M.Arch (Sustainable Architecture) Syllabus

Credit Pattern Syllabus for I Year & II Year M.Arch - Batch 2015-17 & 2014 - 16

Master of Architecture (M. Arch) in SUSTAINABLE ARCHITECTURE
ACADEMIC REGULATIONS,
COURSE STRUCTURE & DETAILED SYLLABUS
Department of Architecture
Contents

I. INTRODUCTION

Master of Architecture (Sustainable Architecture)

The Master of Architecture course in Sustainable Architecture establishes cohesive relation amongst architecture, technology and sustainability, enabling graduates to respond effectively to the growing environmental challenges faced by the building industry and planet Earth.

This program offers an opportunity to expand students' knowledge base for developing solutions for sustainability of Built environment scientifically keeping in mind the socio economical and environmental problems. Grounded in rigorous scientific research and analysis with a multidisciplinary approach of understanding issues related to energy efficiency, traditional wisdom of built environment, this course also delves into the water and Land and vegetation, waste management which are essential subjects of environmental sustainability. The Master of Architecture degree in sustainable Architecture will be a project based course.

1. Course Aims

The School of Planning and Architecture, Vijayawada aims to play a key role in preparing future decision makers to meet the challenges of sustainable development by offering this specialized course. The aim is to develop skills, knowledge and understanding related to environmental sustainability, construction and building technology, adopting the principles and practices of sustainable building design, while responding to environmental challenges such as Climate change, environmental degradation etc.

The course offers a contextualized and deep understanding of sustainability in architecture. Study moves from the broad aspects of Man and Environment, energy and climate zones, through alternative materials and technologies for sustainability, urban sustainability issues, to the specifics of energy and environmental assessment. Waste management, Intelligent buildings, Eco cities, Passive & active solar strategies for energy conservation will be explored along the way. Throughout the course students are encouraged to challenge existing orthodoxies and to explore potential, cultural and technical responses to a changing world, whilst respecting the limits posed by our ecosystem.

2. Admission Requirements

Bachelor’s degree in Architecture from a recognized university with minimum 50% marks with or without GATE score.

3. Learning Environment

Learning process is through a combination of formal and informal methods. Teaching and learning strategies include;

- Tutor guided reading and independent study
- Discussions on lectures
- Seminars
- Presentations
- Tutorials
- Practical studies

4. Assessment

Assessment is through coursework, which builds to form the students' academic file, culminating in a thesis. Exams will be conducted at the end of each semester

5. Relevance to Profession

The programme is designed for architects with an interest in developing expertise in an area of rapidly increasing importance of energy efficient & sustainable strategies (such as environmental strategies, energy monitoring and performance, resource management), where skill shortages are being reported and increasing specialist knowledge is required. The programme is continually being developed to meet the specific demands that industry require and strives to use the latest information including IT packages.

6. Outcomes

This programme is designed to give you the opportunity to:

- Develop design skills in the area of Energy Efficient Design of Buildings.
- develop a sound knowledge and analytical ability utilizing and building on existing knowledge
- facilitate your intellectual, creative and professional development
- develop your judgment in response to complex and unpredictable research and professional issues within the area
- Independent Energy consultants in Built environment
- Specialists to design of energy efficient and sustainable built environment
- Can take a senior/management position in academic research and professional practice

7. Job Opportunities

II. ACADEMIC REGULATIONS

1. Introduction:

- These Regulations will govern the conduct of various full time post graduate academic programs, evaluation pattern, promotion and conduct of examinations and the Juries, leading to the award of various degrees as follows:
  - 2-Year (4 semesters) postgraduate program in Planning leading to the award of the Master of Planning [M.Plng.] Degree.
  - 2-Year (4 semesters) postgraduate program in Architecture leading to the award of the Master of Architecture [M.Arch.] Degree.

2. Courses of Study :

2.

- The following courses of study are available under various degrees.

2. **For the M.Plng. Degree:**
   - Plng. in Urban & Regional Planning
   - Plng. in Infrastructure Planning
   - Plng. in Environmental Planning
   - Plng. in Housing
3. **For the M.Arch. Degree:**
   - Arch. in Energy efficient and Sustainable Architecture
   - Arch. in Coastal Architecture

- The provisions of these regulations shall also apply to any new courses that may be introduced from time to time and added to the above list.
- The Board of Governors may change any or all parts of these regulations at any time, on the recommendations of the Academic Council.

3. Award of the Degrees:

3.

- A student will be declared eligible for the award of the post graduate degree for which he has been admitted, if he fulfils the following Academic Requirements:
  - He has to pursue a course of study for not less than two academic years and not more than four academic years.
  - He has registered for and studied all the subjects for a total of 120 credits and secured at least 100 credits as provided in the following regulations.
  - He has secured a minimum of 5.0 in the Cumulative Grade Point Average (CGPA) on a 10 point scale.
- Students, who fail to fulfil all the academic requirements for the award of the degree, within the stipulated period as above, shall forfeit their seat in the course and their admission shall stand cancelled.

4. Attendance:

4.

- A student has to put in a minimum of 85% of the attendance in each and every subject for becoming eligible to register for the end examinations and for acquiring credits in each semester.
- A student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester.
- Condonation of shortage of attendance in any subject up to 10% (75% and above and below 85%) in any semester may be granted on valid and reasonable grounds by the Department Academic Committee.
- Condonation of shortage of attendance as stipulated above, shall not be automatic but on the merits of the case to the satisfaction of the Department Academic Committee and is subject to production of satisfactory documentary evidence by the student.

5. Distribution and Weightage of the Marks:

5.

- Each semester will consist of the one or more of the following categories of subjects with the distribution of marks and credits as shown against each of the categories.

1.

No.	Category	Maximum Marks				Credits Per period*		
		Internal Evaluation	End Evaluation	External Jury	Total	L	T	S
	Core Theory	50	50	--	100	1	1	-
		100	--	100	200			
	Core – Studios	150	--	150	300	-	-	1
		200	--	200	400			
	Non-Core – Theory	100	--	--	100	0.5	0.5	-
	Non-Core – Studio	100	--	--	100	-	-	0.5
		200	--	--	200			
	Final project	250	--	250	300	-	-	1

NOTE: * The basis of assigning credits to individual subjects is indicative by and large. However, specific subjects may have different credits based on the relative importance of the subjects.

1. While computing the total credits for a subject, all fractional credits shall be rounded off to the nearest integer/whole number.
2. L stands for Lectures, T stands for Tutorials and S stands for Labs, Studios, Practicals, Fieldwork, workshops, etc.

6. Minimum Academic Requirements:

6.

- The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation No.4:
  - A student must obtain at least 50% marks in the internal evaluation in any subject, before he is permitted to appear for the end evaluation or external jury as the case may be, in all the Subjects and the final project.
  - A student shall be deemed to have satisfied the minimum academic requirements in each subject or final project, if he secures not less than

50% of marks in the End Evaluation/External Jury and a minimum of 50 % of marks in the sum total of the internal evaluation and End Evaluation/External Jury taken together.

- A student failing in any core subject and/or the final project, on his first attempt, will not be eligible for any awards, scholarships and/or distinctions including the award of Distinction at the end of the course.
- A student who fails to secure the minimum academic requirements in the internal marks of any core subject (theory and/or studio) and final project, will have to repeat the semester as and when next offered.
- A student who fails to secure the minimum academic requirements in the internal marks of any non-core subject (theory and/or studio) will have to re-register for the subject as and when it is next offered. Such subjects shall be called ‘Backlog’ subjects.
- At any given time a student cannot have more than two backlogs.
- A student eligible to appear for the end evaluation (regular or supplementary) in a subject, will be treated as having availed of the opportunity for the purposes of counting the number of attempts, irrespective of whether he appeared or was absent at such an examination.
- A student who fails to secure the minimum academic requirements in the end evaluation/external jury and/or in the sum total marks, may appear for the supplementary examinations, as and when next offered.
- If a student fails to secure the minimum academic requirements even at the first supplementary examinations in any core subject/s and/or the final project, will have to repeat the subject and/or semester, as and when offered next.
- A student who fails to secure the minimum academic requirements at the first supplementary evaluation/s and/or external jury in any Non-Core Subjects, may appear for the next regular end evaluation and/or supplementary evaluation, for a total maximum attempts of four times. Such subjects shall be called ‘Carry Forward’ subjects.
- At any given time, a student cannot have more than two carry forward subjects.
- If a student has more than two backlog subjects and/or more than two carry forward subjects, then he has to repeat the earliest semester in which he has one or more backlog and/or carry forward subjects.
- Notwithstanding any of the above provisions, a student cannot carry forward any subject for more than one academic year after the completion of the academic year when he has first registered for the subject.

- Supplementary evaluations for both odd and even semesters, will be conducted during the summer break.

7. Grade Points and Computation of SGPA & CGPA:

7.

- Based on the marks obtained in any subject, letter grades will be awarded. Based on the letter grade obtained for the subject, grade points will be awarded as follows:

1. No.	% of Marks		Letter Grade	Grade Point
	Minimum	Maximum		
	90.00	100.00	A	10
	80.00	89.99	B	09
	70.00	79.99	C	08
	60.00	69.99	D	07
	50.00	59.99	E	06
6	00.00	49.99	F	00

- The grade points obtained in a subject multiplied by the credits for that subject will be the weighted grade points.

Weighted Grade Points (W) = c X g

Where ‘c’ is the number of credits assigned for the subject and ‘g’ is the Grade Point obtained as per the Table in 7.1 above.

- The sum of the weighted grade points divided by the total number of credits in a semester will result in the Semester Grade Point Average or SGPA.

SGPA = $\sum c_i g_i / \sum c_i$

i = 1 to n

Where n is the number of subjects registered for in the semester, ‘c’ is the number fo credits allotted to a particular subject, and ‘g’ is the grade-point obtained by the student as per 7.1 above.

- Starting from the second semester, at the end of each semester, a Cumulative Grade Point Average (CGPA) will be computed for every student by dividing the sum of weighted grade point of each subject for all the subjects starting from first semester up to and including the semester under computation, divided by the sum of credits for all the subjects starting from the first semester up to and including the semester under consideration.

$$CGPA = \sum c_i g_{i/} \sum c_i$$

$$i = 1 \text{ to } m$$

Where ‘m’ is the number of subjects registered for in all the semesters from the first semester up to and including the semester under computation, ‘c’ is the number of credits allotted to a particular subject, and ‘g’ is the grade-point obtained by the student as per 7.1 above.

- The CGPA would indicate the cumulative performance of the student from the first semester up to the end of the semester to which it refers.
- The CGPA and SGPA will be rounded off to the second decimal place and recorded as such.
- The CGPA, SGPA and the grades obtained in all the subjects in a semester, will be communicated to every student at the end of every semester, after the results for that semester are declared.
- When a student gets the grade ‘F’ in any subject during a semester, the SGPA & CGPA from that semester onwards will not be calculated, until such ‘F’ grade(s) has been substituted by better grades during a subsequent semester.
- All Subjects and the final Project are compulsory. Consequently, a student must fulfil the minimum academic requirements in all the subjects.
- However, for the purpose of computation of the final CGPA, award of the class as in regulation 8 below, and the award of degree and other honours including awards and medals, the performance in the best credits, to the extent as in regulation 3 above, only will be taken into account.

8. Promotion between Semesters:

8.

- A student shall be promoted from odd to even semester if he fulfils the minimum requirement of attendance as in 4 above and the minimum requirement of internal marks in all the subjects.
- However, a student having two or less than two backlog subjects, shall be promoted from the odd to even semester.
- A student shall be promoted from even to odd semester, if he does not have any backlogs in the core subjects, and has no more than two or less than two carry forward subjects.
- A student has to satisfy the minimum academic requirements in all the subjects of the I and II semesters, within two academic years. Failure to so complete, will result in automatic cancellation of admission and forfeiture of his seat in the academic program for which he has been admitted.
- A student who fails to fulfil all the academic requirements for the award of the degree, within four academic years from the year of his first admission, shall forfeit his seat and his admission shall stand cancelled.

9. Re-Registration:

9.

- A student who fails to fulfil the minimum academic requirements in any core or non-core subject and secures less than 50% marks in the internal evaluation may be permitted the option of re-registering in that subject which will enable him to improve/redo and resubmit the work for internal evaluation. In such cases of re-registration, the student's previous performance both in the internal evaluation and end evaluation in the particular subject/s shall stand cancelled and he shall be required to appear for his end evaluation,(end examination and /or external jury as the case may be), again.
- Re-registration has to be completed within 15 days of declaration of results of the supplementary examinations, in the case of odd semester and within 15 days from the date of commencement of classes in the case of even semester.
- However, such re-registration shall be subject to a limit of only two theory subjects or one theory subject and one non-core studio/seminar/practical subject at any given time. A stipulated fee shall be payable towards re-registration in any subject.

10. Withholding of the results:

1.

- The results of a student may be withheld if:
  - He has not cleared any dues to the Institution / Hostel,
  - A case of disciplinary action against him is pending disposal.

11. Award of Class:

1.

- After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of the M.Plng. or the M.Arch. Degree, he shall be placed in one of the following three classes:

First Class with Distinction	8.0 and above of CGPA and should have cleared each and every subject in a single attempt.	
First Class	Below 8.0 but not less than 6.0 of CGPA and those students who secured a CGPA of 8.0 and above but have cleared at least one or more subjects in more than one attempt.	From the Grade Points secured for the best 100 credits for both the M.Plng. and M.Arch. degrees
Second Class	Below 6.0 but not less than 5.0	

(The marks in the internal evaluation and end evaluation and/or external jury, shall be shown separately in the marks memorandum)

12. Academic Calendar:

2.

- The academic year is divided into two semesters each of approximately 20 weeks duration including the time given for end evaluations and preparation.
- The Semesters will be called Odd (July to December) and Even (January to May)
- Each semester shall have a minimum of 90 working days.

13. Professional Training:

3.

- The Curricula for M.Plng. and M.Arch. would include compulsory Professional Training during the summer vacations at the end of second semester.

- Each such training shall be of a minimum of eight weeks duration and shall carry a total of two credits reflecting in the third semester as Training Seminars

14. General:

4.

- Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
- The academic regulations should be read as a whole for the purpose of any interpretation.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Director is final.
- The School may change or amend the academic regulations or syllabi at any time and the change or amendments made shall be applicable to all the students with effect from the dates notified by the Director.
- A good understanding of the academic regulations and a strict adherence to the proposed schedules will enable the students to complete the M.Plng. / M.Arch. programme or any other programme that may be introduced at a later date, successfully within the stipulated time.

III. CO

URSE STRUCTURE

FIRST SEMESTER

1. No.	Cat	Code	Subject Title	Distribution of Marks				Distribution Periods per week			
				IA	**EE**	**EJ**	**TM**	**L**	**S**	**T**	**T**
1	CT	10210101	PEOPLE, ENVIRONMENT AND BUILDINGS	50	50	-	100	2	-	-	2
2	CT	10210102	CLIMATE AND BUILT FORM RESPONSES	50	50	-	100	2	-	-	2
3	CT	10210103	TRADITIONAL WISDOM AND SUSTAINABILITY CONCEPTS	50	50	-	100	3	-	-	3
4	CT	10210104	ENERGY AUDIT & ENVIRONMENTAL IMPACT ASSESSMENT	100	-	-	100	3	-	-	3
5	NT	10210105	ENVIRONMENTAL CODES AND ENERGY RATINGS	50	50	-	100	2	-	-	2
6	NT	10210106	SUSTAINABLE BUILT ENVIRONMENT, ISSUES & APPROACHES (SEMINAR)	100	-	-	100	4	-	-	4
7	CS	10210107	DESIGN STUDIO - I	150	-	150	300	-	6	-	6
8	NT	10210108	ELECTIVE – I	100	-	-	100	3	-	-	3
TOTAL				**650**	**200**	**150**	**1000**	**19**	**6**	**-**	**2**

ELECTIVES I: Energy Efficient Landscape Design, Post Occupancy Evaluation of Buildings etc.

Cat	Subject Category						
CS	Core Studio	**CT**	Core Theory	**NS**	Non-Core Studio	**NT**	Non-Core Theory
IA	Internal Assessment	**EE**	End Examination	**EJ**	External Jury	**TM**	Total Marks
L	Lecture Periods	**S**	Studio/Lab/Practicals/Workshop Periods	**T**	Tutorial Periods	**TP**	Total Periods

SECOND SEMESTER

1.	**No.**	**Cat**	**Code**	**Subject Title**	**Distribution of Marks**				**Distribution Periods per week**			
					IA	**EE**	**EJ**	**TM**	**L**	**S**	**T**	**T**
1		CT	10210201	WASTE MANAGEMENT	50	50	-	100	2	-	-	2
2		CT	10210202	WATER AND BUILT FORMS	50	50	-	100	2	-	-	2
3		CT	10210203	LAND AND VEGETATION	50	50	-	100	2	-	-	2
4		CT	10210204	SOLAR PASSIVE DESIGN (CONCEPTS, STRATEGIES & SERVICES)	100	-	-	100	3	-	-	3
5		NT	10210205	ALTERNATIVE MATERIALS &TECHNOLOGIES	50	50	-	100	3	-	-	3
6		NT	10210206	DAY LIGHTING + SEMINAR	100	-	-	100	4	-	-	4
7		CS	10210207	DESIGN STUDIO - II (ENVELOPE DESIGN)	150	-	150	300	-	6	-	6
8		NT	10210208	ELECTIVE – II	100	-	-	100	3	-	-	3
TOTAL					**650**	**200**	**150**	**1000**	**19**	**6**	**-**	**2**

ELECTIVE II: Healthy Buildings, Environment and Behaviour etc.

