PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
I. To provide students with additional knowledge and skills as an architect/researcher/teacher.
II. To enable students to add value to the process of architectural design by incorporating depth in already existing fields of study relevant to architecture.
III. To enable students to widen the scope of their professional abilities through additional fields of study that would enhance their knowledge in intellectual, creative, technical, social and environmental realms.
IV. To enable students to take independent, informed and innovative decisions within the discipline of architecture.
V. To enable students to contribute to larger society through their future career as architect/researcher/teacher.

PROGRAMME OUTCOMES (POs):
On successful completion of the programme,
1. Graduates will demonstrate an all round skill in design and research.
2. Graduates will be able to identify additional parameters/issues within the context of architectural design and resolve them.
3. Graduate will be able to resolve architectural problems with due consideration to urban issues and environmental issues.
4. Graduates will be able to bring technical expertise in analysis and synthesis.
5. Graduates will be able to apply cutting edge methods/tools/approaches in the resolution of problems.
6. Graduates will be able to bring critical thinking in the consideration of any aspect of design.
7. Graduates will be able to identify problems or create design solutions in a holistic manner.
8. Graduates will be able to contribute further to society through their design/research/teaching.
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| Project Phase II- Thesis         | ✓     | ✓   |     |     |     |     |     |     | ✓   |
ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS 2017
M.ARC. (ENVIRONMENTAL ARCHITECTURE)
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI FOR I TO IV SEMESTERS

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* Professional Training of duration minimum 4 weeks full time or 8 weeks part time to be done in a firm related to the specialization during semester vacation.

**TOTAL NO. OF CREDITS : 75**

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### ELECTIVE – V

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### PROFESSIONAL ABILITY ENHANCEABILITY COURSE (PAEC)

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OBJECTIVES:
- To sensitize the students to the linkages/relationship between energy, lifestyle, food chain and sustainability. To facilitate understanding of appropriate technologies aiding sustainability.

UNIT I  ENERGY SOURCES  08
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.

UNIT II  ECOLOGICAL PRINCIPLES  08
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.

UNIT III  ENERGY SYSTEMS AND ENVIRONMENT  09
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.

UNIT IV  GREEN INNOVATION & SUSTAINABILITY  10
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.

UNIT V  GREEN ENERGY AND SUSTAINABLE DEVELOPMENT  10
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).

TOTAL: 45 PERIODS

OUTCOMES:
- The students gain an understanding of the linkages between the ecosystem, food web and sustainability.
- The students are also to understand the renewable and non-renewable sources of energies and its effects on the environment.

REFERENCES:
1. E H Thorndike, Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
EA5102 SMART MATERIALS FOR GREEN BUILDING     L T P/S C
                                             3 0 0 3

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

UNIT I INTRODUCTION 08

UNIT II ACTUATOR TECHNIQUES 10

UNIT III STUDY OF ADVANCED BUILDING MATERIALS 07
Aluminum, glass, fabric, various types of finishes & treatments, Construction chemicals – sealants, engineering grouts, mortars , admixtures and adhesives

UNIT IV BUILDING SYSTEMS 10
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

UNIT V NANOMATERIALS AND POLYMERS 10

TOTAL: 45 PERIODS

OUTCOMES:
- The students have an understanding of smart materials and new technology in the building industry, which aids sustainability.

REFERENCES:
3. Cambridge University Press, 2001

EA5103 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  09
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  09
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-SYSTEM  09
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  08
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

OUTCOMES:
- Students are sensitized on the need for natural resource management, and sustainable lifestyles
- Students appreciate the value of ecosystem and the need and methods for conserving the same.
- Students understand how pollution and hazards can be mitigated..

REFERENCES:
5. P. D. Sharma, Ecology And Environment, Rastogi Publications, 2009
OBJECTIVES:
- 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
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
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
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
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.

UNIT V SUSTAINABLE AND GREEN BUILDING DESIGN CASE STUDIES
Instrument and natural case studies to investigate and apply various studio exercises on Green Building Design.

TOTAL: 45 PERIODS

OUTCOMES:
- The students gain an understanding of the various aspects of sustainable and green building design.
- The students are able to comprehend the Green Building rating system.

