ANNA UNIVERSITY, CHENNAI

POSTGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: M. Arch. (Environmental Architecture) **Regulations:** 2025

Abbreviations:

Category

PC – Professional Core

PE – Professional Elective

BS & AE – Basic Sciences & Applied Engineering

PAE – Professional Ability Enhancement

SD – Skill Development

HUM – Humanities (including Languages and others)

Course Type

S - Studio

T – Theory

TS – Theory cum Studio

IT – Internship Training

LIT – Laboratory Integrated Theory

TCP – Total Contact Period(s)

L – Lecture **P –** Practical

T – Tutorials **S -** Studio

Semester I

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.	MH25C01	Research Methodologies for Built Environment	T	3	0	0	3	3	PC
2.	EA25101	Energy, Environment and Sustainable Development	T	3	0	0	3	3	PC
3.	EA25102	Thermal Comfort and Passive Design	T	3	0	0	3	3	PC
4.	EA25103	Environmental Impact Assessment	T	3	0	0	3	3	PC
5.	EA25104	Urban Ecology and Environmental Planning	T	3	0	0	3	3	PC
6.	EA25105	Environmental Design Studio - I	S	0	0	10	10	10	PC
Total Credits							**25**	**25**	

Semester II (Prerequisite- Pass in Environmental Design Studio - I)

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.	EA25201	Environmental Disturbances, Pollution and Remedies	T	3	0	0	3	3	PC
2.	EA25202	Sustainable, Energy Efficient Building Materials and Technologies	T	3	0	0	3	3	PC
3.	MH25C03	Geographical Information Systems for Built Environment	TS	1	0	3	4	4	PAEC
4.	EA25203	Assessment Tools for Environmental Architecture	TS	1	0	3	4	4	PAEC
5.		Professional Elective I	---	X	X	X	3	3	PE
6.	-	Industry Oriented Course	---	X	X	X	---	1	SD
7.	EA25204	Environmental Design Studio - II	S	0	0	10	10	10	PC
Total Credits							**27**	**28**	

Semester III (Prerequisite- Pass in Environmental Design Studio - II)

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.	EA25301	Life Cycle Assessment of Buildings	T	3	0	0	3	3	PC
2.	EA25302	Environmental Laws and Management	T	3	0	0	3	3	PC
3.	EA25303	Dissertation	T	0	0	4	4	4	PC
4.	EA25304	Environmental Design Studio - III	S	0	0	10	10	10	PC
5.		Professional Elective II	---	X	X	X	3	3	PE
6.		Professional Elective III	---	X	X	X	3	3	PE
7.	EA25305	Internship Training	---	---	--	---	---	2	SD
Total Credits							**26**	**28**	

Semester IV (Prerequisite- Pass in Environmental Design Studio - III)

S. No.	Course Code	Course Title	Type	Periods per week			TCP	Credits	Category
				L	T	P/S			
1.	EA25401	Thesis Project	S	0	0	20	20	20	SD
2.		Professional Elective IV	---	X	X	X	3	3	PE
Total Credits							**23**	**23**	

Professional Elective Courses (PEC)

S. No.	Course Code	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P/S		
1.	EA25001	Sustainability and Energy Conservation in Landscape Architecture	3	0	0	3	3
2.	EA25002	Environment Infrastructure	3	0	0	3	3
3.	EA25003	Building Science and Sustainability	3	0	0	3	3
4.	MH25C02	Environmental Psychology	3	0	0	3	3
5.	MH25C06	Soft Skills	2	0	1	3	3
6.	EA25004	Post Occupancy Evaluation of Buildings	3	0	0	3	3
7.	EA25005	Design of Energy Efficient and Healthy Buildings	3	0	0	3	3
8.	EA25006	Carbon Foot Print and Measurement	3	0	0	3	3
9.	EA25007	Natural Resource Management	3	0	0	3	3
10.	EA25008	Environmental Management Systems and Auditing	3	0	0	3	3
11.	MH25C05	Psychology of Learning and Development	3	0	0	3	3
12.	EA25009	Energy, Climate Change and Urban Development	3	0	0	3	3
13.	EA25010	Theory of Environmental Planning	3	0	0	3	3
14.	EA25011	Environment, Development and Disaster Management	3	0	0	3	3
15.	MH25C07	Theory of Architectural Education	3	0	0	3	3

Semester I

MH25C01	Research Methodologies for Built Environment	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To give introduction to the importance of critical inquiry as a way of gaining knowledge and adding to it through research.
- To give exposure to the various forms of research and research methodologies/ processes.
- To understand research in the specific domain of built environment research.

Introduction: 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 including research in the domain of built environment.

Research Process: 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 including research in the domain of built environment.

Researching and Data Collection: Library and archives. Internet: New information and the role of internet. Finding and evaluating sources. Misuse. Test for reliability. Ethics.

Methods of data collection- Primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling. Collecting data from secondary sources. Socio-economic research techniques such as focused group discussions, participant observation.

Methods and Tools in Urban Research: Space syntax: key concepts of space syntax and their development, spatial properties - connectivity, integration, intelligibility, etc. - of the built environment and explore their impact on user behavior, visual field/isovist characteristics - compactness, occlusivity, clustering coefficient, etc. - of the built environment and explore their impact on user behavior, analyse architectural and urban layouts using space syntax methods - convex analysis, justified graph, axial analysis and visibility graph analysis. Use of excel software for analyzing data; applications of features of excel- basic and selected advanced features. Data analysis: Advanced Excel, SPSS. Impact of ‘Big Data’ or statistics on interpretation of urban phenomena

Report Writing & Case Studies: Research writing in general and its components. Developing the outline, referencing, writing the bibliography, presentation, etc,. Case studies of competent research, from project inception to completion with a focus on research in the domain of built environment. Review of research publications.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.

One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Groat, L., & Wang, D. (2013). *Architectural research methods* (2nd ed.). John Wiley & Sons.
2. Booth, W. C., Colomb, G. G., & Williams, J. M. (2008). *The craft of research* (3rd ed.). University of Chicago Press.
3. Borden, I., & Ruedi, K. (2005). *The dissertation: An architecture student's handbook* (2nd ed.). Architectural Press.
4. Kumar, R. (2014). *Research methodology: A step-by-step guide for beginners* (4th ed.). SAGE Publications.
5. Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
6. Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method and research* (1st ed.). SAGE Publications.
7. Ward, K. (2013). *Researching the city*. SAGE Publications.
8. Gaur, A. S. (2011). *Statistical methods for practice and research: A guide to data analysis using SPSS* (2nd ed.). Response Books.

E-resources:

1. Bell, J., & Waters, S. (2018). Doing your research project: A guide for first-time researchers (7th ed.). McGraw-Hill Education. ISBN 9780335243396
2. Sheppard, V. (2020). Research methods for the social sciences: An introduction. BCcampus & Open Textbook Library. https://open.umn.edu/opentextbooks/textbooks/1589
3. Schulman, J. S. (2024, March 28). An exploration of research methods (ResearchMethod.net). Manteio Company.https://researchmethod.net.
4. Phelps, J. (2021). Engaging Research Communities in Writing Studies: Ethics, Public Policy, and Research Design (1st ed.). Routledge. https://doi.org/10.4324/9781003082002
5. Joore, P., Stompff, G., & van den Eijnde, J. (Eds.). (2022). Applied Design Research: A Mosaic of 22 Examples, Experiences and Interpretations Focussing on Bridging the Gap between Practice and Academics (1st ed.). CRC Press. https://doi.org/10.1201/9781003265924

	Description of CO	**PO Mapping**
CO1	Identify, decipher and interpret issues relating to architecture based on research enquiry methods.	PO1(3) PO2(2)
CO2	Exemplify different methods of conducting research and research writing	PO1(3) PO2(2)
CO3	Interpret specific research related to built environment.	PO1(3) PO2(2)

EA25101	Energy, Environment and Sustainable Development	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To enable sensitivity with respect to the linkages/ relationship between energy, lifestyle, food chain and sustainability.
- To facilitate understanding of appropriate technologies aiding sustainability.
- To enhance the knowledge ecological principles and system in sustainable development

Energy Sources: Introduction to nexus between Energy, Environment and Sustainable Development; Energy transformation from source to services; Energy sources, sun as the source of energy; biological processes; photosynthesis; food chains, classification of energy sources, quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory of renewability, renewable resources; overview of global/ India's energy scenario.

Ecological Principles: Ecological principles, concept of ecosystems, ecosystem theories, energy resources and their inter-linkages, energy flow, the impacts of human activities on energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems.

Energy Systems and Environment: Environmental effects of energy extraction, conversion and use; sources of pollution from energy technologies (both renewable and non-renewable); primary and secondary pollutants; consequence of pollution and population growth; air, water, soil, thermal, noise pollution -cause and effect; pollution control methods, sources and impacts; environmental laws on pollution control. Kyoto Protocol; Conference of Parties (COP); Clean Development Mechanism, Reducing Emissions from Deforestation and Degradation.

Green Innovation & Sustainability: Criteria for choosing appropriate green energy technologies, emerging trends process/product innovation-, technological / environmental leap-frogging; Eco/green technologies for addressing the problems of Water, Energy, Health, Agriculture and Biodiversity, eco-restoration/ phyto- remediation, ecological sanitation, renewable energy technologies, industrial ecology, agro ecology and other appropriate green technologies.

Green Energy and Sustainable Development: The inseparable linkages of life supporting systems, biodiversity and ecosystem services and their implications for sustainable development; global warming; greenhouse gas emissions, impacts, mitigation and adaptation; future energy Systems- clean/green energy technologies; International agreements/conventions on energy and sustainability - United Nations Framework Convention on Climate Change (UNFCC).