* Summer Training for a period of ONE Month to be evaluated in III Semester.

Cat	Subject Category						
CS	Core Studio	**CT**	Core Theory	**NS**	Non-Core Studio	**NT**	Non-Core Theory
IA	Internal Assessment	**EE**	End Examination	**EJ**	External Jury	**TM**	Total Marks
L	Lecture Periods	**S**	Studio/Lab/Practicals/Workshop Periods	**T**	Tutorial Periods	**TP**	Total Periods

THIRD SEMESTER

1.	**No.**	**Cat**	**Code**	**Subject Title**	**Distribution of Marks**				**Distribution Periods per week**			
					IA	**EE**	**EJ**	**TM**	**L**	**S**	**T**	**T**
1		CT	10210301	LIGHTING DESIGN	50	50	-	100	2	-	-	2
2		CT	10210302	INTELLIGENT BUILDINGS	50	50	-	100	3	-	-	3
3		CT	10210303	SOLAR ACTIVE DESIGN (CONCEPTS,STRATEGIES & SERVICES)	100	-	-	100	3	-	-	3
4		NT	10210304	HVAC & IAQ DESIGN DIRECTIONS	50	50	-	100	3	-	-	3
5		CT	10210305	ECO CITIES	50	-	-	50	2	-	-	2
6		CT	10210306	SIMULATION STRATEGIES – STUDIO & LAB	150	-	150	300	-	6	-	6
7		CS	10210307	ECO SENSITIVE ACCESSORIES & GREEN PRODUCTS	100	-		100	2		-	2
8		NT	10210308	ELECTIVE – III	100	-	-	100	3	-	-	3

*		SUMMER TRAINING	50	-	-	50	-	-	-	-
TOTAL			**700**	**150**	**150**	**1000**	**18**	**6**	**-**	**2**

ELECTIVE III: Open Ended

* Summer Training undertaken for a period of ONE Month at the end of II Semester.

** Project work for a period of TWO weeks to be evaluated in IV Semester.

Cat	Subject Category						
CS	Core Studio	**CT**	Core Theory	**NS**	Non-Core Studio	**NT**	Non-Core Theory
IA	Internal Assessment	**EE**	End Examination	**EJ**	External Jury	**TM**	Total Marks
L	Lecture Periods	**S**	Studio/Lab/ Practicals Workshop Periods	**T**	Tutorial Periods	**TP**	Total Periods

FOURTH SEMESTER

1.	**No.**	**Cat**	**Code**	**Subject Title**	**Distribution of Marks**				**Distribution Periods per week**			
					IA	**EE**	**EJ**	**TM**	**L**	**S**	**T**	**T**
1		CS	10210401	THESIS	450	-	450	900	6	12	-	1
2		CT	10210402	PROJECT FINANCE & MANAGEMENT	50	-	-	50	2	-	-	2
**				PROJECT WORK	50	-	-	50	-	-	-	-
TOTAL					**550**	**-**	**450**	**1000**	**8**	**12**	**-**	**2**

* * Project work undertaken for a period of TWO weeks at the end of III Semester.

Cat	Subject Category						
CS	Core Studio	**CT**	Core Theory	**NS**	Non-Core Studio	**NT**	Non-Core Theory
IA	Internal Assessment	**EE**	End Examination	**EJ**	External Jury	**TM**	Total Marks
L	Lecture Periods	**S**	Studio/Lab/Practicals/Workshop Periods	**T**	Tutorial Periods	**TP**	Total Periods

IV. DE

TAILED SYLLABUS

SEMESTER I

10210101 *People, Environment & Buildings*

Relationship between people and environment, impact of people on environment and vice versa, extent of the energy and environmental crises facing the world ,Need for implementing energy efficiency on an international, national and individual basis in the context of the building industry & environmental issues. Introduction to Indoor environment – spatial environment, Thermal environment, visual environment, sonic environment and olfactory environment.

The conceptual framework of social and technical determinism on the traditions of building design science and environmental technology informed by social science theory. Field assessments will be developed through a research-based introduction of the Human Relations, environment and buildings to address the cultural/societal and technical realms that describe traditional built form. The issues that have influenced and are currently impacting human settlement, building, and sustainable design are explored through the use of vernacular relevance and connections to built form responses and the interpretation of climate responsive architectural principles of design.

Reference Books:

1. Baker Nick and Steamers Koen, “Energy and Environment in Architecture”, E & FN Spon, London, 1999.
2. Goulding, John, R., Lewis, Owen, J., and Steemers, Theo, C, “Energy in Architecture”, Bastford Ltd., London, 1986.
3. Bansal Narendra, K., Hauser Gerd and Minke Gernot, “Passive Buildings Design: A Hand book of Natural Climatic Control”, Elsevier Science, Amsterdam, 1994.
4. Givoni, B., “Man, Climate and Architecture”, Elsevier, Amsterdam, 1986.
5. Smith, R. J., Phillips, G. M., and Sweeney, M., “Environmental Science”, Longman Scientific and Technical, Essex, England, 1982.
6. Watson Donald, “Climate Design: Energy Efficient Building principles and practices”, McGraw Hill Book Company, New York, 1983.
7. Norbert Schaneur, 6000 years of Housing

10210102 Climate and Built form Responses

Global climate factors, elements of climate, classification of climate zones, desirable conditions, principals of thermal conditions and STI, body heat exchange, thermal balance, psychometric chart, sun path, sun angles ,SAP, sunshine hours, and solar noon, declination, extraterrestrial radiation, solar constant, radiation on different of different directions with different inclination of walls.

Radiation spectrum, spectral sensitivity of eye, visual cone and comfort, daylight assessment, types of reflection, glare and quality and spread of light in buildings. Sound waves, audible range of sounds, equal loudness controls, noise reduction systems, sound transmission path.

Thermal conductivity, emissivity, radiation, Reflectivity and convection. Density, specific heat, latent heat, thermal bridging, diffusivity, thermal insulation. Heat loss through common building elements due to transmission, R-values and U-values - imperial and SI units.

Reduction Heat Transfer or Enhancement, insulation properties of materials and built forms. Radiation versus other Heat Transfer Methods, Evaluating various built form (VERNACULAR, STATE OF ART AND OTHER BUILDINGS) and its components / or materials for comfort conditions with respect to thermal, visual and air movement.

Emphasis on responses related to cultural, strategic, technological, social and physical with specific reference to climate and built forms.

Reference Books:

1. Baird, George The architectural expression of environmental control systems
2. Faber, Oscar and Kell, J.R. Heating and air-conditioning of buildings. 2002.
3. Thomas, Randall & Fordham Max Sustainable urban design: an environmental approach" 2003.
4. Edwards, Brian and Hyett, Paul Rough guide to sustainability 2001.
5. Langston, Craig A. and Ding, Grace Sustainable practices in the built environment 2001.
6. Givoni Baruch,"Passive and Low Energy Cooling of Buildings",VNR, New York, 1994.
7. Martin J Gainsborough, Radford and Helen Bennets, T J Williamson, "Understanding Sustainable architecture", Spon Press, London, 2003.
8. Kulbhushan Jain, Earth Architecture

10210103 Traditional Wisdom and Sustainable Concepts

Socio-cultural aspects in the spatial formation of traditional buildings under different climate zones in India. Concepts of 'Sacred build-up and Landscape', An Architectural and Theological Interface, Indigenous knowledge, antiquity, Indian vernacular architecture concepts covering informal, functional architecture of structures, built of local materials and designs to meet the needs of the local people and the intricate variations in local social customs, craftsmanship and climate.

The interpretations and reintroduction 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. Reposing faith in traditional wisdom, continuum of Vernacular concepts in contemporary Indian architecture.

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

The Architectural concepts may have to emphasize local conditions, geography of region and peoples mind to emphasize traditional wisdom and sustainable concepts.

Reference Books:

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.
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.

10210104 Energy Audit & Environmental Impact Assessment

General Aspects of Energy Management & Energy Audit. Energy Efficiency in Thermal Utilities and Energy Efficiency in Electrical Utilities , Energy Performance Assessment for building envelope, fenestration and embodied energy , it also to emphasize Equipment and Utility systems.

It also covers to Carry out a detailed energy audit, quantify energy consumption and establish base line energy information, Construct energy and material balance, · Perform efficiency evaluation of energy & utility systems, Compare energy norms with existing energy consumption levels,· Identify and prioritization of energy saving measures and to analysis of technical and financial feasibility of energy saving measures, study of energy efficient technologies and alternate energy sources.

