FACULTY OF ARCHITECTURE AND PLANNING
DR APJ ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH LUCKNOW

Syllabus of

M.Arch. in Environmental Design

(Effective from session 2020-21)

FACULTY OF ARCHITECTURE AND PLANNING
Dr APJ Abdul Kalam Technical University, Uttar Pradesh Lucknow

1.	Title of the Course :	**M.Arch. in Environmental Design** (MED)
2.	Eligibility for Admission :	1. B.Arch. degree 2. Admissions on the basis of Written Test followed by an Interview.
3.	Ordinances / Regulations:	Same as M.Arch.
4.	No. of Years / Semesters :	2 years / 4 semesters
5.	Level :	Graduate
6.	Pattern :	Semester
7.	Status :	Approved from BOS held on 04.05.2020
8.	To be implemented from :	From Academic Year 2020-21

Syllabus drafted by:

1. Dr. Ritu Gulati (Course Coordinator)
2. Dr. Farheen Bano (Course Co-coordinator)

Syllabus approved by Board of Studies (BOS), Architecture and Planning, AKTU, Lucknow in meeting held on 04.05.2020 at 11.30 noon and suggested corrections were incorporated. Special invitees in BOS for syllabus of M.Arch. in Environmental Design were**:**

1.	Prof. Somenath Sen	Professor, IIT, Kharagpur	special invitee
2.	Prof. Joydeep Dutta	Professor, Mumbai University	special invitee
3.	Dr. Ritu Gulati	Associate Profesor, FOAP, AKTU	special invitee
4.	Dr. Shubhrajit Banerjee	Associate Profesor, FOAP, AKTU	special invitee
5.	Dr. Shaleen Singhal	Dean, SAS TERI University	special invitee

Date: 01/6/2020

Signature:
Dr. Vandana Sehgal
Principal & Dean,
Faculty of Architecture
and Planning, AKTU,
Lucknow

M.Arch. in Environmental Design

1. Preamble

The Master of Architecture course in Environmental Design establishes cohesive relations 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 the environmental sustainability of the built environment, grounded in rigorous scientific research and analysis with a multidisciplinary approach to understanding issues related to energy efficiency and traditional wisdom of the built environment. This course also delves into water, land, vegetation and waste management which are essential subjects of environmental sustainability.

2. Aim

The FoAP, AKTU aims to play a key role in preparing future decision-makers to meet sustainable development challenges 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, Pandemic, etc.

The course offers a contextualized and deep understanding of sustainability in Environmental Design Solutions. The study moves from the broad aspects of Man and Environment, energy and climate zones through alternative materials and technologies for environmental sustainability, urban sustainability issues, and energy and environmental assessment specifics. 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.

Teaching methodology includes live site visits, special lectures from experts, special training programs, interactions with the client’s promoters, contractors, approving authorities and project managers to get feedback on drawings, details, specifications, selection of materials, techniques of constructions.

3. Admission Requirements

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

4. Course Outcome

The programme is designed for architects interested in developing expertise in an area of rapidly increasing importance of energy-efficient & environmental strategies (such as energy monitoring, performance, assessment and audit, resource management and planning), where skill shortages are being reported and increasing specialist knowledge is required. Thus, this programme is developed to meet the industry's specific demands and strives, such as Green Building evaluators and Auditors. This programme gives students the opportunity to:

- Acquire GRIHA or IGBC accreditation.
- Practise Independent Green Building consultants.

- Become Energy Assessors or Auditors.
- Develop design skills in the area of Environmental Design solutions for Buildings.
- Facilitate intellectual, creative and professional development.
- Develop the judgment in response to complex and unpredictable research and professional issues within the area.
- Design an energy-efficient and sustainable built environment.
- Can take a senior/management position in academic research and professional practice.

The course is thus designed to fill up these gaps by imparting the knowledge in the field of Sustainable Development and Environment Management to those interested to make their rewarding career in this field

5. Career Opportunities

Due to the increased focus on a sustainable built environment, the career outlook in the field of Environmental Design is very bright and promising. The students specializing in this field have a substantial career in the private and government sector. After becoming ECBC mandatory in some states and eventually would be in the whole country, the demand for Energy Auditors is increasing day by day. Consequently, the professional expertise in a similar field graduating from this course would fill the gap.

Candidates would have opportunity to get placement in:

- Every Industry sector (such as Automobile, Food Processing, Chemical, Pharmaceutical, Power including Renewable Energy, Textile, Fertilizer, Cement, Infrastructure, Steel, Refinery, Tyre, etc. and other industry sectors),
- Pollution Control Boards, Municipal Corporations,
- Environmental Consultancy firms,
- NGO's, Banks (study feasibility of environmental projects),
- Research & Development Laboratory,
- Multi-star Hotels (manage Waste Water Treatment Facilities, Environmental Management Systems),
- Hospitals (Environmental Quality Control, Hospital Waste Management),
- Waste Management Industries
- Certifying / Audit agencies.

The passed out candidates/students can have opportunity to serve as :

- Sustainability Executives
- Operations and Marketing Managers
- Environmental Engineers
- Industrial Production Managers
- Environmental Managers
- Environmental Scientists
- Environmental Chemists
- Environmental Consultants
- Project Officers
- Freelancers In the Field Of Environment
- Many more alike as stated above.

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M.ARCH. IN ENVIRONMENTAL DESIGN

SCHEME OF TEACHING & EXAMINATION

SEMESTER I

S.No.	SUBJECT	NAME OF	PERIODS		EVALUATION SCHEME								
	CODE	SUBJECT	L	P/T	SESSIONAL ASSESSMENT			ESE			TOTAL	CREDITS	DURATION
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			HOURS
1	MED-101	Environmental Design Studio-I (Building Level)	2	8	30	70	100	0	50	50	150	5	-
2	MED-102	Research Techniques and Application	2	1	15	35	50	50	0	50	100	3	3
3	MED-103	Traditional Wisdom & Sustainability Concepts	2	1	15	35	50	50	0	50	100	3	3
4	MED-104	Environmental Physics and Application	2	1	15	35	50	50	0	50	100	3	3
5	MED-105	Environmental Modelling and Computer Application	1	1	15	35	50	50	0	50	100	2	3
6	MED-106	Elective-I (Departmental)	1	1	15	35	50	0	0	0	50	2	-
		TOTAL	10	13							600	18	

SEMESTER II

S.No.	SUBJECT	NAME OF	PERIODS		EVALUATION SCHEME								
	CODE	SUBJECT	L	P/T	SESSIONAL ASSESSMENT			ESE			TOTAL	CREDITS	DURATION
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			HOURS
1	MED-201	Environmental Design Studio-II (Campus Level)	2	8	30	70	100	0	50	50	150	5	-
2	MED-202	Design of Lighting, Water & Waste Treatment System (MEP-I)	2	1	15	35	50	50	0	50	100	3	3
3	MED-203	Ecology and Bio-Diversity (Land, Water, Vegetation)	2	1	15	35	50	50	0	50	100	3	3
4	MED-204	Remote Sensing and GIS Applications	2	1	15	35	50	50	0	50	100	3	3
5	MED-205	Environmental Codes; Energy Ratings Audit and Impact Assessment	1	1	15	35	50	50	0	50	100	2	3
6	MED-206	Elective-II (Departmental)	1	1	15	35	50	0	0	0	50	2	-
		TOTAL	10	13							600	18	
		DESIGN ORIENTED				KNOWLEDGE BASED						SKILL ORIENTED	

SEMESTER III

S.No.	SUBJECT	NAME OF	PERIODS		EVALUATION SCHEME								
	CODE	SUBJECT	L	P/T	SESSIONAL ASSESSMENT			ESE			TOTAL	CREDITS	DURATION
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			HOURS
1	MED-301	Environmental Design Studio-III (Urban and Precinct Level)	2	8	30	70	100	0	50	50	150	5	-
2	MED-302	Design of HVAC, Fire & Sound Treatment System (MEP-II)	2	1	15	35	50	50	0	50	100	3	3
3	MED-303	Eco cities	2	1	15	35	50	50	0	50	100	3	3
4	MED-304	Sustainable Building Materials and Technologies	2	1	15	35	50	50	0	50	100	3	3
5	MED-305	Dissertation	1	1	-	50	50	0	50	50	100	2	-
6	MED-306	Elective-III Institutional Elective	1	1	15	35	50	0	0	0	50	2	-
		TOTAL	10	13							600	18	

