**AFFILIATED INSTITUTIONS**

**ANNA UNIVERSITY, CHENNAI**

**REGULATIONS -2013**

**M.ARCH. (ENVIRONMENTAL ARCHITECTURE)**

**REGULAR**

**I TO IV SEMESTERS OF CURRICULA AND SYLLABI**

**SEMESTER I**

| SL NO. | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| 1. | EA7101 | Introduction to Environment and Sustainability | 3 | 0 | 0 | 3 |
| 2. | EA7102 | Urban and Regional Planning | 3 | 0 | 0 | 3 |
| 3. | EA7103 | Socio - Economic Aspects of Planning | 3 | 0 | 0 | 3 |
| 4. | EA7104 | Housing and Community Planning | 3 | 0 | 0 | 3 |
| 5. | EA7105 | Urban Ecology and Environmental Planning | 3 | 0 | 0 | 3 |
| **STUDIO** | | | | | | |
| 6. | EA7111 | Environmental Architecture Design Studio I | 0 | 0 | 12 | 6 |
| | | **TOTAL** | **15** | **0** | **12** | **21** |

**SEMESTER II**

| SL NO. | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| 1. | EA7201 | Environmental Disturbances, Pollution and Remedies | 3 | 0 | 0 | 3 |
| 2. | EA7202 | Thermal Comfort and Passive design | 3 | 0 | 0 | 3 |
| 3. | EA7203 | Environmental Impact Assessment | 3 | 0 | 0 | 3 |
| 4. | EA7204 | Sustainable, Energy Efficient Building Materials and Technologies | 3 | 0 | 0 | 3 |
| 5. | | Elective I | 3 | 0 | 0 | 3 |
| **STUDIO** | | | | | | |
| 6. | EA7211 | Environmental Architecture Design Studio II | 0 | 0 | 12 | 6 |
| | | **TOTAL** | **15** | **0** | **12** | **21** |

**SEMESTER III**

| SL NO. | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| 1. | EA7301 | Sustainable and Green Buildings | 3 | 0 | 0 | 3 |
| 2. | MH7302 | Research Methodologies in Architecture | 3 | 0 | 0 | 3 |
| 3. | EA7302 | Environmental Laws and Management | 3 | 0 | 0 | 3 |
| 4. | | Elective II | 3 | 0 | 0 | 3 |
| **STUDIO** | | | | | | |
| 5. | EA7311 | Dissertation | 0 | 0 | 6 | 3 |
| 6. | EA7312 | Environmental Architecture Design Studio III | 0 | 0 | 12 | 6 |
| | | **TOTAL** | **12** | **0** | **18** | **21** |

## SEMESTER IV

| SL NO. | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| **STUDIO** | | | | | | |
| 1. | EA7411 | *Professional Training | 0 | 0 | 4 | 2 |
| 2. | EA7412 | Thesis | 0 | 0 | 20 | 10 |
| | | **TOTAL** | **0** | **0** | **24** | **12** |

*Professional training of 6 weeks full time or 12 weeks part time with the concerned office at any time during the semester as decided by the institution offering the course.

**Total No. of credits to be earned for the award of Degree 21+21+21+12 = 75**

## LIST OF ELECTIVES - M. ARCH. (ENVIRONMENTAL ARCHITECTURE) REGULAR

### ELECTIVE I

| SL. NO. | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| 1 | EA7001 | Geographical Information Systems and Remote Sensing | 3 | 0 | 0 | 3 |
| 2 | EA7002 | Predictive Building Modeling Softwares and Passive Strategies | 3 | 0 | 0 | 3 |
| 3 | EA7003 | Environmental Psychology | 3 | 0 | 0 | 3 |

### ELECTIVE II

| SL. NO | COURSE CODE | COURSE TITLE | L | T | P/S | C |
|---|---|---|---|---|---|---|
| 1 | EA7004 | Renewable Energy Systems | 3 | 0 | 0 | 3 |
| 2 | MH7008 | Sustainability and Energy Conservation in Landscape Architecture | 3 | 0 | 0 | 3 |
| 3 | MH7007 | Landscape Ecology and Planning | 3 | 0 | 0 | 3 |
| 4 | EA7005 | Environmental Management Systems and Auditing | 3 | 0 | 0 | 3 |

**EA7101 INTRODUCTION TO ENVIRONMENT AND SUSTAINABILITY**

| L | T | P/S | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the basics on Environment and Ecological cycles and Biosphere.
- To study various emerging issues in history and present also an understanding of relevant techniques in formulating various sustainable strategies.

**UNIT I INTRODUCTION** **9**

Introduction to Environmental systems, Components of Environment & their Interrelationships. Definition of Environment, Types of Environment, Pollutants and their effects. Ecosystems - Types, components, Energy flow, Interactions in ecosystem. Physical Environment - Air, Water, Soil.

**UNIT II HISTORICAL PERSPECTIVE** **9**

Natural & Physiological factors influencing human civilizations & settlements. Environmental history, Physical impact of humans on Earth's land, Water, Atmosphere and Biosphere transition, the environmental and human consequences of the industrial and technological revolutions .