REFERENCES:
1. Brenda and Robert Vale; Green Architecture- Design for a Sustainable Future; Thames and Hudson; 1996
2. Catherine Slessor; Sustainable Architecture and High Technology- Eco Tech; Thames and Hudson; 1997
3. Daniel Vallero and Chris Brasier; Sustainable Design- The science of sustainability and Green Engineering; Wiley; 2008
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
OBJECTIVES:
• 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

UNIT II COMPONENTS AND METHODS

UNIT III IMPACT ON SOCIO-ECONOMIC SYSTEMS

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN

UNIT V SECTORAL EIA

TOTAL: 45 PERIODS

OUTCOMES:
• The students gain an understanding about the significance of environmental impact assessment.
• The students can develop the skills to prepare environmental management plan.

REFERENCES:
5. World Bank –Source book on EIA.
OBJECTIVES:
Design of small built-up spaces by taking into consideration of various climatic and environmental design principles.

Design focus:
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.

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

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

TOTAL: 150 PERIODS

OUTCOMES:
• An ability to design a building with all the due considerations of sustainable planning and design principles.
• Ability to technically quantify the sustainable design concepts

REFERENCES:
1. IS:3362-1977, Indian Standard, code of practice For Ventilation Of Residential Building
4. Steven V szokolay, 2008, Introduction to architectural science. Taylor & Francis group, UK
UNIT I  INTRODUCTION  09
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  09

UNIT III  REMEDIAL TECHNIQUES AND DISTURBANCE- BUILT ENVIRONMENT  09

UNIT IV  POLLUTION AND REMEDIES  09

UNIT V  ECOLOGICALLY DISTURBED SITES AND RESTORATION  09
Ecologically sensitive areas -Restoration ecology -Disturbances caused by built structures – from ‘cradle to grave’ –Remedial measures applicable-Fragmentation- Landscape Ecology.

TOTAL: 45 PERIODS

OUTCOMES:
• The students are to understand the factors leading to environmental disturbance and the correctives and prevents to avoid the same.

REFERENCES:

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  09
UNIT II RECYCLABLE AND RENEWABLE MATERIALS 09

UNIT III PASSIVE DESIGN IN MATERIALS 09
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 09
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 09

OUTCOMES:
- An understanding on sustainability as applicable to architecture and planning.
- Ability to critically analyse buildings with respect to sustainability.

REFERENCES:

MH5251 RESEARCH METHODOLOGIES IN ARCHITECTURE L T P/S C 3 0 0 3

OBJECTIVES
- To introduce the students to the importance of critical inquiry as a way of gaining knowledge and adding to it through research.
- To expose the students to the various forms of research and research methodologies/processes.
- To engage this understanding in the specific field of architectural research.

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

UNIT V CASE STUDIES
Case studies in the relevant discipline 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 issues relating to architecture based on research enquiry methods.
- The student will gain knowledge of different methods of conducting research and research writing.

REFERENCES
1. Iain Borden and Kaaterina Ruedi Ray; The Dissertation: An Architecture Student’s Handbook; Architectural Press; 2006
3. John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2011.
5. Ranjith Kumar; Research Methodology- A step by step guide for beginners-3rd Edition ; Sage Publications;2011
6. Wayne C Booth; Joseph M Williams; Gregory G. Colomb; ‘The Craft of Research’, 3rd Edition; Chicago guides to writing, editing and publishing;2008
OBJECTIVES:


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

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.

TOTAL: 150 PERIODS

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.

REFERENCES:

2. Steven V szokolay, 2008, Introduction to architectural science. Taylor & Francis group, UK
3. https://www.designbuilder.co.uk
# LIFE CYCLE ASSESSMENT OF BUILDINGS

## OBJECTIVES:

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

## UNIT I  INTRODUCTION AND TERMINOLOGY  08


## UNIT II  LIFE CYCLE ASSESSMENT IN BUILDING INDUSTRY  07


## UNIT III  DIFFERENT TOOLS FOR LCA  12

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

## UNIT IV  GREEN BUILDING MATERIALS SELECTION  09

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

## UNIT V  LIFE CYCLE COSTING (LCC) TOOL  09

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

## TOTAL: 45 PERIODS

## OUTCOMES:

- Understand all aspects of Life Cycle analysis of a building.
- To be able to analyse building Life Cycle with respect to sustainability

## REFERENCES:

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
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

UNIT II  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

UNIT III  ENVIRONMENTAL PLANNING AND DECISION MAKING

UNIT IV  INTRODUCTION TO ENVIRONMENTAL ACCOUNTING

UNIT V  ENVIRONMENTAL MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
- Understand Environmental laws in the Indian Context.
- Understand specific Environmental laws in special areas such a hilly areas, coastal areas etc.

REFERENCES:

EA5311 ENVIRONMENTAL ARCHITECTURE DESIGN STUDIO III  L  T  P/S  C
0 0 10 5

OBJECTIVES:
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: 150 PERIODS

OUTCOMES:
- Design buildings which are ecologically sensitive considering all traditional and contemporary principles and practices of sustainability.