SEMESTER IV

S.No.	SUBJECT	NAME OF	PERIODS		EVALUATION SCHEME								
	CODE	SUBJECT	L	P/T	SESSIONAL ASSESSMENT			ESE			TOTAL	CREDITS	DURATION
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			HOURS
1	MED-401	THESIS	2	18	-	250	250	0	250	250	500	15	
2	MED-402	Sustainable Conservation of Cultural Heritage	2	1	15	35	50	50	0	50	100	3	3
		TOTAL	4	19							600	18	
		DESIGN-ORIENTED				KNOWLEDGE-BASED						SKILL-ORIENTED	

LIST OF ELECTIVES

ELECTIVE 1 (DEPARTMENTAL)		ELECTIVE II (DEPARTMENTAL)		ELECTIVE III (INSTITUTIONAL)	
1	FAÇADE DESIGN FOR ENVIRONMENT RESPONSIVENESS	1	RESTORATION OF ECOLOGICALLY DISTURBED CITIES	1	ARTIFICIAL INTELLIGENCE FOR LOW CARBON DESIGN
2	BIOMMICRY & MIOMIMETICS	2	ENVIRONMENTAL ECONOMICS	2	ENVIRONMENT PLANNING POLICIES, LAW & LEGISLATION
3	LANDSCAPE DESIGN FOR SUITABLE ENVIRONMENT	3	SMART CITIES	3	SUSTAINABLE LANDSCAPE DESIGN
4	POLLUTION MONITORING AND CONTROL	4	LIFE CYCLE THINKING FOR BUILDINGS	4	INTEGRATED ENVIRONMENTAL MANAGEMENT
5	BUILDING PERFORMANCE ANALYSIS	5	HEALTHY BUILDINGS	5	POST OCCUPANCY EVALUATION OF GREEN BUILDINGS
		6	ENVIRONMENTAL COMPLIANCE & REPORT MAKING	6	INTELLIGENT BUILDING

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 101 ENVIRONMENTAL DESIGN STUDIO-1 (Building Level)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	8	30	70	**100**	-	50	**50**	**150**	5	-

OBJECTIVES:

- The aim is to introduce the students to climate and surroundings as an important aspect of environmental design
- To understand in depth, the environmental factors affecting human comfort and creation of comfort conditions along with the associated building physics.

Module 1	**Environment and Comfort**	Global, macro and micro level climate (global warming, greenhouse effect etc.) Elements of climate and its quantification Earth's energy balance Climatic data and its interpretation Other environmental aspects affecting human comfort – Air Quality, Sound, Pollution, Light, Water, Global Warming
Module 2	**Building Physics**	Energy balance of human and built environment Thermal Environment Adaptive model of Thermal Comfort and its application to environmental responsive design of buildings
Module 3	**Case/ Literature Studies**	Detailed Analysis of Buildings with respect to its thermal properties, environmental comfort factors and others as individual assignments (report/ppt/ sheets)
Module 4	**Design Exercise**	Design of a multi-use built form - Office, Hotel, Apartment (and similar) taking into consideration the above design and assessment criteria.

References;

1. Manual of Tropical housing and climate by Koenisberger
2. Climate responsive architecture by Arvind Krishnan
3. Climate Design: Energy Efficient building principles and practices by Watson Donalt
4. Man, Climate and Architecture, B.Givoni
5. Selected Research Papers and Studies

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 102 RESEARCH TECHNIQUES AND APPLICATION

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To understand the importance of research in Environmental Design.
- To formulate a research plan through application of research techniques, data collection, analysis and interpretation.
- To understand the methods of writing and presenting a research report.

Module-1	**Introduction**	Significance of research in Environmental Design. Basic research issues and concepts - Orientation to research process - Types of Research: Historical, Qualitative, Co-Relational, Experimental, Simulation and Modelling, Logical Argumentation, Case Study And Mixed Methods- Illustration Using Research Samples
Module-2	**Research Problem**	Elements of Research Process: finding a topic - Writing an introduction - Stating a purpose of study identifying key research questions and hypotheses - Reviewing literature using theory, defining, delimiting and stating the significance of the study, advanced methods and procedures for data collection and analysis - illustration using research samples.
Module-3	**Research Design**	Components of research design. Concepts of dependent and independent variables, unit of analysis. Defining the scope and limitations of a research plan, significance of the research outcome. Preparing time schedule & budget for a research plan.
Module- 4	**Sampling Design**	Steps in Sampling, Characteristics of a good Sample design, Types of Sample design. Quantitative and Qualitative
Module- 5	**Data Collection**	Library and archives - Internet: new information and 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 and the advantages, sampling - Problems encountered in collecting data from secondary sources. Methods of qualitative data collection in Architecture: Interview
Module- 6	**Referencing**	Types of referencing styles. Writing the bibliography using M.S Word and Mendeley. Plagiarism checks and process.
Module- 7	**Introduction to Statistics**	Converting data into numerical form for data analysis. Introduction to the simple statistical methods of analyzing numerical data – frequencies / percentages, mean / median / mode, correlation, chi square test – inferring from the data and interpreting the meaning of those inferences. Use of MS Excel/SPSS for statistical data analysis.

Module- 8	**Report Writing**	Presentation & Reporting: Presentation of the Data: Techniques of presenting the numerical data – graphical (pie charts, bar charts, line graphs etc.), tabulations, verbal qualitative data, architectural drawings / maps. Different sections of a research report, technical writing and language (tense, voice, etc.), formatting of a report.

REFERENCES:

1. Research Methodology; C.R.Kothari; New Age International (P) Ltd.
2. Research Methodology; D. K. Bhattachary; Excel Books
3. Research Methodology; Goodday& Hack
4. The Practice of Social Research, by Babbie, E. 3rd Ed.,1983 Belmont :Wadsworth Publishing Co..
5. Research Design: Qualitaitve, quantitative and mixed methods approaches
6. By Creswell, J. W., 2nd Ed, 2003.Thousand Oaks : Sage
7. Research Design: Qualitative & Quantitative Approaches, 1994 Thousand Oaks : Sage
8. Surveys in Social Research, Jaipur, By De Vaus, D. A, 2003, Rawat Publications
9. Qualitative Data Analysis : A User Friendly Guide for Social Scientists, By Dey, I, 1993, London:Routledge
10. Architectural Research Methods, By Groat, L & Wang, D., 2002, NY : John Wiley and Sons Inc.
11. Research Methodology : Methods and Techniques By Kothari, C.R., 2005 New Delhi : WishwaPrakashan
12. Research Methods in the Social Sciences, By Nachmias, C. F. and Nachmias, D., 5th Ed 1996 Great Britain: St. MEDtin's Press Inc
13. Handbook of Qualitative Research By Norman K Denzin and Yvonna S Lincoln (Eds.)
14. pp.377-392., 1994, Thousand Oaks : Sage Publications
15. Qualitative Evaluation Methods, By Patton, M. Q.,1980, Sage Publications
16. Methods of Architectural Programming, By Sanoff, H, 1977 Dowden Hutchinson and Ross, Inc. Vol. 29,Community Development Series
17. Visual research methods in design, By Sanoff, H, 1991 USA : Van Nostrand Reinhold
18. Interpreting Qualitative Data : Methods for Analysing Talk, Text and Interaction By Silverman, D.,1993 , London: Sage Publication
19. Behavioral Methods in Environmental Design, By William Michelson (ed.),1982Stroudsberg, Pennylvania: Dowden Hutchinson and Ross. Inc.
20. Selected Research Papers and Studies

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 103 TRADITIONAL WISDOM AND SUSTAINABILTY CONCEPTS

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- The aim is to introduce the culture and knowledge systems of traditional community systems.
- To facilitate application of learnings from traditional and vernacular strategies both at macro and micro levels to mitigate the negative impacts of environment.
- To analyse the viability of sustainable tactics in traditional knowledge and apply it in design of contemporary environment.

