES

Expert systems, genetic algorithms, Artificial Neural Networks Fuzzy Systems, and their application in Intelligent Buildings especially for HVAC, Electrical, Fire, Vertical Transportation, safety and security systems and energy management and design

UNIT IV

VARIOUS ASPECTS OF INTELLIGENT BUILDING DESIGN

- Environmental controls- traditional building controls, Lighting control- integration of automatic lighting control for buildings
- Sensors, actuators, and end devices-including adjustable speed drives, chillers complete packaged air-conditioning, Fire and Life Safety integration with the automated buildings
- Security integration for the tenants of automated buildings
- Elevators integration for the tenants of automated buildings

UNIT V

BUILDING MANAGEMENT SYSTEM

- Building energy management – trends and advances in energy management systems, Building management systems for retrofit.
- Case-studies of Intelligent Buildings from India and Abroad.

OUTCOMES

• The student will develop necessary skills to identify and interpret issues relating to Intelligent Buildings and Building Automation.

REFERENCES

1. Derek Clements – Croom (ed.), "Intelligent Buildings: Design, Maintenance and Operation, Thomas Telford, London, 2004.
2. Albert Ting-Pat so & Wai Lokchan, " Intelligent Building Systems (The International series on asian studies in computer and information science0, Springer, 1999.
3. Bernaden. A & R.E.Neuba, Intelligent Building Source book, Fairmount press inc. 1988
4. Andrew Harrison et al., Intelligent building in south east asia, IB Asia Lts. 1998
5. Dubin, Freds; Energy Conservation Standards: For building design, construction and operation.
6. ASHRAE Journals.

AAR 846	PROJECT MANAGEMENT	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with various aspects of Project Management.

UNIT I

PROJECT MANAGEMENT

Characteristics of a project Need for project management, Project cycle (conception, planning and execution), Factors contributing to success of a project, Role and responsibilities of a project manager

UNIT II

PROJECT TEAM

The actors involved in a project, project team, role of individual actors and their impact on the management cycle

UNIT III

PROJECT CONTROL

Financing of projects, capital budgeting, financial risk analysis, financial control of projects, tendering and estimating, activity sequencing, duration and time planning, scheduling and control, labor costing and sub- contracting

UNIT IV

QUALITY MANAGEMENT

Factors affecting the quality of a project, Authorities involved in quality assurance and control, Material management, Equipment management, Human resource management, Safety –Factors affecting safety and safety standards.

UNIT V

PROJECT MANAGEMENT LAW

Regulations and laws governing project management, law of contract, the duties and liabilities of different parties in a project, negligence, claims, procurement, risk allocation and remedies.

OUTCOMES

- The student should be able to apply the basics of project and quality management for any given construction project under the given legal framework.

REFERENCES

1. Chitkara, K.K. Construction Project Management: Planning Scheduling and Control, Tata McGraw Hill Publishing Company, New Delhi, 1998.
2. Chris Hendrikson and Tung Au, Project Management and Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall Pitsburgh, 2000.
3. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder. C, Construction Planning Equipment and Methods, McGraw Hill, Singapore, 1995.
4. Jamie Hinze, Construction Contracts, McGraw Hill, 2001.
5. Joseph T. Bockrath, Contracts, the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
6. John L. Ashford, The Management of Qualtiy in Construction, E& F.N, Spon, New York, 1989.

III – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR901	Low Cost Housing	3	0	0	3	50	50	100	3
2	AAR903	Disaster Management	3	0	0	3	50	50	100	3
3	AAR905	Remote Sensing & Geographical Information Systems	2	0	2	3	50	50	100	3
4	AAR921	Design Studio - III	0	9	0	6	400	-	400	Viva-Voce
5	AAR923	Research Seminar	0	0	3	2	100	-	100	-
6	AARxxx	Program Elective - II	3	0	0	3	50	50	100	3
Total			**11**	**9**	**5**	**20**	**700**	**200**	**900**	
Total Hrs. per week			**25**							

Program Elective – II

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR941	Real Estate Management	L	3	0	3	50	50	100	3
2	AAR943	Adaptive Reuse & Retrofit of Buildings	L	3	0	3	50	50	100	3
3	AAR945	Urban Planning: Principles and Techniques	L	3	0	3	50	50	100	3

AAR 901	LOW COST HOUSING	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide the students with in-depth knowledge of various building materials, construction and execution techniques in Low Cost Housing.