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Thorndike, E. H. (n.d.). Energy & environment: A primer for scientists and engineers. Addison-Wesley Publishing Company.
2. Loulou, R., Waaub, J.-P., & Zaccour, G. (Eds.). (2005). Energy and environment set: Mathematics of decision making (Vol. XVIII, p. 282). Springer. https://doi.org/10.1007/978-0-387-25351-0 (if DOI unavailable, omit)
3. United Nations Development Programme. (2000). Energy and the challenge of sustainability: World energy assessment. United Nations.
4. Ristinen, R. A., & Kraushaar, J. J. (2006). Energy and the environment (2nd ed.). Wiley.
5. Wilson, R., & Jones, W. J. (n.d.). Energy, ecology and the environment. Academic Press Inc.

E-resources: https://www.unep.org/geo/

	Description of CO	**PO Mapping**
CO1	Identify the linkages between the ecosystem, food web and sustainability.	PO1(3) PO3(3) PO6(2)
CO2	Describe renewable and non-renewable sources of energies and their effects on the environment	PO3(3) PO4(2)
CO3	Explain how human activity affects the way energy flows through the largest man-made ecosystems	PO2(2) PO3(2) PO5(3)
CO4	Illustrate new developments in green energy technologies and innovation ideas.	PO1(3) PO4(2) PO6(2)

EA25102	Thermal Comfort and Passive Design	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To enable exploration of the relationship between architectural form, materials and environmental performance.
- To give knowledge about how this relation should evolve in response to climate and emerging technical capabilities.

Human Behaviour: Atmospheric and thermal comfort, building performance, and occupant health, safety, and productivity. Factors responsible, energy systems for human comfort, PPD & PMV analysis

Natural Influences: Micro and Macro thermal comfort scales, Interpreting Material data through Bio climatic charts Sun path, Passive strategies, Solar heat gain, Solar radiation, Stack effect, etc.

Design Elements: Modifications of Architectural & Landscape Elements – Fenestration, roof, walls, flooring, trees and landscape. Climatic zones and architectural features -Courtyard, Cross ventilation, Daylight factor, Walls, Trombe wall, Buried pipe system, Wind, Velocity, Wind tower etc.

Building Materials: Properties of building materials related to Climatic zones -Properties of Heat transfer and energy flow, U-value, Appropriate materials. Mass materials/components selection strategy - Photovoltaic-Recycled Materials-Utilization of building water conserving installation- Evaporative coolers.

Human Comfort Standards: Designing for optimum Day Lighting-Ventilation and Thermal Comfort Standards. Acoustics – Manmade influences –Sick Building Syndrome – Indoor Environment and design of Healthy buildings. Adaptive model of thermal comfort and its application to sustainable design of buildings.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Krishan, A., Yanas, S., Baker, N., & Szokolay, S. V. (2001). Climate responsive architecture. Tata McGraw Hill Publishing Company.
2. Chiras, D. D. (2002). The solar house: Passive heating and cooling. Chelsea Green Publishing.
3. Lloyd Jones, D. (1998). Architecture and the environment: Contemporary green buildings. Overlook Hardcover.
4. Givoni, B. (1998). Climate considerations in building and urban design (1st ed.). Wiley.
5. Hawkes, D., & Foster, W. (2002). Energy efficient buildings: Architecture, engineering, and environment (1st American ed.). W. W. Norton & Company.
6. Koenisberger, O. H. (2012). Manual of tropical housing and climate. Longman Group United Kingdom.

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	Description of CO	**PO Mapping**
CO1	Describe human thermal response to natural elements and the influence of architectural design elements.	PO2(3) PO4(2)
CO2	Explain passive design techniques of architectural elements to achieve thermal comfort in built environment	PO1(3) PO5 (2) PO6(3)
CO3	Interpret the characteristics of building materials for different climatic zones	PO3(2) PO4(2)
CO4	Correlate human thermal comfort criteria and sustainable building design.	PO1(2) PO3(3)

EA25103	Environmental Impact Assessment	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To give exposure to the need, methodology, documentation and usefulness of environmental impact assessment.
- To enable skill development to prepare environmental management plan.

Introduction: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA.EIA process-screening – scoping - setting– analysis – mitigation.

Components and Methods: Matrices – Networks – Checklists – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

Impact On Socio-Economic Systems: Definition of social impact assessment. Social impact assessment model and the planning process. Rationale and measurement for SIA variables. Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition - neighborhood and community impacts. Selecting, testing and understanding significant social impacts. Mitigation and enhancement in social assessment. Environmental costing of projects.

Environmental Management Plan: Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

Sectoral EIA: EIA related to the following sectors - Infrastructure – construction and housing Mining – Industrial -Thermal Power - River valley and Hydroelectric – coastal projects-Nuclear Power, Hill area Development and CRZ. EIA for coastal projects.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology:
Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Canter, L. W. (1996). Environmental impact assessment. McGraw Hill.
2. Lawrence, D. P. (2003). Environmental impact assessment: Practical solutions to recurrent problems. Wiley-Interscience.
3. Harvey, N., & Clarke, B. (2012). Environmental impact assessment: Procedures and practices. Oxford University Press.

4. Petts, J. (Ed.). (1999). Handbook of environmental impact assessment. Blackwell Science.
5. World Bank. Sourcebook on environmental impact assessment.

E-resources: https://www.iisd.org/learning/eia

	Description of CO	**PO Mapping**
CO1	Describe the significance of environmental impact assessment	PO2(3) PO4(2)
CO2	Explain the preparation of reports and organize information	PO1(3)
CO3	Recognize the link between social effects and community change	PO3(3) PO4(2)
CO4	Devise the skills to prepare environmental management plan.	PO6(3)

EA25104	Urban Ecology and Environmental Planning	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To enable understanding of the basic concepts of ecology, Urban Ecology, natural systems and environment.
- To bring out awareness of the importance of Environmental planning for sustainability, resource planning and allocation and protection of natural resources and their use for sustainability.
- To enable preparation of plans considering preservation, rehabilitation and environmental policies.

Introduction: Introduction to Urban Eco-systems. Basis of environmental science. Ecology, Ecosystems, Habitat, structure of the ecosystem, major ecosystems, productivity of ecosystems adaptation. Flow of energy, food chain, ecological pyramids, predation, regulatory forces. Components of natural and built environment

Concepts and Approaches to Ecological Planning: Different types of life supporting services provided by the nature. General concept of urban ecological planning. Impact of urbanization and industrialization on nature. Resiliency and Biodiversity, resources planning and climate resilient urban development.

Human Influence on Eco- System: Examination of critical issues underlying the current and future environmental problems. Human impact on environment. Modification of natural environment – Current conditions of natural resources like land, water, air. Over exploitation of natural resources, agriculture, fishing, mineral resources, energy resource, forest wealth etc.

Effects of Growing Population on Eco-Systems: Population and pollution, Overcrowding, congestions, hygiene and health problems. Sanitation, water supply, solid and fluid waste generation and disposal problem, changing climate of the cities-urban heat island, urban flood, etc. energy and human settlement. Ecological Land Planning: Preservation and protection of ecologically sensitive areas, Rehabilitation of degraded sites, Development of sites/ land in accordance to their environmental properties.

Global Issues on Modern Cities: Global environmental problems: Global Warming, Ozone Layer Depletion, oceans, fresh water, trans boundary air pollution, biological diversity, Carbon Rating. International treatises, Land pollution, Overview of Government of India's policies, United Nations contribution to address these issues.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Khanna, D. D. (1997). Sustainable development: Environmental security, disarmament, and development interface in South Asia. Macmillan India.

2. Comín, F. A. (2010). Ecological restoration: A global challenge. Cambridge University Press.
3. Marzluff, J. M. (2008). Urban ecology: An international perspective on the interaction between humans and nature. Springer.
4. Alberti, M. (2007). Advances in urban ecology: Integrating humans and ecological processes in urban ecosystems. Springer.
5. Sharma, P. D. (2009). Ecology and environment. Rastogi Publications.
6. Bhatt, S. (2004). Environment protection and sustainable development. APH Publishing.
7. Fry, T. (2009). Design futuring: Sustainability, ethics and new practice. Berg.

E-resources: https://www.unep.org/geo/

	Description of CO	**PO Mapping**
CO1	Describe the importance of sustainable lifestyles and natural resource management.	PO1(3) PO6(2)
CO2	Relate the interaction between the effects of population growth and the environment	PO3(3) PO5(2)
CO3	Infer the need to conserve ecosystem and effective ways to do so.	PO2(3) PO3(3) PO4(2)
CO4	Summarize the government initiatives to address global environmental challenges	PO1(2) PO6(3)

EA25105	Environmental Design Studio - I	L	T	P/S	C
		0	0	10	10

Course Objectives:

- To enable design of small built-up spaces by taking into consideration of various climatic conditions and strategies of environmental design principles.

Content :

The building shall be designed to minimize energy use and operating costs without affecting the functionality, accommodation standards, occupant health, safety or comfort. Quantification of the results should be based on theoretical and mathematical principles. Manual quantification is essential for the following aspects.

- Microclimatic analysis - Bio climatic and psychometric analysis of comfort zone (based on eco charts, and graphs)
- Whole building Analysis for Energy performance, (based on heat gain and heat loss calculations etc.,)
- Indoor thermal comfort, (Solar Analysis for optimizing Orientation, Shading and shading analysis, TSI, Thermal neutrality, time lag, Decrement factor etc.,)
- Passive energy conservation measures (performance evaluation of passive strategies like, stack effect, thrombe wall, radiant cooling system etc.,) .
- Indoor lighting levels (based on Day light factor method, lumen method etc.,)
- Air quality analysis (IAQ)
- Analysis on Life cycle assessment/ Embodied energy and carbon foot print
- Site contour analysis, Net perforated area, annual run off calculations.

The project submission should be in the form of Drawings, calculations, models and reports.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%

Assessment Methodology: Three Assessments with equal weightage (approx.33.33% each).
Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period.