Module-1	**Philosophy of Primitivism**	Going back to Basics, The Primitive Hut, anthropological relationship between man and Environment; underlying fundamentals of Architecture and Environment Responsiveness; Evolution of the Philosophy and its significance in contemporary Context
Module-2	**Traditional Wisdom and Vernacular Beliefs**	Traditional cities, Historic Buildings, Communities, Neighborhoods and House-Forms as suitable responses to existing environment. Studies from all over the world especially India from the macro to micro levels in lessons for sustainability useful for application in contemporary context.
Module-3	**Water Management Systems from Traditional Settlements**	Responses of Traditional Communities all over the world to land form and Water Systems for effective management drainage and suitable use. Indian Examples from diverse climate zones & Cultures for understanding resource management as steps to Sustainability. For e.g. Kunds, Baolis, Tankas, Stepped wells, Dongs, Jhalaras, Talabs, Ahar Pynes along with city level schemes.
Module-4	**Learning from Vernacular & Traditional Architecture**	Study of Traditional and Vernacular architecture in history of the world, with special emphasis on Indian architecture to understand shelter based on functions, building materials and construction techniques, art and craft, local conditions, traditions, climate and geography, religion & culture. Brief overview of the varied learnings from vernacular including Sense of Place, Spontaneity & variation, Control, Open Ended form Relationship, Symbols & Meanings.
Module-5	**Sustainability concepts**	Sustainable Built Environment: An Indian experience. Perceiving the built environment as a closed and inter-dependent system. Identifying the environmental, social, cultural and economic benefits of each approach.
Module- 6	**Heritage and Cultural Landscape**	Landscape Heritage, meaning, significance especially in Indian Context, Need for their revival as response to Environment, Understanding evolving attitudes to open space design in India: ancient horticultural tradition, Mughal and British colonial influence. Examining Cultural and Sacred Landscapes and their capacity to build knowledge.

REFERENCES:

1. Environment & Culture, F&FN Spon, London, 1998.
2. Gram Swaraj by M. K. Gandhi, Navjeevan Trust publication, Ahmedabad
3. Gram Geeta by Rashtrasant Tukdoji Maharaj, Govt. of Maharashtra publication.
4. Tribes of Central India, Publications of Vriksha mitra, Chandrapur, M. S.
5. Green is Red, by Ar. Anil Laul, New Delhi.
6. Wines James & Jodido Philip, "Green Architecture – The Art of Architecture in the age of Ecology", Tachen Publishers, New York, 2000.
7. Mackenzie Dorothy, "Green design: design for the Environment", Laurence King, London, 1997.
8. Farmer John & Richardson Kenneth, "Green Shift: Changing attitudes in architecture to the Natural World", Architectural Press, Boston, 1999.
9. The European Commission, "A Green Vitruvius: Principles and Practices of Sustainable Architectural Design", James & James, London, 1999.
10. Fred A. Stitt, "The Ecological Design Handbook", McGraw Hill, New York, 1999.
11. Scott Andrew, "Dimensions of Sustainability: Architecture, Form, Technology,

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 104 ENVIRONMENTAL PHYSICS AND APPLICATION

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To understand how to apply the basic thermodynamics to the human environment.
- To comprehend the basic composition, structure and dynamics of the atmosphere.
- To explore the working of hydrologic cycle and discuss the mechanisms of water transport in the atmosphere and in the ground.
- To examine specific environmental problems such as noise pollution, ozone depletion and global warming in the context of an overall understanding of the dynamics of the atmosphere.

Module-1	**Thermodynamics**	Laws of Thermodynamics and the human body. Importance of energy in science and society. Types of energy (mechanical, heat, chemical, nuclear, electrical). Law of conservation of energy. Energy transformations. Mechanical energy: force, work, kinetic and potential energy, PE diagrams, conservation of mechanical energy, bound systems. Electricity Basics. Study of Solar active and passive systems for cooling and heating, structural controls for thermal comfort and ventilation.
Module-2	**Meteorology and Atmosphere**	Structure and composition of the atmosphere, ozone in the atmosphere, greenhouse effect, global warming, hydrosphere and hydrologic cycle. Atmospheric transport of pollutants, Meteorological parameters such as wind direction, wind velocity, temperature, solar radiation, humidity topography, precipitation, inversion etc. Instruments and systems of their measurements.
Module-3	**Daylight**	Radiation spectrum, spectral sensitivity of eye, visual cone and comfort, daylight assessment, types of reflection, glare and quality and spread of light in buildings. Principals of day lighting, day lighting requirements in building, prediction techniques, day lighting systems, simulation techniques and methods.
Module-4	**Noise and noise controls**	Sound waves, audible range of sounds, equal loudness controls, noise reduction systems, sound transmission path. Sound principles, Noise and noise control in various climates, design aids.
Module- 5	**Material Properties**	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.
Module- 6	**Advance heat exchange systems**	Reduction of Heat Transfer or Enhancement, insulation properties of materials and built forms. Radiation versus other Heat Transfer Methods. PCM, Radiant cooling, Chilled beam, Geo-thermal, etc.
Module- 7	**Renewable energy resources**	Working of Renewable energy resources like Solar, Wind, earth and water

REFERENCES:

1. Nigel Mason and Peter Hughes: Introduction to Environmental Physics: Planet Earth, Life and Climate, Taylor and Francis, 2001
2. Baird, George. The architectural expression of environmental control systems
3. Sood, D.D .Environmental Physics.
4. Agarwal, S. K. Pollution Management Vol IV- Noise Pollution.
5. Rao & Rao. Air Pollution.
6. Faber, Oscar and Kell, J.R. Heating and air-conditioning of buildings. 2002.
7. Thomas, Randall & Fordham Max Sustainable urban design: an environmental approach" 2003.
8. Edwards, Brian and Hyett, Paul Rough guide to sustainability 2001.
9. Langston, Craig A. and Ding, Grace Sustainable practices in the built environment 2001.
10. Givoni Baruch,"Passive and Low Energy Cooling of Buildings",VNR, New York, 1994.
11. Martin J Gainsborough, Radford and Helen Bennets, T J Williamson, "Understanding Sustainable architecture", Spon Press, London, 2003.
12. Kulbhushan Jain, Earth Architecture

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 105 ENVIRONMENTAL MODELLING AND COMPUTER APPLICATION

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
		SESSIONAL ASSESMENT			ESE					
LECTURE	PRACTICAL/ TUTORIAL	CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	50	-	**50**	**100**	2	3hrs

OBJECTIVES:

- To introduce and give an overview of methods for environmental modelling and its purpose.
- To impart knowledge and experience in model construction and its evaluation.
- To familiarize software simulation tools for energy efficiency, noise, acoustics, air quality, fire, etc.

Module-1	**Introduction**	History, Significance and Compatibility of relevant Environmental Modelling Software. Selection of Tools and modeling for simulation
Module-2	**Key concepts of Environmental Modelling**	Key concepts within Environmental Modelling, for including calibration, verification, validation, robustness, model error, oscillation, discretization, and distinguishing between deterministic and stochastic models. Identifying dominant processes and carrying out sensitivity analyses.
Module-3	**Environmental Modelling Tools**	Familiarization of some simulation tools for Environmental Modelling of Noise, Pollution, Fire, Energy, Daylight, Thermal Comfort, Urban Heat Islands, Natural Ventilation among others
Module-4	**Material and Schedules Input**	Periodic Heat Transfer Model of a 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. 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.
Module-5	**Simulation Results and Analysis**	Modelling the Building performance enabling optimization of the design for using lesser Energy and Water; along with Noise and Pollution Control; Fire and Rescue Services; and Life Cycle Cost Analysis
Module-7	**Application**	On introductory level, communicating environmental modelling for different users, and describing its role within research and development, environmental (including risk) and policy issues. Application on the on-going Design Project.

REFERENCES:

1. Ford. 1999. Water Flows in the Mono Basin. Chapter 4 in Modeling the Environment. Island Press. Washington, DC.
2. Ford. 1999. Causal Loop Diagrams. Chapter 7 in Modeling the Environment. Island Press. Washington, DC.
3. Ford. 1999. The Steps of Environmental Modeling. Chapter 15 in Modeling the Environment. Island Press. Washington, DC.
4. Hadlock. 1998. Air Quality Modeling. Chapter 3 in Mathematical Modeling in the Environment. The Mathematical Association of America.
5. Hamby. 1994. A review of techniques for parameter sensitivity analysis of environmental models.