UNIT I

INTRODUCTION TO LOW COST HOUSING

Introduction to low cost housing, building components influencing cost of buildings. Adobe, Cob, Rammed earth, Straw bale, Bamboo, earthen finishes, etc., their sustainability, adaptability to local climate, engineering considerations necessary for durability.

UNIT II

MODULAR COORDINATION

Modular coordination in building design, total and partial prefabrication, impact of prefabrication on employment. Various methods of mass production of building components.

UNIT III

LOW COST CONSTRUCTION TECHNOLOGIES

Building construction technology solutions for cost reduction. Available knowledge in low cost construction technologies, Institutions developing low cost construction technologies like BMTPC, CBRI, Auroville Building Center, etc.

UNIT IV

TIME COST MANAGEMENT

Use of CPM and PERT methods in building construction management. Effect of time-cost relationship in low cost housing delivery mechanism.

UNIT V

BUILDING COST REDUCTION

Application of low cost building materials and various construction techniques, Building cost control techniques, research and development by various organizations in the country and foreign countries to reduce the cost.

OUTCOMES

- The course will make the student conversant with various design systems used in Low Cost Housing.

REFERENCES

1. Davis, S. “Architecture of Affordable Housing”, University of California Press, 1995.
2. Ruiz, F. P. “Building an Affordable House, Taunton Press, 1995.
3. Laul, A. K. “A Handbook of Low Cost Housing”, New Age International, 1995.
4. Mathur, G. C. “Low Cost Housing in Developing Countries”, South Asia Book, 1999.

AAR 903	DISASTER MANAGEMENT	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the nature and importance of disaster management.
- To gain an understanding hazard and vulnerability assessment, structural and nonstructural mitigation measures for different types of disasters.

UNIT I

INTRODUCTION TO DISASTER MANAGEMENT

Paradigm shift in Disaster Management thought. The Disaster Management Cycle. Disaster Impact, Response, Recovery, Development, Prevention, Mitigation and Preparedness. Factoring in Disaster Mitigation with Development Projects.

UNIT II

PREVENTION OF HAZARD

Types of Natural disasters. Nature, causes, Impact. Hazard and vulnerability assessment, concepts, tools and techniques, Pre-disaster mitigation and protection of lifeline and critical facilities against natural hazards. Manmade hazards in urban areas and their mitigation.

UNIT III

STRUCTURAL AND NON-STRUCTURAL MITIGATION MEASURES

Structural and non-structural methods of mitigation: Making buildings resilient to earthquakes, cyclones, tsunami and landslides. Building codes and regulations for earthquake prone areas and coastal zone regulations. Capacity building for architects and masons. Retrofitting existing buildings for disaster resistance. Recent advances in housing technologies: base isolation and shape memory alloys and smart materials for disaster resistance.

UNIT IV

INSTITUTIONAL FRAMEWORK FOR DISASTER MANAGEMENT

Environmental policies and programmes, Institutions and National Centers for Natural Disaster Impact Reduction. Environmental legislations in India, awareness, education and training programmes.

UNIT V

METHODS OF COMMUNITY BASED DISASTER MANAGEMENT

Principles and methods of community based approaches for urban disaster management. Community based disaster management practice. Role of self-help communities and case studies of public participation in rehabilitation projects.

OUTCOMES

The students should be able to :

- Get a clear understanding of the concept of disaster management in urban areas from early warning to assessment and recovery and reconstruction.
- Acquire and awareness of various strategies for disaster mitigation, vulnerability reduction, hazard analysis and latest technologies in disaster risk reduction.

REFERENCES

1. Arnold, C and Reitherman, R. Building Configuration and Seismic Design. John Wiley and Sons, New York, 1982.
2. Carter, WN. Disaster Management: A Disaster Manager's Handbook, Asian Development Bank, Manila, 1990.
3. Farrington, K. Natural Disasters – The Terrifying forces of nature, Grammery Books, London, 1999.
4. Sharma, VK. Disaster Management, Rawat Publications, Jaipur, 1995.
5. United Nations. Disaster Prevention and Mitigation, United Nations Disaster Relief Organization, 1986.

		L	P	S	Credits	Total Marks
AAR 905	**REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS**	2	2	0	3	100

COURSE OBJECTIVE

- To educate the students on the principles and applications of Remote sensing and GIS in environmental Architecture

UNIT I

INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Introduction-Definitions of GIS - The Evolution of GIS, Components of GIS, Approaches to the study of GIS, Major application areas of GIS, Map scale, Classes of maps, The Mapping process, Plane Coordinate systems and transformations, Geographic Co-ordinate systems on earth, Map projection, Classification of map projections, aspects of map projections, Establishing a spatial framework for mapping locations on earth: Geo-referencing.

