

Master of Architecture
In
Sustainable Architecture

Course Structure & Syllabus



Department of Architecture
National Institute of Technology Hamirpur
Hamirpur (H.P) – 177005, India

Course Structure of M. Architecture (Sustainable Architecture)

SEMESTER-I

Sr. No.	Course No.	Course Name	Teaching Schedule			Hours/week	Credit
			L	T	P/D		
1	AR-611	Sustainable Architecture Theory and Principles	4	0	0	4	4
2	AR-612	Fundamentals of Ecology	4	0	0	4	4
3	AR-613	Solar Passive Design	4	0	0	4	4
4	AR-7MN	Programme Elective-I	4	0	0	4	4
5	AR-7MN	Programme Elective-II	4	0	0	4	4
6	AR-614	Design Studio-I	2	0	4	6	4
Total			22	0	4	26	24

Programme Elective - I & II: List of Programme Electives is given in the Annexure.

SEMESTER-II

Sr. No.	Course No.	Course Name	Teaching Schedule			Hours/week	Credit
			L	T	P/D		
1	AR-621	Landscape Architecture	4	0	0	4	4
2	AR-622	Urban Design	4	0	0	4	4
3	AR-623	Energy Efficient Architecture	4	0	0	4	4
4	AR-7MN	Programme Elective-III	4	0	0	4	4
5	AR-7MN	Programme Elective-IV	4	0	0	4	4
6	AR-624	Design Studio-II	2	0	4	6	4
Total			22	0	4	26	24

Programme Elective - III & IV: List of Programme Electives is given in the Annexure.

SEMESTER-III

Sr. No.	Course No.	Course Name	Hours/week	Credit
1	AR-800	M. Architecture Dissertation	--	18
Total			--	18

SEMESTER-IV

Sr. No.	Course No.	Course Name	Hours/week	Credit
1	AR-800	M. Architecture Dissertation	--	18
Total			--	18

Total Credit of the Programme = 84

Annexure

List of Programme Electives

Programme Elective - I

- AR-711 Planning for Eco-Tourism
- AR-712 Computer Applications in Architecture
- AR-713 Architectural Conservation

Programme Elective - II

- AR-714 Traffic & Transportation Planning
- AR-715 Disaster Mitigation & Management
- AR-716 Intelligent Buildings & Futuristic Architecture

Programme Elective - III

- AR-721 GIS Applications in Architecture
- AR-722 Housing
- AR-723 Infrastructure Planning

Programme Elective - IV

- AR-724 Eco – Cities
- AR-725 Urban & Regional Planning
- AR-726 Project Management

Course Name: Sustainable Architecture Theory and Principles	
Course Code: AR-611	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To give a preview of the practices, strategies and implementation processes that shape sustainable architecture.	
Course Content	
<p>Sustainable Architecture: Theory and principles, concept of sustainable development, principles of sustainable development, indicators of sustainable development, variables of sustainability and their relation to real world with appropriate examples, use of sustainability variables in identification of sites and development of habitations, towns and cities. Watershed and its importance. An overview of vernacular hill architecture, classification of hill areas, landforms, and slope analysis. Grading on site and its constraints, slope stabilization, reasons of fragility on the hills, constraints of climate, topography and availability of materials. A broad view of traditional hill architecture and medieval European settlements and other places. Modern hills buildings of India. Carrying capacity, Ecological footprints, land capability classification, energy consumption pattern, role of TERI/GRIHA in achieving sustainability, and case study of energy efficient and sustainable buildings in India. urban forms, and sustainability of different urban and regional forms of cities, towns, and regions. Exercise for students: To identify problems related to sustainable environment/sustainability issues in local context and ways to address the issues.</p>	
Course Outcomes	
CO1: Students will be equipped with the understanding of sustainable theory and principles at both regional and local scale. Course will set a base for students in developing hill towns based on sustainable principles.	
Books and References	
<ol style="list-style-type: none"> 1. Towards Sustainable Architecture European Directives and Building Design by Edwards, Brian Butterworth Architecture, London. 2. Alternative Construction Contemporary Natural Building Methods by Elizabeth, Lynne and Adams, Cassandra, John Wiley & Sons, New York. 3. Our Fragile Heritage by Jayal, N.D. Intach Publications, Lodi Estate, New Delhi. 4. Motivation and Personality by Maslow, A., Harper and Row, New York. 5. Energy, Environment and Sustainable Development in the Himalayas by Monga, Pradeep, Indus Publishing Company, New Delhi. 6. Art and Architecture of Himachal Pradesh by Singh, Goverdhan, B.R Publishing Corporation, Delhi. 7. TERI/GRIHA manual, "Sustainable Building Design Manual- Volume I-V" by TERI, Teri Press, ND. 8. The Urban Pattern by Gallion, B. A. and Eisner, F.S, CBS Publishers & Distributors, New Delhi. 	