Environmental Monitoring and Assessment 32:135-154
6. Building Energy Simulation: A Workbook Using DesignBuilder™ ByJyotirmay Mathur, Aviruch Bhatia, Aviruch Bhatia
7. Design Energy Simulation for Architects: Guide to 3D Graphic, by Kjell Anderson
8. Energy Simulation in Building Design by Joseph Clarke

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M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – I

MED – 106 ELECTIVE-I (DEPARTMENTAL)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	-	-	-	**50**	2	-

OBJECTIVES:

A variety of Electives have been proposed to facilitate the design process of Initial Semester Environmental Design Studios

A. FAÇADE DESIGN FOR ENVIRONMENTAL RESPONSIVENESS

An Application based elective course for providing modern concepts on role of Facades in Environmentally Efficient Building Envelopes with Design, Structural and Material Aspects. Shall demonstrate considerations for improving the building performance using various design strategies and Materials. Room Zoning- layer of shades, overhead shades – Solar organizations: heat producing zones, stratification zones, buffer zones, daylight zones – Shape and enclosure: Direct gain, sun-spaces, thermal storage walls, roof ponds, thermal collector walls, wind catchers. Estimation of skin heat flow, window solar gain, ventilation / infiltration gains or loss along with other related aspects of suitable Environmental responses.

B. BIOMIMICRY & BIOMIMETICS

This course will familiarize students with some of the processes and methods of establishing principles through observations, experimentation, and constructing models of living organisms. Assisting students to comprehend how nature (biology) responds to the dynamics of environment and Geology. Students are encouraged to ascertain learnings from nature that be incorporated within the design process. The focus is on the integration among the components of ecosystems: living organisms; climate; and the chemical environment. The ultimate goal of the course is to encourage students to apply the lessons of nature into their design experience in varied fashion and come up with design products supporting sustainability principles.

C. LANDSCAPE DESIGN FOR SUITABLE ENVIRONMENT

The objective of this course is to examine the involvement of developmental activity and its intervention in natural processes in order to minimize its impact. The course introduces the art and general principles of designing, modifying and beautifying natural landscapes using suitable plant species along with other landscape elements. Aspiring to equip students with skills in designing, planning and managing green spaces and natural landscapes in context to urban areas. This course sensitizes students with the importance of landscape design in planning and development of environmentally suitable urban areas along with providing students with knowledge on the types and management of plants suitable for that region. Indoor Gardens, Vertical Garden Terrace Garden etc. for contemporary built environment. How to reduce urban heat islands & Make public spaces more comfortable by efficient Landscape Design.

D. POLLUTION MONITORING & CONTROL

This course is to familiarize students with Pollution – Sources, Causes / Pollutants and their Effects, Emission Sources, Vehicular Emissions, Techniques of Monitoring of Emissions, Emission Standards, and Ambient Air Quality. Concepts of Relevant Meteorological Parameters, and Interpolation of Data, Wind System Measurement, Turbulence, Mixing Height, Plume Use, Dispersion Models. Varied Types of Pollution their control and Monitoring Systems along with Analyses.

E. BUILDING PERFORMANCE ANALYSIS

The objective of this course is to understand Metering systems - Analysis of collected data from existing buildings - Economic aspects of energy simulation results: LCA, payback analysis, break even analysis, benefit cost analysis, present worth analysis, etc. - Selection of appropriate ECM from modelling results - Recalibration of the model from actual performance data.

REFERENCES:

1. Steven V. Szokolay, Introduction to Architectural Science: The basis of sustainable design, Architectural Press, 2004.
2. Brown.G.Z. and Mark Dekay, Sun, Wind & Light : Architectural Design Strategies, John Wiley & Sons inc.,2001.
3. Aravind Krishna, Nick Baker, Simos Yannas and Szokolay S V, Climate Responsive Architecture: a Design handbook for energy efficient buildings, McGraw-Hill Education (Asia) Co. and China Architecture & Building Press, 2005.
4. Norman, R. A., & Paul, S. P. (2017). Biomimicry. In The last natural man (pp. 65-72). Springer, Cham.
5. Chayaamor-Heil, N. (2018, July). The Impact of Nature Inspired Algorithms on Biomimetic Approach in Architectural and Urban Design. In Conference on Biomimetic and Biohybrid Systems (pp. 97-109). Springer, Cham.
6. Cerver Francisco Asensio: Environmental restoration landscape.
7. Cever Francisco a: Elements of landscape world of environment.
8. Mukherjee Pippa: Nature Guides Common Trees Of India. Worldwide Fund For Nature
9. Papanek Victor: Green Imperative Ecology
10. Ethics In Design. Thames And Hudson,
11. Randhawa M S: Flowering Trees. India
12. Hadlock. 1998. Air Quality Modeling. Chapter 3 in Mathematical Modeling in the Environment. The Mathematical Association of America.
13. Hamby. 1994. A review of techniques for parameter sensitivity analysis of environmental models. Environmental Monitoring and Assessment 32:135-154
14. Teaming for Efficiency: technologies, design, performance analysis and building industry trends, American Council for an Energy-Efficient Economy, 2002
15. James P. Waltz, Computerized Building Energy Simulation Handbook, Fairmont PR, 1997
16. Joseph Clarke, Energy Simulation in Building Design, Routledge, 2007
17. Giuliano Dall'O', Green Energy Audit of Buildings: A guide for a sustainable energy audit of buildings, Springer, 2013
18. ASHRAE Press, The ASHRAE Green Guide, Butterworth- Heinemann, 2006
19. Energy Conservation Building Code of India - User manual, 2007

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 201 ENVIRONMENTAL DESIGN STUDIO-2 (Campus design)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	8	30	70	**100**	-	50	**50**	**150**	5	-

OBJECTIVES:

- To apply the design principles for energy efficiency and sustainable development
- Design of Institutional Campus, Group Housing, IT campus etc. OR Project with Increased complexities with respect to energy efficiency and sustainable principles.
- Study and the application of environmental planning at settlement level.

Module 1	**Environmental Planning**	Introduction to Environmental Planning, Definition of environment, types of environment, pollutants and their effects. Ecosystem - types, components, energy flow, interactions is ecosystem. Physical Environment - air environment, water environment, soil environment.
Module 2	**Application of Campus planning environmental design codes**	GRIHA and IGBC etc, guidelines for campus planning
Module 3	**Case Studies**	Analysis of a campus in terms of its thermal properties, infrastructure etc. as an individual assignment in form of a report/ppt/ sheets
Module 4	**Design Problem**	Design of a campus – Housing, institute, commercial etc. considering environmental design concepts

References;

1. König, A. (Ed.). (2013). Regenerative sustainable development of universities and cities: the role of living laboratories. Edward Elgar Publishing.
2. Toor, W., & Havlick, S. (2004). Transportation and sustainable campus communities: Issues, examples, solutions. Island Press.
3. Walter Leal Filho . Towards Green Campus Operations - Energy, Climate and Sustainable Development Initiatives at Universities, Springer
4. Manzi, T., Lucas, K., Jones, T. L., & Allen, J. (Eds.). (2010). Social sustainability in urban areas: Communities, connectivity and the urban fabric. Routledge.
5. Corbett, M., & Corbett, J. (1999). Designing sustainable communities: Learning from village homes. Island Press.

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 202 DESIGN FOR LIGHTING, WATER AND WASTE TREATMENT SYSTEM (MEP-I)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To introduce the services like Mechanical, Electrical and Plumbing (MEP) and its sustainable usage and management for environmental benefits.
- To introduce environmental technologies for lighting design, waste management, water management and waste to energy, at city and building project level.

Module 1	**Introduction**	Introduction to Infrastructure Planning & Management**.** Aspects of Mechanical, Electrical and Plumbing (MEP) services at building and campus level.
Module 2	**Sustainable lighting Design**	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. Classification of lights and luminaries as per the usage, dimmer controls, Sensors etc. 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.
Module 3	**Sustainable Water Management**	Water and its status in India Source, Review of Management of water Type of Waste and review Management system. Environmental Technologies for various status of water. Water conservation, recycling and reuse. Waste water recycling, Rain Water harvesting, Storm water management, water less Landscaping
Module 4	**Sustainable Waste Management**	Waste generation and types of waste. Waste reduction, recycling and reuse. Waste segregation, Reuse, recycling, disposal, landfills.
Module 5	**Application**	Services studied should be applied to Environmental design studio problem.

References;

1. Designing With Light.Gillette,J.Michael.McGrawHill.5thEdition.
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.
7. Vancouver in Focus: The City's Built Form, Author: Mike Chadwick, Publisher: Granville Island Publishing, ISBN-10: 1894694449, ISBN-13: 978-1894694445
8. 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
9. 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
10. 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
11. Sustainable Infrastructure | The Guide to Green Engineering and Design, Author: S. Bry Sarte, Date of publication: September 2010,Publisher: Wiley, ISBN: 978- 0470453612
12. 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
13. 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
14. 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

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 203 ECOLOGY AND BIODIVERSITY (LAND, WATER AND VEGETATION)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
		SESSIONAL ASSESMENT			ESE					
LECTURE	PRACTICAL/ TUTORIAL	CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To study effect on vegetation, water and Land due to excessive usage, and human interventions.