UNIT II

APPLICATION OF GIS SYSTEM AND REMOTE SENSING

GIS Concepts – Spatial and non-spatial data, Vector and raster data structures, analysis, Database management – GIS software, Monitoring and management of environment, Conservation of resources, Sustainable land use &, Coastal zone management – Limitations in Architecture and Planning.

UNIT III

OVERVIEW OF REMOTE SENSING

Introduction Definitions of remote sensing and related terminology, Historical Perspective, Principles of remote sensing, components of remote sensing, Energy source and electromagnetic radiation, Energy interaction, Spectral response pattern of earth surface features.

UNIT IV

REMOTE SENSING TECHNOLOGY

Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning, Multispectral remote sensing, Thermal remote sensing, Microwave remote sensing – Active and passive sensors, RADAR, LIDAR, Satellites and their sensors, Indian space programme - Research and development.

UNIT V

DATA PROCESSING

Characteristics of remote Sensing data, Photogrammetry – Satellite data analysis – Visual image interpretation, Digital image processing –Image rectification, enhancement, transformation, Classification, Data merging, GIS- remote sensing integration, Image processing software.

OUTCOMES

- An understanding of a various applications of Remote Sending and GIS in Disaster Management , Urban Design, Urban Planning and Environmental Projects.

REFERENCES

1. Lillesand, T.M. and Kiefer, R.W, Remote sensing and image interpretation, John Wiley and sons, New York, 2004.
2. Golfried Konechy, Geoinformation: Remote sensing, Photogrammetry and Geographical Information Systems, CRC press, 1st Edition, 2002.
3. Burrough, P.A. and McDonnell, R.A., Principles of Geographic Information systems Oxford University Press, New York, 2001.
4. Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1998.
5. Pmapler and Applications of Imaging RADAR, Manual of Remote Sensing, Vol.2, ASPR, 2001.

AAR 921	DESIGN STUDIO - III	L	P	S	Credits	Total Marks
		0	0	9	6	400

COURSE OBJECTIVES

- To enable the student to analyze Sustainability principles, Strategies and Planning at a Human Settlement Level.
- To train the student to apply the above aspects in developing Policies and Guidelines to ensure sustainability in the long run, in both, urban and rural settlements.

DESIGN PROBLEM

This Studio explores to analyze the underlying principles of Sustainability, Strategies and Planning, Applicable Codes and Regulations. Further, the link between human settlements and sustainability is analyzed in urban and rural settlements. Role of Planning, designing and maintenance of buildings, user behavior and responses, utilization of renewable energy systems, landscaping and waste management are analyzed in achieving sustainability at human settlements level.

The studio will be based on traditional/ historic city quarter, rural habitat, contemporary city space, neighborhood study and housing estates in urban and semi-urban, urban development and township contexts and will examine challenges at a settlement scale: clusters of buildings and public spaces.

The aspects analyzed above are applied at these contexts by integrating various strategies for site planning, urban/rural design, community action to achieve high quality sustainable living environment.

PRESENTATIONS & VIVA VOCE

Stage-wise progress of student's approach to design is continually evaluated by the Studio-In-charges at various internal juries, followed by a final presentation at the Semester-end Design-Jury.

Viva-Voce on the project would be conducted by an external jury to examine the prudence of the student in deriving the design solution, reviewing the complete work done during the design studio.

AAR 923	RESEARCH SEMINAR	L	P	S	Credits	Total Marks
		0	3	0	2	100

COURSE OBJECTIVES

- To provide an opportunity to undertake research work on a topic of their choice related to sustainable architecture.
- To enhance the technical report writing skills of the student.
- To encourage the student to develop the technical report to publishable quality of relevant peer reviewed technical journals.

SEMINAR TOPIC

Students have to select a topic of their choice relevant to sustainable architecture and carryout a comprehensive study in to the subject. They are required to conduct extensive literature study related to the topic, collect applicable data from various secondary sources like text books, technical papers, Codes and Standards, Government Regulations, etc. Students are encouraged to conduct relevant case-studies, as required. The students should integrate the learnings and supported data to draw relevant conclusions in line with the aim and objectives of the research work. Further, the student should attempt to publish the findings in a peer reviews technical journal of high relevance.