References:

1. Bureau of Indian Standards. (1977). IS:3362-1977, code of practice for ventilation of residential buildings. BIS.
2. Rea, M. (2000). The lighting handbook (9th ed.). Illuminating Engineering Society of North America.
3. Illuminating Engineering Society of North America. (1987). Handbook on functional requirements of non-industrial buildings (lighting and ventilation). BIS.
4. Szokolay, S. V. (2008). Introduction to architectural science. Taylor & Francis Group.
5. Givoni, B. (1994). Passive and low energy cooling of buildings. Van Nostrand Reinhold.

	Description of CO	PO Mapping
CO1	Complete the creation of compact built-up spaces while taking into account a variety of climatic variables and environmental design principles.	PO1(3) PO5(3) PO6(2)
CO2	Investigate the link between architectural form, material properties, and environmental performance.	PO2(3) PO4(2) PO5(3)
CO3	Describe the modelling tools and passive tactics for measuring the energy performance, environmental responsiveness	PO1(2) PO4(2)
CO4	Correlate the response to climate change and new technological capabilities.	PO4(3) PO6(2)

Semester II

EA25201	Environmental Disturbances, Pollution and Remedies	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To provide knowledge related to the broad field of environmental disturbances, and tools that can be used in various remedies.
- Introducing the options of renewable resources and appropriate technologies for harnessing them for our benefit.
- To improve environment protection, these technologies are gaining importance in our day-to-day applicative lifestyle..

Introduction

Definition and classification of environmental disturbances – physical, chemical, biological, aesthetic, socio economic factors, natural and man-made, Environmental disturbances at local and global level.

Measurements and Standards

Air, Water, Solid waste, and Noise pollution – Basic parameters, units, sampling, legal standards, measurements and limits. Environmental planning standards.

Remedial Techniques and Disturbance- Built Environment

Reducing the impact of pollution through chemical, biological & physical remediation techniques. Energy & emission generation from building materials throughout its life cycle analysis.

Energy balance of human and built environment -Thermal Environment, Aqueous environment. Environmental impact of building materials, Eco friendly materials, their composition, production and recycling, physical properties etc. Embodied energy /Operational energy of materials like steel, fly ash bricks, gypsum, eco-boards etc. Lifecycle assessment of materials.

Pollution and Remedies

Structure and composition of Atmosphere –Definition, Scope and Scales of Air, Water and Land Pollution –Sources and classification of air pollutants and their effect on human health. Control and preventive measures –Contaminated soil characterization and containment – Sources of water pollution and treatment methods. ICZM and sustainable Development.

Ecologically Disturbed Sites and Restoration

Ecologically sensitive areas -Restoration ecology -Disturbances caused by built structures – from ‘cradle to grave’ –Remedial measures applicable-Fragmentation-Landscape Ecology.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.

One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. David Lee Smith, Environmental Issues for Architecture, Wiley; 1 edition, 2011.
2. Larry W Canter, Environmental Impact Assessment (Hard cover), McGraw-Hill Education, 1996
3. Mritunjoy Sengupta, Environmental Impacts of Mining Monitoring, Restoration, and Control, CRC Press; 1 edition, 1993
4. P.K. Gupta , Methods in Environmental Analysis, Agro bios, 2011
5. Scott Drake, The Elements of Architecture - Principles of Environmental Performance in Buildings, 2009, Routledge, 2009.

E-resources: https://www.unep.org/geo/

Course Outcome

- Understanding the factors leading to environmental disturbance and the correctives and preventives to avoid the same.
- knowledge about legal standards of environmental planning
- Understanding the need for a balanced energy use between people and the built environment
- Understanding of ecological restoration and corrective actions

EA25202	Sustainable, Energy Efficient Building Materials and Technologies	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To Understand the concept of Energy efficiency
- An insight into various Energy Efficient Materials and Sustainable Construction Technology

Introduction on Energy Efficiency

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

Recyclable and Renewable Materials

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

Passive Design in Materials

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

Sustainable Construction

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

Energy Efficient Technologies

Energy Efficient Construction Technology – Filler Slab – Rat trap Bond – Technologies developedby CBRI – Traditional Building Construction Technologies – Introduction to other Technological interventions to save Energy – Intelligent Buildings – Energy Conservation through Technological intervention – Saving Energy used f or lighting by design innovation – Case studies

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.

One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Bansal Naveendra K., Hauser Gerd and Minke Gernot, “Passive Buildings Designs : Handbook of Natural Climatic Control”, Elsevier Science, Amsterdam 1997.

2. Givonji B., “Man, Climate and Architecture”, Elsevier, Amsterdam, 1986
3. Koenigsberger O.H, T.G. Inger Soll, “Manual of tropical Housing and Building”longman Group United Kingdom, 2012.
4. Watson Donald, ‘Climatic Design: Energy Efficient Building Principles & Practices”, Mc Graw Hill Book company, New York, 1993.

E-resources: https://www.unep.org/geo/

Course Outcome

- An understanding on sustainability as applicable to architecture.
- Knowledge about traditional energy-saving construction methods.
- To understand the properties of materials and applications in appropriate usage.
- Ability to critically analyses buildings with respect to sustainability.

MH25C03	Geographical Information Systems For Built Environment	L	T	P	C
		1	0	3	4

Course Objectives:

- To introduce role of GIS in
- To give basic familiarity with the concepts, tools and techniques of GIS
- To give training in the application of GIS for built environment.

Introduction to G.I.S: Introduction to Geographical Information System (GIS). Defining the objectives of GIS in problems related to the macro environment. Outline of commercial and open source GIS software and introduction to basic components of GIS software. Outline of Spatial and non spatial data. Understanding of Projection and Coordinate systems. Preparation of map with appropriate format for specific purposes.

Spatial and Attribute Data Input: Passive and Active Remote Sensing, Image Processing – Spectral Signature Curve, GPS, Aerial Photograph, Satellite Imagery, LIDAR and Drones. Identification of required spatial data layers. Coding schemes. National Urban Information System. Digitisation of spatial data. Editing. Geo-referencing of Satellite Imagery, Cadastral Map, Role of attribute data in defining geographic features. Adding attribute

Spatial Analysis Using GIS: Generation of 3-D Model in GIS. Performing overlay functions. Manipulating attribute data. Preparation of Existing Land use. Map and report generation. Network Analysis.

Modelling the Macro Environment: Need for modelling the macro environment for different scales and purposes. Modelling for suitability/ projects/ situations/ problems in the realm of landscape design, urban design, urban and environmental planning.

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with equal weightage.
One Assessment as Internal written Test /Examination (33.33%), other two assessment (each assessment weightage - 33.33%) as continuous marking of the work and performance during the particular assessment period such as drawings, models, study, seminar, etc.,

References:

1. Arthur. H. Robinson et al., ‘Elements of Cartography’, John Wiley & Sons, New York, 1995.
2. Judith. A. Tyner, ‘ Principles of Map Design’, The Guilford Press, New York, 2010.
3. Ramesh Elmasri and Shamkant.B.Navate, ‘Fundamentals of Database Systems’, Pearson
   Education Limited, USA, 2010.
4. Anji Reddy.M., ‘Text book of Remote Sensing and Geographical Information Systems’, B.S.
5. Publications, Hyderabad, 2008.
6. Michael Law and Amy Collins, ‘Getting to know ArcGIS Pro’, ESRI Press, USA, 2016.
7. Paul. D. Zwick and Margaret.H. Carr, ‘Smart Land-use Analysis: The LUCIS Model’, ESRI Press, USA, 2007.
8. David Maquire, Michael Batty and Michael F.Goodchild, ‘GIS,Spatial Analysis and Modeling’, ESRI Press, 2005.
9. Cynthia A. Brewer, ‘Designing Better Maps: A Guide for GIS Users’ – 2nd Edition, ESRI Press, 2015.

E-resources:

1. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2005). *Geographic Information Systems and Science* (2nd ed.). Wiley. https://archive.org/details/geographicinforma0000long
2. de By, R. A., et al. (2009). Principles of Geographic Information Systems. ITC, University of Twente.https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf (A free textbook developed for university-level GIS courses)
3. Nushi, B., & Bejleri, I. (2017). *The use of GIS for analysis and visualization of building energy consumption*. *IFAC-PapersOnLine*, 50(1), 11736–11741. https://doi.org/10.1016/j.ifacol.2017.08.2189
4. UN-Habitat. (2015). *Using ICTs and GIS for Urban Planning and Service Delivery in the Developing World*. https://unhabitat.org/books/using-icts-and-gis-for-urban-planning-and-service-delivery-in-the-developing-world/
5. Pérez, D., & Ranasinghe, D. (2020). *Smart cities and the role of GIS in urban resilience and planning*. *World Bank Group Technical Report*. https://openknowledge.worldbank.org/handle/10986/34744

Course Outcomes

- Awareness of GIS and the context of its use for different purposes
- Knowledge of concepts, techniques, methods of GIS
- Ability to apply GIS for specific situations/ realms involving the built environment

EA25203	Assessment Tools for Environmental Architecture	L	T	P/S	C
		1	0	3	4

Course Objectives:

- To introduce key software tools used in environmental design and analysis.
- To develop proficiency in digital modeling, simulation, and visualization for sustainable architecture.
- To understand the role of simulation tools in optimizing building energy and environmental performance.
- To train students in parametric design for responsive architecture using environmental datasets.
- To enable students to integrate digital tools in holistic environmental design workflows.