Module 1	**Ecosystem Concept**	Biotic and abiotic factors in the environment. Food chains, Food web, Ecological pyramids and energy flow, Ecological niche, Ecological limits, adaptation to environment, Biogeochemical Cycles [N, S & P]
Module 2	**Major Ecosystems, Biogeography**	Aquatic: Marine & Freshwater Terrestrial: Forests, Deserts & Grasslands
Module 3	**Biodiversity**	Biodiversity and interrelationships between species and their environment and how these interrelationships sustain biodiversity. Biodiversity at Global level, Major Biodiversity areas of the world, Biodiversity Hot Spots, Biodiversity at Indian level
Module 4	**Landforms**	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.
Module 5	**Water**	Introduction to Status of Water Scenario, Rainfall Patterns, Scarcity Issues, Cause and Effect. Physical Hydrology, Traditional Water Management Knowledge, Integrated Water Resource Management, Water strategies and Policies, Surface Water/Irrigation Management, Issues and Challenges, Ground Water Issues, Management and Challenges.
Module 6	**Vegetation**	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.

References;

1. Modern Concepts Of Ecology (E.D. 5) by Kumar H. D.
2. Ecology (ED. 2) by Odum Eugene P.
3. Global Biodiversity Assessment by Heywood V.H. & Watson, R.T.
4. Conservation biology: voices from the Tropics by Gibson, L. & Raven, P.HG.
5. Beryl R. Collins and Karl H. Anderson, Plant Communities of New Jersey, Rutgers University Press, 1994
6. Douglas W. Tallamy, Bringing Nature Home, Timber Press, 2007
7. Grant W. Reid, Landscape Graphics, Watson-Guptill Publications, Revised Edition 2002
8. Tony Bertauski, Plan Graphics for the Landscape Designer, Prentice Hall, Second Edition, 2007

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 204 REMOTE SENSING & GIS APPLICATION

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To comprehend the evolution of urban form and conscious urban planning
- To understand the various strategies planners employ for an ideal urban plan.

Module-1	**Introduction to Remote Sensing**	Basic concepts; Multi-concepts in Remote Sensing Advantages of Remote Sensing data Applications of Remote Sensing
Module-2	**Remote sensing tools and methodology**	Remote Sensing Platforms & Sensors Remote sensing Data products referencing scheme digital data format and characteristics High resolution images Image processing software
Module-3	**Remote Sensing analysis**	Geometric & Radiometric corrections Visual image interpretation methods Digital image enhancement Digital image classification methods Accuracy assessment
Module-4	**Geographical Image System**	Basic concepts of GIS Digital representation of geographic data, digitization of features; Database creation Raster and vector based GIS data Overlay analysis, Buffering, Query, Spatial analysis / 3D analysis Introduction software, Application of GIS.
Module-5	**Data and national Policies**	National Spatial Data Infrastructure in India, National Urban Information system, National Map Policy.

REFERENCES:

1. Principles of Remote Sensing / Curran, P.J.
2. Remote Sensing & DIP / Lillesand&Keifer.
3. Fundamentals of geographical Information System / DeMers, Michael N, John Wiley & Sons, Inc.
4. Principles of Geographical Information Systems / Burrough, P.A., Oxford University Press.
5. The GIS Book, (5^{th} ed.) / Korte, George, Thomson Learning.
6. Analyzing Urban Poverty: GIS for Developing World / De Parez, R.G., ESRI, Redlands. (2008).
7. Remote Sensing and Image Interpretation / Lillesland,T and Kiefer,R, Wiley, London.

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 205 ENVIRONMENTAL CODES: ENERGY RATINGS, AUDIT & IMPACT ASSESSMENT

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- Introduction to energy conservation in buildings, international and national energy conservation building codes and rating systems, use and application of various codes in India, Use of codes or certification.
- The aim of the subject is to introduce the students to techniques for carrying out an assessment of the impact on the environment.

Module 1	**Introduction**	Study of development of various building codes at national and international level, objectives, key features, role and application. Outline understanding of UN frame work convention of climate change, Kyoto protocol, Earth Summit, national policies on sustainable and energy efficient development. 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.
Module 2	**The Environment (protection) Act**	The Environment (protection) Act 1986, rules to regulate environment pollution and Prevention, control and abatement of environmental pollution and institutional mechanism.
Module 3	**Study of Indian codes & Rating systems**	Introduction and guidelines of ECBC 2016, NBC 2016, 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, its legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country.
Module 4	**Energy Audit**	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.
Module 5	**Environmental impact assessment**	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.

Module 6	**Application**	Use of codes and guidelines to get certification and rating for new and old buildings/campuses. Case studies to understand practical application of various codes.

References;

1. The Environment (protection) Act 1986
2. The Energy Conservation (Amendment) Act 2001, and Amendments
3. Energy conservation building code 2016
4. National building code – India 2016
5. Dennis Landsberg & Ronald Stewart, "Improving Energy Efficiency in Buildings: A management guide", State University of New York Press, Albany, 1980.
6. Santamouris, "Energy Performance of Residential Buildings", James & James, London 2005.
7. Moncef Krarti, "Energy Audit of Building Systems: an Engineering approach" CRC Press, LLC, Florida 2000.
8. Chris P Underwood and Francis W H Yik, "Modelling methods for Energy in Buildings", Blackwell publishing co., Oxford 2004.

Faculty of Architecture and Planning, AKTU, Lucknow

M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – II

MED – 206 ELECTIVE-II (DEPARTMENTAL)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	-	-	-	**50**	2	-

OBJECTIVES:

- Electives are such that it facilitates in the design process of the Second Semester Environmental Design Studio based on the Campus Level design problem. Students can select from the following departmental level electives.

A. RESTORATION OF ECOLOGICAL DISTURBED CITIES

The goal of this course is to provide the skills and knowledge that need to restore any ecosystem of city that has been degraded, damaged or destroyed. It will focus on the underlying principles and approaches used in ecological restoration. Historical development of restoration concepts and the role that restoration can serve in the future stewardship of natural resources. The major ecological principles underlying the successful restoration of ecosystems of cities including concepts of disturbance and succession. Ecological and management principles and select appropriate methods and tools for designing and conducting restoration projects.

B. ENVIRONMENTAL ECONOMICS

This course introduces the economic perspectives on modern environmental issues. Students will study economic theories related to natural resources, with an emphasis on the strengths and weaknesses of alternative viewpoints. To learn that economic objectives do not necessarily conflict with environmental goals, and that markets can be harnessed to improve environmental quality. The limitations of economic analysis to provide policy guidance on environmental issues. The empirical techniques used by economists to put values on environmental commodities. Students should able to express an informed view regarding the potential of economics to help societies achieve their environmental goals.

C. SMART CITIES

The overall goals of this course is to obtain basic knowledge of smart cities and to learn how to analyze and compare existing smart cities projects. To learn how to analyze smart cities data using GIS and other related software. To explore how advances in information communication technologies affect the built environment at various scales (e.g., cities, districts, neighborhoods, blocks, buildings and to understand the role of multiple actors working at the intersection of technology and urbanism. To explore how urban spaces are shaped, for better or worse, by the complex interaction of technology, human societies, and the natural environment.

D. LIFE CYCLE THINKING FOR BUILDINGS

This course aims to provide knowledge and understanding about how cost and environmental issues affect the choice of design solutions and which measures need a longer term perspective than others, in order to get back the investment costs or make the building sustainable. To provide knowledge and understanding related to different types of actors' interests (city-owned property owners, private property owners, property developers (build and sell), private home owners, builders, manufacturers etc). Aspects of barriers and possibilities. To explore methodology and tools for determining life cycle perspective issues like life-cycle costs and environmental certification.

E. HEALTHY BUILDINGS

This course attempts to answer two questions: What makes a building healthy, comfortable and productive for its occupants? How can we influence design, construction and operations to ensure healthy, comfortable and productive 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.

F. ENVIRONMENTAL COMPLIANCE AND REPORT MAKING

This course aims to provide students insight and knowledge of the process of environmental compliance process and methods of report making. This would be done through exploring existing environmental compliance reports of sustainable or green buildings achieved any of the green building rating. Second part of the course include report making for environmental compliance for their own design project of the previous semester.

References;

1. Galatowitsch 2012. Ecological Restoration, Chapter 2. Sinauer Associates, Sunderland, MA.
2. Howell et al. 2012. Introduction to Restoration Ecology. Island Press, Washington. pp. 16-22
3. Matthew Kahn, Fundamentals of Environmental Economics: Solving Urban Pollution Problems
4. Charles Kolstad, Environmental Economics (Oxford University Press, 1st edition 2000, or 2nd edition 2010)
5. The RFF Reader in Environmental and Resource Policy (Wallace Oates Editor, 2nd edition 2006, RFF Press)
6. Transforming City Governments for Successful Smart Cities, Editor: Manuel Pedro Rodriguez-Bolivar ISBN: 978-3-319-03166-8
7. Smart Cities: Big Data and the Quest for a New Utopia, Anthony M. Townsend, ISBN: 978-0-393-08287-6
8. Beyond Smart Cities: How Cities Network, Learn and Innovate, Tim Campbell ISBN: 978-1-84971-426-6
9. Start-Up City, Gabe Klein ISBN: 978-1-61091-690-5
10. Building Smart Cities: Analytics, ICT and Design Thinking, Carol L. Stimmel, ISBN: 978-1-4987-0276-8
11. Smart Cities for a Bright Sustainable Future: A Global Perspective, Shark, Toporkoff and Levy ISBN: 978-1-4973-3945-6
12. Bernstein, Harvey M. et. al. 2014. The Drive Toward Healthier Buildings: The Market Drivers and Impact of Building Design and Construction on Occupant Health, Well-Being and Productivity. McGraw Hill Construction.
13. Heschong Mahone Group. 2003. Windows and Offices: a Study of Worker Performance and the Indoor Environment (Technical Report). California Energy Commission.
14. Delos Living LLC. 2015. WELL Building Standard®, v1. International Well Building Institute.
15. Manandhar, M., & Buick, P. 2012. Hospital, Heal Thyself, Clamor is hazardous to your health. Designer have the Rx., ArchitectureBoston
16. Spengler, J., & Africa, J. K. 2014. The Natural Environments Initiative: Illustrative Review and Workshop Statement. Center for Health and the Global Environment at the Harvard School of Public Health.
17. Terrapin Bright Green. 2012. The Economics of Biophilia: Why designing with nature in mind makes financial sense.
18. World Green Building Council. 2014. Health, Wellbeing, and Productivity in Offices, the next chapter for green buildings, Key Findings.

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – III

MED – 301 ENVIRONMENTAL DESIGN STUDIO-III (Urban and Precinct Level)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	8	30	70	**100**	-	50	**50**	**150**	5	-

OBJECTIVES:

- To apply the design principles for energy efficiency and sustainable development
- Design Studio to apply the Environmental Design at the urban scale and generating the Environment Management Plan document for the same

Module 1	**Environmental Design**	Introduction to Environmental Planning, Definition of environment, types of environment, pollutants and their effects. Ecosystem - types, components, energy flow, interactions is ecosystem. Physical Environment - air environment, water environment, soil environment.
Module 2	**Application of Urban planning environmental design codes**	GRIHA and IGBC etc., guidelines for urban and Precinct level
Module 3	**Case Studies**	Analysis of an urban level in terms of its thermal properties, infrastructure etc. as an individual assignment in form of a report/ppt/ sheets
Module 4	**Design Problem**	Design of a region / urban area etc. considering environmental design concepts

References;

1. Integrated Environmental Planning by James K. Lein
2. Urban Wind Environment Integrated Climate-Sensitive Planning and Design by Chao Yuan
3. Sustainable Urbanism: Urban Design With Nature by Douglas Farr
4. Nature Based Strategies for Urban and Building Sustainability by Gabriel Perez, Katia Perini

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – III

MED – 302 Design of HVAC, Fire and Sound Treatment Systems (MEP II)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To introduce the services like Mechanical, Electrical and Plumbing (MEP) and its sustainable usage and management for environmental benefits.
- To introduce environmental technologies for lighting design, waste management, water management and waste to energy at city and building project level.

Module 1	**Introduction**	Introduction to Infrastructure Planning & Management**.** Aspects of Mechanical, Electrical and Plumbing (MEP) services at a building, campus level and precinct level.
Module 2	**Sustainable HAVC Design**	air conditioning thermal comfort indices, basic refrigeration systems, types of air conditioning such as unitary air conditioners, split air conditioners and package air conditioners, central air conditioners, VRV and VRF. Mechanical ventilation and evaporative cooling, heating and humidity controls and design considerations and directions. Humidity controls, design and sizing of air conditioning system, outdoor air requirement for ventilation of air condition areas. Global warming potential (GWP), building-related illness(BRI), sick building syndrome (SBS) and mitigation methods, heat exchangers, radiant cooling, chilled beams.
Module 3	**Indoor and outdoor air quality**	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, dilution method, ventilation rate procedure for multiple spaces and ambient air quality standards.
Module 4	**Sustainable Fire safety**	Sustainable fire safety materials and techniques. Fire safe and sustainable building materials. Sustainable firefighting technologies- springers systems, alarms, smoke detectors, hydrants, extinguishers, etc.
Module 4	**Sustainable Sound Treatment**	Sustainable acoustic materials, Noise calculation and minimum standard from NBC and other standards. Innovative and sustainable acoustic treatments for different building types and surroundings.

Module 5	**Application**	Services studied should be applied to Environmental design studio problem.

References;

1. Challenges for Technology Innovation: An Agenda for the Future by Ana Cristina Lemos, Fernando Moreira da Silva
2. Sustainable Urban Architecture Select Proceedings of VALUE 2020 by G. Balaji, K. Thirumaran, N. Devi Prasad
3. Sustainability in Energy and Buildings 2018 Proceedings of the 10th International Conference in Sustainability on Energy and Buildings (SEB'18) by Robert J. Howlett, John Littlewood, Chandima Ekanyake, Ljubo Vlacic
4. Climate Change, the Indoor Environment, and Health
5. WHO Guidelines for Indoor Air Quality by World Health Organization
6. Fire Safety Challenges of Green Buildings By Brian Meacham, Brandon Poole, Juan Echeverria, Raymond Cheng
7. Sustainable Energy: the Links Between Fire Safety and Sustainability by By David and Fraser-Mitchell Charters (Jeremy)

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – III

MED – 303 Eco cities

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

- To introduce the concepts of eco cities through theories and case studies.
- To introduce parameters of an eco-cities.

Module 1	**Introduction**	Introduction to eco-city, economic, social, and environmental qualities of an eco-city, SDG's 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.
Module 2	**Pollution monitoring and control**	Introduction of various types of pollutants- air, water, land, noise. Their monitoring and control.
Module 2	**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.
Module 3	**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.

References;

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. 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
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.

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – III

MED – 304 Sustainable Building Materials and Technology

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	1	15	35	**50**	50	-	**50**	**100**	3	3hrs

OBJECTIVES:

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

Module 1	**Sustainable building materials-Introduction**	Environmental impact of building materials Introduction to sustainable building materials, qualities, use, examples - Natural building materials, locally available and locally manufactured materials, bio materials - Salvaged and recycled materials - Nontoxic materials: low VOC paints, coating and adhesives.
Module 2	**Concept of Embodied Energy and Carbon Footprint**	Idea of embodied energy - Development of the concept, factors to be considered, calculation techniques for embodied energy - Data sets available for calculation of embodied energy - Case studies of embodied energy calculations - Sample embodied energy calculations for a material - Concept of embodied carbon or carbon footprint of material, calculation techniques, methods to off-set high embodied energy - Cradle to cradle material, whole life cycle and life cycle costing analysis techniques
Module 3	**Sustainable Construction Techniques**	Alternative construction techniques such as SMB, CSEB, and steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, Ferro-cement walls etc., - Case studies of innovative sustainable construction techniques
Module 4	**Use of Innovative /Alternative Building materials**	Use of waste materials such as paper, glass bottles, tires, shipping containers - Use of post-consumer and industrial waste such as fly-ash, bags, building demolition waste – use of salvaged materials from flooring, columns, beams, timber, glass, etc.