PRESENTATIONS & VIVA VOCE

Each student should develop a Technical Report of specified standard on the chosen topic. At various stages, students should give technical presentations for evaluating the progress of research work. For end-semester evaluation, they should present a seminar and submit the technical paper. Student should also make efforts to publish the same in a referred journal.

REFERENCES

1. E Mukhi, H.R. Technical Report Writing: Specially prepared for Technical and Competitive Examinations, Satya Prakashan, New Delhi, 2000.
2. Barrass, Robert. Writing At Work : a guide to better writing in administration, business and management, Routledge, London, 2003.
3. Seely, John. The Oxford guide to effective writing and speaking, 2nd ed., Oxford University Press, New York, 2005.
4. Jo Ray McCuen, Anthony Winkler. Readings for writers, 9th ed., Harcourt Brace College Publishers, Fort Worth, 1998.
5. Treece, Malra. Effective reports, 2nd ed., Allyn and Bacon, Boston, 1985.

AAR 941	REAL ESTATE MANAGEMENT	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable students understand the concept of Real Estate Management, and give them an overview of Real Estate Market.
- Providing exposure to the wide range of issues in the real estate profession.
- Developing Analytical skills methodology necessary to deal with Real Estate Management.

UNIT I

REAL ESTATE DEVELOPMENT

Concepts and Techniques related to Real-Estate Development Process, Stakeholders and Stages of a Real Estate Project, Role of Real Estate Market and Socio-economic Development of a Region.

UNIT II

URBAN POLICY AND REAL ESTATE MARKETS

Impact of Government Regulations and Policies on Real Estate Markets, Relation of Land-use structure and Land rent, Community and Neighbourhood dynamics on Real Estate Projects. Relevant Examples.

UNIT III

PROJECT DEVELOPMENT AND MANAGEMENT

Project Feasibility, Design Development, Life Cycle Costing, Asset Disposal and Redevelopment Options, Project Phases, Construction & Project Management, Project Marketing, Completion and Handing over.

UNIT IV

FINACIAL MANAGEMENT OF REAL ESTATE PROJECTS

Financing of Projects – various types, Capital Budgeting, Cash-flow Analysis, Financial Institutions, Private Sector participation in Project Financing, Relevant examples for Public Private Partnership Projects.

UNIT V

MANAGEMENT IN REAL ESTATE PROJECTS

Real estate Assets and Liabilities management, Property management, Project Appraisals, Asset Pricing Models, Scheduling Costs and Profits, Expenditure – Scheduling and Control Techniques, Problem solving in Management Issues, Relevant Examples, Financial Reporting.

OUTCOMES

- The student will develop necessary skills to identify and interpret issues relating to Real Estate Management, based on Theoretical inputs and Case-studies.
- The student would be capable of working in Real Estate Development Team in various phases.

REFERENCES

1. Cortesi, GR. Mastering Real Estate Principles, Dearborn Trade Publishing, New York, 2001.
2. Chandra, P. Financial Management, Tata McGraw Hill, New Delhi, 2004.
3. Davis, T. Real Estate Developer's Handbook. Atlantic Publishing Company, Ocala, 2007.
4. Galaty, FW. Modern Real Estate Practice, Dearborn Trade Publishing, New York, 2002.
5. Maheswari, S. N. Financial Management, Sultan & Sons, Delhi, 2004.
6. Peiser, RB and Frej, AB. Professional Real Estate Development, The ULI Guide to the Business, Urban Land Institute, USA, 2003.
7. Project Planning Scheduling and Control in Construction: an encyclopedia of terms & applications. New York, Wiley, 1995.

AAR 943	ADAPTIVE REUSE AND RETROFIT OF BUILDINGS	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To give a comprehensive overview on how existing buildings can be adapted and retrofitted to function sustainably.

UNIT I

SUSTAINABLE RETROFIT FOR EXISTING BUILDINGS

Retrofitting options for existing buildings; Structural retrofit; Services; Interior retrofit; Performance analysis of existing buildings; Physical audits; Building simulation; Metering and tracking options; Analysis of the building's current performance; Decision influencers for retrofit; Economic, Social and Environmental issues.

UNIT II

ADAPTIVE REUSE OF OLD BUILDINGS

Need for adaptive reuse; issues to be explored in building adaption; Economic, Social, Environmental and assessment models for adaptive reuse; Case studies of buildings with adaptive reuse.

UNIT III

TECHNOLOGIES FOR ENERGY EFFICIENCY IN EXISTING BUILDINGS

Improving energy efficiency in existing buildings; Facade improvements; HVAC improvements; Indoor environment improvements; Monitoring the performance of retrofits; Case studies on energy efficiency improvements in existing buildings.

UNIT IV

SUSTAINABLE CONSERVATION OF HERITAGE STRUCTURES

Conservation of heritage structures; Sustainability in heritage structures; Adaptive reuse of heritage structures; Issues in adapting a heritage structure; Use of sustainable conservation techniques; Improving the energy performance of heritage structures; Case studies of sustainable conservation in heritage structures.

UNIT V

RETROFITTING TALL BUILDINGS FOR ENERGY EFFICIENCY

Excessive energy consumption by existing tall buildings, Retrofitting existing tall buildings to make them energy efficient. Case studies of tall buildings such as Empire State Building, Sears Towers etc. which have been retrofitted for energy efficiency.

OUTCOMES

- An understanding of how existing residential buildings, tall structures and buildings with heritage value can be retrofitted for energy efficiency.

REFERENCES

1. Sara J. Wilkinson, Hilde Remoy, Craig Langston: Sustainable Building Adaption: Innovations in design making; John Wiley and sons, 2014.
2. John Krigger: Residential Energy: Cost savings and Comfort for Existing buildings; Prentice Hall, 2009.
3. William H. Clark: Retrofitting for Energy Conservation; McGraw Hill Professional, 1997.
4. Paul Apple: Sustainable Retrofit and Facilities Management; Routledge, 2013.
5. Zynep Aygen: International Heritage and Historic Building Conservation: Saving the World's Past; Routledge, 2013.

AAR 945	URBAN PLANNING: PRINCIPLES AND TECHNIQUES	L	P	S	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the basic concepts of urban planning in terms of tools and methods and their application in modern context.

UNIT I

PLANNING PRINCIPLES

Planning terms and definitions; Basic principles of planning and settlements; Aims and Objectives of Physical Planning; Levels of Planning in India; Characteristics of Planning; Models of Planning Process; Components of settlement structure.

UNIT II

URBAN PLANNING

Preparation of Urban Development Plans, types, scope, purpose, contents and approaches to the interim and comprehensive plans; Structure Plan; Master Plan; Zonal Development Plans and Strategic Planning.

UNIT III

URBAN REGULATIONS

Concepts of Urban Land Use, Systems affecting land uses and rationale for land use planning; Locational attributes of urban land uses; Legal framework; Regulations, Byelaws, Standards and norms and their basis.

UNIT IV

URBAN SURVEYS

Survey Research Process: Primary and Secondary sources of data, techniques of data collection, analyzing and presenting physical and socio-economic data, questionnaire design, administration of field surveys, Sampling, sample designs, size, sources of various data.

UNIT V

PLANNING TECHNIQUES

Techniques of understanding spatial structures of cities and towns. Analysis of structure of nodes, roads and networks and spatial structure. Use of aerial and satellite remote sensing for planning; Introduction to GIS.

SUGGESTED SEMINAR TOPICS/ TERM PAPERS

Theories of Urban Planning, Choice Theory, Advocacy Planning, Action Planning, Mixed planning - Relevance in Indian context.

OUTCOMES

- An understanding of various Urban Planning Principles, Urban Regulations and Urban Planning Techniques.

REFERENCES

1. Gallion A, B, and Eisner, S. The Urban Pattern, Van Nostrand, 1986
2. Mukherjee S. and Siddharth K. Cities Urbanization and Urban System , 2013
3. Hall, P. Urban and Regional Planning 4th Edition, London, Routledge, 2002.
4. Yadav K.P, Encyclopedia of Economic Planning and Development, Vol. 1-5, 2001.

IV – SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AAR922	Design Thesis	0	21	0	14	800	-	800	Viva-Voce
2	AOExxx	Open Elective - I	3	0	0	3	50	50	100	3
Total			**3**	**21**	**0**	**17**	**850**	**50**	**900**	
Total Hrs. per week			**24**							

Open Elective – I

Sl. No.	Course Code	Course Name	No. of Hrs per week			Credits	Marks			End Exam Duration
			L	S	P		I	E	T	Hours
1	AOE202	German for Beginners	L	3	0	3	50	50	100	3
2	AOE204	French for Beginners	L	3	0	3	50	50	100	3

AAR 922	DESIGN THESIS	L	P	S	Credits	Total Marks
		0	0	21	14	800

COURSE OBJECTIVES

- To provide an opportunity to the student to undertake a detailed investigation/research independently on a topic of their choice, under supervision.
- To enable the student to develop and convert the investigation/research into development of comprehensive design proposals.
- To test the skills and competence acquired by the student for the award of Master of Architecture in Sustainable Architecture.

DESIGN PROBLEM

The main areas of study and research shall be on Sustainable and Green Buildings, Energy Efficiency in Buildings, Landscape, Urban Housing, Urban Design, Urban Renewal, Sustainable and Environmental Design, etc. The selected topic should be on current research and of professional planning interest.

The student should review related theoretical approaches, collect, document and analyze relevant data and formulate proposals to address the problems identified. The work being carried shall be an original work by the student for a selected context. It should have definable program and actions, implementation strategy and mechanisms to address the identified objectives of the Thesis work.

PRESENTATIONS & VIVA VOCE

The Thesis Project shall be submitted in the form of Thesis Report as per the specifications notified, Presentation drawings of appropriate scale, Physical Model of the proposals, Documentation on Digital Media (CD/DVD), and Presentation in the Viva-voce.

Stage-wise progress of student's approach to design is continually evaluated by the Studio-In-charges at various internal juries, followed by a final presentation at the Semester-end Design-Jury.

Viva-Voce on the project would be conducted by an external jury to examine the prudence of the student in deriving the design solution, reviewing the complete work done during the design studio.

AOE 202	GERMAN FOR BEGINNERS	L	P	S	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

- To introduce basic knowledge about German Language.
- To encourage preliminary conversation in German.
- To educate basic grammar, speaking & reading skills in German.

UNIT 1

Introduction to the German language, grammar and pronunciation. Language: Greetings; Introducing oneself, asking the way, giving directions. Grammar: The nouns, gender distinctions, cases, definite and indefinite articles. Pronunciation: Vowels.

UNIT 2

Language: Asking for and giving information; Discussing home and the household. Grammar: Conjugation of verbs, verbs with separable and inseparable prefixes, modal verbs. Pronunciation: Vowels.

UNIT 3

Language: Describing people and their qualities, describing shape, size and colour of objects. Grammar: Personal pronouns, possessive pronouns, reflexive pronouns. Pronunciation: Consonants.

UNIT 4

Language: The Working World: Returning faulty goods to a shop, asking someone to repeat something; Refusing or declining politely. Grammar: Cases: nominative, accusative, dative. Pronunciation: Diphthongs.

UNIT 5

Language: Making Comments and Suggestions: Asking for and giving opinions. Grammar: Structure of sentence and categories of sentences; subordinate clause - causative and conditional sentences. Pronunciation: Umlaut.

Course Outcomes:

- Students are equipped to listen, understand German language.
- Sufficient skills to converse in German Language are established.

Recommended Books:

1. Deutsch als Fremdsprache IA Grundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language, 2004.

AOE 204	FRENCH FOR BEGINNERS	L	P	S	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

- To introduce basic knowledge about French Language.
- To encourage preliminary conversation in French.
- To educate basic grammar, speaking & reading skills in French.

UNIT 1

Asking for and giving personal information, asking for and giving direc-tions, gender and number. Grammar: Verbs "avoir" and "etre", present tense, questions, vocabulary: countries and nationalities, professions, family, food

UNIT 2

Asking and giving the time, asking when something is open or someone is available, asking for prices and describing what one wants. Grammar: Alphabet and numbers, possessive adjectives, negative sentences. Vocabu-lary: Days of the week, months, money.

UNIT 3

Asking for information related to travel and accommodation, expressing one's wants/needs. Grammar: Present tense for verbs in -er, -ir and -re, present tense of irregular verbs. Verbs: to be able to, to want, to know. Vocabulary: Food, shops, packaging and measures.

UNIT 4

Talking about daily routine and the working day, describing things, ex-pressing oneself when buying things. Grammar: Possessive pronouns, reflexive verbs. Vocabulary: Clothes, colours and shapes, weather.

UNIT 5

Describing places; visiting the doctor, reading short advertisements, de-scribing places, feelings and symptoms. Grammar: Using avoir aller, etre faire, vouloir pouvoir. Vocabulary: Parts of the body, rooms and features of interior spaces.

Course Outcomes:

- Students are equipped to listen, understand French language.
- Sufficient skills to converse in French Language are established.

Recommended Books:

1. LE NOUVEAU SANS FRONTIÈRES - Textbook
2. LE NOUVEAU SANS FRONTIÈRES - Workbook CD and selected passages/ exercises