**UNIT III GEOGRAPHICAL & CLIMATOLOGICAL INFLUENCES** **9**

Flora, Fauna, Biodiversity & plant classification based on climate, soil and other environmental conditions. Ecological changes and social, Cultures in conflict, Climate change. Climatic history - The Koppen system and Thornthwaite's climate system

**UNIT IV HUMAN IMPACT ON EARTH ECO SYSTEM** **9**

Impact of human civilizations on the earth's major Ecosystem, Forests, Oceans & Atmosphere. Assessing the impacts and ways for its mitigation. Land use matrix - Consumption, Carbon Footprint, Ecological Footprint.

**UNIT V CHALLENGES IN SUSTAINABLE DEVLOPMENT OF STRATEGIES FOR SUSTAINABILITY** **9**

Introduction to sustainability, its historical precedence global & local relevance – its correlation to population growth & consumption patterns. Bruntland Commission Report, Kyoto Protocol, Earth Summit, Strategic Environmental Assessment.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Carlos Hernandez & Rashmi Mayur, Pedagogy of the Earth : Education for a sustainable future 1999.
2. Norman J Vig & Michaeal E Kraft, Environmental Policy: New Directions for the Twenty – First Century , CQ Press, 2012.
3. Gordon Wilson, Pam Furniss and Richard Kimbowa, Environment, Development, and Sustainability: perspectives and cases from around the world, Oxford University Press, USA; 1 edition, 2009.
4. Madhav Gadgil, Ramachandra Guha, This Fissured Land, Second Edition, An Ecological History of India, Oxford University Press; 2 edition, 2012
5. Paul Appleby, 2010, Integrated Sustainable Design of Buildings, Routledge, 2010.

**EA7102 URBAN AND REGIONAL PLANNING L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

- To introduce to the students various theories of Planning and City design with relevant Planning techniques, standards etc.

**UNIT I EVOLUTION OF HUMAN SETTLEMENTS 9**

Origin and growth of cities, Relevance of the study of evolution of urban settlements. Socio- cultural, economic, political and religious influence in urban form. Town planning history – ancient Egypt, Mesopotamia and Indus valley. Greece and Rome, Medieval, Renaissance, Industrial and post industrial age, Colonial cities. Town planning in India.

**UNIT II PLANNING PHILOSOPHIES 9**

Planning philosophies of Ebenezer Howard, Patrick Geddes, Lewis Mumford, Le-Corbusier, C.A. Doxiadis, Clarence Stein etc., and their contribution to Urban and Regional Planning. Case studies and discussions.

**UNIT III OVERVIEW OF INDIAN PLANNING SYSTEM 9**

Planning systems in India, Master plans, Structure plan, Detailed development plans, Comparison of planning systems in UK & USA with that of India. Planning Surveys, Different types used for data identification for Plan preparation, Aerial Photography and Remote Sensing techniques in planning, Urban economic analysis , Planning norms and standards, Land surveys.

**UNIT IV INTRODUCTION TO REGIONAL PLANNING 9**

Aims and objectives and need for Regional Planning. Concept of Region, Types and classification of regions, Delineation of planning regions by various techniques. Regional analysis- Input output analysis – growth model, core periphery model, gravity potential model, industrial location theory, agricultural land use model

**UNIT V APPLICATION OF REGIONAL PLANNING 9**

Regional planning in India – Multi level planning, District planning, Special Area Development Programme and Schemes. Regional planning as a tool to integrate rural and urban areas. Application of Regional Planning.

**TOTAL : 45 PERIODS**

**REFERENCES:**


1. Aurthur Gallion – Urban Pattern, Wiley; 6 edition, 2004 (Reprint).
2. Ebenezer Howard – Garden Cities
3. Aidan William Southall, Urban Anthropology cross and Cultural Studies, Oxford Univ. Pr., 1973
4. Cecilia Wong, Indicators for Urban and Regional Planning, The Interplay of Policy and Methods, Routledge, 2013
5. Amitabh Shukla, Regional Planning And Sustainable Development, Kanishka Publishers, Distributors, 2000
6. Allen G. Noble, Ashok K. Dutt, Indian Urbanization and Planning, Vehicles of Modernization, South Asia Books, 1986

**EA7103 SOCIO - ECONOMIC ASPECTS OF PLANNING L T P/S C**
**3 0 0 3**

**OBJECTIVES :**

- To cover basic sociological aspects and theories and its application in the field of planning and development. The focus will be on social issues and problems in the contemporary Indian society, particularly the urban India.
- To provide an understanding on the Economic base on Planning and Development.

**UNIT I INTRODUCTION 9**

Nature and scope of sociology – Basic concepts of sociology like family, institution, group, association, community, social processes, social norms, Culture, social structure social stratification .