Introduction to Environmental Design Tools

Overview of environmental architecture and digital workflows, Introduction to BIM and CAD tools for sustainable design. Understanding climate and site analysis using software (e.g., Climate Consultant), Environmental data sources and interpretation Integration of environmental analysis in design process- Data visualization, reporting, and dashboards, Software interoperability and scripting basics,Studio-based application of software tools in design project

Daylighting and Visual Comfort Simulation

Principles of daylighting and visual comfort, Radiance-based simulation tools (e.g., DIVA, Honeybee),Daylight autonomy, glare analysis, and lux level predictions
Designing for daylight optimization using simulation feedback,Case studies using daylighting simulation tools

Thermal and Energy Performance Analysis

Building energy simulation fundamentals by open source Software: DesignBuilder, EnergyPlus, OpenStudio,Thermal zoning, internal loads, HVAC modeling,Interpreting energy simulation outputs,Strategies for improving building energy performance

Parametric and Responsive Design Tools

Introduction opens source software for environmental design(eg: Grasshopper Rhino),Using plugins for parametric analysis ,Responsive architecture using environmental inputs, Optimization techniques using Galapagos and Octopus, Project-based learning with environmental parametric models- Combining tools for integrated performance evaluation, Workflow from concept to simulation

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with equal weightage.
One Assessment as Internal written Test /Examination (33.33%), other two assessment (each assessment weightage - 33.33%) as continuous marking of the work and performance during the particular assessment period such as drawings, models, study, seminar, etc.,

References:

1. “Sun, Wind & Light: Architectural Design Strategies” – Mark DeKay and G. Z. Brown
2. “Environmental Design: An Introduction for Architects and Engineers” – Randall Thomas
3. “Daylighting Handbook” – Christoph Reinhart
4. “Building Performance Simulation for Design and Operation” – Jan Hensen and Roberto Lamberts
5. “Architectural Design with SketchUp: Component-Based Modeling, Plugins, Rendering, and Scripting” – Alexander Schreyer Official Documentation and Tutorials of: EnergyPlus, DesignBuilder, Rhino, Grasshopper, Ladybug Tools, and DIVA for Rhi

E-resources: https://www.unep.org/geo/
Course Outcomes: • Apply appropriate software tools for climate and site analysis. • Simulate daylight, energy, and ventilation performance of buildings. • Use parametric tools for environmentally responsive design iterations. • Visualize and communicate environmental data through digital workflows. • Critically evaluate and improve building performance using simulation outputs.

EA25204	Environmental Design Studio – II	L	T	P	C
		0	0	10	10

Course Objectives:

- Detailed theoretical study of Global, Macro and Micro level Climate – Elements of climate and its qualification – Earth energy balance – Climatic data and its interpretation – Energy balance of human and built Environment – Thermal Environment – Adaptive model of thermal comfort and its application to sustainable design of building – Design of any type of building – hotel / commercial buildings, etc. – with the above principles.

<u>The detailed scope of the design project is not limited to the following</u>

Whole building Analysis for Energy performance, Climatic Comfort & ECBC Compliance

1. Solar Analysis for optimizing Orientation, Shading and glazing areas
2. Detailed whole building thermal / Energy Simulation to achieve thermal comfort indoors through detailed analysis.
3. GRIHA/LEED related analysis and further bio climatic considerations:

Building Analysis for Day lighting and artificial Lighting

1. Day lighting simulation for optimizing natural lighting
2. Luminance Analysis

Natural ventilation and Indoor air quality

1. CFD analysis for exterior and interior wind movements (Comparison with bio-climatic chart)
2. Indoor air quality and air change analysis

Site Planning & Water Management

1. Design and recommendation for erosion control & sedimentation control on site.
2. Assist on Low water Usage, Rainwater Harvesting, wastewater recycling and construction waste usage and other waste management strategies
3. Transportation Management Strategies
4. Embodied energy calculations using online simulation tools
5. Carbon foot print analysis using online simulation tools

The project submission should be in the form of drawings, models and reports.

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with equal weightage.
Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. Each assessment weightage - 33.33%.

References:

1. Givoni Baruch, “Passive and Low Energy Cooling of Buildings”, Van Nostrand Reinhold, New Yord, 1994
2. Steven V szokolay,2008, Introduction to architectural science. Taylor & Francis group,UK
3. https://www.designbuilder.co.uk
4. https://www.iesve.com/

E-resources: https://www.unep.org/geo/

Course Outcomes

- An ability to design a building or a group of buildings with all the due considerations of sustainable planning and design principles.
- Ability to use energy simulation tools and its result analysis
- To balance human needs with environmental concerns in architectural design.
- Ability to critically analyses buildings with respect to Bio-climatic and GRIHA/LEED related.

Semester III

EA25301	Life Cycle Assessment of Buildings	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To enable an understanding of life-cycle analysis as a means to achieving sustainable buildings and the various tools to assess the same

Introduction and Terminology

History of LCA, Aspects of LCA, variants of LCA, Life cycle stages, end of life, Functional unit, System boundary, Life Cycle Inventory (LCI) data base, Life Cycle Management (LCM), Life Cycle Energy Analysis (LCEA), Carbon Accounting.

Life Cycle Assessment in Building Industry

Material level, Product Level, building level, Industry level, LCA and Design process, Pre-design, Schematic Design and Design Development Stage.LCA process and impact categories: Inventory Analysis, Impact assessment, interpretation, Different impact categories like Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Smog Formation Potential, Fossil fuel and Ozone Depletion Potential.

Different Tools for LCA

Configuration of a tool, Classification of tools, Impact estimator and eco-calculator, Building for Economic and Environmental Sustainability (BEES), International LCA Tools, Related tools, Green footsteps & eco-friendly applications. Guidelines to integrate: LCA with design and evaluation, Different Scenarios of use of LCA, Sustainability targets, Selection of a LCA tools, LCIA

Green Building Materials Selection

Figure of Merit (FOM), Parameter selection for FOM, Selection based on FOM, Building into components-three phase building breaking down a materials, Criteria for material selection

Life Cycle Costing (LCC) Tool

Component characteristics of an element group, Input for energy Calculation, LCC calculations conduct of LCI and LCC calculations, Slective Assessment, Normalization and Weighing Factors LCA and LCC for different materials. Case studies- Two and Three variants of a house, office building, retrofitting buildings

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. A. Kapur and T.E. Graedel: Industrial Ecology. Encyclopedia of Energy, Volume 3, 2004.
2. Environmental life cycle analysis by David Ciambrone, CRC-Press 1997.
3. Life-cycle analysis of energy systems from methodology to applications, by Bent Sorensen, Published by Royal Society of Chemistry, June 2011.
4. Lifecycle Assessment: Principles and Practice Chapter 1.
5. R. A. Frosch and N. E. Gallopoulos: Strategies for Manufacturing, Scientific American 261 (3), 144-152 1989

E-resources: https://iere.org/life-cycle-programs/
Course Outcomes • Understand all aspects of Life Cycle analysis of a building. • To be able to analyze building Life Cycle with respect to sustainability. • Understanding the criteria for selecting building materials • Ability to critically analyses buildings with respect to Bio-climatic and GRIHA/LEED related.

EA25302	Environmental Laws and Management	L	T	P/S	C
		3	0	0	3

Course Objectives:

- An Understanding of various Environmental Laws and Protection
- To expose the students to the concepts of Environmental Ecology, Accounting and Management

Environmental Law and Policy

Constitutional Provisions for Environmental Protection: Specific Provisions for Environmental Protection in the Constitution of India, Provisions in the Directive Principles of State Policy - Environmental Acts, Rules and Notifications - Water (Prevention & Control of Pollution) Act - Water (Prevention & Control of Pollution) Cess Act - Air (Prevention & Control of Pollution) Act and the corresponding Rules- Environment (Protection) Act and Rule - Hazardous Waste (Management & Handling) Rules - Manufacture, Storage and Import of Hazardous Chemicals Rules - Public Liability Insurance Act and Rule. International Law on Environmental Protection

Industrial Ecology

Definitions- Fundamentals of Ecology- Metaphor - Food Webs and Industrial Eco Parks- Generation and Evaluation of Alternatives-Decision Methods-Life Cycle Assessment (LCA); Components - Goals - Definition and Scope - Industrial Metabolism - Anthropogenic Vs Natural Fluxes of Toxic Heavy Metals-Industrial Law in Environmental Protection- Mitigation and Environmental Management Plan

Environmental Planning and Decision Making

Environmental Concepts – Sustainability and Environmental Carrying Capacity - Strategies in Land use, Transportation, Infrastructure Planning and Management - Generation and Evaluation of Alternatives -Decision Methods-Mitigation and Environmental Management Plan - Public Participation in the Process of Environmental Decision-Making Process

Introduction to Environmental Accounting

Defining Environmental Costs - Managing Environmental Costs - Identifying Environmental Costs - Controlling Environmental Costs (Waste and Effluent Disposal- Water Consumption - Energy - Transport and Travel Consumables and Raw Materials) - Accounting for Environmental Costs – Environmental Audit- Input/Outflow Analysis.

Environmental Management

Environmental Protection Act 1986-Coastal Zone Regulations, Hill Area Conservation, Forest Conservation Act- Components of Environment – Classification of Environmental Resources - Purpose and Objectives in Environmental Protection, and Management – Institutional and Legal Support in management of the Environment-Environmental Policies, and Protocols-Global Environmental Initiatives- Environmental Indicators - Concepts and Measures in Environmental Standards - Environmental Management Options

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Christian Ndubisi Madu, 'Environmental Planning And Management', Imperial College Press Business & Economics, 2007.
2. John Randolph, 'Environmental Land Use Planning and Management', Island Press, Architecture, 2004.
3. Narasimha Murthy D.B., 'Environmental Planning and Management' Deep and Deep Publications, Environmental policy, 2005.
4. P. Leelakrishnan , Environmental Law in India, Butterworths Wadhwa; 3rd edition, 2008
5. Trivedy R. K- Handbook of Environmental Laws, Guidelines, Compliance & Standards, Vol. 1 & 2 Environ – Media karad, India, 2010

E-resources: https://www.unep.org/geo/

Course Outcomes

- Understand Environmental laws in the Indian Context.
- Identifying the role that industrial law plays in environmental protection
- Understand specific Environmental laws in special areas such a hilly area, coastal areas etc
- Ability to analyze the Global Environmental Initiative for environmental resource protection

EA25303	Dissertation	L	T	P	C
		0	0	4	4

Course Objectives:

- To expose the students to the various thrust areas in environmental architecture.
- To inculcate the spirit of research in environmental architecture by providing opportunities to read on various issues.
- To expose the students to the finer details of technical writing.
- To provide a platform for a prelude to the 'Design Thesis'

Dissertation is best expressed as 'Design in text'. It offers an opportunity to look at the research component in architecture in various thrust areas such as history, theory, design and other value-based aspects through texts.

Students are encouraged to choose any topic of their interest. This may range from analyzing and a critique of the works of an architect, ideologies and philosophies of architects that get transformed spatially, history, typological architecture, sustainability issues and so on the Dissertation must comprise of an aim, the objectives, the scope and limitations of their dissertation, hypothesis (if any), methodology followed by extensive review of literature through references and documentation.

The analysis of the work must be substantiated either empirically or through extensive arguments.

A dissertation could also be a thesis preparation course and gives the student scope for independent study and opportunity to explore specific area of interest which will form the basis of his/ her design thesis project in the next semester.

The topic will have to be approved at the start of the semester and reviewed periodically to a jury at the end of the semester.

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology:

Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively.

Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

References:

1. Iain Borden and Kaaterina Ruedi; The Dissertation: An Architecture Student's Handbook; Architectural Press; 2000.
2. John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2002.
3. Linda Grant and David Wang, Architectural Research Methods, John Wiley Sons
4. Ranjith Kumar; Research Methodology- A step by step guide for beginners; Sage Publications; 2005
5. Wayne C Booth; Joseph M Williams; Gregory G. Colomb; The Craft of Research, 2nd Edition; Chicago guides to writing, editing and publishing, University of Chicago Press, 2003.

E-resources: https://www.unep.org/geo/

Course Outcomes

- An understanding leading to formation of thesis ideas.

- To allow students to do the more intricate elements of technical writing.
- Ability to explain research procedures and approaches and how they relate to environmental architecture.
- To provide insight on how linkages between climate change and emerging trends

EA25304	Environmental Design Studio- III	L	T	P/S	C
		0	0	10	10

Course Objectives:

- To develop creative skills, abilities, judgment and control in the design of built environment.
- The student should be able to have a whole building design approach for energy efficiency.

The detailed scope of the design project is not limited to the following

- Designing eco house, green roofs and walls, building with environmentally friendly technologies, sustainable landscape design, green cities. Conserving traditional buildings for sustainability.
- Designing to mitigate climate change. Building design through simulation.
- Design through biological and ecological principles.
- Design/Retrofitting of buildings/campuses for energy efficiency.
- Focus should be on buildings/campuses which are conventionally energy guzzlers.
- The project submission should be in the form of drawings, models and reports

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with equal weightage (approx.33.33% each).
Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period.

References:

1. Steven V Szokolay. Introduction to Architectural Science: The Basics of Sustainable Design. Architectural Press, Second Edition. 2010.
2. Vishal Garg, Jyothirmay Mathur, SurekhaTetali, Aviruch Bhatia. Building Energy Simulation: A workbook using Design Builder. CRC Press. 2017
3. Reddy T.A., et al. Heating and Cooling of Buildings: Principles and Practice of Energy Efficient Design, Third Edition, CRC Press
4. ISHRAE IEQ Standard. 2017
5. Jens Lausts. Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings. International Energy Agency (IEA) Information paper. March 2008
6. Reddy T.A., et al. Heating and Cooling of Buildings: Principles and Practice of Energy Efficient Design, Third Edition, CRC Press

E-resources: https://www.unep.org/geo/

Course Outcomes

- Design buildings which are ecologically sensitive considering all traditional and contemporary principles and practices of sustainability.
- To balance human needs with environmental concerns in architectural design.
- Ability to use energy simulation tools and its result analysis
- Ability to Understand the process of building retrofitting for energy efficiency

EA25305	Internship Training	L	T	P/S	C
		0	0	0	2

Course Objectives:

- To help in developing depth of knowledge and inquiry in any one of a chosen area of specialty in Environmental architecture.
- To enable interacting with practicing architects, allied professionals, researchers and organizations working in the field of specialty in Environmental architecture.

Content

- The students will undertake the Internship Training in any organization engaged in activities relating to a specialized area of architecture for a period of 4 weeks.
- The Internship Training is expected to make aware how specific areas in architecture can be pursued to depth in the realm of practice and research.
- The Internship Training can thus be in any architectural practice/ research organization/ university, etc., where there are such pursuits.
- Through the Internship Training, the students could obtain mastery in a specific area of practice or research. The students may also utilize the Internship Training to strengthen their ability to do Thesis in the subsequent semester.
- The students are expected to complete the Internship Training in the Summer Vacation between second and third semesters, before the commencement of the third semester, and enroll for the course in the third semester.
- The students shall submit an Internship Training Report, on or before the last working day of the third semester.

The students shall be evaluated on the basis of the Report submitted, through a Viva-Voce Examination, as part of the End Semester Examinations of the third semester.

Weightage: End Semester Examinations: 100%.

E-resources: https://www.unep.org/geo/

Course Outcomes

- Exposure in and enrichment with respect to specific areas of architecture for pursuing practice or independent research
- Facilitating communication with associated professionals, groups engaged in research
- Ability to deeply comprehend how something works in practice

Semester IV

EA25401	Thesis Project	L	T	P/S	C
		0	0	20	20

Course Objectives:

- To integrate the knowledge gained in the previous semesters with respect to issues/tools of architectural design at a more advanced level.
- To understand and identify issues appropriate to a particular project or area of architecture, through independent thinking as well as to design in a manner appropriate to the project context.

CONTENT

- The students will synthesize the areas of knowledge, skills and techniques acquired in the various courses of the previous semesters through a thesis project of their choice.
- This thesis project would be a design project with a strong research component.
- The project would desirably extend the critical position developed within the theory and studio projects as well as dissertation. The scale of the project could extend from individual site to settlement levels.
- The initial process shall be rigorous, incorporating background research on the topic, case studies, documentation of project issues, context, site and building information, programming.
- The process would culminate in design interventions at scales appropriate to the topic. The project shall desirably have the potential to serve as a starting point for practice and/ or further research.
- Students will submit a detailed proposal on their topic of interest(s). The Proposal shall be approved by the thesis review committee. The thesis project will be reviewed periodically by the review committee. At the end of the semester, the final thesis will be submitted and presented through a viva voce examination before a jury.

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively.
Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

E-resources: https://www.unep.org/geo/

Course Outcomes

- Students would be able to use numerous modern and conventional sustainability strategies into the architectural design process.
- Students would be able to recognise, delve deeply into, and reflect on specific and suitable environmental concerns in the field of design.
- Student would be able to integrate the knowledge learned in the course with more complex architectural design tools and concerns.

Professional Elective Courses

EA25001	Sustainability And Energy Conservation In Landscape Architecture	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To expose the students on the issues of sustainability at the global level.
- To Focus on the energy conservation landscape and sustainability at the micro level.
- Sustainable landscape design for various climates of India

Introduction to Sustainability

Need and concept of sustainability, Brundtland report, World Commission on environment and development, sustainable development, sustainable growth, sustainable economy and sustainable use. Visions of sustainability. Source and ethics of sustainability. Sustainability and Climate Change.

Sustainable Site

Sustainable site – LEEDS, BREAM, rating erosion and sedimentation control, site selection, urban development, landscape and exterior design etc., Green Building in the context of sustainability. Ecology and sustainability. Eco-City.

Introduction to Energy Conservation in Landscape

Energy conservation and sustainability, principles of energy systems, energy and global environment, scope for energy conservation in landscape.

Energy Conservation Methods in Landscape Architecture

Various methods of energy conservation in landscape architecture, energy conservation techniques in various climates- hot and humid, hot dry, etc. Energy efficient site planning and landscape development. Energy efficient planting design.

Sustainable Landscape Practices

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

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

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

Course Outcomes

- Understanding the concept of sustainability from macro to micro level

- A comprehension of energy conservation landscape in relation to site planning and other functional space typologies
- Understanding the impact that landscape design plays in varying outdoor surroundings both on a micro and macro scale, in terms of sustainability and ecological
- Ability to adopt sustainable landscape techniques at the urban level

EA25002	Environmental Infrastructure	L	T	P	C
		3	0	0	3

Course Objectives:

- The main objective of this course is designed to provide a general understanding of various issues and approaches to planning, designing, and maintenance of Infrastructure.
- The major emphasis in this course will be on water supply, sewerage, storm water drainage and solid water management

Introduction

Concepts of basic needs, formation of objectives and standards. Data requirements for programme planning of urban networks and service; feasibility planning studies for structure the infrastructure systems.

Water Supply

Planning water supply; resource analysis quality of water system design; technological choices of alternatives – Issues related to the choice of centralized city water supply versus decentralized systems.

Strom Water Management

Sewerage and Storm Water Drains (Need Assessment in the context of Urbanization, Planning Considerations and Norms, Basic Design Parameters and Appurtenances). Waste generation process in cities.

Waste Water Management

Waste water disposal systems including storm water drainage, system designs, nodal facilities, technological and environmental considerations. Issues related to hydrological and geographical and development parameters – eutrophication. Biological concepts in environmental sanitation.

Solid Waste Management

Sanitation technologies, their relevance to incremental growth of urban areas. Low-cost sanitation technologies and concepts as related to Indian and third world country contexts Sewage Treatment Plant and Water Treatment Plant (Components, Planning Considerations, Basic Design Parameters.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. G.M. Fair, J.C. Geyer and D.Okin, 'Water and Waste water engineering Volume II', John Wiley & Sons, Inc. New York, 1968.
2. 'Manual of Water Supply and Treatment', second edition, CPHEEO, Ministry of works and housing, New Delhi, 1977
3. AFE Wise, JA Swaffied Water, 'Sanitary & Waste Services in buildings', V Edition, Mitchell Publishing, Co. Ltd., 2002.
4. Arceivala S.J., 'Waste Water Treatment for Pollution Control', Tata McGraw Hill, 2008.
5. 'Renewable Energy, Basics and Technology, Supplement Volume on Integrated energy systems', Solar Agni systems, Sri Aurobindo Ashram, Pondicherry 605002.

