GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A++ Grade

CURRICULUM AND SYLLABUS

OF

Master of Architecture (Sustainable Architecture)

w.e.f. 2024-25 admitted batch

SCHOOL OF ARCHITECTURE

GITAM (Deemed to be University)

VISION AND MISSION OF THE UNIVERSITY

VISION

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

MISSION

- Build a dynamic application-oriented education ecosystem immersed in holistic development.
- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.
- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.
- Permeate a culture of kindness within GITAM, fostering passionate contributors.

QUALITY POLICY

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

SCHOOL OF ARCHITECTURE

VISION AND MISSION OF THE SCHOOL

VISION

To be an architecture school of excellence driven by culture, context, and social responsibility for building inclusive and agile human habitats.

MISSION

- Foster a progressive learning environment by promoting critical thinking for designing context-specific built environments.

- Impart multidisciplinary research aptitude through a curriculum based on social responsibility, sustainable built environment, cultural context, and evolving technologies.

- Nurture valuable futures by providing exposure to best practices across the world.

- Sensitize students to universal human values through a culture of empathy and ethics in articulating spaces.

Master of Architecture (Sustainable Architecture)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To enable Architects/ Students to design context specific built environment that is sustainable and energy efficient for building.
PEO 2	To impart Architects/ students the knowledge of Green Rating systems in India and worldwide.
PEO 3	To enable Architects/students to provide optimum solution through computational and evidence-based design.
PEO4	To enable Architects/students to pursue research with interdisciplinary approach per changing global and local needs of the society and built environment.

MAPPING OF THE MISSION OF THE SCHOOL WITH THE PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8
M1	H	M	M	M				
M2	H	M	H	H				
M3	M	H	H	H				
M4	M	L	L	H				

H- High Correlation M – Medium Correlation L- Low Correlation

PROGRAMME OUTCOMES (POs)

&
PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME OUTCOMES

The students of M. Arch, after completion of the program will be able to:

PO-1: Develop sound knowledge and analytical ability utilizing and building on existingknowledge.

PO-2: Apply the knowledge of passive design strategies, building materials and construction technologies to create sustainable architecture.

PO-3: Develop design skills in Energy Efficient Design of Buildings.

PO-4: Facilitate intellectual, creative, and professional development.

PO-5: Structure a research work and write in proper academic language.

PO-6: Use simulation tools for improving overall building performance during the architectural design process.

PO-7: Appraise architectural designs and assist in the preparation of documents for green certifications and environmental clearances.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 01: Enable Students to be aware of the necessary practices in Energy Efficiency, Green Rating, Sustainable Methodologies to achieve Environmental, Social, and Economic Sustainability in the Built Environment.

PSO 02: Acquaint the students with the Sustainable aspect of different building typologies from Low-Rise Buildings to Tall-Buildings.

PSO 03: Enable Students with the knowledge to carry out Building Simulations to Evaluate Energy Efficiency.

SCHOOL OF ARCHITECTURE

GITAM (Deemed to be University) REGULATIONS

Master of Architecture (Sustainable Architecture)

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.
- Design Thesis approved by the faculty of architecture.

4.2. Each academic year consists of two semesters. The curriculum and course content (syllabus) 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 100 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

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.

7.3. In addition to the attendance requirement, a student has to secure a minimum of 50% marks in internal component of sessionals to appear for jury.

8.0 EVALUATION

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

8.2. Other courses such as Research Seminar, Design Studios (I, II & III Semesters) and Design Thesis (IV Semester) will be assessed based on two components – Continuous Evaluation (50%) and External Jury (50%).

8.3. A student has to secure an aggregate of 50% 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 50% in the Semester-end Examination component of the respective course.

8.4. Fundamentals of Entrepreneurship is a Unviersity Core and will be assessed by Countnuous Evaluaion only (100 marks). A student has to secure a minimum of 50% marks in the course to be declared to have passed the course.

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

M.ARCH (Sustainable Architecture) – Assessment Structure (admitted 2024-25):

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) One mid-semester examination shall be conducted for twenty-five (25) marks.
				(ii) twenty-five (25)marks are allotted for assignments.
		50	Semester-end Examination	Fifty (50) marks are allotted for the semester-end examination.
	Total	100		
2	Research Seminar	50	Continuous Evaluation	i) Fifteen (15) marks allotted for Mid-semesterevaluation
				ii) Thirty-five(35) marksallotted for end-semester evaluation
		50	External Jury	External viva-voce on the end-semester portfolio by anexternal member.
	Total	100		
3	Design Studio (I, II & III Semesters)	200	Continuous Evaluation	i) Sixty (60) marks allotted for mid-semester evaluation of the thesis by a panel of external and internal member(s).
				ii) One Hundred and Forty (140) marksallotted for end-semester evaluation of the thesis by a panel of

				external and internal member(s)
		200	External Jury	External viva-voce on the end semester portfolio by a Practicing Architect.
	Total	400		
4	Fundamentals of Entrepreneurship	100	ContinuousEvaluation	i) Mid semester Portfolio comprisingof sheets/model/assignments shall be evaluated for thirty (30)marks.
				ii)End semester Portfolio comprisingof sheets/ model/assignments shallbe evaluated for seventy (70)marks.
5	Design Thesis (IV Semester)	400	Continuous Evaluation	i) One Hundred and Twenty (120)marks allotted for mid-semester evaluation of the thesis by panel reviews and the internalguide.
				ii) Two hundred and eighty (280) marks allotted for end-semester evaluation of the thesis by panel reviews and the internalguide.
		400	External Jury	(ii) Four Hundred (400) marks are allotted for the external viva-voce.
	Total	800		

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 50% 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

1.1. 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 canappear 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	F (Fail)	0	Less than 50
8	Ab (Absent)	0	---

12.2. A student who earns a minimum of 5 grade points (C grade and above) 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 course.

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 withDistinction	≥ 8.0*
First Class	≥ 7.0
Second Class	≥ 6.0
Pass	≥ 5.3

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses

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,
d) No disciplinary action is pending against him/her.

15.0 DISCRETIONARY POWER

Not with standing anything contained in the above sections, the Vice-Chancellor may review allexceptional 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 of every semester. The theory papers of end-semester examination will be evaluated by internal/external examiner.
2. 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.
3. The examiner for evaluation should have a minimum of three years teaching experience.
4. 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.

CurriculumStructure

I - SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs. per week				Credits	Marks			End Exam Duration
			L	T	ST	J		I	E	T	Hours
1	AAR801	Sustainable Development & Environmental Management	3	0	0	0	3	50	50	100	3
2	AAR803	Sustainable and Green Building Design	3	0	0	0	3	50	50	100	3
3	AAR805	Sustainable, Energy Efficient Building Materials & Technologies	3	0	0	0	3	50	50	100	3
4	AAR807	Solar Passive Architecture	3	0	0	0	3	50	50	100	3
5	AAR809	Sustainability and Energy Conservation in Landscape Architecture	3	0	0	0	3	50	50	100	3
6	AAR821	Design Studio - I	3	0	6	0	9	200	200	400	Jury
Total			**18**	**0**	**6**	**0**	**24**	**450**	**450**	**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	T	ST	J		I	E	T	Hours
1	AAR802	Sustainable Urban Design	3	0	0	0	3	50	50	100	3
2	AAR804	Research Methodology in Architecture	3	0	0	0	3	50	50	100	3
3	AAR806	Performance Evaluation of Buildings	2	0	2	0	4	50	50	100	3
4	AAR808	Sustainable Infrastructure & Services	3	0	0	0	3	50	50	100	3
5	AAR822	Design Studio - II	3	0	6	0	9	200	200	400	Jury
6	AARxxx	Program Elective - I	3	0	0	0	3	50	50	100	3
7	IENT1051	Fundamentals of Entrepreneurship	2	0	0	0	2	100	-	100	-
Total			**19**	**0**	**8**	**0**	**8**	**550**	**450**	**1000**	
Total Hrs. per week			**27**								

III–SEMESTER

Sl. No.	Course Code	Course Name	No. of Hrs per week				Credits	Marks			End Exam Duration
			L	T	ST	J		I	E	T	Hours
1	AAR901	Low-Cost Housing	3	0	0	0	3	50	50	100	3
2	AAR903	Disaster Management	3	0	0	0	3	50	50	100	3
3	AAR905	Remote Sensing & Geographical Information Systems	2	0	2	0	4	50	50	100	3
4	AAR921	Design Studio - III	3	0	6	0	9	200	200	400	Jury
5	AAR923	Research Seminar	0	0	3	0	3	50	50	100	J
6	AARxxx	Program Elective - II	3	0	0	0	3	50	50	100	3
Total			**14**	**0**	**11**	**0**	**11**	**450**	**450**	**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	T	ST	J		I	E	T	Hours
1	AAR922	Design Thesis	0	0	21	0	21	400	400	800	Jury
2	EOExxx	Open Elective - I	3	0	0	0	3	50	50	100	3
Total			**3**	**0**	**21**	**0**	**21**	**450**	**450**	**900**	
Total Hrs. per week			**24**								

Note: L = Lecture, T = Tutorial, ST = Studio, J = Internship

Program Elective –I

Sl. No.	Course Code	Course Name	No. of Hrs per week				Credits	Marks			End Exam Duration
			L	T	ST	J		I	E	T	Hours
1	AAR842	Tall Buildings	3	0	0	0	3	50	50	100	3
2	AAR844	Intelligent Buildings	3	0	0	0	3	50	50	100	3
3	AAR846	Project Management	3	0	0	0	3	50	50	100	3
4	AAR848	Traditional wisdom & sustainability concepts	3	0	0	0	3	50	50	100	3
5	AAR850	Energy Auditing	3	0	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	T	ST	J		I	E	T	Hours
1	AAR941	Real Estate Management	3	0	0	0	3	50	50	100	3
2	AAR943	Adaptive Reuse & Retrofit of Buildings	3	0	0	0	3	50	50	100	3
3	AAR945	Urban Planning: Principles and Techniques	3	0	0	0	3	50	50	100	3
4	AAR947	Healthy Buildings	3	0	0	0	3	50	50	100	3
5	AAR949	Green Built Environment	3	0	0	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	T	ST	J		I	E	T	Hours
1	EOE202	German for Beginners	3	0	0	0	3	50	50	100	3
2	EOE305	French for Beginners	3	0	0	0	3	50	50	100	3

COURSE - PO MAPPING THROUGH CURRICULUM M. Arch

S.NO	COURSE CODE	COURSE NAME	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3
1	AAR801	Sustainable Development & Environmental Management	H	M	M	M	L	L	L			H	L	L
2	AAR803	Sustainable and Green Building Design	H	H	H	L	L	-	H			H	-	-
3	AAR805	Sustainable, Energy Efficient Building Materials & Technologies	L	H	M	L		M	M			H	L	M
4	AAR807	Solar Passive Architecture	M	H	L	L		-	-			-	-	-
5	AAR809	Sustainability & Energy Conservation in Landscape Architecture	H	H	H	-	-	M	-			-	-	-
6	AAR821	Design Studio - I	H	M	H	M	M	H	H			H	L	H
7	AAR802	Sustainable Urban Design	H	H	H	-	-	M	-			-	-	-

8	AAR804	Research Methodology in Architecture	H	M	L	M	H	L	L			-	-	-
9	AAR806	Performance Evaluation of Buildings	L	M	H	M	M	H	H			M	M	M
10	AAR808	Sustainable Infrastructure & Services	H	M	L	L	L	L	H			H	M	M
11	AAR822	Design Studio - II	M	M	H	M	M	H	H			H	L	H
12	AAR842	Tall Buildings	H	M	-	-	L	-	-			-	-	-
13	AAR844	Intelligent Buildings	M	-	H	M	-	L	L			-	-	-
14	AAR846	Project Management	M	L	L	H	H	L	L			M	L	L
15	AAR848	Traditional wisdom & sustainability concepts	H	M	M	L	M	L	L			H	M	L
16	AAR850	Energy Auditing	H	-	H	L	-	-	-			H	-	-
17	AAR901	Low-Cost Housing	H	H	M	M	H	L	M			M	H	L
18	AAR903	Disaster Management	H	M	-	M	M	M	M			M	M	-
19	AAR905	Remote Sensing & Geographical Information Systems												
20	AAR921	Design Studio	H	H	H	H	M	H	H			H	H	H

		– III											
21	AAR923	Research Seminar	L	M	M	H	H	H	H			H	L	M
22	AAR941	Real Estate Management	H	M	H	M	L	M	M			M	M	L
23	AAR943	Adaptive Reuse & Retrofit of Buildings	H	H	H	-	-	M	-			-	-	-
24	AAR945	Urban Planning: Principles and Techniques	H	H	L	L	L	M	M			M	M	L
25	AAR947	Healthy Buildings	H	H	H	L	L	M	M			H	H	L
26	AAR949	Green Built Environment	H	H	H	H	M	H	M			H	H	M
27	AAR922	Design Thesis	H	H	H	H	H	H	H			-	-	-
28	EOE202	German for Beginners												
29	EOE305	French for Beginners												

AAR 801	SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To introduce fundamental strategies and concepts of sustainable development.
- To help comprehend the role of resource conservation in Sustainable Development and its relevance in settlement design
- To explain about Environmental Planning terms and techniques
- To recapitulate the applications of sustainable concepts at different Levels
- To create awareness about the legislative mechanisms for environmental protection and Environmental Impact Assessment (EIA) methods and procedures

UNIT 1 Overview of Sustainable Development

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

UNIT 2 Sustainable Development for Resource Conservation

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

UNIT 3 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 4 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 5 Statutory Acts, Regulations and Environmental Impact Assessment

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.

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, Earths can 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 Environmental Science, Prentice Hall of India, New Delhi, 2005.

Course Outcomes:

1. Understand the overview of sustainable development.
2. Understand the Strategies and concepts of Sustainable Development for resource conservation.
3. Identify the environmental planning terms and techniques.
4. level and application of sustainable concepts at the regional level, settlement level, and building level.
5. Evaluate the Importance of regulations, acts to protect the environments in India.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	-	1	3	1	1
CO2	3	2	1	1	1	1	1	2	1	-
CO3	3	2	2	1	1	2	1	3	1	1
CO4	2	3	3	1	1	2	1	3	2	1
CO5	2	1	1	2	1	1	3	1	1	1

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 11 & 15

SDG Justification:

This course gives insight to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

AAR 803	SUSTAINABLE AND GREEN BUILDING DESIGN	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 Introduction

A historical perspective. General premises and strategies for sustainable and green design, objectives, and basis. Biomimicry as a design tool based on ecosystem analogy. Relationship between people, buildings, and environment.