Course Name: Fundamentals of Ecology	
Course Code: AR-612	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
This course aims to provide students with appropriate knowledge to identify and analyse environmental problems related to built environment and implement sustainable solutions.	
Course Content	
<p>Ecological concepts: Evolution and process, eco-systems, adaptation, ecological pyramids, material cycles- carbon, nitrogen and sulphur cycles, watershed, carrying capacity, ecological footprint. Impacts of urbanization: Modifications of natural environment- causes and consequences, environmental pollution, climate change, solid waste management, water management. Environmental policies: Govt. of India policies on environment- related to hills, forest, wild life, wetlands, waste lands, and oceans, EIA and its role in environmental protection, environmental protection- natural reserves, conservation and recycling of resources. Ecological design approaches: Vulnerability analysis, ecological planning in relation to designing settlements and other man made eco-systems.</p>	
Course Outcomes	
CO1: The course will make students more sensible towards ecological vulnerability.	
CO2: It will help them in evaluating the importance of ecological impacts on both pre and post project/ design results.	
Books and References	
<ol style="list-style-type: none"> 1. Environmental protection of the Himalaya: A mountaineers view by Ali, Aamir, Indus publishing company, New Delhi. 2. The survival of the Himalaya', Eco-systems- A scenario of unsustainability by Bahuguna, Sunder Lal, Singh, TejVir, Sharma, M.L. Indus publishing company, New Delhi 3. Environmental concerns and strategies by Khoshoo, T.N., Ashish publishing house, New Delhi. 4. Fundamentals of ecology by E. P. Odum, W.B. Saunders, Philadelphia, UAR. 5. Himalaya: A regional perspective resources, environment and development by Rawat, M.S.S, Daya publishing house. 	

Course Name: Solar Passive Design	
Course Code: AR-613	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To make aware of the importance and to facilitate students with the required knowledge of passive solar architecture, passive systems including modern and postmodern passive architecture.	
Course Content	
Introduction of passive solar architecture, appreciation of built form for different climates, building clusters and solar exposure, thermal environment. Types of passive systems; direct gain, thermal storage wall, attached green house, thermal storage roof and convective loop. Classification of passive cooling systems according to the major natural source. Minimizing cooling needs by building design; building shape & layout, orientation, size of windows, shading of window, color of the envelope and climatic impact of plants around building. Radiative cooling; Earth as a cooling source for buildings. cooling of attached outdoor spaces. Passive solar configuration; outline of various passive systems for heat gain, indirect gain, trombe wall, water wall and trans wall. sun space , solarium, conservatory, roof pond ,skytherm, vary thermal wall, earth sheltered ,earth bermed structures and earth-air tunnels. The use of earth-air tunnels to heat or cool the buildings. Modern and postmodern passive architecture; methods, strategies, systems, and construction details emphasizing the passive architecture and nonactive services.	
Course Outcomes	
CO1: Students will get detailed knowledge about the importance of passive solar architecture and passive systems design at various building typologies.	
Books and References	
<ol style="list-style-type: none"> 1. Passive and low energy cooling of buildings by Givoni Baruch, Van Nostrand Reinhold, New York. 2. Solar passive buildings by Sodha, M., Bansal, N. K., Bansal, P. K., Kumbhkar, A., and Malik, M. A. S., Pergamon press, Oxford. 3. Passive buildings design: A hand book of natural climatic control by Bansal Narendra, K., Hauser Gerd and Minke Gernot, Elsevier science, Amsterdam. 4. Energy in architecture by Goulding, John, R., Lewis, Owen, J., and Steemers, Theo, C., Bastford Ltd., London. 	