**UNIT II OVERVIEW OF URBANIZATION AND SOCIO ECONOMIC SYSTEM 9**

Patterns and trends in Indian urbanization and its role, socio -economic transformation in India, Social Problems of slums and housing. Rural Housing and culture in India. Social planning, Policies and Programmes, Pubic Participation in Planning, Poverty in India.

**UNIT III ECONOMIC THEORY AND PLANNING 9**

Basics of Economics – Concepts of Economics and Economic Growth, Demand and Supply Theory, Production Economics, Internal and External Economics, Basic Non - Basic Concept, Economies of scale, Social cost, Urban and Regional Growth, Urban land economics.

**UNIT IV DEMOGRAPHY 12**

Population studies – demography concepts – population problems in India – source of demographic data in India (Population census, Civil Registration systems, Sample registration systems etc).Population structure – Composition, vital rates like fertility, mortality, birth and death rates. Various population forecasting techniques and projections.

**UNIT V MIGRATION AND IMPACT ON URBAN DEVLOPMENT 6**

Migration, Urban growth and Urban development – migration and its implication in spatial planning and development planning. Carrying capacity and Threshold population limits in urban planning,

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Economic and social development by S.L.Sinha
2. Dr. Ashal A. Bende & Mrs. Tara Kanitkar – Principles of Population Studies – Himalaya Publishing House – Bombay, **1982**
3. Dand M. Heu – Society& Population – Eastern Economy Edition, 1978.
4. Prakash Vohra, Rakesh Mehta, Economic Planning And Development, Commonwealth Publishers, 2007
5. Baleshwar Thakur, , K. Thakur, City Society And Planning (in 3 Volumes), Concept Publishing Company, 2007

**EA7104 HOUSING AND COMMUNITY PLANNING L T P/S C**
**3 0 0 3**

**OBJECTIVES**:

- Main objective is to introduce the concepts of Community Planning and the various emerging issues.
- To provide an understanding and relevant techniques in formulating urban housing strategies.

**UNIT I INTRODUCTION 9**

Concepts, definitions and components of Housing. Role of housing in socioeconomic development of a nation. Housing in relation to non-residential components of settlement. Effects of Urbanization & Industrialization in Housing including problems and possibilities of Slums and Squatters settlement in India and abroad.

**UNIT II NORMS AND DESIGN STANDARDS OF HOUSING 9**

Housing norms, design and standards, units of housing design, layouts, densities and neighborhood units; infrastructure and community facilities, form and structure of housing as shaped by socio-economic and physical parameters. Social aspects: built environment and human behavior.

**UNIT III HOUSING AND ECONOMIC DEVLOPMENT 9**

Evaluation of user's satisfaction. Materials, technology and housing production, Industrialization and future of housing, including cost reduction techniques in housing. Role of Housing in National and State Economic development. Integrated sustainable housing and community planning- Case studies and discussions.

**UNIT IV HOUSING DEMAND AND SUPPLY 9**

Theories and approaches to housing. Housing process and sequence of development. Housing need, demand and supply, formal and non-formal housing. Housing characteristics and situation (indices and statistics), Housing in five year plans and social housing programmes. Urban and Rural housing

**UNIT V HOUSING POLICY AND LEGISLATION 9**

Major elements of a housing policy, land, finance, legislation for institutions and housing development, approaches and contents of National Housing Policy. Finance for housing: priority in the national plans – role of public and private agencies, role of cooperatives and various institutions.

**TOTAL : 45 PERIODS**

**REFERENCES:**


1. Eric Damian Kelly ,Community Planning: An Introduction to the Comprehensive Plan, Second Edition , Island Press; 2 edition, 2009
2. National Urban Housing & Habitat policy – 2007, Govt of India /Ministry of Housing & Urban poverty Alleviation, NewDelhi .
3. Ashok Ranjan Basu, Urban Squatter Housing in the Third World Mittal Publications 1988 .
4. Girish Kumar Misra, P. S. N. Rao Housing Legislation in India: Policies and Performance, Kanishka Publishers, Distributors, 2000
5. Brian Edwards, David Turrent, Sustainable Housing: Principles and Practice, Taylor & Francis, 2013
6. Guru Charan Mathur, Low-Cost Housing in Developing Countries, Oxford & IBH Publishing Company, 1993.

**EA7105 URBAN ECOLOGY AND ENVIRONMENTAL PLANNING L T P/S C**
**3 0 0 3**

**OBJECTIVES:**

- The aim of this course is to make the students understand the basic concepts of ecology, Urban Ecology, natural systems and environment.
- To make the students understand the importance of Environmental planning for sustainability, resource planning and allocation and protection of natural resources and their use for sustainability. Also to prepare plans considering preservation, rehabilitation and environmental policies.

**UNIT I INTRODUCTION 9**

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,

**UNIT II CONCEPTS AND APPROACHES TO ECOLOGICAL PLANNING 9**

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.

**UNIT III HUMAN INFLUENCE ON ECO-SYTEMS 9**

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.

**UNIT IV EFFECTS OF GROWING POPULATION ON ECO-SYSTEMS 10**

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.