Course Outcomes

- Knowledge of feasibility assessments for planning the infrastructure systems
- Ability to conceptually plan/ design waste management in simple context

- Understanding the impact biological concepts in environmental sanitation
- Understanding sanitation technologies and how they relate to the gradual expansion in urban areas

EA25003	Building Science and Sustainability	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To expose the students to the applications of smart materials and nanotechnology in the building industry to achieve sustainability.

Introduction

Heat transfer processes in buildings. Thermal conductivity, resistance, transmittance, surface characteristics, surface coefficient, heat capacity, insulation.

Building Systems

Lighting – day lighting; ventilation – natural ventilation; indoor air quality; heating/cooling - geothermal; passive and active systems for energy production and conservation; water conservation – grey water reuse, water saving plumbing fixtures

ECO House

The form of the house: the building as an analogy- design from first principles: conserving energy; working with climate: passive solar design; minimizing new resources; respect for users; respect for site and holism- photovoltaics and solar hot water systems; water usage; Case studies- design of eco houses: context specific.

Building Energy

Calculation of principle building energy gains and losses. Estimation of building energy performance for heating and cooling for different climatic contexts.

Green Construction and Environmental Quality

Sustainable architecture and Green Building: definition- Green building Evaluation Systems; LEED Certification and GRIHA; Green Globe Certification; Case studies which look at the environmental approach- renewable energy- controlling the water cycle- impact of materials on the environment – optimizing construction- site management- environmental management of buildings.

References:

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

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.

One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

Course Outcomes

- Knowledge of heat flow through building envelope
- Ability to understand the passive and active system of built environment
- Ability to calculate energy performance of heating and cooling load of building
- Understanding of the effects of building materials and environmental management

MH25C02 **Environmental Psychology** L T P/S C
3 0 0 3

Course Objectives

- To give introduction to the realm of environmental psychology.
- To introduce interdisciplinary social science approaches and to explore ways that people experience environments and make decisions about them.

Introduction to Architectural Psychology

Introduction to the discipline, its importance in the field of architecture. Understanding the principle of psychology- Form, perception, attention, concepts, types of concepts, physical settings and varied emotions. Creative Thinking: Process of creativity, visual and creative thinking. Types of thinking- directed thinking, convergent, divergent. Articulation of masses and spaces, sense and sensation modalities. Language of architecture and its role in creativity, like rhythm, harmony, balance and other visual traits.

Environmental Response

Environmental variables-fixed feature variable, semi-permanent feature variable, ambient feature variable and human comportment, human adaptation to the given environment, collective behaviour and spatial orders, effects of colour and behaviour in built environment

Concept Of Beauty and Human Attitude

Philosophies of beauty, aesthetics and physio -psychological association to it and the human mind, simulated by 'pull' and 'push' factors of the environment physical manifestation and emotional impact attitudes towards typical physical settings form, space and attitude relations.

Application of Psychology In Architecture Design

Evaluation of the satisfactory levels of a residential building. Parameters to provoke desired emotions in the built environment application of the knowledge in the design of a residence, community, neighbourhood in all stages of design.

Psychology of Sustainable Behavior / Green Interventions

The green organizational imperative. Green work performance. The psychology of going green. Green recruitment, development and engagement. Maslow's Hierarchy of Needs. Herberg's Theory. The Cycle of organisational Change and Progression. Challenges to sustainability and participation.

Course Outcome

CO1 Understanding the principle of psychology in field of environmental Architecture
CO2 Ability to understand the linkage between form , space and attitude
CO3 ability to evaluate whether a building is at a sufficient level
CO4 Knowledge of the changes and difficulties in participation and sustainability.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References

1. Bakker, A.B. and Leiter, M.P. 'Work Engagement; A Handbook of Essential Theory and Research', Psychology Press, 2010.
2. Canter D.V and Lee.T,'Psychology and the Built Environment', Architectural Press, London, 1974.
3. Hall E.T, 'The Hidden Dimension',Anchor, 1990.

4. Kayem,S.M., ‘Psychologyin relation to design’, Dowden, Hutchinson and Ross, 1973.
5. Morgan T. of Clifford, ‘Introduction to Psychology’, Tata McGraw–Hill Publications, New York, 1983.
6. Proshansky. H.M, ‘TheField of Environmental Psychology: Securing its Future’, Wiley, 2002.
7. D. Stokols and I. Altman, ‘Handbook of Environmental Psychology’, New York, John Wiley and Sons, 1987.
8. Proshansky. H.M, Ittleson. W.H, Rivlin. L.G, ‘Environment Psychology- People and Their Physical Settings’, New York, Holt, Rinchatand Winston, 1976.

MH25C06 **Soft Skills** L T P/S C
2 0 1 3

Objectives:

- To give introduction to the soft skills and personality
- To give understanding of and enable better interpersonal communication.
- To apprise of aspects of organisational communication and develop skill in it.
- To enable skill in reading and writing.

Introduction to Soft Skills and Personality

Introduction to Soft Skills. Understanding of self. Self-awareness, self- management and Self Development. Values. Attitude. Positive Thinking and optimism. Confidence and excellence. Developing perception. Patience, persistence and flexibility. Empathy and Emotional Intelligence. Types of stress and stress management. Time Management and overcoming procrastination. Career planning.
Exercises and case studies for the various topics.

Interpersonal Communication

Classification and types of Communication. Verbal and non-verbal communication. Formal and informal communication. Barriers in communication.
Listening Skills, Types of Listening. Enhancing listening. Understanding context of words.
Responding. Speaking. Self development through speaking.
Nonverbal Communication. Body language and etiquette. Proxemics. Understanding of cultural, social and economic diversity and adapting to others.
Exercises and case studies for the various topics.

Organisational Communication

Group Communication. Organisational Communication. Communication Breakdown. Conflict Management. Negotiation Skills. Meeting Management. Team Building and Team work. Leadership Skills. Emotional intelligence. Critical Thinking.
Speeches and debates, Combating nervousness and anxiety, Patterns and Methods of Presentation, Oral presentation- Planning and preparation, Making effective presentation. Speaking for various occasions at different scales. Public speaking. Group Discussions.
Exercises for the various topics.

Advanced Reading and Writing Skills

Critical reading and understanding. Reviewing articles and books. Technical explanatory writing. Report writing for project. Structure of scientific/ technical papers. Writing papers for journals and conferences.
Assignments for the various topics.

Course Outcome

CO1 Awareness of importance of soft skills.
CO2 Knowledge and skill in interpersonal communication.
CO3 Knowledge and skill in organisational communication.
CO4 Competency in reading and writing.

Weightage: Continuous Internal Assessment: 50%, End Semester Examinations: 50%
Assessment Methodology: Three Assessments with weightage of 30%:30%:40% for the first, second and third assessments respectively. Each assessment shall incorporate continuous marking of the work and performance during the particular assessment period. The first, second and third assessment shall be with the proportion of 15:15:20 respectively.

References

1. Soft Skills, K.Alex, S.Chand, 2010
2. Soft Skills, Hariharan S, Sundararajan N, Shanmugapriya S.P, MJB Publishers 2010.
3. The ACE of Soft Skills, Gopalaswamy Ramesh, Mahadevan Ramesh, Pearson 2010.
4. Understanding Interpersonal Communication, Richard West and Lynn H.Turner, Cengage Learning, 2010.
5. Interpersonal Communication, Steven A. Beebe, Susan J. Beebe, Mark V. Redmond, Pearson 2011.
6. Business Correspondence & Report Writing, R. C. Sharma , Krishna Mohan,Tata McGraw Hill, 5th Edition 2017
7. How to Research and write a scientific paper, Robert A. Day, Barbara GasteCambridge University Press 2012.

EA25004	Post Occupancy Evaluation of Building	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To impart an understanding of an overview of energy consumption and its effects. Current energy consumption scenario in India. Need to reduce emissions.
- Aims and main aspects of energy management of buildings. Benefits and methodology for conducting the Historical Energy audit.
- Objectives & benefits and conducting Diagnostic Energy Audit. Instrumentation

Energy Management

Energy management matrix as a tool to diagnose the current state of energy management in any given organization. Management issues covered in the matrix – energy policy, organization, motivation, information systems, Marketing & investment.

Energy Consumption

Identification of opportunities for reducing energy consumption – improvements to the building. Determining the organizational profile. Monitoring & Targeting of energy use

Building Physical Data

Details of building energy survey – building information, building physical data, building envelope construction details, mechanical systems, electrical systems & equipment, hot water systems, indoor environmental conditions for each space, control systems and operating schedules.

Assessing Building Energy

Assessing existing buildings on their energy use, environmental impact and occupant satisfaction. Building performance bench marks – rating and comparison of buildings. Techniques, methods & procedures of Post Occupancy Evaluation.

Building Energy Evaluation

Post occupancy evaluation of a building and document the relationship between building design, energy use, occupant satisfaction, environmental impact and report their observations.

References:

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

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

Course Outcomes

- Awareness of importance of energy management matrix
- Knowledge and skill about control and operating systems
- Ability to understand techniques of building assessment
  Understanding the linkages between design and energy usage

EA25005	Design Of Energy Efficient and Healthy Buildings	L	T	P	C
		3	0	0	3

Course Objectives:

- The main objective of this course is to have a holistic understanding of healthy buildings and the various preventives and technologies available to ensure healthy buildings

Healthy Buildings Theory

Performance of building services against standards, Work place standards of health, Observation and analysis of health risk in buildings, and maintenance requirements, Environmental and health impact of building materials.

Investigations of Healthy Living Practices

Washing people, washing clothes, removing waste, improving nutrition, reducing crowding, separating people from animals, vermin or insects, reducing dust, controlling temperature and reducing trauma.

Design of Basic Air Conditioning System for Buildings

Process of air conditioning system selection, heat load estimation, and design of air distribution. Air conditioning design for energy efficiency. A C system components : Fans, coils, filters and heat rejection equipment. Sick building syndrome, Issues of Indoor air quality.