UNIT 2 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; Optimizing construction; Site management; Environmental management of buildings.

UNIT 3 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 4 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, and sustainable materials. Small scale wind and hydro power systems. Case study of eco house.

UNIT 5 Basics Of Daylighting & Natural Ventilation

Day lighting &Natural ventilation basics; Techniques incorporating Daylight in buildings- light wells, light shelves, light pipes; Natural Ventilation- Stack effect, Courtyard Effect, cross ventilation.

References

1. Ken Yeang: Eco Design- A manual for Ecological design; Wiley Academy,2006.
2. Sue Roafet 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.

Course Outcomes:

1. Understand the Role of Vernacular architecture and biomimicry in sustainability.
2. Identify the need for Green certification systems and understand the different sustainable aspects in a building with exemplary studies.
3. Understand the impact of Materials and their parameters which effect on building's energy consumption.
4. Concepts of building which makes it an Eco house.
5. Explore, investigate, and apply various parameters of sustainability for design development of projected building.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	3	-	-
CO2	3	3	1	-	-	-	3	3	-	-
CO3	-	3	2	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	-	3	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN
BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: 3, 6 & 12

SDG Justification:

Ensuring healthy lives and promoting well-being by understanding the passive and active strategies which help in maintaining good indoor air quality and climate responsive building design parameters.

AAR 805	SUSTAINABLE, ENERGY EFFICIENT BUILDING MATERIALS AND TECHNOLOGIES	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 Introduction

Energy Efficiency – Energy Conservation – Resource 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 –Embodied energy of different building materials- Energy needs in Production of Materials – Transportation Energy – Concept of light footprint on Environment; Introduction to Energy Audits

UNIT 2 Environmental Impact of Building Materials

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

UNIT 3 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 4 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 5 Energy Efficient Technologies

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.

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.

Course Outcomes:

- To understand the concept of Energy.
- Explain the use of the natural and conventional building materials which are cost-effective, environmentally friendly, and appropriate to the context of the site, climate, and culture.
- Demonstrate an understanding of the 'modern' building material developed using advanced technologies and testing methods.
- Describe the application of recycled/reconstructed building materials in the construction of green buildings.
- Explain various Energy Efficient Materials and Sustainable Construction Technology

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	3	1	2	-	-	1	-	-
CO2	1	3	2	1	1	1	-	3	-	-
CO3	-	2	2	1	-	3	-	-	1	3
CO4	1	1	1	1	-	-	2	2	-	-
CO5	2	2	2	-	1	-	3	-	2	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **1, 3,6,9,11,12 & 17**

SDG Justification:

Affordable housing technology and supply system helps improves living through social housing, co-op, and urban improvement which in turn helps in poverty alleviation. Use of environmentally hazardous materials & substances should be avoided. The holistic understanding of Sustainable materials & technologies leads to sustainable living & reduced climatic impact.

AAR 807	SOLAR PASSIVE ARCHITECTURE	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- 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 1 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 2 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 3 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 4 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, fenestration, color and texture of walls and daylighting.

UNIT 5 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.

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: AHand bookof 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

Course Outcomes:

- To understand the principles of Solar Passive Architecture by simple techniques.
- Explain the advance solar passive techniques, Direct Gain, Indirect Gain and Isolated Gain.
- To Study Various Passive cooling concepts in solar Architecture.
- Analyze solar passive design guidelines for different climatic zones like Hot & Dry, Warm&Humid, Composite, Moderate, Cold Climate.
- To understand techniques for estimating thermal performance, building thermal simulation flow path etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-
CO5	1	3	1	1	-	-	-	-	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 3 &7

SDG Justification:

Solar Passive features are affordable techniques, which utilizes the cleanest energy(solar)

AR 809	SUSTAINABILITY AND ENERGY CONSERVATION IN LANDSCAPE ARCHITECTURE	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 Sustainable Landscape Practices

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.

References

1. John.F.Benson and Maggie.H.Roe, Landscape and sustainability, John WileyPublication, 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.Grady Clay, Water and the Landscape McGraw-Hill Inc.,US; First Edition edition1979.

Course Outcomes:

1. Understand the Paradigm shift in Landscape design thought and its significance in achieving
   energy conservation through passive tools.
2. Understand the sustainable site and green rating, analyze Green landscaping techniques in the context of sustainability, Ecology and sustainability.
3. Evaluate the role of Landscape design as a means for effectively modifying the microclimate of a place.
4. Study about Xeriscaping and other sustainable landscaping practices.
5. Analyze low-cost maintenance and management of landscape and study sustainable landscape practice at the regional and national level.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	3	-	-
CO3	3	3	3	-	-	3	-	3	-	-
CO4	3	3	3	-	-	-	-	3	-	-
CO5	3	3	2	-	-	3	-	3	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) ACADEMIC COUNCIL: 17-09-2021

SDG Nos. & Statement: **2,3,6,7,11,13 & 15**

SDG Justification: Ensure availability and sustainable management of water. Access to affordable, reliable, sustainable and modern energy. Take urgent action to combat climate change and its impacts. Promote, restore and protect sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reserve, land degradation and halt biodiversity loss.

AAR 821	DESIGN STUDIO - I	L	T	ST	J		C
		3	0	6	0		9
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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.

Course Outcomes:

. 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.
. To explore passive design strategies to arrive at an energy efficient and environmentally friendly solutions.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	1	2	-	1	-	3	1	2
CO2	1	1	3	-	-	2	-	2	3	1
CO3	2	1	3	1	-	1	-	3	1	1
CO4	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-		-	-	

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN

BOS :05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **3,4,6,7, & 13**

SDG Justification:

Use of passive design strategies is to promote natural light & ventilation, promote thermal comfort to ensure good health &well-being Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities. Ensuring clean water for everyone by adopting methods to conserve & recycle water. Use of renewable energy and less dependence on non-renewable energy. Use of sustainable infrastructure services. Ensuring reduced carbon footprint.

AAR 802	SUSTAINABLE URBAN DESIGN	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

To introduce concepts of sustainability related to urban design

UNIT 1 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 2 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 3 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 4 Urban Renewal and Inner-City Regeneration

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

UNIT 5 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.

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.

Course Outcomes:

- Understanding the characteristics of urban climate, urban heat island and various countermeasures for reduction of urban heat island.
- Ability to understand different climatic factors that influence the morphology and urban fabric of any city.
- Ability to understand and analyze the concept of neighborhood planning and its comprehensive process in the formulation of urban design strategies.
- Ability to understand and review various urban renewal concepts and theories and respective implications in case examples across the globe.
- Ability to understand various concepts and strategies related to proposed solar and smart cities in the Indian context.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-		3	-	-
CO2	3	3	3	-	-	-		3	-	-
CO3	3	3	3	-	-	2		3	-	-
CO4	3	3	3	-	-	-		3	-	-
CO5	3		3	2	-	-	2	3	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 11 & 13

SDG Justification:

The course gives insight to make cities and human settlements,inclusive, safe, resilient and sustainable

AAR 804	RESEARCH METHODOLOGY IN ARCHITECTURE	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 Case Studies

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

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.

Course Outcomes:

- Identify a potential research topic related to sustainability in the built environment and present an overview of the research design process and frame a research question.
- Describe the conceptual and analytical frameworks for the literature review.
- Explain various methods commonly used for research in Architecture and identify pertinent methods for their research.
- Learn how to write and publish research work in journals.
- Review of research publication.

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CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	3	-	2
CO2	3	2	-	-	-	-	-	3	-	-
CO3	1	-	-	-	3	-	-	3	-	-
CO4	-	-	-	2	3	-	-	3	-	-
CO5	-	-	-	2	3	-	-	3	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4, 5 & 10

SDG Justification:

This course provides basic knowledge on research methodology which encourages students to actively pursue research and use research informed practice as a means to achieve sustainable development.

AAR 806	PERFORMANCE EVALUATION OF BUILDINGS	L	T	ST	J		C
		2	0	2	0		4
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 Introduction to Building Performance Evaluation

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

UNIT 2 Environmental Assessment Methods and Modeling For Passive Systems

Modeling 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 3 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 4 Energy Modeling

Computer based simulation. Building performance with respect to function, program, micro climate, urban planning, envelope design, and material –. Energy Modeling and performance simulation of existing buildings – residential – institutional – design of a new residential building.Building Geometry Modeling & Energy Modeling-Thermal Comfort Analysis- Daylighting Analysis- Solar Radiation Analysis, Energy Codes & Standards-Integration of Renewable, Life Cycle Assessment (LCA)-Occupant Comfort & Productivity- Report Generation.

UNIT 5 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.

References

1. Energy Audit of Building Systems – Moneef Kranti (Ph. D) – CRC Press2000
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, Oxford2002.

Course Outcomes:

- Identify the requirements for Performance Evaluation of buildings and the factors that contribute to the energy performance gap.
- Understand the concept of thermal comfort and select different methodologies and established standards used for evaluation of building performance based on building type.
- Investigate the simulation and audit techniques for assessing the energy performance, environmental response and impact of built form.
- Understand techniques, methods and procedures of post occupancy evaluation and document the relationship between building design, energy use, occupant satisfaction, and environmental impact so as to make their observations.
- Add value to architectural design processes and equip students with energy modeling skills.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	3	1	1	2	3	2	1	3
CO2	-	3		1	1	1	2	2	1	3
CO3	2	-	1	-	1	1	2	3	1	2
CO4	1	-	2	-	1	3	-	1	2	3
CO5	-	-	1	-	1	2	3	2	1	3

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **3,9 & 12**

SDG Justification:

Ensuring healthy lives and promoting well-being by maintaining and assessing the indoor air quality and climate responsive building design parameters through simulations. Sustainable industrialization and foster innovation. Ensuring sustainable consumption and production patterns by evaluating performance of buildings.

AAR 808	SUSTAINABLE INFRASTRUCTURE AND SERVICES	L	T	PT	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 Standards And Guidelines

Norms and standards for infrastructure planning, National and local guidelines- URDPFI guidelines & National Building Code (NBC).

UNIT 2 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 3 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 4 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 5 Special Services for Multistoried 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.

References

1. T.P.Salvats, Environmental engineering and Sanitation, Wiley and Sons , NewYork,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.

Course Outcomes:

- Understand the norms and standards for designing of the infrastructure services required for housing.
- Interpret Water Supply System with respect to urban structure.
- Identify the Innovative approach to optimal use of waste and separations of wastewater and Grey water for disposal / recycling.
- Identify the current/innovative practices in Solid Waste Management System level(B4)
- Determine the services required for multistorey buildings.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	2	1	1	1	1	1	3	3	2	1
CO2	3	2	2	1	1	-	2	2	1	1
CO3	3	2	2	1	1	-	2	1	1	1
CO4	3	1	1	1	1	-	2	1	1	2
CO5	3	2	2	2	1	1	2	2	3	2

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 9, 10 & 13

SDG Justification:

This course gives insight to Build resilient infrastructure, promote inclusive and sustainable development.

IENT 1051	FUNDAMENTALS OF ENTREPRENEURSHIP	L	T	P	S	J	C
		2	0	0	0	0	2
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Introduction

Entrepreneurship is a vital life skill that fosters curiosity, creativity, and a focus on seizing opportunities. By embracing entrepreneurship, individuals can achieve professional independence, tackle complex challenges with innovative solutions, and take calculated risks. This course, "Introduction to Entrepreneurship," is designed to provide students with essential knowledge and practical skills for their entrepreneurial journey. Contrary to popular belief, entrepreneurship can indeed be learned, and this course dispels those myths. It offers a comprehensive understanding of the entire entrepreneurial process, from generating ideas to launching a minimum viable product (MVP). Through a combination of theory and hands-on activities, students will explore various aspects of entrepreneurship, such as identifying opportunities, discovering customers, designing solutions, and employing lean startup methods. To succeed, students must demonstrate self-direction and a genuine enthusiasm for learning, whether independently or in collaboration with peers.

Learning Objective

S. No.	Learning Objective
1	Understand the fundamental concepts and processes of entrepreneurship.
2	Identify and evaluate business ideas and opportunities.
3	Know the techniques for effective problem-solving.
4	Understand the customer and the customer discovery process and how to develop market insights.
5	Effectively pitch your Venture Idea

Course outline and indicative content

Unit I: Entrepreneurial Process and Mindset **L-6**

Introduction to Entrepreneurship, Pilot Your Purpose, Innovation, Risk-Taking and Value Creation, Myths around Entrepreneurship, Distinct Types of Entrepreneurship, Entrepreneurial vs. Managerial Mindset.

Unit II: Problem Identification and Ideation **L-6**

Entrepreneurship Opportunity identification, Market and Need Analysis, Problem Discovery, Problem Statement Identification and definition, Evaluating and Selecting Ideas

Unit III: Customer Discovery & Market Insights **L-6**

Users and Buyers, Target Group and Persona, Customer Research Methods (People Shadowing, laddering etc.), Use Cases, Market Sizing & Segmentation, Customer Value Proposition

Unit IV: Solution Design **L-6**

Principles of Effective Solution Design, Prototyping Methods and Tools, Building and Testing Prototypes, Gathering Feedback on Prototypes, Iterating and Refining Solutions, Building Minimum Viable solution.

Unit V: Crafting your Venture Narrative **L-6**

How you can launch a successful venture. Tell your venture story

Course Outcomes

On successful completion of this course, students will be able to:

S. No.	Learning Outcome	Assessment
1	To discover skills and competencies needed for entrepreneurial career	A1
2	Effectively utilize frameworks for business planning and development.	A3

3	Implement customer research methods such as shadowing, laddering etc to gather insightful data.	A2
4	Build and refine a minimum viable product (MVP) based on real customer feedback.	A3
5	Present a process pitch that integrates learnings across all units to propose a viable entrepreneurial venture.	A4

Assessment Methods

Task	Task type	Task mode	Weightage (%)
A1	**Class Participation and Activities**: Engagement in class discussions, group activities, and case studies throughout the course.	Individual	20
A2	**Problem Statement and Ideation Report**: A detailed report identifying a market problem, supported by a Problem Statement Canvas.	Group	20
A3	**Customer Discovery Assignment**: A comprehensive analysis of target customers, including persona creation and market sizing.	Group	20
A4	**Process Pitch**: Share your learning from the course	Group	40

**as per grouping made by the course facilitator (no deviation permitted)*

Evaluation pattern

A1: Classroom Participation and Engagement

a) Class Participation – 5 Marks.
b) Group discussions- 5 Marks,
c) Group Activity – 5 Mark
d) Case Study discussion- 5 Marks.

A2: Problem Statement and Ideation.

a) Problem Identification - 5 Marks.
b) Drawings / Prototype Product or Service-5 Marks

c) Discussion on Market Survey-5 Marks
d) Problem Statement Canvas-5 Marks.

A3: Customer Discovery Assignment

a) Analysis on Target Customers - 10 Marks.
b) Report on Market Size - 10 Marks

A4: Process Pitch

a) Presentation from Problem Identification to Launching a Product or Service - 40 Marks.

Learning and teaching Activities

In classrooms

Reflection videos, Case Discussions, Simulations

Outside classrooms

Field Visits

Teaching and Learning Resources

"Entrepreneurship: Theory, Process, and Practice" by Donald F. Kuratko

https://www.teachingentrepreneurship.org/ Justin Wilcox

Other Books

- The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries
- Blank, S. and Dorf, B. (2012) The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. BookBaby, Pennsauken.
- Neck, Heidi & Greene, Patricia & Brush, Candida. (2014). Teaching entrepreneurship: A practice-based approach. 10.4337/9781782540564.

Documentaries

- Bloomberg Game Changers (e.g. Zuckerberg, Brin & Page; Jobs, Musk, etc.) - YouTube
- Elon Musk: The future we're building and boring | TED – YouTube
- Inspirational series about the entrepreneurial path of 5 of the most admired business entrepreneurs: Cornelius Vanderbilt (Railroads), John D. Rockefeller (Oil), Andrew Carnegie (Steel), J.P. Morgan (Banking) and H. Ford (Automobile)
- 6 Tips on Being a Successful Entrepreneur | John Mullins | TED – YouTube
- Social Entrepreneurship - The Journey of Lakshmi Menon: https://open.spotify.com/episode/3frmNkjUNCZgXCbLsPpfve?si=fd13d7efa85741eb

- Keep the spirit of customer centricity alive with Zoho I YouTube
- Blinkit's Genius Strategy that stunned Amazon and Flipkart | Business Case Study – YouTube
- How is Zerodha's GENIUS Business strategy CRUSHING its competition? Zerodha vs Upstox Case study

Learning articulation (LO-PO mapping and SDG mapping)

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:			
BOS	**:<< date >>**	**ACADEMIC COUNCIL**	**:04-07-2023**
SDG No. & Statement	**: 8**		
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all			
SDG Justification:			
To achieve sustained per capita income growth and ensure higher economic productivity, focus should be on youth by grooming them to be creative and innovative, have productive employment and quality of life through Skill development and Entrepreneurship			

AAR 822	DESIGN STUDIO - II	L	T	ST	J		C
		3	0	6	0		9
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To enable the student to explore Sustainability principles, to experiment and utilize them in various aspects of neighborhood design at 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.

Course Outcomes:

- 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.
- To incorporate the knowledge gained from theory courses into the design solutions.
- Incorporating simulation strategies as a tool for design decisions and energy efficiency.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	2	3	-	-	1	1	3	3	1	2
CO2	1	-	3	-	1	2	3	2	3	1
CO3	2	-	3	1	1	-	3	3	1	1
CO4										
CO5										

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **4,6,7,11 & 13**

SDG Justification:

Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities. Ensuring clean water for everyone by adopting methods to conserve & recycle water. Use of renewable energy and less dependence on non-renewable energy. Ensuring reduced carbon footprint.

AAR 842	Tall Buildings	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 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 2 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 3 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 4 Fire Safety and Management

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

UNIT 5 Tall Buildings and Sustainability

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

References

1. Robert Sinn, I.D. Bennetts, Max B. Kilmister Tall Building Structural Systems McGraw- Hill,199
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 CBSPublishers, 2009.

Course Outcomes:

- Define a tall building and understand the genesis, historical background, and evolution of tall buildings.
- Understand various structural systems of tall buildings and their behavior under lateral loading along with their advantages and limitations.
- Acquire knowledge on various building service systems, like vertical circulation, parking, plumbing etc., required in tall buildings.
- Gain awareness on firefighting equipment and design considerations for fire safety and its effective management in tall buildings.
- Gain an understanding of the sustainability aspects of tall buildings and emerging green technologies in tall buildings.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	1	-	-	3	2	-
CO2	3	-	-	-	1	-	-	-	-	3
CO3	3	3	2	-	1	-	-	-	-	-
CO4	3	2	2	2	2	1	3	-	-	-
CO5	3	3	2	1	2	2	2	2	3	2

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13TH BOC)	**ACADEMIC COUNCIL: 17-09-2021**
SDG Nos. & Statement:	**3,7,8,9,10,11,12,13,15,16 & 17**

SDG Justification:

To develop built forms which can define a better future of human habitat and settlement which has least impact on the environment

AAR 844	Intelligent Buildings	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 Building Automation and Controls

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

UNIT 3 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 4 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 5 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.

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 eastasia, IB Asia Lts.1998
5. Dubin, Freds; Energy Conservation Standards: For building design, construction and operation.
6. ASHRAEJournals.

Course Outcomes:

- Define an intelligent building and understand the history, its development, features, use of AI and technology contributing to intelligent buildings concept.
- Understand about BAS (Building Automation Systems), its components and interface.
- Acquire knowledge on various building automation techniques, like Fuzzy Systems, Expert System, etc. required in intelligent buildings.
- To understand various aspects of Intelligent Building Design- like Environmental controls, lighting controls, Sensors, Security Systems, Elevators Integration etc. for the tenants of automated buildings.
- Analyze the need for Building Management Systems and case studies of intelligent buildings in India and abroad.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	-	3	3	-	2	2	-	-	-
CO2	3	-	3	3	-	2	2	-	-	-
CO3	3	-	3	3	-	1	2	-	-	-

CO4	3	-	3	3	-	1	2	-	-	-
CO5	3	-	2	3	-	1	1	-	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13TH BOC) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 9 & 11

SDG Justification:

Intelligent Buildings aims to build resilient infrastructure, promote sustainable industrialization and foster innovation.

AAR 846	Project Management	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

To acquaint the students with various aspects of Project Management.

UNIT 1 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 2 Project Team

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

UNIT 3 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 4 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 5 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.

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 PlanningEquipment 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 Quality in Construction, E& F.N, Spon, NewYork, 1989.

Course Outcomes:

- Understand characteristics of Project cycle.
- Understand the components of the project team and its impact on the project management cycle.
- Understand project finance, capital budgeting, financial risk analysis etc.
- Understand the factors affecting the quality of the project, Human resource management and safety standards.
- Understand the legal aspects of project management.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	2	3	1	2
CO2	2	3	1	2	3	1	1	2	1	2
CO3	2	3	1	2	2	1	2	2	1	1
CO4	2	3	2	2	1	3	2	3	2	2
CO5	1	2	1	2	2	1	2	3	1	1

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13TH BOC)	**ACADEMIC COUNCIL: 17-09-2021**
SDG Nos. & Statement:	**9,11 & 13**

SDG Justification:

innovation, smarter ways of designing cities and great concern to stall the process of climate change by climate responsive design and minimize resource consumption.

AAR 848	Traditional Wisdom & Sustainable Concepts	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

To acquaint the students with various indigenous traditional climate responsive practices.

UNIT 1 Introduction

Traditional buildings and the associated socio-cultural aspects, Design considerations for different climate zones in India. Concepts of 'Sacred build-up and Landscape'- Architectural and Theological interface, the intricate variations in local social customs, craftsmanship and climate.

UNIT 2 Indigenous Knowledge

Concepts of Indian vernacular architecture covering informal architecture and functional architecture of structures, adaptation of local building materials, designs fulfilling the needs of local people.

UNIT 3 Building Element

Introduction and re-interpretations of spatial elements such as columns, brackets, jaalis, zarokhas, chhajas, stairs and cupolas to the remake of spatial themes such as courts, terraces, pavilions and caves related to sustainable concepts.

UNIT 4 Sustainable Concepts from History

Concepts from Indus valley, Aryan cultures, Buddhist, Dravidian, Indo Aryan, Hoysala Architecture, Islamic, provincial style, Mughal, colonial and post-colonial architecture; components of consideration such as - materials, high ventilated roofs, integrated design, lighting, ventilation, vegetation and adopting to natural environment.

UNIT 5 **Solutions for Sustainable Human Cities**

Responsible cities with focus on walkability, cyclability with open and breathable spaces, and traditional ways of city design using passive design systems.

References

1. Wines James &Jodido Philip, "Green Architecture – The Art of Architecture in the age of Ecology", Tachen Publishers, New York, 2000.
2. Mackenzie Dorothy, "Green design: design for the Environment", Laurence King, London, 1997.
3. Farmer John & Richardson Kenneth, "Green Shift: Changing attitudes in architecture to the Natural World", Architectural Press, Boston, 1999. Jamie Hinze, Construction Contracts, McGraw Hill,2001.
4. The European Commission, "A Green Vitruvius: Principles and Practices of Sustainable Architectural Design", James & James, London, 1999.
5. Fred A. Stitt, "The Ecological Design Handbook", McGraw Hill, New York, 1999
6. Scott Andrew, "Dimensions of Sustainability: Architecture, Form, Technology, Environment & Culture", F&FN Spon, London, 1998.

Course Outcomes:

- Insight on existing sustainable traditional solutions based on local conditions, geography of region and fulfilling needs of local people.
- Understand the socio-cultural implication in design decisions.
- Understand local material use to satisfy climate responsive design.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	2	3	1	-
CO2	2	3	-	2	1	1	3	2	-	-
CO3	2	3	-	1	1	1	1	2	-	-
CO4	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13TH BOC) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: **1,3,5,7 &11**

SDG Justification:

Experimental affordable house, applying knowledge of traditional wisdom. Use of local natural materials & techniques. Upcycling waste materials. Involving the leaders of local communities, who promote to accept & understand the house. Climate change causes heavier rainfall putting a growing pressure on wastewater treatment & sewer systems. Design can make our cities more inclusive, safe and resilient, sharing the common resources, reducing the use of space & energy.

AAR 850	Energy Auditing	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To understand energy scenario and general aspects of energy audit.
- To learn about the methods and concept of energy audit

UNIT 1 Energy Audit Concepts

Need of Energy audit – Types of energy audit – Energy management (audit) approach – understanding energy costs – Bench marking – Energy performance – Matching energy use to requirement – Optimizing the input energy requirements -Duties and responsibilities of energy auditors- Energy audit instruments – Procedures and Techniques.

UNIT 2 Principles And Objectives of Energy Management

Energy management systems -Importance – Indian need of Energy Management – Duties of Energy Manager – Preparation and presentation of energy audit reports

UNIT 3 Energy Audit Assessment

Energy Performance Assessment for building envelope, fenestration and embodied energy, quantify energy consumption and establish base line energy information, Construct energy and material balance

UNIT 4 Energy Efficiency Evaluation

Perform efficiency evaluation of energy & utility systems, Compare energy norms with existing energy consumption levels, Identify and prioritization of energy saving measures and analysis of technical and financial feasibility of energy saving measures, study of energy efficient technologies and alternate energy sources

UNIT 5 Electrical Energy Management

Methods to minimize demand and supply gap- Energy Efficiency in Thermal Utilities and Energy Efficiency in Electrical Utilities.

References

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.
3. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley (Interscience publication).
4. Industrial Energy Management and Utilisation -L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)
5. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
6. Energy Conservation guide book Patrick/Patrick/Fardo (Prentice hall1993)

Course Outcomes:

1. To understand the basic concepts of energy audit and energy management.
2. To identify energy saving potential and prepare energy audit report.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	3	1	2	1	-	3	1	-
CO2	2	-	3	1	2	1	-	2	1	-
CO3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13TH BOC) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **3,4,7 & 17**

SDG Justification:

Good health and well-beingcome from better designed neighborhood and climate responsive architecture. With education all the challenges in the society can be addressed correctly, shift to renewable and clean energy is the demand today as our non-renewable resources are nearing depletion. Collective partnership globally in achieving all the targeted SDGs.

AAR 901	**Low-Cost Housing**	**L**	**T**	**ST**	**J**		**C**
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 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.Existing Finance system in Low-Cost Housing, Recommendation of Housing and Urban Development Corporation

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.

Course Outcomes:

- Comprehend the current Housing Situation in India, various Developmental Programmes with the gained knowledge and understand the application of sustainable building material including their cost implications.
- Understand the fundamentals of Modular coordination and its application in both in total & partial prefab construction technology, Analyze the merits & demerits of the impact of prefab/precast application in terms of employment and production.
- Apply the cost reduction solutions developed by National Institutions for a given assignment.
- Gain and understand the use of CPM & PERT in project management analyze the time cost
- relationship and its application to overcome the time overrun losses in the project management cycle.
- Able to synthesize the knowledge gained in terms of material and techniques for optimum output of speedy construction and cost reduction. Knowledge of ongoing research in low-cost building materials and construction technologies at both the National & International level.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	2	2	3	1
CO2	3	3	1	2	2	1	2	2	3	1
CO3	3	3	1	2	2	1	2	2	3	1
CO4	3	1	2	2	2	1	2	2	3	1
CO5	3	3	2	2	3	1	2	2	3	1

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

Provide affordable housing for the homeless with proper sanitation & clean drinking water facility through innovative technology. Such sustainable developments would generate job opportunities, reduce inequalities, and help in carbon action.

AAR 903	Disaster Management	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 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 2 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 3 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 4 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 5 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.

References

1. Arnold, C and Reitherman, R. Building Configuration and Seismic Design. JohnWiley and Sons, New York,1982.
2. Carter, WN. Disaster Management: A Disaster Manager's Handbook, AsianDevelopment 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 DisasterRelief Organization,1986.

Course Outcomes:

The students will develop an understanding of the paradigm shift in disaster management from response and recovery to prevention, preparation, mitigation and response, recovery.

Get an understanding of various causes and impacts of natural and man-made disasters.

Students will gain an understanding of structural and nonstructural mitigation methods and various techniques for retrofitting buildings affected by natural calamities.

Awareness about environmental policies and programs, disaster impact reduction and environmental legislation in India.

Principles of community-based disaster management and case studies of public participation in rehabilitation projects.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: **1, 2, 3, 6, 9, 11, 13, 14 & 15**

SDG Justification:

Disaster risk reduction cuts across different aspects and sectors of development. There are 9 of the 17 sustainable development goals, firmly establishing the role of disaster risk reduction as a core development strategy. This course gives insight on urgent action to combat climate change and its impacts and also adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement

AAR 905	Remote Sensing and Geographical Information Systems	L	T	ST	J		C
		2	0	2	0		4
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 Data Processing

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

References

1. Lillesand, T.M. and Kiefer, R.W, Remote sensing and image interpretation, John Wiley and sons, New York,2004.
2. GolfriedKonechy, 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.