**UNIT V GLOBAL ISSUES ON MODERN CITIES 8**

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.

**TOTAL : 45 PERIODS**

**REFERENCES:**


1. P. D. Sharma, Sharma P.D., Ecology And Environment, Rastogi Publications, 2009
2. Saligram Bhatt,Environment Protection and Sustainable Development, APH Publishing, 2004
3. Francisco A. Comín,Ecological Restoration: A Global Challenge, Cambridge University Press, 2010
4. D. D. Khanna, Sustainable development: environmental security, disarmament, and development interface in South Asia, Macmillan India, 1997
5. Tony Fry, Design Futuring: Sustainability, Ethics and New Practice, Berg, 2009 - Architecture
6. Marina Alberti, Advances in Urban Ecology: Integrating Humans and Ecological Processes in Urban Ecosystems, Springer, 2007
7. John M. Marzluff, Urban Ecology: An International Perspective on the Interaction Between Humans and Nature, Springer, 2008

**EA7111 ENVIRONMENTAL ARCHITECTURE DESIGN STUDIO I L T P/S C**
**0 0 12 6**

Design of a Housing cluster taking into consideration of various aspects of planning, climate environment, socio economic and other physical characteristics. The project should also aim to achieve the concept of sustainable community development.

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

**TOTAL : 180 PERIODS**

**EA7201 ENVIRONMENTAL DISTURBANCES, POLLUTION AND REMEDIES L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

- To provide knowledge related to the broad field of environmental disturbances, and tools that can be used in various remedies.

**UNIT I INTRODUCTION 9**

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

**UNIT II UNIT, MEASUREMENTS AND STANDARDS 9**

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

**UNIT III REMEDIAL TECHNIQUES AND DISTURBANCE- BUILT ENVIRONMENT 9**

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.

**UNIT IV POLLUTION AND REMEDIES 9**

Structure and composition of Atmosphere –Definition ,Scope and Sclaes 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 .

**UNIT V ECOLOGICALLY DISTURBED SITES AND RESTORATION 9**

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

**TOTAL: 45 PERIODS**

**REFERENCES:**


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

| EA7202 | THERMAL COMFORT AND PASSIVE DESIGN | L | T | P/S | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVE:**

- The main objective of this course is to explore the relationship between architectural form, materials and environmental performance, and how this relation should evolve in response to climate and emerging technical capabilities.

**UNIT I CLIMATIC ZONES IN INDIA 9**

Climatic classifications for India – Hot and Dry, Warm and Humid, Hot and Humid, Moderate, Composite, Cold –Zones .Study of Vernacular Architecture in India –Climatic response-Case studies.

**UNIT II NATURAL INFLLUENCES 9**

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.

**UNIT III DESIGN ELEMENTS 9**

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.

**UNIT IV BUILDING MATERIALS 9**

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.

**UNIT V HUMAN COMFORT STANDARDS 9**

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.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Hawkes Dean and Foster Wayne, Energy Efficient Buildings: Architecture, Engineering, and Environment . W. W. Norton & Company; First American Edition, 2002.
2. O.H Koenisberger, Manual of Tropical housing and climate, Longman Group United Kingdom, 2012.
3. Givoni, Climate Considerations in Building and Urban Design, Wiley; 1st edition, 1998.
4. David Lloyd Jones, Architecture and the Environment: Contemporary Green Buildings, Overlook Hardcover, 1998.
5. Arvind Krishan, SimosYanas, Nick Baker, S.V. Szokolay, Climate Responsive Architecture, Tata McGraw Hill Pub. Co, 2001
6. Daniel D. Chiras, The Solar House: Passive Heating and Cooling, Chelsea Green Publishing, 2002

**EA7203 ENVIRONMENTAL IMPACT ASSESSMENT L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.

**UNIT I INTRODUCTION 7**

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

**UNIT II COMPONENTS AND METHODS 10**

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.

**UNIT III IMPACT ON SOCIO-ECONOMIC SYSTEMS 8**

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.

**UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 10**

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.

**UNIT V SECTORAL EIA 10**

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.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.
2. World Bank –Source book on EIA
3. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.
4. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
5. Nick Harvey, Beverley Clarke, Environmental Impact Assessment: Procedures and Practices, Oxford University Press, USA, 2012.

| EA7204 | SUSTAINABLE, ENERGY EFFICIENT BUILDING MATERIALS AND TECHNOLOGIES | L T P/S C 3 0 0 3 |
|---|---|---|

**OBJECTIVES:**

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

**UNIT I INTRODUCTION ON ENERGY EFFICIENCY 9**

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

**UNIT II RECYCLABLE AND RENEWABLE MATERIALS 9**

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

**UNIT III PASSIVE DESIGN IN MATERIALS 9**

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

**UNIT IV SUSTAINABLE CONSTRUCTION 9**

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

**UNIT V ENERGY EFFICIENT TECHNOLOGIES 9**

Energy Efficient Construction Technology – Filler Slab – Rat trap Bond – Technologies developed by 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

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Koenigsberger O.H, T.G. Inger Soll, “Manual of tropical Housing and Building” Longman Group United Kingdom, 2012.
2. Bansal Naveendra K., Hauser Gerd and Minke Gernot, “Passive Buildings Designs : Handbook of Natural Climatic Control”, Elsevier Science, Amsterdam 1997.
3. Givonji B., “Man, Climate and Architecture”, Elsevier, Amsterdam, 1986.
4. Watson Donald, ‘Climatic Design: Energy Efficient Building Principles & Practices”, Mc Graw Hill Book company, New York, 1993.

**EA7211 ENVIRONMENTAL ARCHITECTURE DESIGN STUDIO II L T P/S C**
**0 0 12 6**

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.

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

**TOTAL : 180 PERIODS**

**EA7301 SUSTAINABLE AND GREEN BUILDINGS L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

- To sensitize the students to the various aspects of sustainable and green building design in the context of global warming and climate change and to address the very process and tools of design to enable architecture that is environmentally friendly and sustainable.

**UNIT I INTRODUCTION 6**

Attitudes to architecture: a historical perspective- General premises and strategies for sustainable and green design- objectives and basis- Eco-mimicry as a design tool based on ecosystem analogy- theoretical basis for a sustainable and eco friendly design

**UNIT II ECO HOUSE 12**

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; small scale wind systems and hydro power; Case studies- design of eco houses: context specific

**UNIT III ENVIRONMENTAL IMPACT OF BUILDING MATERIALS 9**

Measuring the impact of building materials- calculating embodied energy- recycling and embodied energy- processing and embodied energy- time and embodied energy- embodied energy of different building materials- low energy building and masonry materials- life cycle analysis- Case studies and analysis

**UNIT IV GREEN CONSTRUCTION AND ENVIRONMENTAL QUALITY 12**

Sustainable architecture and Green Building: definition- Green building Evaluation Systems; LEED Certification and Gritta; 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

**UNIT V SUSTAINABLE AND GREEN BUILDING DESIGN CASE STUDIES 6**

Instrument and natural case studies to investigate and apply various studio exercises on Green Building Design.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Brenda and Robert Vale; Green Architecture- Design for a Sustainable Future; Thames and Hudson; 1996
2. Daniel Vallero and Chris Brasier; Sustainable Design- The science of sustainability and Green Engineering; Wiley; 2008
3. Catherine Slessor; Sustainable Architecture and High Technology- Eco Tech; Thames and Hudson; 1997
4. Dominique Gauzin- Muller; Sustainable architecture and Urbanism; Birkhauser; 2002.
5. Ken Yeang; Eco design - A Manual for Ecological design, Wiley- Academy; 2006
6. Sue Roaf et all; Ecohouse: A design Guide; Elsevier Architectural Press; 2007
7. Thomas E Glavinich; Green Building Construction; Wiley; 2008


**MH7302 RESEARCH METHODOLOGIES IN ARCHITECTURE L T P/S C**
**3 0 0 3**

**OBJECTIVES:**

- To make the students to distinguish various theoretical ideologies influencing the philosophy and values of architecture.
- To establish the sense of systematic inquiry in students mind to analyze and infer the issues and aspects relating to Architecture.

**UNIT I INTRODUCTION 9**

Basic research issues and concepts- orientation to research process- types of research: historical, qualitative, co-relational, experimental, simulation and modeling, logical argumentation, case study and mixed methods- illustration using research samples

**UNIT II RESEARCH PROCESS 9**

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

**UNIT III RESEARCHING AND DATA COLLECTION 9**

Library and archives- Internet: New information and the role of internet; finding and evaluating sources- misuse- test for reliability- ethics

Methods of data collection- From primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling- Problems encountered in collecting data from secondary sources-

**UNIT IV REPORT WRITING 6**

Research writing in general- Components: referencing- writing the bibliography- developing the outline- presentation; etc.

**UNIT V CASE STUDIES 12**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The student will develop the skill to identify, decipher and interpret the issues relating to Architecture, based on research enquiry methods.
- The student will widen the information and will prepare the students for scientific method of researching and research process.

**REFERENCES:**


1. Linda Groat and David Wang; Architectural Research Methods, Wiley; 1 edition, 2001.
2. 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.
3. Iain Borden and Kaaterina Ruedi; The Dissertation: An Architecture Student's Handbook; Architectural Press; 2000
4. Ranjith Kumar; Research Mehodology- A step by step guide for beginners; Sage Publications; 2005
5. John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2002


**EA7302 ENVIRONMENTAL LAWS AND MANAGEMENT L T P/S C**
**3 0 0 3**

**OBJECTIVES:**

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

**UNIT I ENVIRONMENTAL LAW AND POLICY 9**

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.

**UNIT II INDUSTRIAL ECOLOGY 9**

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

**UNIT III ENVIRONMENTAL PLANNING AND DECISION MAKING 9**

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

**UNIT IV INTRODUCTION TO ENVIRONMENTAL ACCOUNTING 9**

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.