Fundamental Principles of Fire Safety Engineering

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

Source and Nature of Hazardous Waste

Impact on Environment – Hazardous Waste – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Abrams, D. W., “Low Energy Cooling: A Guide to the practical Application of Passive Coolingand Cooling Energy Conservation Measures”, Van Nostrand Reinhold Co.,
2. Chadderton, D. V., “Air Conditioning: A practical Introduction”, E & FN Spon, London
3. Chadderton, David, V., “Building Services Engineering”, E & FN Spon.
4. K.M.Hangos and I.T.Cameron, “Process Modeling and Model Analysis”, Academic Press, 2001
5. Stoecker, W. F., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi.
6. Torr, A. R., “Refrigeration and Air Conditioning”, Butterworth publishers, London, 1989.

Course Outcomes

- Understanding methods to remove pollutants from indoor environment
- Knowledge and skill about energy efficient air-conditioning design
- Ability to understand techniques of fire safety systems in building design
- Understanding the impacts of hazardous waste to environment

EA25006	Carbon Foot Print and Measurement	L	T	P	C
		3	0	0	3

Course Objectives:

- By the end of this course students will be expected to Calculate the carbon intensity of the electricity supply for a specific geographic area. Conduct full life cycle analysis of greenhouse gas emissions from a defined consumer product

Trends in Building Sector Emission

Energy consumption in different sectors like residential, commercial and public buildings, offices, markets, hospitals, research laboratories. Environmental data in these sectors. - Carbon emission resulting from energy use in buildings.

GHG Mitigation Options in Buildings

Energy efficiency principles, building energy management systems, -lighting systems, day-lighting, appliances, on-site power, and cost estimate of GHG mitigation in buildings.

Low Carbon Refurbishment in Buildings

Low carbon refurbishment process-3 different phases (prepare, design, construct) refurbishment policy, embodied energy considerations for existing buildings in different sectors. Constraints in adopting building techniques- Limitations of traditional building designs- misplaced incentives- regulatory barriers- social engineering (culture, behavior, rebound effect)- interaction of mitigation options with vulnerability and adaption.

Carbon Foot Printing During Construction

Social and economic aspects. –Promoting low carbon construction materials- reducing environmental impacts during construction, - aspects of sustainability. Carbon foot print measurement, Methodology of calculating carbon foot print, carbon trust, - system boundary, functional units, life cycle inventory data, carbon credit.

Road Map for Reducing Emissions

GHG inventory, baseline measures- strategic climatic action plans, - implementation mechanism Techniques to reduce energy consumption in building, Steps to be adopted for reduction, usage of low carbon materials, green travel, transport carbon- case study analysis

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. ICLEI – Local Governments for Sustainability USA, “The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions”, October 2012 (Appendix C-I)
2. What colour is your building? David H. Clark, RIBA publishing house, London-2013
3. World Resources Institute and World Business Council for Sustainable Development, The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition), pages 10-33.

Course Outcomes

- Understanding methods of carbon emission from the building usage
- Knowledge about building energy management systems
- Ability to calculate carbon foot print measures of whole building envelope
- Ability to understand the techniques to reduce energy consumption in building

EA25007	Natural Resource Management	L	T	P	C
		3	0	0	3

Course Objectives:

- This course provides an overview of the main management issues which relate to natural resources, particularly land, water, biodiversity, forests and fisheries. The range of topics covered in the course will provide students with a wider perspective on many national and international natural resource management issues and challenges. The focus of the course is to develop understanding for linking community resource management systems with macro- level policies and programmes to create long-enduring management systems

Introduction to Natural Resource Management

Overview of the Subject – Need and Scope; Basic Concepts of Natural Resource Management like Common Property Rights, Collective Action, Traditional Knowledge about Natural Resources Management, Community Based Natural Resource Management.

Land

Perception of Land Degradation; Understanding the Causes of Land Degradation; Land Management Practices; Like Soil Conservation, Watershed Management, Management Issues and Challenges.

Water

Water Supply and Demand, Water Quality Issues, Understanding the Causes, Water Management Practices, Management Issues and Challenges

Biodiversity

Biodiversity Services and Human Well-Being; Global and National Trends in Biodiversity Loss; Understanding the Causes, Biodiversity Management Practices, Management Issues and Challenges

Forests- The Principles of Sustainable Forest Management; Forests and Economic Development; Forest Ecosystem Services; Forest Certification Schemes; Community Forest Management. Joint Forest Management, Management Issues and Challenges.

Wildlife and Fisheries

Conserving Wildlife through Sustainable Use; The Drivers of Marine Fisheries Depletion. Current Approaches to Implementing Sustainable Fisheries Management, Management Challenges and Issues

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. A Methodological Framework for Gender Participation in Agricultural Resources: A Study ofJhabua District of M.P., Singh S.P. and K.N. Krishna Kumar.
2. Community Forest Management in Tribal States of India (with special reference to MadhyaPradesh), Daspugta S. and D. Debnath, International Book Distributors.
3. Criteria and Indicators for Sustainable Forest Management, Kotwal P.C. and M.D. Omprakash, International Book Distributors, Dehradun.
4. Ecotourism and Livelihoods, Bhattacharya A.K., Concept Publishing Company, New Delhi Forest Certification: A Tool for Sustainable Forest Management, Yadav M., P.C. Kotwal and B.L. Menaria, ISBN: 81-7969-047-4.

5. Governing the Commons: The Evolution of Institutions for Collective Action, Elinor Ostrom.
6. Natural Resources, Agarwal et. all, International Institute for Environment & Development.
7. The Science of Sustainable Development: Local Livelihoods and the Global Environment, Jeffrey Sayer, Cambridge University Press.

Course Outcomes

- Understanding methods of carbon emission from the building usage
- Knowledge about Land and water management systems
- Knowledge of forest management systems
- Ability to understand the trending techniques of sustainable fisheries management

EA25008	Environmental Management Systems and Auditing	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart an understanding of systems, approach as per ISO 14001 and skills for the management of environmental issues

Environmental Management Standards

Development, trade and environment linkages – Environmental guidelines - Business and Citizen Charters for Sustainable Production and Consumption - National policies on environment, abatement of pollution and conservation of resources-Environmental quality objectives - Environmental standards - Concentration and Mass standards - Effluent and stream standards - Emission and ambient standards -Minimum national standards - Measuring performance evaluation: Indicators, Benchmarking - Systems approach to environmental management.

Preventive Environmental Management

Pollution control vis a vis Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies - source reduction, raw material substitution, toxic use reduction and elimination, process modification – Cleaner Production Assessment- Material or resource balance – CP option generation and feasibility analysis.

Environmental Management System

EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

Environmental Audit

Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement - Due diligence audit.

Applications

Applications of EMS , Waste Audits and Pollution Prevention opportunities in Textile , Sugar, Pulp & Paper, Electroplating, Mining, petroleum refining, Tanning industry, Dairy, Cement, Chemical industries, etc

References:

1. Christopher Sheldon and Mark Yoxon, “Installing Environmental management Systems – a step by step guide” Earthscan Publications Ltd, London, 1999.
2. Environmental Management Systems: An Implementation Guide for Small and Medium- Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.
3. ISO 14001/14004: Environmental management systems – Requirements and Guidelines International Organisation for Standardisation, 2004
4. ISO 19011: 2002, “Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002

5. Paul L Bishop ‘Pollution Prevention: Fundamentals and Practice’, McGraw-Hill International, Boston, 2000.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

Course Outcomes

- Understanding the concepts of approach to environmental management
- Knowledge about process of environmental management systems
- Knowledge about roles of environmental audit
- Ability to evaluate the environmental performance indicators of different industries

MH25C05 **Psychology of Learning and Development** L T P/S C
3 0 0 3

Course Objectives

- To introduce general concepts of learning theory.
- To help understand research related to theories of learning.
- To enable opportunity to engage in critical analysis of theories through discussions.

Introduction

Introduction to learning. Behaviourism - Classical and Operant. Social Learning Theory. Taxonomies. Mastery Learning. Cognitive Information Processing. Problem Solving, Transfer. Meaningful Learning. Situated Cognition. Development and Learning. Interactional Theories of Learning. Nature and Meaning of Psychology. Methods and Scope Psychology.

Educational Psychology

Nature and Meaning of Educational Psychology. Functions Educational Psychology. Physical, Social, Emotional and Cognitive development patterns. Stage. Specific Characteristics of Infancy and Childhood and their developmental tasks. Characteristics and Problems of Adolescents. Needs, aspiration, attitudes and Self-concept of Adolescents. Guidance and Counselling for adolescents.

Understanding Learner Stages of Human Development

Cognitive Development. The Self, Social, and Moral Development. Learner Differences and Learning Needs. Language Development. Language Diversity and Immigrant Education. Culture and Diversity, Behavioural Views of Learning. Cognitive Views of Learning. Complex Cognitive Processes.

Learning and Motivation

Concept of learning and its nature. Factors influencing learning – Personal and Environmental. Motivation – Nature, Types. Techniques of enhancing learner's motivation. Theory of Learning. Operant Conditioning theory of learning. Gestalt theory of Learning. Learning goals with classroom activities, create motivating and inclusive environments, and integrating assessment into learning. Frameworks like Backward Design. Effective teaching and learning frameworks from psychological, cognitive, sociological, and educational research.

Appreciation And Criticism

Ability of Understanding– appreciation, advocatory, descriptive, evaluative, interpretative and other evaluation criteria and methodology. Development of Design Thoughts-understanding, developing and expressing a design thought in its right perspective purpose, manner and mode. Theories and models for experiencing architecture.

Course Outcomes

CO1 Knowledge about major social and psychological processes involved in learning and development in an educational setting.