EA5312 PROJECT PHASE I - 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

OUTCOMES:
- A Dissertation book which is based on accepted norms of technical writing.
- An understanding leading to formation of thesis ideas.
REFERENCES:
2. John W Creswell; Research design: Qualitative, Quantitative and Mixed Methods Approaches; Sage Publications; 2002.
4. Ranjith Kumar; Research Methodology- A step by step guide for beginners; Sage Publications; 2005

EA5412 PROJECT PHASE II - THESIS

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: 300 PERIODS

OUTCOMES:
- Students would be able to integrate various contemporary and traditional techniques of sustainability into the architectural design process.
- Students would be able to identify and go in depth into specific and appropriate environmental aspects and reflect this in the realm of design.
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

UNIT II 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.

UNIT III INTRODUCTION TO ENERGY CONSERVATION IN LANDSCAPE
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
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
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. Anne simon Moffat and marc schiler, Landscape design that saves energy, William monow and co.,Inc., New york, 1981.
5. Publications of Centre for Science and Environments, New Delhi and TERI.
OBJECTIVES:

- 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  HUMAN BEHAVIOUR  09
Atmospheric and thermal comfort, building performance, and occupant health, safety, and productivity. Factors responsible, energy systems for human comfort, PPD & PMV analysis.

UNIT II  NATURAL INFLUENCES  09
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  09
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  09

UNIT V  HUMAN COMFORT STANDARDS  09

OUTCOMES:

- Understand Human thermal response to natural elements and the influence of architectural design elements.
- Understand human thermal comfort and the means to achieving the same.

REFERENCES:

OBJECTIVES:
- Expose the students with concepts of cartography as major components of input and output related to cartography.
- To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.
- To expose the concept of quality and design of cartographic outputs in open GIS environment.

UNIT I  FUNDAMENTALS OF CARTOGRAPHY AND GIS  9

UNIT II  GIS DATA MODELS AND DATA INPUT  9

UNIT III  RASTER AND VECTOR DATA ANALYSIS  9

UNIT V  DATA OUTPUT AND WEB BASED GIS  9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall
- Acquire knowledge about cartographic principles, spatial data models and spatial analysis.
- Understand the cartographic outputs in open GIS environment.

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

### UNIT I  SOLAR ENERGY
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

### UNIT III  BIO-ENERGY
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
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
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.

### OUTCOMES:
- Understand the various types of renewable energy sources.
- Also understand the environmental and cost economics of using renewable energy sources compared to fossil fuels.

### REFERENCES:

EA5004 LANDSCAPE ECOLOGY AND PLANNING L T P/S C

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 09

UNIT II LANDSCAPE ECOLOGY 09
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 09
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 09
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 09
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:
- Understanding the basics of Ecology and Landscape Ecology.
- Knowledge about landscape planning history, evolution, process and case studies.
REFERENCES:

EA5005 ENVIRONMENTAL MANAGEMENT SYSTEMS AND AUDITING

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

UNIT I  ENVIRONMENTAL MANAGEMENT STANDARDS 09

UNIT II  PREVENTIVE ENVIRONMENTAL MANAGEMENT 09
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

UNIT IV  ENVIRONMENTAL AUDIT 08
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 09
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

OUTCOMES:
- Understand the Environmental standards as per ISO 14001 and environmental auditing systems as per ISO 19011

REFERENCES:

EA5006 ENVIRONMENTAL PSYCHOLOGY L T P/S C
3 0 0 3

OBJECTIVES:
- To impart an understanding of systems approach as per ISO 14001 and skills 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 09
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 09
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

UNIT III CONCEPT OF BEAUTY AND HUMAN ATTITUDE 09
Philosophies of beauty, aesthetics and physics, -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.
UNIT IV APPLICATION OF PSYCHOLOGY IN ARCHITECTURE DESIGN 09
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 09
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

OUTCOMES:
• Students gain knowledge of application of spatial and color psychology in architectural design.

REFERENCES:

EA5007 CARBON FOOT PRINT AND MEASUREMENT L T P/S C 3 0 0 3

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

UNIT I TRENDS IN BUILDING SECTOR EMISSION 09
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.

UNIT II GHG MITIGATION OPTIONS IN BUILDINGS 09
Energy efficiency principles, building energy management systems, -lighting systems, day-lighting, appliances, on-site power, and cost estimate of GHG mitigation in buildings.
UNIT III  LOW CARBON REFURBISHMENT IN BUILDINGS  09
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.

