### SEMESTER I

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*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**

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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

UNIT II  HISTORICAL PERSPECTIVE

UNIT III  GEOGRAPHICAL & CLIMATOLOGICAL INFLUENCES
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

UNIT V  CHALLENGES IN SUSTAINABLE DEVELOPMENT OF STRATEGIES FOR SUSTAINABILITY

REFERENCES:
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

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.

REFERENCES:
2. Ebenezer Howard – Garden Cities
3. Aidan William Southall, Urban Anthropology cross and Cultural Studies, Oxford Univ. Pr., 1973
5. Amitabh Shukla, Regional Planning And Sustainable Development, Kanishka Publishers, Distributors, 2000

TOTAL : 45 PERIODS
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 of the Economic base on Planning and Development.

UNIT I  INTRODUCTION
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
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

UNIT IV  DEMOGRAPHY

UNIT V  MIGRATION AND IMPACT ON URBAN DEVELOPMENT
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,

REFERENCES:
1. Economic and social development by S.L.Sinha

TOTAL: 45 PERIODS
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

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

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 DEVELOPMENT

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

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

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:

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

UNIT II
CONCEPTS AND APPROACHES TO ECOLOGICAL PLANNING
Different types of life supporting services provided by the nature. General concept of urban ecological planning. Impact of urbanization and industrialization on nature. Resiliency and Biodiversity, resources planning and climate resilient urban development.

UNIT III
HUMAN INFLUENCE ON ECO-SYSTEMS
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
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
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:
5. Tony Fry, Design Futuring: Sustainability, Ethics and New Practice, Berg, 2009 - Architecture
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

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

UNIT III REMEDIAL TECHNIQUES AND DISTURBANCE- BUILT ENVIRONMENT 9

UNIT IV POLLUTION AND REMEDIES 9

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:
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 INFLUENCES  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

UNIT V  HUMAN COMFORT STANDARDS  9

TOTAL: 45 PERIODS

REFERENCES:
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

UNIT II COMPONENTS AND METHODS

UNIT III IMPACT ON SOCIO-ECONOMIC SYSTEMS

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN

UNIT V SECTORAL EIA

TOTAL: 45 PERIODS

REFERENCES:
2. World Bank –Source book on EIA
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

UNIT II  RECYCLABLE AND RENEWABLE MATERIALS  9

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

TOTAL: 45 PERIODS

REFERENCES:

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

**TOTAL : 180 PERIODS**

**EA7301 SUSTAINABLE AND GREEN BUILDINGS**

**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
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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
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 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:
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

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

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

UNIT IV INTRODUCTION TO ENVIRONMENTAL ACCOUNTING 9
UNIT V ENVIRONMENTAL MANAGEMENT


TOTAL: 45 PERIODS

REFERENCES:

EA7311 DISSERTATION

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:
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  
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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**
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 Coordinate 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

UNIT III OVERVIEW OF REMOTE SENSING: 8

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

TOTAL: 45 PERIODS

REFERENCES
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

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.

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

UNIT IV APPLICATION OF PSYCHOLOGY IN ARCHITECTURE DESIGN
Evaluation of the satisfactory levels of a residential building. Parameters to provoke desired emotions in the built environment application of the knowledge in the design of a residence , community ,neighborhood in all stages of design.

UNIT V THE PSYCHOLOGY OF SUSTAINABLE BEHAVIOR / GREEN INTERVENTIONS
The green organizational imperative- Green work performance- The psychology of going green-Green recruitment, development and engagement-Maslow’s Hierarchy of Needs- Herberg’s Theory. The Cycle of organisational Change and Progression -Challenges to sustainability and participation.

REFERENCES:

TOTAL: 45 PERIODS
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
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.

TOTAL: 45 PERIODS

REFERENCES:
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:
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.
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

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:
- Landscape planning history, evolution, process and case studies.

REFERENCES:
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

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

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: