FACULTY OF ARCHITECTURE

M.ARCH. IN ENVIRONMENTAL DESIGN

SEMESTER I **SCHEME OF TEACHING & EXAMINATION**

(Effective from Session 2020)

S.No	SUBJECT CODE	NAME OF SUBJECT	PERIODS		EVALUATION SCHEME						TOTAL	CREDITS	DURATION
			L	P/T	SESSIONAL ASSESSMENT			ESE					
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			
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	MED-103	Traditional Wisdom & Sustainability Concepts	2	1	15	35	50	50	0	50	100	3	
4	MED-104	Environmental Physics and Application	2	1	15	35	50	50	0	50	100	3	
5	MED-105	Environmental Modelling and Computer Applications	1	1	15	35	50	50	0	50	100	2	
6	MED-106	Elective-I	1	1	15	35	50	0	0	0	50	2	
			10	13								18	

SEMESTER II

S.No	SUBJECT CODE	NAME OF SUBJECT	PERIODS		EVALUATION SCHEME						TOTAL	CREDITS	DURATION
			L	P/T	SESSIONAL ASSESSMENT			ESE					
					CT	TA	TOTAL	THEORY	VIVA	TOTAL			
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 Systems (MEP-I)	2	1	15	35	50	50	0	50	100	3	
3	MED-203	Ecology and Bio-Diversity (Land , Water,Vegetation)	2	1	15	35	50	50	0	50	100	3	
4	MED-204	Remote Sensing and GIS Applications	2	1	15	35	50	50	0	50	100	3	
5	MED-205	Environmental Codes; Energy Ratings Audit and Impact Assessment	1	1	15	35	50	50	0	50	100	2	
6	MED-206	Elective-II	1	1	15	35	50	0	0	0	50	2	
			10	13								18	

DESIGN ORIENTED KNOWLEDGE BASED SKILL ORIENTED

Faculty of Architecture and Planning, AKTU, Lucknow

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

Faculty of Architecture and Planning, AKTU, Lucknow

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

Faculty of Architecture and Planning, AKTU, Lucknow

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.

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F. SUSTAINABLE BUILDING MATERIAL & TECHNOLOGIES

To introduce concepts of Eco Friendly building materials and Technologies along with alternative methods of building energy efficient construction. Environmental impact of building materials & Technologies, Eco Friendly building materials, their composition, production and recycling, physical properties etc. Embodied energy of materials like steel, flyash bricks, gypsum, eco-boards etc. Life Cycle assessment of materials. Introduction to alternative building technologies: Traditional, Curtain Walls, Pre-fabrication and Modular etc. An In-depth understanding of Sustainable Technologies and their applications.

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

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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
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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;

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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

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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.

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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.

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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
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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
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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.
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