**UNIT V ENVIRONMENTAL MANAGEMENT 9**

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

**TOTAL: 45 PERIODS**

**REFERENCES:**


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


**EA7311 DISSERTATION L T P/S C**

**0 0 6 3**

**OBJECTIVES:**

- To expose the students to the various thrust areas in architecture.
- To inculcate the spirit of research in 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.

**TOTAL: 90 PERIODS**

**REFERENCES:**


1. Iain Borden and Kaaterina Ruedi; The Dissertation: An Architecture Student's Handbook; Architectural Press; 2000.
2. Linda Grant and David Wang, Architectural Research Methods, John Wiley Sons 2001.

3. 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.
4. Ranjith Kumar; Research Methodology- A step by step guide for beginners; Sage Publications; 2005
5. John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2002.

| EA7312 | ENVIRONMENTAL ARCHITECTURE DESIGN STUDIO III | L | T | P/S | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 12 | 6 |

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.

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

**TOTAL : 180 PERIODS**

| EA7412 | THESIS | L | T | P/S | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 20 | 10 |

**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.

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.

**TOTAL: 330 PERIODS**

**EA7001 GEOGRAPHICAL INFORMATION SYSTEMS AND REMOTE SENSING**

| L | T | P/S | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVE:**

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

**UNIT I INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEM (GIS) 10**

Introduction-Definitions of GIS - The Evolution of GIS, Components of GIS, Approaches to the study of GIS. Major application areas of GIS, Map scale, Classes of maps, The Mapping process, Plane Co-ordinate systems and transformations, Geographic Co-ordinate systems on earth, Map projection, Classification of map projections, aspects of map projections, Establishing a spatial framework for mapping locations on earth: Geo-referencing.

**UNIT II APPLICATION OF GIS SYSTEM AND REMOTE SENSING: 9**

GIS Concepts – Spatial and non-spatial data, Vector and raster data structures, analysis, Database management – GIS software, Monitoring and management of environment, Conservation of resources, Sustainable land use &, Coastal zone management – Limitations in Architecture and Planning.

**UNIT III OVERVIEW OF REMOTE SENSING: 8**

Introduction Definitions of remote sensing and related terminology, Historical Perspective, Principles of remote sensing, components of remote sensing, Energy source and Electromagnetic radiation, Energy interaction, Spectral response pattern of earth surface features.

**UNIT IV REMOTE SENSING TECHNOLOGY: 8**

Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning, Multispectral remote sensing, Thermal remote sensing, Microwave remote sensing – Active and passive sensors, RADAR, LIDAR, Satellites and their sensors, Indian space programme - Research and development

**UNIT V DATA PROCESSING: 10**

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

**TOTAL: 45 PERIODS**

**REFERENCES**


1. Lillesand, T.M. and Kiefer, R.W, Remote sensing and image interpretation, John Wiley and sons, New York, 2004.
2. Golfried Konechy, Geoinformation: Remote sensing, Photogrammetry and Geographical Information Systems, CRC press, 1st Edition, 2002.
3. Burrough, P.A. and McDonnell, R.A., Principles of Geographic Information systems Oxford University Press, New York, 2001.
4. Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1998.
5. Pmapler and Applications of Imaging RADAR, Manual of Remote Sensing, Vol.2, ASPR, 2001.

| EA7002 | PREDICTIVE BUILDING MODELLING SOFTWARES AND PASSIVE STRATEGIES | L T P/S C 3 0 0 3 |
|---|---|---|

**OBJECTIVE :**

- This course will investigate the Modelling techniques and passive strategies for assessing the energy performance, environmental response and impact of built form.

**UNIT I PREDICTIVE BUILDING MODELLING 9**

Modelling-Simple Modelling, Advanced Modelling . Understanding and familiarizing with Layers and Zones, Objects and Nodes ,Element, Types ,Object Relationships ,Display Options ,Viewing the Model and Operational Modes.

**UNIT II SOLAR ANALYSIS 9**

Solar Analysis- Shading Analysis , Shading Design.

Learning to:

- Display and animate complex shadows and reflections,
- Generate interactive sun-path diagrams for instant overshadowing analysis and
- Calculate the incident solar radiation on any surface and its percentage shading

**UNIT III LIGHTING ANALYSIS 9**

Lighting Analysis–Day lighting Analysis, Artificial Lighting Analysis.

Learning to work out daylight factors and artificial lighting levels either spatially or at any point.

**UNIT IV THERMAL ANALYSIS 9**

Thermal Analysis- Thermal Modelling Issues, Basic Thermal Analysis ,Advanced Thermal Analysis. Understanding how to calculate monthly heat loads and hourly temperature graphs for any zone.

**UNIT V INTEGRATED PASSIVE ENERGY STRATEGIES 9**

Cognitive ,analytical and simulated modeling and design of buildings .zero net energy (ZNE) building-Traditional buildings-electrical grid -HVAC and lighting-Net Zero Energy Building -Case studies.