CO2 Ability to engage in knowledgeable and productive dialogue with colleagues about human learning, development, and educational practice.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References

1. Ellen D. Gagne, Carol Walker Yekovich, Frank R. Yekovich,‘ The Cognitive Psychology of School Learning’ , Pearson, 1997.
2. Derville, Leonore, M.T ,’The use of Psychology in Teaching’, Longman London, 1982.
3. Biggs, Jhon B, ‘The Process of Learning’, Pearson Higher Education,1993.
4. McShane, J, ‘Cognitive Development, An Information Processing Approach Basic’, Black Well, Oxford, 1991.
5. Glover, J.A and Bruning,‘Educational Psychology Principles and Applications, Pearson, 1990.
6. Dececco J.P, ‘Psychology of Learning and Instruction: Educational Psychology’, Prentice Hall of India Ltd, NewDelhi, 1970.
7. Herbert J. Klausmeier, Richard E. Ripple, ‘Learning and Human Abilities: Educational Psychology’, Joanna Cotler Books, 1975.
8. Carol Davidson Cragoe, ’How to Read A Building’, Rizzoli, 2008.

EA25009	Energy, Climate Change and Urban Development	L	T	P/S	C
		3	0	0	3

Course Objectives:

- The objective of this course is to make students aware of the scenario of climate change and to provide exposure on discussions happening at national and international levels. After attending this course, the students will be in a position to appreciate the role of settlements in climate change mitigation at the same time they will be able to address impact and adaptations issues faced by human settlements.

Introduction

Energy, Climate change and Urban Development – Interface. Understanding Climate Change: Greenhouse gases, Anthropogenic causes, Carbon Cycle, Global Warming, Inventory of GHGs,Urban Heat Islands.

Energy Generation and Consumption

Energy Supply and Demand, Energy Consumption in cities, determinants of energy demand, phenomenon of climate change, factors influencing climate change, impacts of climate change.

Energy Planning and Management, and Mitigation and Adaptation to Climate Change

Energy efficient development, Compact city form, Transit oriented development. Mechanisms and measures for mitigating and adapting to climate change at various levels.

Plans, Policies and Strategies

Related to energy planning, conservation, climate change mitigation and adaptation.

Climate Change

An introduction to the Earth's Climate System and Climatic Zones as Basis for Human Activity and Settlements, The Development of Society in Relation to the Local Climatic and Topographic Conditions, Resources Availability (Food, Building Material, Energy), Technical Skills and the Societal Framework, The Conditions for Development, Evolution and Collapse of Civilizations. An Assessment of Population Development and its Implications on Settlements, Buildings and Resource Consumption with Particular Focus on Energy Consumption.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Andres Duany, Jeff Speck and The Smart Growth Manual 2009 McGraw-Hill.
2. Bicknell, Jane Adapting cities to climate change: understanding and addressing the development Change 2009 Earthscan, London.
3. Jenks, Mike; Burgess, Rod Compact cities: Sustainable urban forms for developing countries2000 Spon Press, London.
4. Mike Lydon David Owen Green Metropolis: Why Living Smaller, Living Closer, and Driving Lessare the Keys to Sustainability.

5. S.K Dash Climate change: an Indian perspective, New Delhi 2007 Cambridge University Press.

Course Outcomes

- Knowledge about climate change and its influences in urban areas
- Knowledge about measures for mitigating and adapting to climate change
- Ability to understand linkage about the micro-climatic and topographic condition
- Ability to understand an assessment of population density and resource consumption

EA25010	Theory of Environmental Planning	L	T	P/S	C
		3	0	0	3

Course Objectives:

- To enable the student to understand the various aspects of environment, their characteristic and mechanism. The policies pertaining to the conservation of the natural environment system.

Concepts of ecology, ecosystem and environmental Planning
History of Environmental Planning, Development of habitat patterns, settlement structure and form in response to environmental challenges; Concepts of Ecology and Ecosystem, Urban Ecosystem.

Resource Analysis and Conservation
Resource analysis for Various ecosystems and development imperatives (land, geology, soil, climate, water, vegetation) characteristics, exploitation, causative factors for degradation, analytical techniques.

Environmental Zones
Environmental Zones (Hill, coastal, arid, characteristics, resources, settlements pattern, problems and potentials, regulating mechanisms for development.

Environmental Policies, Significant Conventions, Conferences
Environmental Policies and initiatives including policies, strategies, protocols, treaties and agreements.

Environmental Legislations in India
Evolution of Indian Legislation (Brief Overview of environment related laws in India); Environmental Movements; Union Government Initiatives • Indian Environmental Acts, Laws and Notification.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References:

1. Andrews, Goudie The Human Impact on the Natural Environment – Past, Present and Future2006 Wiley Publishers
2. J.S. Singh, S.P. Ecology Environment and 2008 Anamaya Publishers, New Delhi
3. James K. Lein Integrated Environmental Planning 2002 Wiley Publishers
4. Singh, and S.R. Gupta Resource Conservation Delhi.
5. V.H. Dale, Mary R. English Tools to Aid Environmental Decision Making Latest EditionSwinger.
6. William Fox, Enslin Van Rooyen (eds.) The Quest for Sustainable Development 2004 Juta &Co. Ltd., Cape Town.

Course Outcomes

- Understand the various aspects of environment and the policies for its protection
- Identifying the resource analyses of all ecosystem
- Understand specific Environmental laws in special areas such a hilly area, coastal

areas etc

- Ability to analyze the evolution of laws and Initiative for environmental resource protection

EA25011	Environment, Development And Disaster Management	L	T	P/S	C
		3	0	0	3

Course Objectives:

- At the end of the course, the students must have an understanding of the resource optimization and the measures to be taken in the face of a disaster

Environment, Development and Disaster Management Interface
Resource use, exploitation and conservation; Impact of human activities on environment; Environment and economy interaction, introduction to environmental accounting.

Environmental Management
Environmental Impact Assessment, thresholds, indicators, audits, environmental certification, lifecycle analysis, environment and poverty links, environmental policy, Acts and regulations; Environmental education, participatory approaches, emerging concepts. Disaster classification, concepts, hazards, vulnerability, risks, human response to disaster, impacts.

Concepts of Hazard
Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Risks, Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems, Political, Social, Economic impacts of Disasters, Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters, Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters. Impact on Environment.

Disaster Mitigation and Management
Environmental Policies and initiatives including policies, strategies, protocols, treaties and agreements.

Policies and Legislation Pertaining to Environment and Disaster Management
Policies and Legislation at various levels., Institutional and Legal Arrangements Disaster Management Act, 2005. Role of Central Ministries and Departments, and States, Communications and Information Technology (IT) Support, Community Based Disaster Preparedness, Stakeholders' Participation , Corporate Social Responsibility (CSR) and Public- Private Partnership (PPP).

References:

1. Jegadish Gandhi P Disaster Mitigation & Management Post Tsunami Perspectives 2007 Deep & Deep Publications Pvt Ltd, New Delhi
2. Ministry of Home Affairs Model Amendment in Town and Country Planning Legislations, Regulation for Land Use Zoning and Building Byelaws for Structural Safety 2004 MHA 8. Ministry of Home Affairs National Policy on Disaster Management(NPDM) 2006 MHA
3. NDMA Disaster Management Guidelines 2007-11 NDMA

4. P C Sinha Introduction to Disaster Management 2007 Anmol Publications, New Delhi
5. Pardeep Sahni, Alka Dhameja, Uma Medury Disaster Mitigation: Experiences and Reflections 2008 PHI Learning Pvt. Limited, New Delhi
6. Rajib Shaw Community, Environment and Disaster Risk Management 2010 Emerald GroupPublishing Limited\\
7. Rajib Shaw Hari Srinivas, Anshu Sharma Urban Risk Reduction An Asian Perspective 2009Emerald Group Publishing Limited

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

Course Outcomes

- Understand the various contexts leading to disaster.
- Understand the vulnerability, risks, human response to disaster and its impacts
- Awareness about disaster management and provision of infrastructure for disaster mitigation
- Ability to understand policies and Legislation of disaster management

MH25C07 **Theory of Architectural Education** L T P/S C
3 0 0 3

Course Objectives

- To give familiarity about theories of architectural education.
- To introduce the idea of cognition development.
- To give familiarity about ways of thinking and learning with respect to architecture.

Introduction

Overview of the important aspects of the discipline of architecture. Nature of Architectural Education based on the nature of the discipline of architecture.

Tools/ Techniques to Teach Architecture

Models and methods of Teaching. Teaching Aids In Architecture Education. Types of Teaching Aids- Visual, Audio, etc., Learning by Doing, reflection, exploring, arguing, incidentally. Case-Based Teaching. Advanced Organizer, Concept attainment model, Simulations.

Synectics as a Model of Teaching.

The essence of creativity in synectics. Use of synectics in the design studio. Techniques of teaching-learning: Maxims of teaching and its application to subjects of architecture. Concept mapping, creating concept maps. Basic aspects of classroom management.

Student Development

Need of development. Cognitive Development. Connection between seeing and remembering. Memory Retention. Attention Span. Organizing Communication. Comprehension. Create a Focal Point. Evolution of technology in education. Testing of module/ survey conducted.

Learning In Architecture Design Studio

Development of Critical, Creative and Pragmatic Thinking in Architectural Design Studio. Bloom Taxonomy in Design Studio. Qualities which can be attained at various stages in Architectural Design Studio.

Course Outcome

CO1 Awareness of the importance of contextual excellence in architectural design and methods for the same.

CO2 Knowledge about and ability to integrate interdisciplinary and cognitive aspects of learning, teaching and development.

Weightage: Continuous Internal Assessment: 40%, End Semester Examinations: 60%.

Assessment Methodology: Two Assessments with equal weightage.
One Assessment as Internal written Test /Examination (50%), second as Assignment (50%) of any mode such as study, seminar, and or a combination of modes, etc.

References

1. S. K. Mangal, ‘Essential of Educational Technology’, PHI Learning Pvt. Ltd., 2009.
2. Bruce Joyce, Emily Calhoun, Marsha Weils, ‘Models of Teaching’, Pearson, 2014.
3. Klausmier, Ripple,’Learning and Human Abilities’ Harper and Row, New York, 1971.
4. Eames Charles, Ray, ‘An Eames Anthology’, Yale University Press, 2015.