UNIT IV  CARBON FOOT PRINTING DURING CONSTRUCTION  09

UNIT V  ROAD MAP FOR REDUCING EMISSIONS  09
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

TOTAL: 45 PERIODS

OUTCOMES:
• Understand Human thermal response to natural elements and the influence of architectural design elements.
• Understand human thermal comfort and the means to achieving the same.

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-1)
2. What colour is your building? David H. Clark, RIBA publishing house, London-2013

EA5008  PREDICTIVE BUILDING MODELLING SOFTWARES AND PASSIVE STRATEGIES  09

OBJECTIVES:
• 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  09
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  09
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  09
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  09

UNIT V  INTEGRATED PASSIVE ENERGY STRATEGIES  09
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.

OUTCOMES:
• Students gain knowledge of predictive Modelling techniques and passive strategies for assessing the energy performance.

REFERENCES:
4. Manual of the selected software – Ecotect Analysis 2011 ,TAS-version 9.2.1.6, etc

TOTAL: 45 PERIODS

EA5009  DESIGN OF ENERGY EFFICIENT AND HEALTHY BUILDINGS  L  T  P/S  C
3  0  0  3

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.

UNIT I  HEALTHY BUILDINGS THEORY  09
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.

UNIT II  INVESTIGATIONS OF HEALTHY LIVING PRACTICES  09
Washing people, washing clothes, removing waste, improving nutrition, reducing crowding, separating people from animals, vermin or insects, reducing dust, controlling temperature and reducing trauma.

UNIT III  DESIGN OF BASIC AIR CONDITIONING SYSTEM FOR BUILDINGS  09
UNIT IV  FUNDAMENTAL PRINCIPLES OF FIRE SAFETY ENGINEERING  09
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.

UNIT V  SOURCE AND NATURE OF HAZARDOUS WASTE  09

TOTAL: 45 PERIODS

OUTCOMES:
- Understanding methods to remove pollutants from indoor environment.
- Methods to enhance IAQ

REFERENCES:

EA5010  WATER CONSERVATION PRACTICES IN BUILDINGS  L T P/S C 3 0 0 3

OBJECTIVES:
- The main objective of this course is to understand the methods for water management and conservation. An understanding of the traditional and contemporary methods of water conservation

UNIT I  WATER CONSERVATION  09
Basic concepts of soil erosion; control of soil erosion; Mechanics of wind and water erosion; water and wind erosion control practices; concept of runoff and its estimation; Design, construction and maintenance of vegetated waterways; Planning, Design, Construction and maintenance of terraces, contours and bunds; Design of water harvesting structures and farm ponds.

UNIT II  WATERSHED DEVELOPMENT AND WATERSHED MANAGEMENT  09
Concept of watershed development and management; collection of hydrological data; watershed characteristics and hydrologic cycle; problems of land degradation; Land use capability classification and topographical characteristics of watershed; Appropriate soil and water conservation measures, Hydrological and sediment monitoring of watershed; Estimation of peak design runoff rate; Planning, management and economic evaluation of watershed development projects; case studies.

UNIT III  WATERSHED PLANNING AND MANAGEMENT  09
Concept of characteristics of watershed, causes and consequences of watershed deterioration, Identification of watershed Management, people’s participation in watershed Management, Socio economic survey of watershed, Land use capability, classification, appropriate soil and water conservation measures for watershed Management, Integrated multi disciplinary approach for watershed Management.
UNIT IV  FOREST WATERSHED MANAGEMENT  09
Concept, characteristics and hydrology of forest watershed; Investigation of streams; Impact of land use changes; Deforestation, road building and other forest uses on forest stream quality and quantity; Radiation energy and water balance; Interception process and estimation; Precipitation and run-off estimation; Soil erosion in forest watershed; Selection and design of soil and water conservation structures; Simulation of hydrological processes in forest watershed.

UNIT V  WATER CONSERVATION PROJECTS  09
Procedure for planning of soil and water conservation projects; Survey and investigation; Analysis of watershed problems; Calculation techniques of different watershed parameter; Legal, organizational and financial aspects of soil and water conservation projects; Responsibilities of different operation offices; Economic and financial analyses of soil and water conservation projects; Project evaluation; Management of soil and water conservation projects; Education, training and peoples participation in watershed development projects; Case study

OUTCOMES:
• Understand methods to conserve and manage water for human consumption and other uses.

REFERENCES:
1. A Text Book of Environmental Studies edited by Dr. Shanta Satyanarayan, Dr. Suresh Zade, Dr. Shashikant Sitre, Dr. Pravin Meshram, 2009, Allied publishers.
4. Water Shed Management By Dhruvanarayan

EA5011  ENVIRONMENT, DEVELOPMENT AND DISASTER MANAGEMENT  L T P/S C
MANAGEMENT  3 0 0 3

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

UNIT I  ENVIRONMENT, DEVELOPMENT AND DISASTER MANAGEMENT – INTERFACE  06
Resource use, exploitation and conservation; Impact of human activities on environment; Environment and economy interaction, introduction to environmental accounting.

UNIT II  ENVIRONMENTAL MANAGEMENT  09
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

UNIT III  CONCEPTS OF HAZARD  12
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.

UNIT IV DISASTER MITIGATION AND MANAGEMENT

Relevance of disaster management in development and environment, disaster preparedness, prevention, displacement and development, Role and responsibilities of government and non–government organizations, Disaster Education – awareness of individuals, communities and participation at various levels; Integrating disaster mitigation in the spatial planning process, provision of infrastructure for disaster mitigation.

UNIT V 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).

TOTAL: 45 PERIODS

OUTCOMES:

• Understand the various contexts leading to disaster. Also understand the correctives to help humans and the environment bounce back to normalcy.

REFERENCES:

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 Group Publishing Limited

EA5012 NATURAL RESOURCE MANAGEMENT

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.
UNIT I INTRODUCTION TO NATURAL RESOURCE MANAGEMENT 09
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

UNIT II LAND 09
Perception of Land Degradation; Understanding the Causes of Land Degradation; Land Management Practices; Like Soil Conservation, Watershed Management, Management Issues and Challenges

UNIT III WATER 09

UNIT IV BIODIVERSITY 09
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

UNIT V WILDLIFE AND FISHERIES 09
Conserving Wildlife through Sustainable Use; The Drivers of Marine Fisheries Depletion. Current Approaches to Implementing Sustainable Fisheries Management, Management Challenges and Issues

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the various natural environmental resources and the ways to manage them.

REFERENCES:
2. Community Forest Management in Tribal States of India (with special reference to Madhya Pradesh), Daspugta S. and D. Debnath, International Book Distributors
7. Natural Resources, Agarwal et. all, International Institute for Environment & Development
8. The Science of Sustainable Development: Local Livelihoods and the Global Environment, Jeffrey Sayer, Cambridge University Press
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.

UNIT I 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

UNIT II 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

UNIT III 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

UNIT IV PLANS, POLICIES AND STRATEGIES
Related to energy planning, conservation, climate change mitigation and adaptation.

UNIT V CLIMATE CHANGE

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the various issues involved in climate change and the strategies to mitigate the same.

REFERENCES:
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 countries 2000 Spon Press, London
4. Mike Lydon David Owen Green Metropolis: Why Living Smaller, Living Closer, and Driving Less are the Keys to Sustainability
5. S.K Dash Climate change: an Indian perspective, New Delhi 2007 Cambridge University Press
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.

UNIT I  CONCEPTS OF ECOLOGY, ECOSYSTEM AND ENVIRONMENTAL PLANNING  09
History of Environmental Planning, Development of habitat patterns, settlement structure and form in response to environmental challenges; Concepts of Ecology and Ecosystem, Urban Ecosystem.

UNIT II  RESOURCE ANALYSIS AND CONSERVATION  12
Resource analysis for various ecosystems and development imperatives (land, geology, soil, climate, water, vegetation) characteristics, exploitation, causative factors for degradation, analytical techniques.

UNIT III  ENVIRONMENTAL ZONES  12
Environmental Zones (Hill, coastal, arid, characteristics, resources, settlements pattern, problems and potentials, regulating mechanisms for development.

UNIT IV  ENVIRONMENTAL POLICIES, SIGNIFICANT CONVENTIONS, CONFERENCES  06
Environmental Policies and initiatives including policies, strategies, protocols, treaties and agreements.

UNIT V  ENVIRONMENTAL LEGISLATIONS IN INDIA  06
Evolution of Indian Legislation (Brief Overview of environment related laws in India); Environmental Movements; Union Government Initiatives • Indian Environmental Acts, Laws and Notification

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the various aspects of environment and the policies for its protection.

REFERENCES:
5. V.H. Dale, Mary R. English Tools to Aid Environmental Decision Making Latest Edition Swinger
6. William Fox, Enslin Van Rooyen (eds.) The Quest for Sustainable Development 2004 Juta & Co. Ltd., Cape Town