**TOTAL:45 PERIODS**

**REFERENCES:**


1. Manual of the selected software – Ecotect Analysis 2011 ,TAS-version 9.2.1.6, etc
2. Energy Efficient Buildings in India,The Energy and Resources Institute, TERI, 2009.
3. Clarke, Joseph; "Energy Simulation in Building Design", Second Edition Butterworth, 2001.
4. Voss, Karsten; Musall, Eike: "Net zero energy buildings - International projects of carbon neutrality in buildings", Munich, 2011.
5. MoneefKrarti, Energy Audit of Building Systems- CRC Press, 2000
   ESRU,. Building Energy Simulation Environment; User Guide Version 9 Series. “ESRU Manual U 96/1, University of Strathclyde, Energy Systems Research Unit, Glasgow, 1996.
6. Kabele, K., “Modeling and analyses of passive solar systems with computer simulation”, in Proc. Renewable energy sources, PP. 39 – 44, Czech Society for Energetics Kromeriz 1998.

**EA7003** **ENVIRONMENTAL PSYCHOLOGY** **L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

- To introduce the students about interdisciplinary social science approaches and to explore ways that people experience environments and make decisions about them, both as individuals and also in the social contexts where environmental decision making is institutionalized.

**UNIT I INTRODUCTION TO ARCHITECTURAL PSYCHOLOGY 9**

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 thinking 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.

**UNIT II ENVIRONMENTAL AND HUMAN RESPONSE 9**

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

**UNITIII CONCEPT OF BEAUTY AND HUMAN ATTITUDE 9**

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 from ,space and attitude relations.

**UNITIV APPLICATION OF PSYCHOLOGY IN ARCHITECTURE DESIGN 9**

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 ,neighborhood in all stages of design.

**UNIT V THE PSYCHOLOGY OF SUSTAINABLE BEHAVIOR / GREEN INTERVENTIONS 9**

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.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Morgan T. of Clifford, "Introduction to Psychology", Tata McGraw–Hill publications New York, 1983
2. Kayem,S.M., "Psychologyin relation to design", Dowden, Hutchinson and Ross, 1973
3. Hall E.T."The Hidden Dimension" New York, Doubleday, 1966.
4. Canter D.V & Lee.T. Psychology and the built Environment", Architectural Press, London, 1974.
5. Proshansky. H.I Hleson. W.H."Environment Psychology-people and their physical settings", Newyork, Holt, Rinchatand Winston, 1976
6. Proshansky, H.M. 1987. "The field of environmental psychology: securing its future." 'Handbook of environmental psychology.' D. Stokols and I. Altman. New York, John Wiley & Sons.
7. Bakker, A.B. & Leiter, M.P. Work engagement; A handbook of essential theory and research. Hove: Psychology Press 2010.

**EA7004 RENEWABLE ENERGY SYSTEMS L T P/S C**
**3 0 0 3**

**OBJECTIVES:**

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications
- To analysis the environmental and cost economics of using renewable energy sources compared to fossil fuels.

**UNIT I SOLAR ENERGY 9**

Solar radiation its measurements and prediction - solar thermal flat plate collectors concentrating collectors – applications - heating, cooling, desalination, power generation, drying, cooking etc - principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, and water pumping, power generation schemes.

**UNIT II WIND ENERGY 9**

Atmospheric circulations – classification - factors influencing wind - wind shear – turbulence - wind speed monitoring - Betz limit - Aerodynamics of wind turbine rotor- site selection - wind resource assessment - wind energy conversion devices - classification, characteristics, applications. Hybrid systems - safety and environmental aspects.

**UNIT III BIO-ENERGY 9**

Biomass resources and their classification - chemical constituents and physicochemical characteristics of biomass - Biomass conversion processes - Thermo chemical conversion: direct combustion, gasification, pyrolysis and liquefaction - biochemical conversion: anaerobic digestion, alcohol production from biomass - chemical conversion process: hydrolysis and hydrogenation. Biogas - generation - types of biogas Plants- applications

**UNIT IV HYDROGEN AND FUEL CELLS 9**

Thermodynamics and electrochemical principles - basic design, types, and applications - production methods - Biophotolysis: Hydrogen generation from algae biological pathways - Storage gaseous, cryogenic and metal hydride and transportation. Fuel cell – principle of working- various types - construction and applications.

**UNIT V OTHER TYPES OF ENERGY 9**

Ocean energy resources - principles of ocean thermal energy conversion systems - ocean thermal power plants - principles of ocean wave energy conversion and tidal energy conversion – hydropower – site selection, construction, environmental issues - geothermal energy - types of geothermal energy sites, site selection, and geothermal power plants.