Introduction and components such as physical, biological and socio-economical of Environmental impact assessment (EIA) in India based on the Environmental Protection Act (EPA), 1986 , Ministry of Environment and Forest (MoEF) January 1994 for Environmental Clearance (EC) known as EIA Notification, 1994., Subsequent, amendments. The current practice is adhering to EIA Notification, 2006 and its amendments.

An appraisal of the EIA system against systematic evaluation criteria for various categories such as (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, and (iv) inter-State boundaries and international boundaries and If any Industrial Estate/Complex/Export processing

Zones/Special Economic Zones/Biotech Parks/Leather Complex with homogeneous type of industries and others.

Standards and indicators for appropriateness and optimum threshold considerations for new and additions & alterations to existing structures, heritage buildings, protective/ non protective monuments with reference to pre and post construction and design considerations for EIA.

Reference Books:

1. Dennis Landsberg & Ronald Stewart, “Improving Energy Efficiency in Buildings: A management guide”, State University of New York Press, Albany, 1980.
2. Santamouris, “Energy Performance of Residential Buildings”, James & James, London 2005.
3. Moncef Krarti, “Energy Audit of Building Systems: an Engineering approach” CRC Press, LLC, Florida 2000.
4. Chris P Underwood and Francis W H Yik, “Modelling methods for Energy in Buildings”, Blackwell publishing co., Oxford 2004.

10210105 Environmental Codes and Energy Ratings

Outline understanding of UN frame work convention of climate change , Kyoto protocol, Earth Summit , national policies on sustainable and energy efficient development and Introduction and guidelines of ECBC 2007, The Indian Green Building Council and LEED ,The Energy and Research Institute and the GRIHA System , policy guidelines of sustainable architecture, mandatory requirements, the Energy Conservation Act, 2001 (52 of 2001) its legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country.

The Energy Conservation (Amendment) Act, 2010- Main Amendments, Energy Efficiency Measures such as 1.Standard and labelling programme, 2.Demand side management, 3. Energy Conservation Building Code (ECBC), 4.Bachat Lamp Yojana (BLY), 5. Strengthening Institutional Capacity of State Designated Agencies (SDAs), 6.State Energy Conservation Fund (SECF), 7.Energy Efficiency in Small and Medium Enterprises (SMEs) and Designated consumers, 8.Professional certification and accreditation, 9.School Education Programme, 10. Indo-German Energy Efficiency Project, 11.Energy Conservation Awards

National mission for Enhanced Energy Efficiency (NMEEE), Perform, Achieve and Trade (PAT), Market Transformation for Energy Efficiency (MTEE), Energy Efficiency

Financing Platform (EEFP), Framework for Energy Efficient Economic Development (FEEED), Partial Risk Guarantee Fund (PRGF), Venture Capital Fund for Energy Efficiency (VCFEE).

The Environment (protection) Act 1986, rules to regulate environment pollution and Prevention, control and abatement of environmental pollution and institutional mechanism.

Reference Books:

1. The Environment (protection) Act 1986
2. The Energy Conservation (Amendment) Act 2001, and Amendments
3. Energy conservation building code 2007
4. National building code – India
5. International building code

10210106 Sustainable Built Environment, Issues and approaches (Seminar)

Building on the general appreciation of this area in the core studies, students will be required to have a greater insight into matters relating to specific issues concerning the environment and the ecology. An appreciation of particular issues relating to urban and rural morphological sensitivity will be expected. Scarce material/physical resources should be discussed in the context of (a) choice of materials and (b) diminishing natural resources as should eco-friendly and 'safe' materials with specific reference to thermal, visual comforts. Besides, Students should have an appreciation of aesthetic issues in the built environment. The participants should also have knowledge of the principal considerations involved in the evaluation or survey of built up environment intended for sustainable concepts. They should be familiar with safety considerations relating to the built environment.

Students will need to know that the human need for shelter has developed in many ways and with great diversity throughout the world. Climate, available materials, current technological developments and human ingenuity all contribute to the development of built up spaces throughout millennia. Students will need to understand the evolution of building types and technologies. This will include focusing on both vernacular architecture and formal architecture. They will get exposed to the relationship between buildings and landscape, how traditional buildings express an organic link with their

surroundings and reflect local and regional variations with respect to sustainable approach. Students will be encouraged to develop a visual awareness of the aesthetic appeal of buildings as visual elements of the landscape.

The participants will engage with the grammar of design to enable them to criticize both traditional and modern building design. Students will study the development of urban architecture from the village and small town to the growth of larger urban centers and cities. The seminar will be encouraged to examine the evolution of building types and styles in urban areas. This will include a consideration of streetscapes and the challenges posed by the growth of urbanization and it influence on natural resources.

The seminar will develop an appreciation for the history, scale, proportions and materials of existing buildings and the need for sensitive and sympathetic approaches to restoration, renovation, conservation and reuse of older buildings. Understanding of the building traditions of the past will inform the students' critique of the evolving architectural tradition of the past and contemporary architecture with sustainable concepts.

1. Sustainable Built Environment: an Indian experience (Developing country)
2. Integrated approach to development.
3. Perceiving the built environment as a closed and inter-dependent system.
4. Identifying the environmental, social, cultural and economic benefitsof each approach
5. Ideas shaping the future
6. The business of sustainable development
7. The sustainability of affordable housing and informal settlement
8. Community participation in sustainable development
9. Building for sustainability
10. Sustainable resource use
11. Urban sustainability
12. Evaluating the Sustainable Development in the Built Environment.
13. Roof form responses towards Sun, Wind and Water
14. Integration of Courtyard in Built form
15. Any other relevant topics

10210107 Design Studio – I

Design Studio that explores vernacular strategies for sustainable practises, design, theoretical and/or technological issues that focus for proper scientific architectural thought and practice to lead to energy efficient and environmental friendly solutions.

Our built environment has a substantial impact on energy and material resources as well as being a critical determinant of health, comfort, and productivity for occupants. In response, there are numerous local, national, and international entities adopting green, sustainable criteria for new construction and renovations. This studio design approaches sustainable development for buildings by examining physiology required for human function (comfort, ergonomics, and respiratory requirements, as well as sensory perception) and then by considering how building components and systems affect human performance and well being. Sustainable development starts with site planning and evaluation, and proceeds through construction, commissioning, and occupancy phases. The studio includes many case studies of historic and contemporary structures exemplifying various energy and sustainability features.

The continuously actuating processes generate design and analysis process where the relationships between formal, material, structural and spatial systems are informed from the designer intentions and intuitions with an objective of energy efficient and sustainable designs, but also from the strategies and solar active/passive options inherent performances, properties and behaviors. Field trips are arranged to tour buildings in India.

Students are exposed to the contemporary discourse of comfort and energy consumption realm and their impact on architecture and built space. Incorporating simulation strategies is an advanced topical studio that requires a substantial dedication and investment of student’s time and skills, both during and after official class hours. As a part of their involvement, students are required to actively participate in all lectures, discussions, readings, assignments, design tasks as a class group and/or individually. The design and lab oriented work must be actively in progress on a daily basis for collection readings and development of design.

The Subjects taught in the previous and there may be books, articles, texts required and they will be indicated by the instructor in the course of the semester with the assignments.

A list of assignments, links, books, articles, references, web-materials, images, lectures etc.

All students are required to attend field trips if scheduled. Permission sheet will be signed beforehand. There might be optional field trips at the instructor’s discretion.

10210108 Elective - I

1. **Energy Efficient Landscape Design**

Introduction to the Plant Kingdom

Basic plant structure / morphology / anatomy, Basic plant functions / growth & development / physiology, principles of taxonomy / classification, identification and naming, familiarity with local flora. Classification of soils and use: (a) Soil evaluation and land-use planning, (b) Soil and water conservation, (c) Soil fertility and plant nutrition, (d) Soil degradation control, remedial actions and reclamation techniques and (e) Managing difficult soils.

Characteristics of drainage basins

Introduction to watersheds, Types of Flow: channel and over-land, Occurrence and movement of ground water, Water bearing properties of geological formation, artesian conditions and development of karst topography; salt water intrusions, Aquifers recharge area, infiltration characteristics, rainwater harvesting, artificial recharge, ground water management, ground water pollution and its control.

Historical geomorphology

Landscape evolution models, Geomorphologic processes: Endogenic, Exogenic, Extra-terrestrial. Major processes and associated landforms: tectonic, fluvial, aeolian, coastal, karst, glacial and topography caused by ground water.

Climatic geomorphology and morphogenic regions

Structural geomorphology, land forms developed on sedimentary sequences, volcanoes and volcanic landforms, pseudo structural landforms. Running water and underground water; channel networks and drainage basins. Hill slope geomorphology, land forms related to the activities of organisms and man.

Site planning process and its significance

Relationship between site features and design requirements. Site planning checklist, topographic surveys and their methodology, visualizing land forms. Understanding contours and their characteristics. Earth form Grading, symbols and annotations, basic grading principles, grading terraces, grading of roads across/along contours, road alignment (horizontal and vertical). Surface Drainage: Site planning for efficient drainage; understanding drainage pattern and watershed area, surface run off, determination of catchment area and discharge rate; types of drainage systems, design of drainage elements: swales, culverts etc. Sub surface drainage planning.

Criteria for plant selection

Planting design through the ages - a historic perspective, planting as a design element for structuring the landscape. Differentiation between trees, shrubs, ground cover and creepers. Planting for appearance of form, leaf colour and texture, branching habit and trunk form and their texture, colour of flowers and fruits. Spring, winter, summer and autumn variation in appearance. Visual aesthetic and functional considerations in planting design. Planting for visual effect and accent. The role of plant material in environmental improvement, (e.g. soil conservation, modification of microclimate). Planting for shelter, windbreaks and shelter belts. Planting in various environments such as woodlands, forests, rural areas, urban areas, roadside planting in urban and rural areas, industrial sites etc. Planting design for habitat such as grasslands, woodlands, sloping areas, marshes, bogs, wetlands, waterside, aquatic planting etc. Planting design and ecological considerations, stratification of plant material in nature, herbal plants and their uses.

Plants and sustainability

Merits and demerits of fast, medium and slow growing trees. Growth rate of plants as a criterion for choice of plant for particular situations. Nurse planting, preparing for plant establishment, planting and transplanting trees and shrubs.

Evaluating energy efficient site planning and landscape development

Design of sustainable landscape features such as bioswales, bio retention ponds etc. Contemporary concepts and concerns: “Green” Architecture and energy-saving site planning and Landscape Architecture; Definition, identification, characteristics and policies of Cultural landscapes; Landscape inventory and conservation of historical landscape. Artistic sensibility in Landscape Architecture, land art; new developments in urban landscape design.

Trends in landscape design in India in the late 20th century and first decade of the 21st Century; the search for a theoretical base. Understanding contemporary attitudes to open space design in India: ancient horticultural tradition, Mughal and British colonial influence.

Landscape heritage

Open space systems, cultural and sacred landscapes, typology and role in the development of cities. Landscape resources specific to distinctive city types viz., religious centres, historic cities, coastal or port cities, hill station etc. City development Plans, Zonal Plans and Structure Plans. Development controls and their role in the conservation and creation of urban landscape.

Reference Books:

1. Gray, O., Robinetle, “Landscape Planning for Energy Conservation”, Van Nostrand Reinhold, New York, 1984.
2. Geiger, R. “The Climate near the Ground” Harvard University Press, Cambridege, Massachusetts, 1965.
3. McPherson, E. G. “Energy Conserving site Design” American Society of Landscape Architects, 1984.
4. MEBsh, W. M., “Landscape Planning Environmental Applications”, John Wiley & Sons Inc., New York, 1991.
5. Oke, T. R., “Boundary Layer Climates” 2nd edition Melthuen & Co. Ltd., London
6. Robers D. Brown, Terry J. Gillespie, “Microclimatic Landscape Design”, John Wiley & Sons, Inc., New York.

2. **Post Occupancy Evaluation of Buildings**

A solid understanding of the conceptual frame works underlying different types of post occupancy evaluation that addresses specific organizational objectives or needs. The generic attributes such as to identify and formulate the problems and to envisage, enact processes in response to them.

Assessing existing buildings on their energy use, environmental impact and occupant satisfaction. Building performance bench marks – rating and comparison of buildings. Techniques, methods & procedures of Post Occupancy Evaluation. It also covers the user satisfaction survey identifying areas of deficiency particularly in maintenance, and facilitate the assessment of the over all performance of the building.

Students are required to carry out post occupancy evaluation of a building and document the relationship between building design, energy use, occupant satisfaction, environmental impact and report their observations.

Reference Books:

1. Wolfgang Preiser & Edlaine Ostroff “Universal Design Handbook”, McGraw Hill, 2001.
2. Robert B. Bechtel and Arza Churchman “Handbook of Environmental Psychology”, John Wiley & Sons Inc., New York 2002.
3. James Douglas “Building Adaptation”, Elsevier, Oxford 2002.

SEMESTER II

10210201 Waste Management

The primary goal is to provide a comprehensive understanding of waste management from an environmental public health perspective. Identify and discuss the public health, regulatory, planning, technical and economic principles that influence the solid waste management system. Describe appropriate methods to minimize the impact on the public's health from solid waste related activities. Analysis of an integrated solid waste handling system including source reduction, recycling and reuse, composting, land filling and combustion. Develop a more informed opinion on a variety of waste related issues such as electronic waste, industrial waste, medical waste and C&D (construction and demolition) waste etc.

Sustainable techniques in municipal solid waste management and others: Introduction, Segregation, Sorting, Composting, Vermi composting, Home composting, Recycling and Reuse. Incineration method, Scientific Land filling, Energy development and Management of urban waste services.

Reference Books:

1. Constitutional Law of India – J.N. Pandey 1997 (31st Edition.) Central Law Agency,
2. Administrative Law U.P.D. Kesari 1998. Universal Book Trade, Delhi.
3. Environmental Law H.N. Tiwari, Allahabad Law Agency, 1997.
4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi, Bombay.
5. Environmental Policy. Forest Policy. Bare Acts – Government Gazette notification.
6. Environmental Laws of India-C.P.R. Environmental Education Centre
7. DEWATS, Auroville.
8. Publications by Vastu Shilpa Foundation, Environmental Sanitation Institute, Ahmedabad.

10210202 Water and Built Forms

Introduction, water demand, growing water misuse, pollution, threat to environment, social implications, sustainability of water recourses, ground water management, issues related to urban water supply. Running water and underground water; channel networks and drainage basins, hill slope geomorphology.

Surface Drainage, Site planning for efficient drainage; understanding drainage pattern and watershed area, calculation of surface runoff, determination of catchments area and discharge rate; types of drainage systems, design of drainage elements (swales and culverts etc.) Sub surface drainage planning and water conservation strategies (rain water harvesting, Percolation pits etc.)

Analysis and critical assessment to investigation through Design hypotheses focusing on 1) Connection between the human settlements and use of the water 2) Through provision for collective use and inhabitation of the water-edge for certain areas of the sea/river/lake/ stream bank should act as social condensers. 3) Definitions of physical form along the river / water body and its manifestation with urbanism that celebrates density and diversity. Population - as necessary positive attributes of contemporary civil life with testing the hypotheses by case studies and analysis.

It is important to note that this subject is an exploration of built form at the water's edge and not a comprehensive settlement planning effort. Its core thrust is directed at architecture that is, at the organization of habitable physical definitions and their spatial and experiential implications with water and built forms.

Reference Books:

1. Vancouver in Focus: The City's Built Form, Author: Mike Chadwick, Publisher: Granville Island Publishing, ISBN-10: 1894694449, ISBN-13: 978-1894694445
2. Water Sensitive Urban Design: Principles and Inspirations for Sustainable Storm water Management in the City of the Future, Author: Jacqueline Hoyer, Wolfgang Dickhaut, Lukas Kronawitter, Björn Weber, ISBN 978-3-86859-106-4
3. Design for Water | Rainwater Harvesting, Storm water Catchment, and Alternate Water Reuse,Author: Heather Kinkade-Levario, Date of publication: June 2007,Publisher: New Society Publishers; 1 edition, ISBN 978-0865715806
4. Living Systems | Innovative Materials and Technologies for Landscape Architecture, Authors: Liat Margolis, Alexander Robinson, Publisher: Birkhäuser Architecture,Date of publication: June 2007, ISBN 978-3764377007
5. Sustainable Infrastructure | The Guide to Green Engineering and Design, Author: S. Bry Sarte, Date of publication: September 2010,Publisher: Wiley, ISBN: 978-0470453612
6. Water and Urban Development Paradigms,Towards an Integration of Engineering, Design and Management Approaches, Author & Editors: Jan Feyen, Kelly Shannon, Matthew Neville, Publisher: CRC Press, Date of publication: Sept, 2008, ISBN 978-0415483346
7. Water Centric Sustainable Communities | Planning, Retrofitting and Building the Next Urban Environment, Author: Vladimir Novotny, Jack Ahern, Paul Brown Publisher: Wiley, Date of publication: October, 2010. ISBN 978-0470476086
8. Waterscapes | Planning, Building and Designing with Water, Author Editors: Herbert Dreiseitl, Dieter Grau, Karl H.C. Ludwig, Publisher: Birkhäuser Basel, Date of publication: April, 2001, ISBN 978-3764364106

10210203 Land and Vegetation

Introduction, land forms, Grazing lands, soil erosion, deforestation, air pollution. Growing concerns of vegetation due to excessive usage, impact of vegetation on soil erosion, prevention of erosion, live stock management, sustainability of urban landscape, wet lands, sustainable agriculture.

Structural geomorphology, landforms developed on sedimentary sequences, volcanoes and volcanic landforms, pseudo structural landforms. Geomorphologic processes: endogenic, exogenic, extra-terrestrial. Major processes and associated landforms: Tectonic, fluvial, Aeolian, coastal, karst, glacial, and topography caused by ground water. Landforms related to the activities of organisms and man.

Vegetation as a design element affecting function, comfort, energy efficiency and aesthetic quality. Selection of appropriate vegetation to serve functional and aesthetic purposes. Specifications for planting design.

Site engineering principles: grading, drainage, earthwork, and road alignment: their interaction with landscape architecture design. Planting design through the ages - a historic perspective. Planting as a design element for structuring the landscape, Differentiation between trees, shrubs, ground cover and creepers. Planting for appearance of form, leaf color and texture, branching habit and trunk form and their texture, color of flowers and fruits. Spring, winter summer and autumn variation in appearance. Visual aesthetic and functional considerations in planting design. Planting for visual effect and accent.

The role of plant material in environmental improvement, (e.g. soil conservation, modification of microclimate). Planting for shelter, windbreaks and shelter belts. Planting in various environments such as woodlands, forests, rural areas, urban areas, roadside planting in urban and rural areas, industrial sites etc. Planting design for habitat such as grasslands, woodlands, sloping areas, marshes, bogs, wetlands, waterside and aquatic planting etc. Planting design and ecological considerations, stratification of plant material in nature, herbal plants and their uses.

Plants and sustainability. Growth rate of plants as a criteria for plant choice for particular situations. Comparison of advantages and disadvantages of fast, medium and slow growing trees. The concept of nurse planting. Creating conditions for plant establishment, planting and transplanting trees and shrubs.

Reference Books:

1. Beryl R. Collins and Karl H. Anderson, Plant Communities of New Jersey, Rutgers University Press, 1994
2. Douglas W. Tallamy, Bringing Nature Home, Timber Press, 2007
3. Grant W. Reid, Landscape Graphics, Watson-Guptill Publications, Revised Edition 2002
4. Tony Bertauski, Plan Graphics for the Landscape Designer, Prentice Hall, Second Edition, 2007
5. Norman K. Booth and James E. Hiss, Residential Landscape Architecture, Pearson Prentice Hall, 5th Edition, 2008

10210204 Solar Passive Design (Concepts, Strategies & Services)

Introduction of passive solar architecture, appreciation of Built form for different climates, building clusters and solar exposure, thermal environment. Types of passive systems, direct gain, thermal storage wall, attached green house, thermal storage roof and convective loop.

Classification of passive cooling systems according to the major natural source from which the cooling energy is derived. Minimizing cooling needs by building design: building shape & layout, orientation, size of windows, shading of window, colour of the envelope and climatic impact of plants around building.

Radiative cooling –The earth as a cooling source for buildings. Cooling of attached outdoor spaces. Passive solar configuration – outline of various passive systems for heat gain. Indirect Gain – Trombe wall, Water wall and Transwall. Sun space / attached solarium / conservatory. Roof Pond / Skytherm – Vary Thermal Wall – Earth sheltered / earth bermed structures and earth-air tunnels. The use of earth-air tunnels to heat or cool the buildings.

Modern and post modern passive architecture , methods, strategies, systems , and construction details emphasizing the passive architecture and non active services.

Reference Books:

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

10210205 Alternative Materials and Technologies

To introduce the concepts of Eco Friendly building materials and alternative methods of building construction.

Eco Friendly Building Materials: Environmental impact study of building materials about composition, production and recycling, physical properties etc.

Embodied energy for materials like steel, fly ash bricks, gypsum, steam cured bricks, mud, eco-boards etc., Life Cycle assessment of materials. Sustainable Building Technologies, Introduction to alternative building technologies: Traditional, vernacular, advanced technological such as bamboo , cavity walls, core unit slabs, filler slabs etc.

Reference Books:

1. Energy efficient buildings by Wagner Walter
2. Architecture, Engineering and Environment by Hawkes Dean and Foster Wayne
3. The architecture of Energy by Hawkes Dean and Owets Janet
4. Design for Environment by Mackenzie
5. Energy Efficient Buildings in India by Milli Majumdar
6. Earth Construction by Houben Hugo
7. Publications of BMPTC, Vastu Shilpa foundation

10210206 Day Lighting + Seminar

The primary objective of this subject is to introduce the contemporary theory, methods and design applications of day lighting and electrical lighting integration as key elements in sustainable architectural design. To develop an understanding of the impact and design limits that the architectural system of daylight enclosure have on lighting, energy performance, and on the attainment of sustained environmental quality. It also covers contemporary tools, analytical methods and digital media used in the simulation, evaluation and prediction of luminous and thermal performance by various options such as study and analysis methods, introduction of exploration into the use of light in space.

To provide a vehicle of design synthesis acting as a catalyst to further design exploration and laboratory exercises. To explore a number of issues that surround the discussion of the appropriate application of day lighting technology in commercial and institutional buildings.

Seminar:

The seminar provides an understanding of how to shape the building and design the skin for day lighting through an integrative design approach. Day lighting design is the catalyst to applied research in architecture and allied disciplines instead of projecting component technologies. Day lighting shaped and delivered by shape, form and fabric of building envelope with reference to models, methods and simulations.

*Day lighting Seminar topic will be given to students as per their choice which has to be presented for evaluation at the end of the semester.

Reference Books:

1. Day lighting in Buildings Source Book; LBNL and International Energy Agency; 2008. Millet, M; Light Revealing Architecture; Van Nostrand Reinhold, 1996.
2. Hopkinson, R.G.; Day lighting; Heinemen; 1966.
3. Lam, William M.C.; Perception and Lighting as Form Givers for Architecture, 1968.
4. Moore, Fuller; Concepts & Practices of Architectural Daylighting; Van Nostrand Co., Inc.; 1985.
5. Robins, Claud: Day lighting, Design & Analysis; VNR, 1986.
6. Fitch, J. Marston; American Building - The Environmental Forces that Shape It; 2nd Ed 1999.
7. Banham, R; Architecture of the Well Tempered Environment; 2nd Ed.; 1984, Chicago Press, Prerequisite: Arch 3142/ 6141 Environmental Forces (ECS) or consent of instructor.

10210207 Design Studio - II (Envelope Design)

Design Studio where students learn and hone their architectural design skills and required to incorporate the knowledge gained from theory courses into the design solutions. Typically, at the end of the Design Studio, each student or team is required to explain the key concepts and integrated design philosophy with the supporting program of diagnostic (Advanced) and computational tools.

In order to propagate knowledge and learning, it is important to create networks, establishing platforms that can encourage sharing of ideas and information.

Subjects with high technical content need elaboration with examples as well as explanation of basic rules of thumb that are widely used in the profession. The results in limited assimilation of environmental science and energy efficiency concepts with the overall building design sensibility. A wide covering topics such as energy efficiency, life-

cycle cost analysis, Building Physics, Building Diagnostics, role of building and energy appliance codes, Energy policy in designing sustainable buildings with the help of laboratory and simulation software tools.

Incorporating simulation strategies is an advanced topical studio that requires a substantial dedication and investment of student's time and skills, both during and after official class hours. As a part of their involvement, students are required to actively participate in all lectures, discussions, readings, assignments, design tasks as a class group and/or individually. The design and lab oriented work must be actively in progress on a daily basis for collection readings and development of design.

Reading List to start:

The Subjects taught in the previous and there may be books, articles, texts required and they will be indicated by the instructor in the course of the semester with the assignments. Assignments, more readings, web-sites, digital-info. A list of assignments, links, books, articles, references, web-materials, images, lectures etc.

10210208 Elective - II

1. **Healthy Buildings**

Healthy buildings theory, Performance of building services against standards, Work place 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: washing people, washing clothes, removing waste, improving nutrition, reducing crowding, separating people from animals, vermin or insects, reducing dust, controlling temperature and reducing trauma.

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. A C system components : Fans, coils, filters and heat rejection equipment. Sick building syndrome, Issues of Indoor air quality.

Fundamental principles of fire safety engineering. Fire safety in large modern buildings, fire detection and suppression systems. Design of manual and automatic water based systems to warn / extinguish fires. Alternatives to conventional prescriptive design.

Reference Books:

1. Chadderton, D. V., “Air Conditioning: A practical Introduction”, E & FN Spon, London.
2. Abrams, D. W., “Low Energy Cooling: A Guide to the practical Application of Passive Cooling and Cooling Energy Conservation Measures”, Van Nostrand Reinhold Co., N Y
3. Stoecker, W. F., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi.
4. Torr, A. R., “Refrigeration and Air Conditioning”, Butterworth publishers, London, 1989.
5. Chadderton, David, V., “Building Services Engineering”, E & FN Spon.

2. **Environment and Behaviour**

Prediction of environmental attitudes and behavior. Environmental assessment. 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.

Introduction to the theories of Environment-Behavior relationships. The nature and function of theories. Arousal approach, stimulation approach, Adaptation level, Behavior constraint and Environmental stress approach. Barker’s ecological psychology approach.

Environment and Behavior 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.

Reference Books:

1. Chadderton, D. V., “Air Conditioning: A practical Introduction”, E & FN Spon, London.
2. Abrams, D. W., “Low Energy Cooling: A Guide to the practical Application of
3. Morgan, T., & Clifford, "Introduction to Psychology", Tata McGraw - Hill Publications New York, 1983.
4. Kayem, M., "Psychology in relation to design" Dowden, Hutchinson and Ross, 1973.
5. Hall, E.T., "The Hidden Dimension" New York, Doubleday, 1966.
6. Bell, A. Paul, Greene, C. Thomas, Fisher, D. Jeffrey, Baum Andrew, “Environmental Psychology” Harcourt Brace College Publishers, New York, 1996.

Summer Project

(For a period of ONE Month to be evaluated in III Semester)

*****The summer project will be spread across a broad range of energy and sustainable systems focusing alternative technologies, architectural design, vernacular approach, as well as design of components, systems and furnishings. The learning approach throughout the summer project will focus on learning by experiencing, observing and doing, all of which will find particular expression and to pave a way to select a suitable thesis topic. It is aimed to have appropriate learning environment through investigating, understanding and doing and will Endeavour to nurture the attributes of energy savings, sustainable strategies, creativity, enterprise and entrepreneurial skills in order to promote innovation. The summer project work should comply with contemporary regulations, codes and be informed by best practice.

To contribute to a balanced education, giving students a broad and challenging experience that will enable them to acquire a body of knowledge, understanding, cognitive and manipulative skills and competencies and so prepare them to be creative participants in a technological world. It is also to enable students to integrate such knowledge and skills, together with qualities of co-operative enquiry and reflective thought, in developing design solutions with due regard for issues energy efficiency and sustainability. To provide a context in which students can explore and appreciate the impact of past, present and future technologies on the economy, society, and the environment with due consideration climate change and carbon foot prints.

At the end of their project / training, students will understand the contributing technologies, which combine in the design and construction of buildings and which make them safe and comfortable to occupy with specific reference to energy savings and sustainable practices in architecture. It is aimed to develop a critical scientific awareness of the design of buildings and their relationship with their surroundings.

SEMESTER III

10210301 Lighting Design

Introduction-Light, Vision, Characteristics, importance of day light, methods of lighting

Lamps and Sources- Optics, Controlling light, Electricity and basics of wiring for lighting fixtures. Light in Architecture-Psychology of light, perception, Quality of the visual environment, Light distribution, light and shade, light levels/contours

Luminaries and Applications: Types of fixtures (CFL, LED, Halogen, Metal halide etc) their specifications. Classification of lights and luminaries as per the usage, dimmer controls, Sensors etc.

Lighting Design process: historical and cultural aspects of lighting; theory of current lighting design practice; Design concepts, methods for placing windows, interior and exterior lighting installations. Aesthetic, economic and environmental issues,lighting systems integration,

Lighting calculations, representation/presentation of spaces with light, Computer simulation of visual effects of various lamps and luminaries. Integration of artificial lighting with natural light.

Reference Books:

1. Designing With Light.Gillette,J.Michael.McGrawHill.5thEdition.ISBN:978---0---07---351415---4,SweeneyTodd:The Demon Barber of Fleet Street (Applause Musical Library).Sondheim,Stephen.2000.ISBN:978---1557830661
2. Benjamin Evans, “Daylight in Architecture”, McGraw Hill Book Co., New York, 1981
3. Pritchard, D.C., “Lighting”, Longman Scientific & Technical, Harlow, 1995
4. MEBc Schiler, “Simplified Design of Building Lighting”, John Wiley & Sons, Inc., New York, 1992
5. Hopkinson, R. G., “Architectural Physics – Lighting”, HMS Office, London, 1963
6. Tregenza Peter & Loe David, “The Design of Lighting”, E & FN Spon, London, 1998.

10210302 Intelligent Buildings

Significance of Intelligent building, Artificial Intelligence, knowledge based systems, neural networks, genetic algorithms, fuzzy controls. Composition of Intelligent buildings – physical building intelligence, building management and operation. Economical and technical aspects of intelligent building technologies. Facilities management for Intelligent buildings.

Building Automation Systems : Approaches, application – lighting, security, fire detection, office automation, vertical transportation, surveillance.

Technologies: Field devices, digital controllers, system controllers, man-machine interface, Sensors. Automation control strategies.

Reference Books:

1. Derek Clements – Croom(ed), “Intelligent Buildings: Design, Maintenance and Operation, Thomas Telford, London, 2004.
2. Michael Nigginton & Jude Harris, “Intelligent skins” Architectural Press, Oxford, 2002.
3. Albert Ting-Pat so & Wai Lokchan, “Intelligent Building Systems (The international series on Asian studies in computer and information science), Springer, 1999.
4. Andrew Harrison & Eric Loe, “Intelligent Buildings in South East Asia”, Spon Press, 1997.

10210303 Solar Active Design (Concepts, Strategies and Services)

Introduction of Active solar architecture and appreciation of solar active strategies. Flat plate heating system, solar stilts, water heating, solar kitchens and PV cells, solar lighting, solarium and attached solarium, water / liquids for active heating system.

Design and Materials for flat plate heating system, efficiency of flat plate collector, heat loss coefficients, performance, air heating and other type of collectors, some novel designs of solar air heaters, solar ponds, ASHRAE standards, collector time constant, incident angle and calculation of efficiency.

Auxiliary heating load, Solar lights, photo voltaic installations, wind mills, Wind mills cum PV(Hybrid Systems), solar pumping, solar fencing and solar energy harvesting, solar parks, solar forms and solar stations, stand alone systems such as telephones, refrigerators, parking meters and trash compactors, Solar conditioning etc.

Solar lighting design for indoor and outdoor spaces. Sizing, installation, economics and other benefits and maintenance of solar active systems for buildings.

Current developments in Active Solar Architecture, Integration of PV cells in design

Reference Books:

1. Moss J. Keith, “Energy Management and Operating Costs in Buildings”, E & FN Spon, London, 1996.
2. O’Callaghan, Paul, W – “Buildings for Energy Conservation”, Pergamon Press, London, 1980
3. Levermore Geoff, “Building Energy Management Systems”, E&FN Spon, London, 2000.
4. Moncef Krarti, “Energy Audit of Building Systems: an Engineering approach” CRC Press, LLC, Florida 2000.
5. Albert Thulmann & William J Younger, “Handbook of Energy Audits”, The Fairmont Press, 2003.

10210304 HVAC and IAQ, Design Directions

Natural ventilation & energy efficiency. Wind: Characteristics & significance. The atmosphere boundary layer. Wind pressure & wind pressure coefficient. Functions of ventilation – supply of fresh air, physiological cooling and night time cooling of buildings. Ventilation requirements of various buildings & spaces, Ventilation standards, Ways of natural ventilation – single side ventilation, cross ventilation, stack effect and reverse stack effect. Dissipation of structural heat. Ventilation strategies for various climatic zones in India. Air movement around the buildings and through the buildings. Effects of building form and orientation. Fenestration design of buildings to enhance air movement and ventilation. Use & application of ventilation analysis software. Natural ventilation – prediction, measurement & Techniques of evaluation. Effects of shading devices on indoor air velocity. Effect of area of openings on average indoor wind velocity. Effect of size of inlet on the performance efficiency. Global warming potential (GWP) , air conditioning, basic refrigeration systems, building related illness(BRI),sick building syndrome (SBS) and mitigation methods, humidity controls, design and sizing of air conditioning system, outdoor air requirement for ventilation of air condition areas. types of air conditioning unites such as unitary air conditioners, split air conditioners and package air conditioners, mechanical ventilation and evaporative cooling, heating and humidity controls and design considerations and directions.

Outdoor and indoor air quality standards (NBC, ASHRAE, etc.,), methods and models for designing desirable levels IAQ. IAQ and health, Causes of SBS, air contaminants of indoor origin, International standards, IAQ in offices , residential and commercial and Industrial buildings etc., NBC ,ASHRAE guidelines for ventilation. Accepted IAQ for different functional spaces and uses, indoor air quality survey affects of architecture design on IAQ, ventilation standards for IAQ v/s energy conservation, enthalpy at selected pollution levels, Administrative and legislative response, urban air, indoor environment and human exposure. Indoor climate, urban context and energy use, heat

islands, Mechanical ventilation , dilution method, systems and equipment , air conditioning, ventilation rate procedure for multiple spaces and ambient air quality standards.

Reference Books:

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.
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.

10210305 Eco Cities

Introduction to eco-city, economic, social, and environmental qualities of an eco-city, carbon-neutral and renewable energy production, Public transportation systems, Resource conservation (water and energy), waste management and its reuse, Urban Farming, Urban Infill, Walkable Urbanism, Obstacles, Social factors of Sustainable Cities, discussion on international and national eco cities.

Sustainable communities: Basic principles and strategies, systems thinking and strategies; race, class, and equity; place-based learning and planning; and social capital and community empowerment. Urban Eco-Design, Integrating Nature and Urban life , Building healthy Community Systems, Transforming Community Systems.

Sustainable city development: participatory planning, land use, poverty and racism, green economy, local food systems, nature in the city, healthy neighborhoods, transportation/access, housing, energy systems, bio diversity etc., Green Urbanism, Learning from Existing Cities.

Reference Books:

1. Biopolis: Patrick Geddes and the City of Life Welter, Volker, MIT Press, 2001.
2. Car free Cities Crawford, J. H., International Books, 2002,
3. Cities for a Small Planet Rogers, Richard, Westview Press, 1998,

4. The City After the Automobile: An Architect's Vision Safdie, Moshe, Westview Press, 1998,
5. The City in Mind: Notes on the Urban Condition Kunstler, James Howard, Touchstone Books, 2003
6. Crabgrass Frontier: The Suburbanization of the United States Jackson, Kenneth T., Oxford University Press, 1987,
7. Eco-City Dimensions: Healthy Communities, Healthy Plants Roseland, Mark, New Society Publishers, 1996,
8. From Eco-Cities to Living Machines: Principles of Ecological Design Todd, John, North Atlantic Books, 1994,
9. The Ecological City: Preserving and Restoring Urban Biodiversity Platt, Rutherford H., University of Massachusetts Press, 1994,
10. Gaviotas: A Village to Reinvent the World Weisman, Alan, Chelsea Green Publishing Company, 1999,
11. The Geography of Nowhere: The Rise and Decline of America's Man-Made Landscape Kunstler, James, Touchstone Books, 1994.
12. Home from Nowhere: Remaking Our Everyday World for the 21st Century Kunstler, James Howard, Touchstone Books, 1998.
13. Human Settlements and Planning for Ecological Sustainability: The Case of Mexico City Pezzoli, Keith, MIT Press, 2000.

10210306 Simulation strategies, Studio & Lab

Introduction of simulation strategies related to thermal, visual, embodied energy performance of different components and parameters, energy analysis for building covering approximate methods, correlation methods, analytical methods, and numerical methods and preparing programmes on mat lab(soft ware).

Periodic heat transfer model of a non –air conditioned building comprising of heat balance equations for inside air, periodic heat flux through walls, roof, isothermal mass, conduction through floor/ ground, windows and heat loss through ventilation and infiltration etc., analysis of thermal trap roof and walls, solar thermal models for direct and indirect gain such as underground floor storage , earth air tunnels, earth covered structures, rock bed storage ,phase change materials for conditioned and non air conditioned buildings. DOE and TRNSYS, Energy Plus and day lighting etc., simulation programmes for energy quantification for buildings. Modelling the performance of a building with Energy Plus enables to optimize the building design to use less energy and water. Calibration and validation studies for simulated contemporary and internationally recognised models / soft wares.

Understanding of "Consortium of Material Emissions and Indoor Air Quality Modeling (CMEIAQ)" with the overall goal to develop and design guidelines for indoor material selection and ventilation strategies to meet specific indoor air quality requirements. Understanding of Dayism, description and easy-to-use daylight simulation tools to predict the annual daylight availability and artificial lighting demand in a building. The tools are based on the RADIANCE ray-tracing engine, the concept of daylight coefficients and the Perez sky model.

Use of Daylight softwares (former Lightswitch Wizard) as a analysis tool that supports daylighting-related design decisions in commercial buildings during the initial design and design development stages. Predicting daylighting and energy performance of sidelit and/or toplit private offices, open plan offices, and classrooms. The main objective is to understand day lighting to and to develop climate-responsive day lighting design concepts; to optimize façade/ roof layout and orientation with respect to daylight and energy use; and to quantify energy savings from occupancy sensors and/or photocell controlled dimming.

10210307 Eco Sensitive Accessories & Green Products

The creation of high performance “green” buildings challenges designers to create or find environment friendly materials and construction processes that suggest future value; concepts such as designing for adaptability, disassembly, reuse, reduced waste or energy self-sufficiency promise new innovations. The selection of materials in architecture design and construction is inextricably linked to assessment methods for determining environmental and resource impacts over the life and after-life of buildings.

Develop knowledge of how the materials selection and performance aspects of sustainable design fit into the context of a whole building design process. Develop knowledge of determining materials resource and energy flows and ways to evaluate sustainable product certification methods – the interaction between manufacturing conservation, recycle/reuse and waste – as fundamental to the design process.

Develop evaluation and assessment (decision making) processes for material life-cycles; construction use and maintenance; manufacturing and fabrication; material acquisition/preparation/ and reuse, recycling and disposal.

Develop knowledge of Eco-Labelling and LCA assessment tools and their function with other strategies (Athena™, LEED, and B3) that improve energy efficiency, conserve materials resources and reduce waste during construction, building operations and de-construction. Develop methodologies for assimilating sustainable materials knowledge within the design process; utilizing design judgment as well as analytical judgment to evaluate green materials and systems; integrating right and left-brain thinking To

introduce concepts of Eco Friendly building materials and alternative methods of building construction and energy efficient construction.

10210308 Elective - III (Open Ended)

SEMESTER IV

10210401 Thesis

The Thesis gives the student an opportunity to apply the discipline and skills of the programme to an individually selected research topic, requiring a measure of original development, providing a vehicle for conducting an in-depth investigation, analysis and critical review of relevant material.

The Thesis should reflect the Philosophy of Sustainable Architecture and the technical knowledge gained from the entire course which may include the simulations. The Thesis is the culmination of work done on the programme and is considered to be of prime importance. The process of producing the Thesis consists of a number of Thesis Workshop day long events followed by group discussions and one to one tutorials.

Each student is allocated a Thesis supervisor who is responsible for academic guidance through the process. All students are encouraged to produce a publishable paper based on the Thesis material.

At the end of the semester each student is expected to submit all the original drawings as per the department's specifications. Three copies of the report in the prescribed format set by the department has to be submitted after taking approval from the supervisor/guide.

The department shall schedule a date for the viva-voce as per the academic calendar. The performance sheet submitted by the Guide/supervisor and the Thesis committee should be the basis for allowing the student to appear for the final viva-voce.

10210402 Project Finance & Management

Introduction to Project finance & Management.

Project Management: Construction projects, Project development process, project management, main causes of project failure.

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Project formulation: Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report.

Project Planning Process: Plan development process, time planning process, work scheduling process, resource planning process, Importance of planning, scheduling and controlling projects.

Project Finance: Introduction to project finance, Means of financing, Costs associated with projects, estimates, Economic analysis of project, economic studies, sensitivity analysis. Cost estimating principles. Detailed estimates, cost concepts, classification of costs, elements of costs, Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT

Working Capital Management: Concept, Need and types of Working Capital; Determination of Working Capital; Estimation of Working Capital Needs; Financing of current assets – Matching, Conservative Approach, Aggressive Approach (Problem and Theory) .

Reference Books:

1. Gupta, B.L. and Gupta, Amit., Construction Management, Machinery and Accounts, 3rd ed. Standard Pub, 2005.
2. Loraine, R.K, Construction Management in Developing Countries. Thomas Telford, London, 1993
3. Srinath, L.S., PERT and CPM Principles and Applications, 3rd ed. Affiliated East-West Press, New Delhi, 2003.
4. Singh, Harpal., Construction Management and Accounts 14th ed. Tata McGraw-Hill Pub., New Delhi, 1981

5. Gould, E.Frederick and Joyce, E.Nancy., Construction Project Management. Prentice Hall, New Jersey, 2000
6. Shrvastava, U.K., Construction Planning and Management, 3rd ed. Galgotia Pub., New Delhi, 2004
7. Chitkara, K.K, Construction Project management: Planning. Scheduling and Controllling. Tata McGraw-Hill Pub., New Delhi. 1999.
8. Sharma, S.C, Construction Equipment and its Management, 4th ed. Khanna Pub., New Delhi, 2004.