Course Name: Design Studio – I	
Course Code: AR-614	
Course Type: Core	
Contact Hours/Week: 2L + 4P	Course Credits: 04
Course Objectives	
This studio intends to facilitate students with the required knowledge and skills and preparing a neighbourhood design with sustainable development strategies.	
Course Content	
Design studio that explores vernacular strategies for sustainable practices, design, theoretical and technological issues that focus for proper scientific architectural thought and practice toward energy efficient and environmental friendly solutions. This studio design approaches sustainable development for buildings by examining physiology required for human function and then by considering how building components and systems affect human performance and wellbeing. Sustainable development starts with site planning and evaluation, and proceeds through construction, commissioning, and occupancy phases. The studio includes many case studies of historic and contemporary structures exemplifying various energy and sustainability features.	
Course Outcomes	
CO1: Students will be able to implement sustainable development strategies in designing and preparing a neighbourhood design as a self sustainable unit.	
Books and References	
<ol style="list-style-type: none"> 1. Government of India, Urban and regional development plans formulation and implementation (URDPFI) guidelines. Vol. 1, Town and country planning organisation, Ministry of urban development, New Delhi. 2. Manitoba intergovernmental affairs and city of winnipeg’s planning, Property and development, Department of planning and land use division, A guide for developing neighbourhood plan. 3. Site planning and design handbook by R.Thomas Russ, Mcgraw Hill Publications. 4. Rural development principles, policies and management by Singh.K, Sage Publications, Pvt. Ltd, New Delhi. 	

Course Name: Landscape Architecture	
Course Code: AR-621	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
This course is aimed at providing a comprehensive knowledge regarding ecological aspects and environmental concerns in landscape architecture besides the advanced knowledge of basic elements of landscape design.	
Course Content	
Introduction (history, nature and scope). Exposure to historical landscape (English, French, Italian, Chinese, Japanese, Mughal, and ancient India), elements of landscape : natural (earth forms, water, and vegetation) and manmade, open space design, purpose of designed open space, and analysis of various kinds of open spaces. Site analysis and site planning . Ideas of Kevin Lynch, Ian Mcharg, Gorden Cullen, Geoffrey Jellicoe on natural and built environment. Contemporary landscape design projects in India. Case studies of varied urban situations. Landscape design proposal based upon the above mentioned analysis as a studio exercise.	
Course Outcomes	
CO1: This course will give advanced knowledge and idea about various landscape principle applicable at site analysis and site planning stages.	
Books and References	
<ol style="list-style-type: none"> 1. Landscape Architecture by Simonds, John Ormsbee, McGraw-Hill New York. 2. Introduction to Landscape Design by Motloch, John L., John Wiley and Sons, New York. 3. Site Engineering for Landscape Architects by Kurt, Nathan, Strom et al. AVI Publishing Co; Connecticut. 4. Flowering trees by Randhawa MS, National Book Trust, New Delhi India. 5. Landscape design with Plants by Clouston Brian, Van Nostrand Reinhold Company, New York. 	

Course Name: Urban Design	
Course Code: AR-622	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
This course is aimed at providing a comprehensive knowledge regarding understanding the principles and applications of urban design.	
Course Content	
<p>Urban design concept: Role and scope, urban morphology, urban structure, urban form, visual and performance analysis of city, impact of factors such as climate, economy, politics, religion and regional.</p> <p>Urban transformation: Compression of time and space and birth of suburbia- edge city and peripheral city, study of urban developments like Brasilia, Canberra and Chandigarh. Humanizing city: City and human network- Gender issue, elderly people and child, inclusive cities, resilient cities, gentrification, city riots and crime. Neighborhood planning: Concept of urban redevelopment, urban renewal and urban rejuvenation, study of existing urban developments, futuristic city, eco city, new urbanism and smart city.</p>	
Course Outcomes	
CO1: Detailed discussion on various contents will enable the student in understanding the need and role of public realm in sustainable design.	
Books and References	
<ol style="list-style-type: none"> 1. The image of the city, Kevin A. Lynch, MIT 2. Urban Design: Green Dimensions by J. C. Moughtin , Peter Shirley,Rouledge. 3. A new theory of urban design ,Center for environmental structure series, Vol 6(1986) by Christopher Alexander, HajoNeis, Artemis Anninou, , Ingrid King. 4. The concise townscape by Gordon Cullen , Architectural press 5. The urban design handbook: Techniques and working methods byurban design associates, W.W.Norton & Company. 6. Urban design: Street and square by J. C. Moughtin, Architectural press. 7. Urban Spaces, No. 4 by John Dixon, Visual references publications. 8. Good city form by Kevin A. Lynch, MIT press 9. Urban design- Architecture of towns and cities by Paul D. Spreiregen, McGraw- Hill Inc. 	

Course Name: Energy Efficient Architecture	
Course Code: AR-623	
Course Type: Core	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To make familiarize with and providing a comprehensive knowledge anout the role of energy in built environment and the efficient use of energy in design process, to the students.	
Course Content	
<p>Elements of climate: global climatic factors, classification of climates, bioclimatic classification of India. Introduction of microclimate and the role of landscape and other passive devices for climatic control. Energy conservation through site selection, planning and design; siting and orientation. Detailed study of climatic design of indigenous shelters in response to different climatic zones of India. Building envelope, and fenestrations. Introduction to design of shading devices; overhangs; factors that affect energy use in buildings; ventilation and its significance. Relevance of energy conservation, Energy Conservation Act 2001, introduction to BEE, building envelope design as per energy conservation building code using prescriptive and trade off method. Introduction to simulation software for carrying out thermal design of buildings and predicting performance, materials and construction techniques for achieving energy efficiency. Day lighting concepts, and energy efficient illumination. study of the various green rating systems.</p>	
Course Outcomes	
CO1: Students will be able to design energy efficient built spaces on the basis of knowledge augmented during this course.	
Books and References	
<ol style="list-style-type: none"> 1. Manual of Tropical housing and Building by Koenigsberger Ingersoll et al. Longman Group Ltd. London now published by Orient Longman Ltd., Madras, India. 2. Design with climate: bioclimatic approach to architectural regionalism by Olgyay, V., Princeton University Press. 3. Climate responsive architecture: a design handbook for energy efficient buildings by Krishan, A., Tata McGraw-Hill Education. 4. Bureau of Energy Efficiency, “Energy Conservation Building Code 2017”, Ministry of Power, Govt. of India. 5. Bureau of Indian Standards, “SP 41: Handbook on Functional Requirements of Buildings (Other than Industrial Buildings)”, Bureau of Indian Standards, New Delhi 	

Course Name: Design Studio- II	
Course Code: AR-624	
Course Type: Core	
Contact Hours/Week: 2L + 4P	Course Credits: 04
Course Objectives	
This studio provides exposure to sustainable building design and enables students to understand the context, building physics and energy efficiency.	
Course Content	
Design Studio where students learn and refine their architectural design skills, and required to incorporate the knowledge gained from theory courses into the design solutions. Typically, at the end of the design studio, each student or team is required to explain the key concepts and the integrated design philosophy with the supporting program of diagnostic and computational tools. A wide covering topics such as energy efficiency, life-cycle cost analysis, building physics, building diagnostics, role of building and energy appliance codes, and energy policy in designing sustainable buildings with the help of laboratory and simulation software tools. As a part of their involvement, students are required to actively participate in all lectures, discussions, readings, assignments, and design tasks as a class group and/or individually. The design work must be actively in progress on a daily basis for data collection and development of design.	
Course Outcomes	
CO1: Students will be able to design various built forms based upon the concepts of sustainability and integrated design philosophy.	
Books and References	
<ol style="list-style-type: none"> 1. Paul Rough guide to sustainability by Edwards, Brian and Hyett, RIBA. 2. Grace Sustainable practices in the built environment by Langston, Craig A. and Ding, Butterworth-Heinemann. 3. Passive and Low Energy Cooling of Buildings by Givoni Baruch, VNR, New York. 4. Understanding Sustainable architecture by Martin J Gainsborough, Radford and Helen Bennets, T J Williamson, Spon Press, London. 	

Course Name: Planning for Eco Tourism	
Course Code: AR-711	
Course Type: Programme Elective I	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To understand the concepts and strategies for planning and development of ecotourism.	
Course Content	
<p>Introduction to tourism: Definitions, scope, nature, classification and dimension, tourism as an industry, and tourism in developed and developing world. Relationship between tourism and urban development, tourism multiplier and forecasting methods: capacity building and carrying capacity planning for tourism projects, tourism and cultural and social change: Socio-cultural problems, and environmental degradation.</p> <p>Introduction to ecotourism: Types of ecotourism. Understanding the natural potentials of different regions and to exploit them for tourism, and approaches to ecotourism. Costs and benefits of ecotourism. Cases of ecotourism around the world, issues of cultural tourism, policies and laws relating to ecotourism.</p> <p>Community involvement in ecotourism. Enterprise establishment and management. Current ecotourism trends.</p>	
Course Outcomes	
CO1: This course will lay foundation for improving design skills for towns having potential for heritage, environmental, religious, educational and recreational tourism.	
Books and References	
<ol style="list-style-type: none"> 1. Culture on tour: ethnographies of travel by Bruner, E.M., The University of Chicago Press. 2. The Earthscan reader in sustainable tourism by France, L. editor, London: Earthscan Publications. 3. Social change and conservation: environmental politics and impacts of national parks and protected areas by Ghimire, K.B. and M. Pimbert, London: Earthscan Publications. 4. Ecotourism & certification: setting standards in practice by Honey, M., Washington, D.C.: Island Press. 5. Sustainable tourism: a marketing perspective by Middleton, V, Woburn, Butterworth-Heinemann. 	

Course Name: Computer Applications in Architecture	
Course Code: AR-712	
Course Type: Programme Elective I	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To acquire proficiency in creating three dimensional objects in space, which can also be used for the purpose of presentation as well as visualization using different rendering techniques.	
Course Content	
Basics of computer; Introduction to latest software for computer applications, advanced techniques in report writing, presentation and tabulation softwares. Computer aided drafting (CAD) ; Fundamental and advanced commands, working layouts. Report making ; Photo editing softwares 3D modelling ; Generating models, editing and rendering.	
Course Outcomes	
CO1: Improved skills in graphic presentation and stimulation of design.	
Books and References	
<ol style="list-style-type: none"> 1. Fundamentals of MS Office Douglas, Mark., Connell, Gretchen, Kendall Hunt Pub Co, Dubuque, IA 2. Mastering AutoCAD 2010 by Geroge, Omura, CBS Publication, New delhi. 3. Official Courseware of Revit architecture by Autodesk. 	

Course Name: Architectural Conservation	
Course Code: AR-713	
Course Type: Programme Elective I	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To equip students to deal with Architecture conservation, along with the related design issues of existing architecture, old monuments, and natural and urban heritage areas.	
Course Content	
Introduction to the concepts of conservation, restoration, redevelopment, revitalization, and adaptive reuse . Approach to conservation in India and other countries. Examples of conservation of historic monuments, inner city areas and other natural elements. Role of conservation in socio-economic development and tourism infrastructure development. Institutional aspects of conservation and charters. Study of materials and technologies and there usage for various conservation measures. Conservation project on the basis of above mentioned studies as a studio exercise.	
Course Outcomes	
CO1: This course will lay foundation for improving design skills for buildings/ built environment having potential for heritage, environmental, cultural and architectural conservation.	
Books and References	
<ol style="list-style-type: none"> 1. Putting Conservation Into Local Plans And Ordinances by G. Arendt Randall, Growing Greener, Island Press. 2. Protecting the Land: Conservation Easements Past, Present, and Future by Gustanski. Julie Ann, Hocker. Jean, Squires. Roderick, Island Press. 3. The New Eco-Architecture: Alternatives from the Modern Movement by Porteous. Colin, Taylor and Francis. 4. Architecture in Existing Fabric: Planning, Design, Building by Breitling. Stefan , Cramer .Johannes, Birkhausern Basel 5. Urban Neighbourhood Revitalization and Heritage Conservation: The Architecture of Urban Redesign by Ugochukwu Chukwunyere C., Edwin Mellen Press Ltd. 	

Course Name: Traffic & Transportation Planning	
Course Code: AR-714	
Course Type: Programme Elective II	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
<p>To make aware of the aspects of planning for traffic and transportation, such as urban sprawl, and the linkages between city and region.</p> <p>To provide exposure to the planning processes and Models.</p>	
Course Content	
<p>Transport and socioeconomic activities, historical development of transport, urban and regional transport system, freight transportation, and future developments. Role and importance of transport in national development. Traffic characteristics, traffic and transportation surveys & analysis, geometric design of roads & intersection, and road capacity. Urban traffic problem, traffic management, traffic & environment. Transport planning process, transportation system analysis, evaluation and choice, and sequence of activities involved in transport analysis. Transport Related land use models.</p>	
Course Outcomes	
CO1: This course will give advanced knowledge and idea about various transportation planning principles at site and city level planning.	
Books and References	
<ol style="list-style-type: none"> 1. Traffic Engineering, by Roger P. Roess, Elena S. Prassas, and William R. McShane. 2. Principles of Urban Transport Systems Planning, by Hutchinson, B.G. Mc Graw Hill Book Company, New York. 3. Traffic Transportation and Urban Planning by George Godwin, International Forum Series. 4. Transportation Engineering and Planning by Papacostas, C.S., and Prevedouros, P.D., Prentice- Hall of India Pvt Ltd. 5. Transportation, Traffic Safety and Health - Prevention and Health by Hans v. Holst, Ake Nygren, and Ake E. Andersson, Third International Conference, Washington. 	

Course Name: Disaster Mitigation & Management	
Course Code: AR-715	
Course Type: Programme Elective II	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To let the students understand the type of in natural disasters and its effects on structural and non-structural elements. To understand the mechanism involved in the management of disasters, and techniques related to it.	
Course Content	
Concepts of disaster; Types of disaster: Natural and manmade, cyclone, flood, land slide, land subsidence, fire and earthquake. Issues and concern for various causes of disasters. Management issues related to disaster; Mitigation through capacity building, legislative responsibilities of disaster management, disaster mapping, assessment, pre-disaster risk & vulnerability reduction, post disaster recovery & rehabilitation. disaster related infrastructure development, disaster management, mitigation, and preparedness. Techniques of monitoring and design against the disasters; Remote-sensing and GIS applications in real time disaster monitoring, prevention and rehabilitation.	
Course Outcomes	
CO1 : The knowledge gained during this course will help in creating resilient community designs at both neighbourhood and city level.	
Books and References	
<ol style="list-style-type: none"> 1. Vulnerability atlas of India by BMTPC, GOI, India. 2. Disaster management by Ghosh, G.K., A.P.H. publishing corporation, New Delhi. 3. Encyclopaedia of disaster management by Goel, S. L., Deep & Deep publications Pvt Ltd, Delhi. 4. Disaster management - Recent approaches by Arvind Kumar, Anmol publications, Delhi. 5. Disaster management by Narayan, B., A.P.H. publishing corporation, New Delhi. 	

Course Name: Intelligent Buildings & Futuristic Architecture	
Course Code: AR-716	
Course Type: Programme Elective II	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
This course provides exposure on future trends of architecture and its practice, intelligent building systems, energy optimization strategies.	
Course Content	
Future concepts envisioned by earlier theorists and architects like Antonio Saint Elia and F.L. Wright. Evolution of contemporary architectural concepts -Historical revival, biomimicry ,adaptive reuse ,low-cost buildings, building tectonics and systems. Review of design philosophy of present and future architecture ; Futuristic needs and culture affecting forms of architecture, futuristic building forms and architectural systems, futuristic building materials, construction and technologies. Study of emerging architectural paradigms ; Programme generated architecture, dynamic architectural systems, virtuality, trans architecture and data driven structures. Intelligent buildings systems and information architecture ; Integration of various services, stocks and flow of information through building, energy optimization strategies through building management systems. Role of Intelligent Building Systems ; Sustainable buildings, energy efficiency, zero energy buildings and resource conservation.	
Course Outcomes	
CO1 : Developed knowledge of sustainable buildings, energy efficiency, zero energy buildings and futuristic architectural systems.	
Books and References	
<ol style="list-style-type: none"> 1. Intelligent Buildings: Design Management and Operation by Clements, Derek, Croome, Thomas Telford, Ltd. 2. Visionary Architecture: Unbuilt Works of the Imagination by Burden, Ernest, McGraw-Hill Professional. 3. Intelligent Building and Building Automation by Shengwei Wang , Spon press. 	

Course Name: GIS Applications in Architecture	
Course Code: AR-721	
Course Type: Programme Elective III	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To provide exposure to the emerging concepts and role of GIS Applications concerning current and future development.	
Course Content	
Introduction, various GIS packages and their salient features , geographical coordinate systems, map projections, projected coordinate system, geo relational vector data model, concepts of topology, object based vector data model, raster data model, elements of raster data model, data conversion, integration of raster and vector data, data input, geometric transformation, spatial data editing, data exploration, vector and raster data analysis, role of remote sensing in GIS, applications of GIS for various natural resources mapping, monitoring, and analysis for design and planning applications.	
Course Outcomes	
CO1: Course will develop the concepts on the role of GIS application in sustainable design.	
Books and References	
<ol style="list-style-type: none"> 1. Digital Elevation Model Issues in Water Resources Modeling. in Hydrologic and Hydraulic Modeling Support with Geographic Information Systems by Garbrecht, J., Martz, L.W., ESRI Press 2. Confronting Catastrophe: A GIS Handbook. By Greene, R.R., ESRI Press. 3. Arc Hydro: GIS for water resources. by Maidment, D.D., ESRI Press. 4. Introduction to Geographical Information systems by K.T. Chang, McGraw Hill Education. 	

Course Name: Housing	
Course Code: AR-722	
Course Type: Programme Elective III	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To equip students to deal with housing, along with the related issues of existing housing stock and its future requirement.	
Course Content	
<p>Introduction to housing & human settlements; settlements in the development of human civilization, role of housing in social and economic development of the nation. Housing demand; qualitative and quantitative. Housing situation; Impact of industrialization and urbanization ,housing density as related through environmental and climatic aspects of housing, location aspects and layouts. Housing policies; housing finance, resources mobilization, housing, institutions, housing co-operatives, housing programs and schemes-national and local level. Principles & standards; Development concepts and human settlement planning, housing design typologies housing design, socio economic and physical factors, partial and integrated environment quality, post occupancy evaluation, housing satisfaction, housing demand and policy analysis.</p>	
Course Outcomes	
CO1 : Students will understand the importance of housing sector and urban development.	
Books and References	
<ol style="list-style-type: none"> 1. Time Saver Standards for Housing and Residential Development by Chiara, J. D., Julius, P. and Zelnik, M., McGraw Hill. 2. The Architecture of Affordable Housing by Sam Davis, University of California Press 3. Housing and Dwelling: Perspectives on Modern Domestic Architecture by Barbara Miller Lane , Routledge. 4. National Building Code, 2005 National Housing and Habitat Policies, 1998, 2007 (urban), Govt of India. 5. Hand Book Of Low Cost Of Housin,by Lal, A.K, New Age Publishers. 	

Course Name: Infrastructure Planning	
Course Code: AR-723	
Course Type: Programme Elective III	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To provide exposure to infrastructure and its sub-sectors relevant to physical planner in planning and design of urban and regional Infrastructure.	
Course Content	
<p>Elements of physical infrastructure: Water supply, drainage, sewerage, solid waste management electricity, other utilities and services, data requirements for programme planning of urban network and services, feasibility planning studies and structuring the infrastructure systems. Planning of water supply; Resource analysis, quality of water, system design, technological choices and alternatives, issues related to the choice of centralized city water supply system versus decentralized systems. Waste generation processes ; Waste water disposal system , storm water drainage system. system designs, nodal facilities, technological and environmental considerations. Solid waste disposal and management ; Resource recovery technology options and determinants of type choice of systems as related to land use, density, economy levels and location of urban industrial and commercial activity areas. Planning for fire protection; services and space standards, fire fighting and renewable energy sources.</p>	
Course Outcomes	
CO1 : Students will be able to integrate physical infrastructure in developing sustainable design strategies at local and regional level.	
Books and References	
<ol style="list-style-type: none"> 1. Infrastructure Planning Handbook: Planning, Engineering, and Economics Alvin Goodman, Makarand , McGraw- Hill Professional. 2. The Urban Pattern by Gallian, Arthur B. & Eisner, Simon (1963), D.Van Nostrand Company,Inc., New York 3. Infrastructure Development Finance Company (2007), “India Infrastructure Report, 2007: Rural Infrastructure”. 	

Course Name: Eco-Cities	
Course Code: AR-724	
Course Type: Programme Elective IV	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To provide exposure to the emerging concepts and issues concerning eco-cities, sustainable city development, and sustainable communities.	
Course Content	
Introduction to eco-city, carbon-neutral and renewable energy production, public transportation systems , resource conservation (water and energy), waste management and its reuse, urban farming, urban infill , walkable urbanism. Obstacles, social factors of sustainable cities, discussion on international and national eco-cities. Economic, social, and environmental qualities of an eco-city. Sustainable communities : basic principles and strategies, systems thinking and strategies; race, class, and equity; place based learning and planning; and social capital and community empowerment. Urban eco-design , integrating nature and urban life, building healthy community systems, transforming community systems. Sustainable city development : participatory planning, land use, poverty and racism, green economy, local food systems, nature in the city, healthy neighborhoods, transportation/access, housing, energy systems, bio diversity etc., green urbanism, learning from the existing cities .	
Course Outcomes	
CO1: Detailed discussion on various contents will enable the student in understanding the need and role of eco-city design ideas in sustainable design development.	
Books and References	
<ol style="list-style-type: none"> 1. Bio polis: Patrick Geddes and the City of Life by Welter, Volker, MIT Press. 2. Car free Cities by Crawford, J. H., International Books. 3. Cities for a Small Planet by Rogers, Richard, Westview Press. 4. The City After the Automobile: An Architect's Vision by Safdie, Moshe, Westview Press. 5. The City in Mind: Notes on the Urban Condition by Kunstler, James Howard, Touchstone Books. 6. Crabgrass Frontier: The Suburbanization of the United States by Jackson, Kenneth T., Oxford University Press. 7. Eco-City Dimensions: Healthy Communities, Healthy Plants by Roseland, Mark, New Society Publishers. 8. From Eco-Cities to Living Machines: Principles of Ecological Design by Todd, John, North Atlantic Books. 9. The Ecological City: Preserving and Restoring Urban Biodiversity by Platt, Rutherford H., University of Massachusetts Press. 10. Gaviotas: A Village to Reinvent the World Weisman by Alan, Chelsea Green Publishing Company. 11. The Geography of Nowhere: The Rise and Decline of America's Man-Made Landscape Kunstler by James, Touchstone Books. 12. Home from Nowhere: Remaking Our Everyday World for the 21st Century Kunstler by James Howard, Touchstone Books. 13. Human Settlements and Planning for Ecological Sustainability: The Case of Mexico City by Pezzoli, Keith, MIT Press. 	

Course Name: Urban & Regional Planning	
Course Code: AR-725	
Course Type: Programme Elective IV	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To provide exposure to students on the concepts of urban and regional planning, urban development plans, and planning practices in India.	
Course Content	
Goals & objective, methodology of goal formation, five-year plans, development plan, structure plan, local plan, district plan, action area plan, public participation, regional plans. Urban development plans , structure plans: types, scope, comprehensive planning, structure planning, strategic planning, physical surveys for planning, landuse, density, national policy on urban settlement. Planning practices in India, classification of regions, regionalization and delineation techniques of various types of regions.	
Course Outcomes	
CO1: This course will give advanced knowledge and idea about various urban & regional planning concepts for sustainable city planning and design.	
Books and References	
<ol style="list-style-type: none"> 1. New town planning: principles and practice by Golnay, John Wiley & Sons, Inc., New York. 2. Introduction to city, designing the new city: a systematic approach by Gibson, J.B, John Wiley & Sons, Inc., New York. 3. The Urban Pattern by Gallian, Arthur B. & Eisner, Simon D. VanNostrand Company, Inc., New York. 4. Urban and Regional Planning by Peter, Printies Hall. 	

Course Name: Project Management	
Course Code: AR-726	
Course Type: Programme Elective IV	
Contact Hours/Week: 4L	Course Credits: 04
Course Objectives	
To impart knowledge on the onsite problems related to building construction and causes of delay in construction, as well as to inculcate the skills as a team manager.	
Course Content	
<p>Introduction and definitions of project management; Type and nature of project, project objectives and formulation, preparation of pre-feasibility and detailed project reports. Components of construction project; Formulation of stages and significance, construction team formulation and role of owner, an architect, consultant and contractor in construction management. Methods of feasibility studies; Finance, environment and social, cost estimates, economic and financial analysis, internal rate of return, cost benefit analysis. Role of financial institutions in project financing and sources of finance project planning; Background of network charts, and bar charts, program evaluation and review techniques (pert), drawing and development of critical path method (cpm) for project management. resources scheduling methods through bar charts, cpm and line of balance method. Methods of inspection and quality control; project implementation methods and management, project management agencies, public hearing process. Contract –types, preparation of contract documents general conditions of contract, interim certificates defect liability period, retention amount and virtual completion,duties and liabilities of architects, contractors. articles of agreement, execution of work payment and arbitration. Tenders – types and the process of calling, security and selection system, pre-tender qualifications and registration of contracts, office organizations and management, role of design staff and supporting managerial staff and personal management.</p>	
Course Outcomes	
CO1 : Students will learn and gain knowledge about practical implementation of design projects and responsibilities as a team manager.	
Books and References	
<ol style="list-style-type: none"> 1. The Engineering and Constructive Contract by Proceedings of The Institutions of Civil Engineers. 2. American Society of Civil Engineers, “Quality in the Constructed Project- A Guide for Owners, Designers and Constructors”, Vol.-I, Manual No. 73. 3. Effective Project Management: Traditional, Adaptive, Extreme by Robert K. Wysocki,Wiley. 4. A Guide to the Project Management Body of Knowledge by Project Management Institute, Pmbok Guide. 	