References;

1. Sustainable Building - Design Manual Pt 1 & 2, The Energy and Resources Institute, TERI, 2004
2. Ross Spiegel.G, Green Building Materials. A Guide to Product Selection and Specification, 3rd Edition by, John Wiley & Sons, 2010
3. Jagadish. K.S. Alternative Building Materials and Technologies, New age International Pvt Ltd Publishers, 2008
4. Traci Rose Rider, Stacy Glass, Jessica McNaughton, Understanding Green Building Materials, W.W.Norton and Company, 2011
5. Johan van Lengen, The Barefoot Architect: A Handbook for Green Building, Shelter Publication, 2008
6. http://www.sustainablebuild.co.uk/ecofriendlyconstructionmethodsmaterials.html
7. http://www.epa.gov/greenhomes/SmarterMaterialChoices.htm
8. http://inhabitat.com/tag/sustainable-building-materials/

MED – 305 Dissertation

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	-	50	**50**	-	50	**50**	**100**	3	-

OBJECTIVES:

- To research on a topic relevant to the final thesis topic and do the necessary background work.
- Present the findings in report form.

INTRODUCTION

- Preparation of an Environmental Design Dissertation includes an extensive study on related works and precedents in the selected field of study. The study can be related to the final thesis next semester.
- Each student is expected to submit one or more synopsis for the finalization of their topic. After finalization of a topic, by a set of faculty members, the student shall be allotted one or more faculty member(s)/Guide(s)under whose guidance they have to carry out their dissertation.

Module 1	**Introduction**	Synopsis submission- Selection of topic.
Module 2	**Stage-I:** **Dissertation Plan** **Marks: 10**	Aims, Objectives, Hypothesis, Methodology, Scope & limitations. Brief literature review.
Module 2	**Stage-II:** **Literature study** **Marks:15**	Extensive Literature survey- referencing books, journals, reports, related dissertation and thesis reports, websites, etc. Case studies, Data collection & analysis. Revised dissertation plan.
Module 3	**Stage-III:** **Primary study** **Marks: 15**	Site study, survey or simulation. Pre-final presentation of dissertation after incorporating suggestions of the jury. Draft report.
Module 4	**Stage-IV:** **Conclusions** **Marks: 10**	Conclusions and Formulation of Recommendation Submission of Final report (10 – 15 thousand words) after incorporating suggestions of jury. It shall be duly referenced in a standard format.

COMPOSITION OF JURY PANEL FOR EVALUATION OF DISSERTATION AT INTERNAL JURY STAGES:

- There shall be one or more jury panels. Each panel shall consist of the following -

1. Senior faculty member (Professor/Asso. Professor) of the Department of the parent institution.
2. Junior faculty member (Asst. Professor) of the Department of the parent institution.
3. Thesis Guide(s).

There shall be three juries/presentations for each student to assess Stage I, Stage II and Stage III. The same jury members shall assess Stage IV submission, i.e. Final Report as in Stage III.
Further, the Dissertation Coordinator will act as facilitator.

COMPOSITION OF JURY PANEL FOR FINAL (EXTERNAL) EVALUATION / EXAMINATION OF THESIS.

- There shall be one or more jury panels. Each panel shall consist of the following -

1. An eminent architect/faculty from the profession with at least 15 years experience.
2. Thesis Guide(s) as a member, but not part of the evaluation.

References:

1. Raman Meenakshi and Sharma Sangeeta, "Technical Communications – Principles and Practices", Oxford University Press, New Delhi.
2. Kate L.Tourabian, A manual for Writers of Research Papers, Theses and Dissertation, 8th edition.
3. Joseph Gibaldi, MLA handbook for Writers of Research Papers.

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – III

MED – 306 ELECTIVE-II (INSTITUTIONAL)

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	-	-	-	**50**	2	-

OBJECTIVES:

- Electives are such that it facilitates in the design process of the third Semester Environmental Design Studio based on the Urban /precinct Level design problem. Students can select from the following institutional level electives.

A. ARTIFICIAL INTELLIGENCE FOR LOW CARBON DESIGN

The potential of applying AI to enhance sustainability through- Monitoring Emissions, Predicting Emissions, Reducing Emissions. Application of AI and machine learning to Create new low-carbon materials, monitor agricultural emissions and deforestation, build better electricity systems, make transportation more efficient, reduce wasted energy from buildings, give individuals tools to reduce their carbon footprint.

B. ENVIRONMENTAL PLANNING POLICIES, LAWS AND LEGISLATIONS

Environment: Definition and Explanation if objects. Environmental Pollution. Environmental Challenges. Ancient ethics and environmental protection. Introduction and State Obligation to Protect & Improve Environment. The Fundamental Duty of Citizens to protect environment. The Right to Wholesome Environment. Right to constitutional remedies and environment. Other relevant provisions. Convections on Chemicals and Hazardous Waste. Convention on Ozone Depletion. International Principles and Doctrines. The Water (Prevention and Control of Pollution) Act, 1974, The Water Cess Act,1977. National Water Act. The Air Act, 1981. The Forests and Wildlife Protection Acts: The Forest (Conservation) Act, 1980; The Wildlife Protection Act, 1972. The Environment (Protect) Act, 1986. Issues in Enforcement: Problems and Perspective. Case studies and important judgments. Institutional Arrangement: The CPCB, PCB and its functions

C. SUSTAINABLE LANDSCAPE DESIGN

Introduction to landscape ecology. Formation of various landforms. Landforms and landscape process. Pattern and structure of landscapes. Concepts of patch, corridor and matrix. Landscape dynamics and function. Topological and chronological process within landscape. Concept of landscape metrics. Understanding dynamic interaction between landscape structure and function. Relationship between man and nature, Analytical aspects of landscape, The natural and cultural setting, Evolution of landscape planning. The purpose of landscape planning. Domain and context for landscape planning. Principles of planning. Procedure in landscape planning. Problem defining, goal setting, inventory and analysis. Basics of collecting and analyzing, projecting and presenting data in landscape planning, visual assessment and aesthetic dimension. Suitability analysis – Techniques for identifying preferences - Planning options – Proposing landscape plan. Case studies on landscape – site and regional planning. Landscape management at regional scale. Managements practices with emphasis on urban forest, urban ecology, riverfront development green belt. Regional open spaces, national parks, reserved forests, wet lands, coastal areas. Horticultural practices.

D. INTEGRATED ENVIRONMENTAL MANAGEMENT

Introduction to Environment Management: an interdisciplinary approach. Significance of environment and its management. Assessing the status of environment by ecosystem indicators, remote sensing, GIS. Setting the management and conservation priorities. Environment conservation and management in human-modified world: challenges and measures to meet them: overcoming the obstacles. Social and political responsibilities for environmental conservation and protection- environmental education, significant political and social movements. Environmental Quality Matters. Measuring and monitoring the environmental quality: Parameters and standards – Air, Water, Soil, Noise, Radiation. Tools for managing the environmental quality- Understanding Natural Disaster: vulnerability, hazard, risk, catastrophe- Geo-physical disaster, meteorological disaster and man-made disaster, Disaster preparedness, Disaster response. Disaster medicine- Rehabilitation, Reconstruction and Recovery.

E. POST-OCCUPANCY EVALUATION OF BUILDINGS

Understanding the conceptual frame works underlying different types of post occupancy evaluation that address specific organizational objectives or needs. The generic attributes such as identifying and formulating the problems and envisaging enact processes in response to them. Assessing existing buildings on their energy use, environmental impact and occupant satisfaction. Building performance benchmarks – 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 overall performance of the building. Students must carry out a post-occupancy evaluation of a building and document the relationship between building design, energy use, occupant satisfaction, environmental impact, and report their observations.

F. INTELLIGENT BUILDING

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. Economic 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.