Course Outcomes:

- Understand the basic concept of GIS and its applications, different components of GIS andknowledge on map projections, their classifications and process on georeferencing.
- Understand the different types of data representation and compare vector and raster data structure, outline concept of Database Management System and usage of GIS in day-to-day activities.
- Understand the various terminology used in Remote Sensing, summarize the historical perspective, principles and components of remote sensing and develop knowledge on various energy interactions related to Electro Magnetic Radiation.
- Understand the systems in Remote Sensing and energy recording technologies, developments in Indian Space Program, interpret satellite data and knowledge on process involved in digital image processing develop knowledge on process involved in digital image processing.
- Know the fundamentals of spatial data, digital image processing, analysis and merging by using software ArcGIS, etc.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	-	-	-	3	2	-	-	-	-	-
CO2	-	-	-	3	2	-	-	-	-	-
CO3	-	-	-	3	2	-	-	-	-	-
CO4	-	-	-	3	2	-	-	-	-	-
CO5	-	-	-	3	2	-	-	-	-	-
Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation										

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

AAR 921	Design Studio-III	L	T	ST	J		C
		3	0	6	0		9
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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.

Course Outcomes:

- understand and identify sustainability principles, strategies and planning applicable at human settlement level
- articulate the above aspects using simulation
- analyze and evaluate the above aspects using simulation at a human settlement level
- apply the above aspects in developing policies and guidelines to ensure long term sustainability
- develop responsibility, communication, rational thinking, and empathy

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	3	3	3	1
CO2	2	1	1	1	3	3	1	2	2	3
CO3	3	2	1	3	2	3	3	1	1	3
CO4	3	3	2	3	2	2	1	2	2	2
CO5	2	1	-	2	3	1	1	2	-	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS: 05-08-2021 (13th BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG Nos. & Statement: **4,6,7,11 & 13**

SDG Justification:

Ensuring an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities. Ensuring clean water for everyone by adopting methods to conserve & recycle water. Use of renewable energy and less dependence on non-renewable energy. Ensuring reduced carbon footprint.

AAR 923	Research Seminar	L	T	ST	J		C
		0	0	3	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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.

Course Outcomes:

- Evaluate multiple perspectives and synthesize ideas to undertake research work on a topic of their choice related to sustainable architecture.
- Work individually or in teams to present evidence-based arguments through essays/articles/papers.
- Enhance the technical report writing skills of the student.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO3
CO1	1	2	1	2	3	3	2	3	1	2
CO2	-	1	1	3	1	3	1	2	1	3
CO3	2	1	-	3	2	3	-	2	1	3
CO4										
CO5										

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4, 5 & 10

SDG Justification:

This course provides basic knowledge on research methodology which encourages students to actively pursue research and use research informed practice to achieve sustainable development.

AAR 941	Real Estate Management	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 1 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 2 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 Neighborhood dynamics on Real Estate Projects. Relevant Examples.

UNIT 3 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 4 **Financial 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 5 **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.

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.

Course Outcomes:

- Understand the concept of Real Estate Management and get an overview of Real Estate Market.
- Get exposed to a wide range of issues in the real estate profession.
- Develop analytical skills and methodology necessary to deal with Real Estate Management.

CO-PO Mapping:										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	3	3	2	3	1
CO2	2	1	1	1	2	2	2	2	3	2
CO3	1	2	2	2	1	2	2	2	3	2
CO4										
CO5										

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

The course gives insight to ensure access to affordable, reliable, and sustainable modern energy for all. Ensure to make cities and human settlements, inclusive, safe, resilient and sustainable. Ensure sustainable consumption and production pattern by evaluating performance of buildings.

AAR 943	Adaptive Reuse and Retrofit of Buildings	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 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.

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. ZynepAygen: International Heritage and Historic Building Conservation: Saving the World's Past; Routledge,2013.

Course Outcomes:

- Understand the concepts of retrofitting & adaptive reuse of existing buildings.
- Analyze the needs and drivers of adaptive reuse in old buildings.
- Analyze various technologies to make existing buildings energy efficient.
- Comprehend and analyze sustainable conservation practices specifically in the case of heritage buildings.
- Analyze various energy efficiency retrofitting techniques for tall buildings.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	3	-	-
CO3	3	3	3	-	-	3	-	3	-	-
CO4	3	3	3	-	-	-	-	3	-	-
CO5	3	3	3	-	-	3	-	3	-	-
Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation										

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: **7,11, & 12**

SDG Justification:

The course gives insight to ensure access to affordable, reliable, and sustainable modern energy for all. Ensure to make cities and human settlements, inclusive, safe, resilient and sustainable. Ensure sustainable consumption and production pattern by evaluating performance of buildings.

AAR 945	Urban Planning: Principles and Techniques	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

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

UNIT 1 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 2 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 3 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 4 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 5 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.

References

1. GallionA, 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.

Course Outcomes:

- Understand the basic principles of planning and settlement design and components of settlements.
- Understand features of urban development plans, interim and comprehensive plans, Structure plan, Master Plan; Zonal Development Plans and Strategic Planning.
- Understand concepts of urban land use and related regulations.
- Understand the survey research process, carry out field survey and sampling.
- Understand techniques of spatial structures of cities and towns and use of GIS.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	2	2	3	3	2
CO2	3	3	2	1	1	2	2	2	3	1
CO3	3	2	2	1	1	2	2	1	3	1
CO4	2	2	1	1	1	1	2	2	2	1
CO5	2	2	1	1	1	1	2	2	2	1

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: **11 & 13**

SDG Justification:

The course gives insight to make cities and human settlements, inclusive, safe, resilient and sustainable

AAR 947	**Healthy Buildings**	**L**	**T**	**ST**	**J**		**C**
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To understand the concepts related to the design of healthy buildings and spaces
- To analyze the theories of Environment-Behaviour relationships

UNIT 1 Introduction to Healthy Buildings

Healthy buildings theory; Performance of building services against standards, Workplace standards of health, Observation, and analysis of health risk in buildings, and maintenance requirements, Environmental and health impact of building materials. Investigations of healthy living practices

UNIT 2 Indoor Air Quality

Sick building syndrome, Issues of Indoor air quality. Characteristics associated with indoor air contaminants (IAC) (Particulate matters (PM2.5, PM10), Radon, Volatile organic compounds (VOCs), Asbestos, Bio-aerosols, and more)

UNIT 3 Design of Basic Air Conditioning System for Buildings

Process of air conditioning system selection, heat load estimation, and design of air distribution. Air conditioning design for energy efficiency. AC system components: Fans, coils, filters, and heat rejection equipment.

UNIT 4 Environmental Perception

Environmental Perception and cognition. Perspectives on perception, learning, habituation, and perception of change. Models and acquisition of spatial cognition and cognitive maps. Way finding, characteristics, settings.

UNIT 5 Environment-Behaviour Relationships

The nature and function of theories. Arousal approach, stimulation approach, Adaptation level, Behaviour constraint and Environmental stress approach. Barker's ecological psychology approach. Environment and Behaviour studies related to Noise, Weather, Climate, Territoriality, Disasters, Crowding. Issues related to built environment such as design of residential, institutional, work, learning and leisure environments.