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Sukhatme, S.P., Solar Energy, Tata McGraw Hill, 1984**.**
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kreith, F and Kreider, J. F., Principles of Solar Engineering, McGraw-Hill, 1978.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.
5. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
6. Veziroglu, T.N., Alternative Energy Sources, Vol 5 and 6, McGraw-Hill, 1990
7. Anthony San Pietro, Biochemical and Photosynthetic aspects of Energy Production, Academic Press, 1980.
8. Bridgurater, A.V., Thermochemical processing of Biomass, Academic Press, 1981.
9. Hart, A.B., and Womack, G. J., Fuel Cells: Theory & Applications, Prentice Hall, 1997.
10. Khandelwal K.C, Mahdi S.S., Biogas Technology - A Practical Handbook, Tata McGraw Hill, 1986.

**MH7008 SUSTAINABILITY AND ENERGY CONSERVATION IN LANDSCAPE ARCHITECTURE.** **L T P/S C 3 0 0 3**

**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

**UNIT I INTRODUCTION TO SUSTAINABILITY 10**

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.

**UNIT II SUSTAINABLE SITE 7**

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.

**UNIT III INTRODUCTION TO ENERGY CONSERVATION IN LANDSCAPE 9**

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

**UNIT IV ENERGY CONSERVATION METHODS IN LANDSCAPE ARCHITECTURE-CASE STUDIES 10**

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. .

**UNIT V SUSTAINABLE LANDSCAPE PRACTICES 9**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Understanding of sustainability from macro to micro level.
- Knowledge on Energy conscious Landscape design

**REFERENCES:**


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

**MH7007 LANDSCAPE ECOLOGY AND PLANNING L T P/S C**
**3 0 0 3**

**OBJECTIVES:**

- To understand any developmental activity involves intervention in the natural processes and to minimize the impact due to this intervention.
- To outline the evolution of landscape planning, its premises and the process.

**UNIT I ECOLOGY 9**

Understanding the ecosystem and their functioning — components of ecosystem - natural process- Fundamentals of ecology - Ecological processes and dynamics– understanding ecological concepts like population growth, regulation, carrying capacity- colonization and succession - stability and resilience of ecosystem – ecosystem degradation.

**UNIT II LANDSCAPE ECOLOGY 9**

Introduction to landscape ecology – formation of various landforms – landforms and landscape process – pattern and structure of landscapes– concepts of patch, corridor and matrix - landscape dynamics and function – topological and chorological process within landscape - concept of landscape metrics – understanding dynamic interaction between landscape structure and function – ecological services of landscape.

**UNIT III LANDSCAPE PLANNING 9**

Relationship between man and nature – analytical aspect of landscape - the natural and cultural setting - evolution of landscape planning –concepts and projects of McHarg, Carl Steinite, Warren Manning, Augus Hills, Phil Lewis – Izank Zonneveld, Ervin Zube - landscape planning models – METLAND concept

**UNIT IV PROCESS IN LANDSCAPE PLANNING 9**

The purpose of landscape planning – domain and context for landscape planning – principles of planning – procedure in landscape planning - problem defining, goal setting, inventory and analysis - basic of collecting and analyzing, projecting and presenting data in landscape planning, visual assessment and aesthetic dimension.– Suitability analysis – techniques for identifying preferences - Planning options – proposing landscape plan.

**UNIT V CASE STUDIES: LANDSCAPE PLANNING 9**

Reclamation and restoration of derelict landscapes - conservation and preservation of ecological fragile areas such as wetlands, creeks etc. - conservation ordinances. Case studies on landscape regional planning - policies and landscape.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Basics of Ecology and Landscape Ecology.
- Landscape planning history, evolution, process and case studies.

**REFERENCES:**


1. Richard T.T.Forman & Michel Godron , Landscape Ecology, John Wiley & Sons; 1986
2. Tom Turner, Landscape Planning and Environmental Impact Design, UCL Press, London, 1998.
3. Ervin H. Zube, Robert O Brush, Julios G.Y.Fabos, Landscape assessment –values, perceptions, 1975.
4. G. Tyler Miller Jr., Living in the Environment: Principles, Connections, and Solutions, Brooks / Cole publishers co., 2004.
5. William M. Marsh, Landscape planning – Environmental Application, John Wiley and sons Inc., 1997.

**EA7005 ENVIRONMENTAL MANAGEMENT SYSTEMS AND AUDITING L T P/S C**
**3 0 0 3**

**OBJECTIVE:**

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

**UNIT I ENVIRONMENTAL MANAGEMENT STANDARDS 9**

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

**UNIT II PREVENTIVE ENVIRONMENTAL MANAGEMENT 9**

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

**UNIT III ENVIRONMENTAL MANAGEMENT SYSTEM 10**

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.

**UNIT IV ENVIRONMENTAL AUDIT 8**

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

**UNIT V APPLICATIONS 9**

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

**TOTAL: 45 PERIODS**

**REFERENCES:**


1. Christopher Sheldon and Mark Yoxon, “Installing Environmental management Systems –a step by step guide” Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3. ISO 19011: 2002, “Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop ‘Pollution Prevention: Fundamentals and Practice’, McGraw-Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium- Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.