References;

1. https://www.mdpi.com/1996-1073/13/20/5289/pdf
2. https://www.nature.com/articles/s42256-020-0219-9?proof=t
3. https://www.theverge.com/2019/6/25/18744034/ai-artificial-intelligence-ml-climate-change-fight-tackle
4. https://blog.google/technology/ai/minimizing-carbon-footprint/
5. Cerver Francisco Asensio: Environmental restoration landscape.
6. Cever Francisco a: Elements of landscape world of environment.
7. Mukherjee Pippa: Nature Guides Common Trees Of India. Worldwide Fund For Nature
8. Papanek Victor: Green Imperative Ecology
9. Ethics In Design. Thames And Hudson,
10. Randhawa M S: Flowering Trees. India
11. Integrated Environmental Management By John Cairns, Jr., Todd V. Crawford
12. Integrated Environmental Management, A Transdisciplinary Approach By Sven Erik Jørgensen , Joao Carlos Marques, Søren Nors Nielsen
13. Wolfgang Preiser & Edlaine Ostroff "Universal Design Handbook", McGraw Hill, 2001.
14. Robert B. Bechtel and Arza Churchman "Handbook of Environmental Psychology", John Wiley & Sons Inc., New York 2002.
15. James Douglas "Building Adaptation", Elsevier, Oxford 2002.
16. Derek Clements – Croom(ed), "Intelligent Buildings: Design, Maintenance and Operation, Thomas Telford, London, 2004.
17. Michael Nigginton & Jude Harris, "Intelligent skins" Architectural Press, Oxford, 2002.
18. Albert Ting-Pat so & Wai Lokchan, "Intelligent Building Systems (The international series on Asian studies in computer and information science), Springer, 1999.
19. Andrew Harrison & Eric Loe, "Intelligent Buildings in South East Asia", Spon Press, 1997

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – IV

MED – 401 THESIS

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
		SESSIONAL ASSESMENT			ESE					
LECTURE	PRACTICAL/ TUTORIAL	CT	TA	TOTAL	THEORY	VIVA	TOTAL			
2	18	-	250	**250**	-	250	**250**	**500**	2	-

OBJECTIVES:

- To prepare a student to independently handle and present all aspects of an Environmental design solution, from its evolution to the final solution incorporating the learnings from the previous semesters.
- To develop students' ability to handle specific aspects/thrust areas of Environmental design relevant to the topic.
- To do research on related thesis topics and formulate the findings.
- Design a built form/ campus/ urban level proposal that incorporates the done research.

INTRODUCTION

The multiple challenges of 'sustainable built environment' offer unlimited scope for the choice of an Environmental design thesis. The selection of the thesis subject may result either from the issue/s involved, or from the challenges of design, or from the inherent and acquired aptitude of a student, which they wishes to perfect and present. The variety of intentions gives students a choice to select the thesis topic from a purely hypothetical to a 'live' programme, as long as the topic can result in a tangible 'sustainable built environment' solution. Consequently, the size of the project has no relevance in the selection of the topic, the riding clause being the topic's relevance to serve the laid down specific objectives inherent in the philosophy of the institution.

1. To maintain uniformity in results and standards, the thesis presentation shall be in two distinct compartments: a report comprising of all the preliminary studies required for the thesis topic and the final design solution.
2. The Thesis report shall consist of all relevant contextual studies: user, place and time to enable the formulation of design criteria.
3. The design solution shall be in the form of drawings and models of the concept and design and shall further include presenting at least one specific aspect relevant to the selected topic in complete detail.
4. The report, in duplicate, shall be submitted in a bound form with prints/photographs of all the drawings and model/s.
5. All relevant/ pertinent drawings, sketches, models from previous stages to be put up for the jury to show evolution of design.

Module-1	**Selection of the topic**	**Synopsis** - Identification of topic, needs of the study and outcome. Brief Description of Literature/ library/ case studies to form background.
Module-2	**Stage -I** **Thesis Plan** **Marks:50**	Identify aims and objectives (for implementing the thrust area from dissertation in subsequent design proposals), methodology, scope, and limitations. Literature study from relavent research papers.
Module-3	**Stage -II** **Literature Study** **Marks:50**	Detailed Case Studies identified for Thesis Project. Detailed Site Studies and Analysis. Thesis Project Concept and Sketch Design through drawings and models.
Module-4	**Stage -III** **Design Development** **Marks:50**	Design development in the form of Site Plan(s), Floor Plan(s), Sections and Elevations, Views and Working Models fully explaining the design, Structural Systems, Services Compliance.
Module-5	**Stage -IV** **Final Jury** **Marks:50**	Finalized Detailed Drawings complete with thrust area details, 3Ds views, walkthroughs and models with Final Thesis report.

COMPOSITION OF JURY PANEL FOR EVALUATION OF DISSERTATION AT INTERNAL JURY STAGES:

- There shall be one or more jury panels. Each panel shall consist of the following -

1. Senior faculty member (Professor/Asso. Professor) of the Department of the parent institution.
2. Junior faculty member (Asst. Professor) of the Department of the parent institution.
3. Thesis Guide(s).

COMPOSITION OF JURY PANEL FOR FINAL (EXTERNAL) EVALUATION / EXAMINATION OF THESIS.

- There shall be one or more jury panels. Each panel shall consist of the following -

1. An Architect Director / Principal / Head of the Department / Course Coordinator of the parent institution/university.
2. An Architect Director / Principal / Head of the Department / Professor of other than the parent institution /university.
3. An eminent architect from the profession with at least 15 years of field experience.
4. Thesis Guide(s) as member, but not part of evaluation.

Faculty of Architecture and Planning, AKTU, Lucknow
M.ARCH. IN ENVIRONMENTAL DESIGN SEMESTER – IV

MED – 402 SUSTAINABLE CONSERVATION OF CULTURAL HERITAGE

PERIODS		EVALUATION SCHEME						SUBJECT TOTAL	CREDITS	DURATION OF THEORY PAPER
LECTURE	PRACTICAL/ TUTORIAL	SESSIONAL ASSESMENT			ESE					
		CT	TA	TOTAL	THEORY	VIVA	TOTAL			
1	1	15	35	**50**	-	-	-	**50**	2	-

OBJECTIVES:

- To understand the role of conservation of cultural heritage as a tool for sustainable development.
- To study the global and national charters, discourses and case studies to incorporate cultural heritage conservation as part of sustainable development.

Module 1	**Meaning of Cultural heritage and Sustainability**	Meaning of cultural heritage, its conservation and sustainability, ICOMOS charters and UNESCO discourse on cultural heritage conservation. Students will be given global case studies to research upon, analyze and understand which will be discussed within the framework of the 3modules.
Module 2	**Conservation of built heritage and vernacular architecture**	To understand the meaning of the built heritage conservation, its integration in environmental planning and development. Meanings of vernacular architecture for local communities. Assessment of energy passive techniques and embodied energy in traditional building techniques
Module 3	**Conservation of traditional knowledge systems**	Cultural landscape as a concept. Global discourses like HUL, places of significance and community based natural resource management. Intangible cultural practices related to traditional knowledge systems.

References;

1. Brundtland, G. H. 1987. *Report of the World Commission on Environment and Development: Our Common Future.* United Nations World Commission on Environment and Development (WCED), Oslo.
2. Bieling, C., Plieninger, T., Pirker, H., and Vogl, C.R. 2014. *Linkages between landscapes and human well-being: An empirical exploration with short interviews.* Ecological Economics 105: 19-30.
3. CHCfE Consortium; Europa Nostra. 2015. *Cultural Heritage Counts for Europe. Research Summary*, Krakow: CHCfE Consortium/International Cultural Centre, Krakow.
4. Czech, B. 2010. *Ecological Economics. Vol. 1, in Animal and Plant Productivity*, by EOLSS-UNESCO, edited by Robert J. Hudson, 333-363. Paris: EOLSS-UNESCO. www.eolss.net/sample-chapters/c10/e5-15a-13.pdf.
5. Denier, L., Scherr, S., Shames, S., Chatterton, P., Hovani, L., Stam, N. 2015. *The Little Sustainable Landscapes Book*, Global Canopy Programme: Oxford.
6. Dessein et al. 2015. *Culture in, for and as Sustainable Development. Conclusions from the COST Action IS1007 Investigating Cultural Sustainability*. Edited by Dessein, J., Soini, K., G. Fairclough and L. Horlings. Finland: University of Jyväskylä.
7. ICOMOS Charters and UNESCO operational guidelines for management of World Heritage Sites.
8. Plieninger, T., Bieling, C., Fagerholm, N., Byg, A., Hartel, T., Hurley, P., López-Santiago, C.A., Nagabhatla, N., Oteros-Rozas, E., Raymond, C.M., van der Horst, D., and Huntsinger, L. (2015): *The role of cultural ecosystem services in landscape management and planning.* Current Opinion in Environmental Sustainability 14: 28-33.
9. Plieninger, T., Bieling, C., Ohnesorge, B., Schaich, H., Schleyer, C. and Wolff, F. 2013: *Exploring futures of ecosystem services in cultural landscapes through participatory scenario development in the Swabian Alb, Germany*. Ecology and Society 18 (3): 39.
10. Upadhyay, N. 2015. *Community Involvement in Post disaster Cultural Regeneration – Case of Marathwada,India*. Community involvement in Heritage. Edited by - Van Balen, K. & Vandesande, A. Garant: Antwerp.