References

1. Indoor Air Quality: A Comprehensive Reference Book: v.3 (AIr Quality Monographs) by M. Maroni (Editor), B. Seifert (Editor), T. Lindvall (Editor)Chadderton, D. V., "Air Conditioning: A practical Introduction", E & FN Spon, London.
2. Kayem, M., "Psychology in relation to design" Dowden, Hutchinson and Ross, 1973. 5. Hall, E.T., "The Hidden Dimension" New York, Doubleday, 1966.
3. Bell, A. Paul, Greene, C. Thomas, Fisher, D. Jeffrey, Baum Andrew, "Environmental Psychology" Harcourt Brace College Publishers, New York, 1996.

Course Outcomes:

- Understanding the concept of indoor air quality and common indoor air contaminants.
- Analysing design consideratio9ns for basic air conditioning systems in buildings.
- Understanding the concepts related to passive design techniques for better ventilation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	3	3	2
CO2	3	3	3	1	1	2	2	3	3	2
CO3	3	3	3	1	1	2	2	3	3	2
CO4										
CO5										

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 11 & 15

SDG Justification:

This course gives insight to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

AAR 949	Green Built Environment	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- Impart knowledge on Green concepts in design, construction & operation of buildings
- Exposure to the latest Green Building trends & technologies

UNIT 1 Sustainable Architecture & Sites

Integrated Approach for Green Building design: Factors for Site selection, Understanding Site Ecology & Site Analysis; Soil erosion & pollution control measures: types of Soil Erosion, strategies to Mitigate Land Degradation, Design Techniques & Challenges; Microclimate: Factors affecting microclimate & heat Islands, Strategies to handle heat island in built environment, Designing Green Spaces and Enhancing Biodiversity in built environment; Universal Design: Key accessibility issues and Design guidelines

UNIT 2 Water Management

Water Balance and approach for water efficiency: 3R Approach for water efficiency – Reduce, Reuse/ Recycle and Recharge; Water efficient plumbing fixtures, Standards & Codes; Efficient irrigation practices – Hydro zoning, Control devices for water supply, Irrigation systems – Drip & Sprinklers; Wastewater treatment & reuse, wastewater treatment technologies: Physical, Biological and Natural; Rainwater harvesting and utilization, Groundwater recharge techniques: Design considerations.

UNIT 3 Energy Management

Introduction, Performance Evaluation and Approach for Energy Efficiency in Buildings: Energy Efficiency Standards & Codes: ECBC 2017 & EPI, ASHRAE 90.1, ASHRAE 62.1, ASHRAE 55, ASHARE 170, ISHRAE 1001, Star labelling for appliances; Efficient Building Envelope: Heating loads in buildings, Building orientation and form, Envelope Heat Transfer & Material Specifications – Wall, Roof & Fenestration; Air Conditioning: Types of air conditioning systems, Design Considerations and control systems; Lighting in Building: Daylighting & Artificial Lighting, Methods to determine ECBC compliance for interior lighting and Lighting Controls; Renewable Energy systems and technologies

UNIT 4 Sustainable Building Materials

Attributes of Sustainable Building Materials: Recycled content, Regional material, Renewable material, Embodied energy, Embodied carbon, Material performance, Recyclability, Elimination of hazardous materials; Ecolabeling of Products: Types of Ecolabels – Type I, II & III; Sustainable Materials for Green Buildings: Ready mix concrete, Construction Blocks, Glass, Steel TMT Bars, Construction Chemicals, Insulation Materials, Cement, Paints; Waste management during construction & post-occupancy: Segregation strategies, Types of waste management – organic, inorganic, e-waste, hazardous waste

UNIT 5 INDOOR ENVIRONMENT QUALITY

Indoor Air quality: Codes and Standards, Fresh air requirements, Design considerations; Approach for improving Indoor air quality: Measures to reduce sick building syndrome, Demand control ventilation, CO_2 monitoring in buildings, Air quality monitoring; Enhancing occupants' Comfort, Health and Wellbeing: Thermal Comfort, Visual Comfort, Acoustics, Ergonomics, Olfactory Comfort.

References

1. Guide on Green Built Environment, IGBC, 2021
2. IGBC Green New Buildings rating system, IGBC, 2016
3. IGBC Green Homes rating system, IGBC, 2019
4. National Building Code 2016
5. ECBC 2017
6. ASHRAE 90.1, 62.1, 55

Course Outcomes:

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

- Students would be Industry ready for in their careers in green built environment
- Opportunity to get accredited as 'IGBC AP - Associate'

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	2	3	3	3	3
CO2	2	3	3	3	2	3	3	3	2	2
CO3	-	-	-	-	-	-	-	-	-	-
CO4										
CO5										

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :20-05-2022 (15TH BOS) **ACADEMIC COUNCIL: 17-06-2021**

SDG No. & Statement: **3, 4, 5, 6, 7, 9, 11, 12 & 13**

SDG Justification:

The course gives insight on Green concepts in design, construction & operation of buildings to mitigate the negative effects of resource consumption and climate change.

AAR 922	Design Thesis	L	T	ST	J		C
		0	0	21	0		21
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational Objectives:

- To provide an opportunity to the student to undertake 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.

Course Outcomes:

- Understand the application of various concepts and strategies to reduce the environmental impact of the built environment.
- Read and interpret climatic data and understand the architectural potential of climate responsive design for optimizing the buildings to enhance thermal comfort.
- Critically analyze various green and clean energy systems that could be integrated with building design at different scales and for various building typologies.
- Analyze energy consumption / environmental performance / comfort conditions using advanced simulation tools and propose green solutions accordingly.
- Understand and analyze in detail the advantages and limitations of selected green and sustainable concepts and strategies.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	2	3	2	-
CO2	3	3	2	-	-	-	-	2	-	3
CO3	1	2	3	-	-	1	2	2	3	1
CO4	-	-	-	-	-	3	2	2	-	3
CO5	-	2	2	-	2	-	3	3	2	-

Note: 1 - Low Correlation, 2 - Medium Correlation, 3 - High Correlation

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: **3, 4, 5, 6, 7, 9, 11, 12 & 13**

SDG Justification:

The course gives insight into all the responses that can be adopted to stall the ill effects of climate change and depleting non-renewable natural resources. It includes environmental responsive design solution approach.

EOE 202	German For Beginners	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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.

References

1. Deutsch alsFremdsprache IAGrundkurs
2. Ultimate German Beginner - Intermediate (Coursebook), Living Language,2004.
3. German for Dummies, Paulina Christensen

Course Outcomes:

- General awareness of certain aspects of German culture.
- Acquisition of elementary Reading and Writing Skills.
- Ability to hold a general conversation for a few minutes.

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

EOE 305	French for Beginners	L	T	ST	J		C
		3	0	0	0		3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	None						

Course Educational 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 directions, 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. Vocabulary: 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 avoiraller, etre faire, vouloirpouvoir. Vocabulary: Parts of the body, rooms and features of interior spaces.

References

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

Course Outcomes:

- General awareness of certain aspects of French culture
- Acquisition of elementary Reading and Writing Skills
- Ability to hold a general conversation for a few minutes.

APPROVED IN:

BOS :05-08-2021 (13TH BOS) **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification: