

**AFFILIATED INSTITUTIONS  
ANNA UNIVERSITY, CHENNAI  
M.ARCH. (REAL ESTATE DEVELOPMENT)  
R-2013**

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

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
<b>THEORY</b>						
1.	RE7101	Introduction to Real Estate Development and Design	3	0	0	3
2.	RE7102	Urban Policy and Development Regulation	3	0	0	3
3.	RE7103	Urban Design, Retrofitting and Adaptive Reuse	3	0	0	3
4.	RE7104	Construction Planning, Scheduling and Control	3	0	0	3
5.		Elective – I	3	0	0	3
<b>STUDIO</b>						
6.	RE7111	Project – I (Corporate Development, Land Development)	0	0	12	6
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>

**SEMESTER II**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
<b>THEORY</b>						
7.	RE7201	Real Estate Finance	3	0	0	3
8.	RE7202	Law Relating to Land and Property Procurement	3	0	0	3
9.	RE7203	Management Information System for Real Estate Business	3	0	0	3
10.	RE7204	Valuation and Arbitration in Real Estate	3	0	0	3
11.		Elective – II	3	0	0	3
<b>STUDIO</b>						
12.	RE7211	Project – II (Mega Project Township Land and Building)	0	0	12	6
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>

**INTERNSHIP - 4 WEEKS DURING SUMMER VACATION**

**SEMESTER III**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
<b>THEORY</b>						
13.	RE7301	Turnkey Approach To Corporate Commercial and Residential Development	3	0	0	3
14.	RE7302	Construction Project Management	3	0	0	3
15.	RE7303	Contract Law and Regulation	3	0	0	3
16.	RE7304	Project Formulation and Appraisal	3	0	0	3
<b>STUDIO</b>						
18.	RE7311	Dissertation	0	0	6	3
19.	RE7312	Project – III (Specialized Activities SPV – Infra structure / SEZ)	0	0	12	6
<b>TOTAL</b>			<b>12</b>	<b>0</b>	<b>18</b>	<b>21</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
20.	RE7411	Thesis	0	0	22	11
21.	RE7412	Seminar / workshop (on selected theme for each scholar)	0	0	2	1
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>
<b>Total no of credits required for the award of the degree</b>			<b>75</b>			

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

### LIST OF ELECTIVES FOR M.ARCH – (REAL ESTATE DEVELOPMENT)

#### SEMESTER – I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
22.	RE7001	Elements of Sociology and Economics	3	0	0	3
23.	RE7002	Developmental Economics	3	0	0	3
24.	RE7003	Capital Markets and Real Estate	3	0	0	3
25.	RE7004	Ecology and Landscape	3	0	0	3

#### SEMESTER – II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P/S	C
24.	RE7005	Services in High Rise Building Development	3	0	0	3
25.	RE7006	Heritage Properties and Conservation Practices	3	0	0	3
26.	RE7007	Environmental Impact Assessment Techniques.	3	0	0	3
27.	MH7202	Performance Evaluation of Buildings.	2	0	2	3

**AIM:**

To create an interface between real estate development as a continuous process and design as an input into such process.

**OBJECTIVES:**

- To understand land as a resource.
- To appreciate the role of team work to make a successful project
- To provide adequate inputs so as to make to the whole development as a smooth activity and ultimately be aware of the tactical aspects of marketing the completed property.

<b>UNIT I</b>	<b>CONCEPTS</b>	<b>4</b>
Fundamental Concepts & Techniques involved in Real Estate Development Process		
<b>UNIT II</b>	<b>EVENTS AND PRE PROJECT STUDIES</b>	<b>6</b>
Modeling Sequential events in real estate development process – Site evaluation – Land Procurement – Development Team assembly – market study		
<b>UNIT III</b>	<b>DEVELOPMENT PLANNING &amp; APPROVAL PROCESS</b>	<b>10</b>
Identifying technical inputs required, planning objectives, front end clearances from various authorities, timing of the project and scheduling.		
<b>UNIT IV</b>	<b>CONSTRUCTION &amp; PROJECT MANAGEMENT</b>	<b>10</b>
Identifying the elements of infra structure and the resource mobilization, disaggregating the project components, mobilizing the human and fiscal resources procuring and storing materials.		
<b>UNIT V</b>	<b>PROJECT MARKETING &amp; HAND-OVER OF THE COMPLETED PROJECT</b>	<b>15</b>
Communication tools required for presenting the project, In house sales promotion, franchisee system, joint venture and sharing issues, procedure and laws relating to transfer of completed project.		

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Gerald R Cortesi, "Mastering Real estate principles" (2001); Dearborn Trade Publishing, New York, U.S.A.
2. Fillmore W Galaty, "Modern Real estate practice" (2002); Dearborn Trade Publishing, New York, U.S.A.

**REFERENCES**

1. Tanya Davis, "Real estate developer's handbook", (2007), Atlantic pub company, Ocala, USA.
2. Mike .E. Miles, "Real estate development – Principles & Process 3<sup>rd</sup> edition, (2000); Urban Land Institute, ULI – Washington DC
3. Richard B Peiser & Anne B. Frej, "Professional real estate development" – The ULI guide to the business – (2003), Urban Land Institute U.S.A.

**AIM:**

To obtain an overview of the policy implication at national and state level and their relevance at the micro level.

**OBJECTIVES:**

- To understand the implications of the urbanisation on urban land.
- To capture the form and pattern of cities growth and market prices.
- To provide inputs for keeping tag of quality even while trying to make profit taking note of various regulatory regimes on land and development present in the country.

**UNIT I UNDERSTANDING URBAN GROWTH 9**

Basics of Urban Planning - dynamic forces driving Urban growth – Urban spatial configuration. Regional influences on settlement hierarchy.

**UNIT II LOCATIONAL DETERMINANTS 6**

Land use structure – Community & Neighbourhood Dynamics - Urban Land rent & Location Theories

**UNIT III QUALITY OF DEVELOPMENT 10**

Urban Quality – degeneration – Urban Renewal – regeneration - Sustainable development

**UNIT IV URBAN POLICIES 10**

Government Policies – on public & private housing – Urban Fiscal Policies – Property Taxation – local Govt. Finance – Public policies on land & real estate, Land acquisition & alienation, Land pooling, Plot Reconstitution, TOD, TDR & Premium FSI and their implications – Impact of Govt. Regulations

**UNIT V PUBLIC PRIVATE PARTICIPATION 10**

System drawn and informal participation, various models of public participation, participatory plan formulation, resource mobilisation, maintenance and management.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. David T Betto, "The Voluntary city Markets, Communities & Urban Planning" (2006)
2. Frieden, Bernard & Lyne Sagalyn, "Entrepreneurial cities & market developers, deal making, getting & spending", (1990) MIT. Press, U.S.A

**REFERENCES**

1. Jonathan Barnett; "Urban design as a public policy", (1974), McGraw Hill book co; New York.
2. Robert Freestone; "Urban Planning in a changing world – the 20<sup>th</sup> century experience 2000; Taylor & Francis pub. U.K.
3. John Ratcliffe; "Urban Planning & Real estate development, (2004); Taylor & Francis pub. U.K.

**AIM:**

To impress upon the professionals to look at the Real Estate from a broader perspective of urban aesthetics rather than islands of excellence / dreary development.

**OBJECTIVES:**

- To provide adequate inputs to understand the larger implications of the property as an integral part of the urban fabric.
- To demonstrate the value addition to property development by adhering to urban aesthetics as a leverage for price mechanism.
- Emphasizing the need for sustainability of the existing morphology through adaptive reuse pr prolonging the life for longer time with consistency in price.

**UNIT I INTRODUCTION TO URBAN DESIGN THEORY 6**

City as a three – dimensional entity, study of volumes & open spaces, a brief historic review of the development of the urban design discipline and principles.

**UNIT II ELEMENTS OF URBAN DESIGN 10**

Urban form as determined by the inter-play of masses, voids, building typology, scale, harmony, symmetry, colour, texture, light & shade, dominance, height, urban signage & graphics, organization of spaces & their articulation in the form of squares, streets, vistas & focal points, image of the city & its components.

**UNIT III PHYSICAL & NON –PHYSICAL DETERMINANTS OF URBAN FORMS 10**

Activity & Morphology of space, form, size & structure of cities, related geometry co-related with their determinants, case studies of urban design characteristics of cities in India & abroad, issues for public intervention.

**UNIT IV RETROFITTING OF BUILDINGS / PROPERTIES AND ADAPTIVE REUSE 10**

Methods & mechanisms – Urban Renewal – Rehabilitation, Redevelopment & Conservation – Basic principles, values, conservation importance of sites, area, typology, techniques of conservation.

**UNIT V CASE STUDIES 9**

Legal & administrative aspects, policies, charters, case studies of proposals for conservation / adaptive reuse from India & Abroad.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Jonathan Barnett, “Designing cities without designing building”, (1982), Harper & Row, New York.
2. Edmond Bacon, “Design of cities”, (1976), revised edition, Viking Penguin Inc; U.S.A.

**REFERENCES**

1. Jon Lang, “Urban design” – a typology pf procedures & products 2005, Glsevier, North America.
2. Gcoffrey Broadbent, “Emerging concepts in Urban Space Design-(1995), Jayker & Fravels.
3. Cliff Monghtin, “UD-Street & Square,” (2003), Architectural Press.

**AIM:**

To emphasize the need to integrate the building design process into development cycle.

**OBJECTIVES:**

- Packing adequate knowledge to work with multi disciplinary team.
- To make aware of the scheduling and accounting issues which will affect the cost.
- Capacity to identify and develop the data base for quality, control and safety.

**UNIT I CONSTRUCTION PLANNING****8**

Basic concepts of development of construction plans – Choice of Technology & Construction method - defining Work Tasks – Precedence relationships among activities – Estimating Activity Durations – Resource requirements for work – Coding Systems.

**UNIT II SCHEDULING PROCEDURE & TECHNIQUES****12**

Relevance of Construction Schedule – Critical Path method – Calculations for critical path Scheduling – Presenting Project Schedules – Activity Float. Critical Path scheduling for activity - on –node with leads. Lags & Windows – Calculations for scheduling with lags & windows – resource oriented Scheduling – scheduling with resource constraints and precedence – use of advanced scheduling techniques – scheduling with uncertain durations – calculations for Monte – Carlo Schedule Simulations – crashing and time-cost trade-offs – scheduling in poorly structured problems – improving the scheduling process.

**UNIT III COST CONTROL MONITORING & ACCOUNTING****10**

The cost control problem – the project Budget – Forecasting for activity cost control – Financial accounting systems and cost accounts – Control of project Cash Flows – Schedule control – Schedule & Budget Updates – Relating cost & Schedule information.

**UNIT IV QUALITY CONTROL & SAFETY DURING CONSTRUCTION****7**

Quality & Safety Concerns in construction – Organising for Quality & Safety – work and material specifications -Total quality control – quality control by statistical methods – statistical quality control by sampling and Variables – Safety.

**UNIT V ORGANISATION & USE OF PROJECT INFORMATION****8**

Types of project information – accuracy and use of information – computerized organisation & use of information – organizing information in databases – relational model of databases – other conceptual models of databases - centralized databases. Management systems – databases & application programmes - Information transfer and flow.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. John Rodger Illingworth, (2000), "Construction methods & Planning", Taylor & Francis, U.K
2. Frank Harris, "Modern Construction management", (2006), Blackwell publishing, U.S.A.

**REFERENCES**

1. Jimmie W. Hinze, "Construction planning & scheduling" (1997), Pretince hall. USA.
2. Calin M Popescn, "Project Planning, Scheduling & Control in Construction (1995), John Wiley & Sons. USA.
3. James O' Brien, "CPM in Construction Management" (2006) McGraw hill, USA.

<b>RE7111</b>	<b>PROJECT – I (CORPORATE DEVELOPMENT LAND DEVELOPMENT)</b>	<b>L T P/S C 0 0 12 6</b>
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Projects on Corporate Development as well as Land Development to sensitize students to the issues of land and corporate development is to be undertaken

**TOTAL: 180 PERIODS**

<b>RE7201</b>	<b>REAL ESTATE FINANCE</b>	<b>L T P/S C 3 0 0 3</b>
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**AIM:**

To provide an insight into the financial aspects of Real estate.

**OBJECTIVES:**

- Basic analytical methods for investment and financing in properties.
- Influences of international modes of decision making.
- Understanding risks in real estate as a tool in mortgaging and investment performance.

<b>UNIT I</b>	<b>FUNDAMENTAL CONCEPTS</b>	<b>8</b>
Principles, analytical methods and tools useful for making investment and finance decisions regarding individual properties (Commercial, Industrial, Residential)		

<b>UNIT II</b>	<b>NON CONVENTIONAL FINANCE</b>	<b>7</b>
Institutional real estate decision making (pension funds, banks, life insurance companies, investment trusts, joint venture)		

<b>UNIT III</b>	<b>RISK ANALYSIS</b>	<b>10</b>
Forecasting cash flows and estimating risk in real estate investments		

<b>UNIT IV</b>	<b>SECURITIZATION</b>	<b>10</b>
Development of real estate securitization and structured financing including mortgage contract – Mortgage and options including calculation of various durations to evaluate risk sharing		

<b>UNIT V</b>	<b>PRICING AND BENCH MARKING</b>	<b>10</b>
Equilibrium pricing of assets clauses – investment performances measurement – bench marking – counseling for purchase and sale.		

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Terrence M Clairtie, “Real estate finance: Theory & practice”, (2005), Prentice hall, U.S.A
2. Steve Bergsman, “Maverick real estate financing”, (2006), John Wiley & Sonss Inc, New Jersey, U.S.A.

**REFERENCES**

1. David Falk; “The fundamentals of Real estate finance”, (2005).USA
2. Ira Nachem, The complete guide to “Financing real estate development” 2007- Mc Graw hill companies, USA.
3. Nathan. S. Collier, “Construction finding – the process of RE development, Appraisal & finance (2007); John Wiley & Sons Inc; New Jersey.

<b>RE7202</b>	<b>LAW RELATING TO LAND AND PROPERTY PROCUREMENT</b>	<b>L T P/S C</b>
		<b>3 0 0 3</b>

**AIM:**

Introducing the various laws that affect land and property.

**OBJECTIVES:**

- To expose to land ownership, transfer, lease and mortgage regulations.
- Development control rules as the affect the property market.
- To relate the land use to property market.

<b>UNIT I</b>	<b>REGULATORY REGIME</b>	<b>9</b>
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Laws and regulatory Framework – Understanding and appraisal of the regulatory regime

<b>UNIT II</b>	<b>REGISTRATION</b>	<b>10</b>
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Law of Property, examining the rules relating to the transfer of land, the system of registration of title, co-ownership of land - Land title – Tenancy

<b>UNIT III</b>	<b>TRANSFER OF PROPERTY</b>	<b>10</b>
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Property – Possession – transfer of Property – rights – leases – mortgage

<b>UNIT IV</b>	<b>DEVELOPMENT CONTROL</b>	<b>10</b>
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Controls on land use – Land use regulations – ordinances – subdivision rules – Principles and procedures on Land Acquisition & Land ceiling act.

<b>UNIT V</b>	<b>LAWS SUPPORTING PLAN IMPLEMENTATION</b>	<b>6</b>
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Town and country planning Act, municipalities and local bodies act, Acts relating to environmental quality and infra structure development.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Judith – Anne Mackenzie, “Text book on Land Law”, (2004), Oxford University Press, U.K.
2. Kevin J Gray, “Elements of land law”, (2004), Lexis Nexis, U.K.

**REFERENCES**

1. Kendem adward Digby, “An introduction to the history of the law of real property” (2005), the law book exchange Ltd. UK.
2. V.G. Ramachandran, “Law of land acquisition & compensation, 8<sup>th</sup> edition, 2000, Eastern Book Company, Lucknow.
3. K.C. Gopalakrishnan, “Legal Economics (Interactional Dimensions of economics and Law), (1998) ed; reprinted (2005), Eastern Book Company, Lucknow.

<b>RE7203</b>	<b>MANAGEMENT INFORMATION SYSTEM FOR REAL ESTATE BUSINESS</b>	<b>L T P/S C</b>
		<b>3 0 0 3</b>

**AIM:**

To develop a comprehensive global information system in the area of Real estate business.



## OBJECTIVES:

- To develop easily updatable and retractable information system Architecture for Real estate business.
- Modular system for each layer of the business cycle.
- Conceiving and put in practice the facility management for managing different types of property.

### UNIT I INTRODUCTION TO INFORMATION SYSTEM 4

Information Systems – Establishing the framework – Business model – Information system architecture – Evolution of Information Systems

### UNIT II SYSTEM DEVELOPMENT 9

Modern Information System – System development Life cycle – Structured Methodologies – Designing computer based methods – Procedures, control, designing structured programme – development of urban forms, Land use planning process, property development process.

### UNIT III INFORMATION SYSTEMS 15

Integrated construction management Information System – Project Management Information System – Functional Areas – Finance, Marketing, Production – Personnel Levels – DSS, EIS, ES-Comparison, and Concepts & Knowledge Representation – Managing International Information System – Property & Facility Management – Management of different types of property developments – formulating management plan – Tools & Techniques in managing physical assets – corporate business plan.

### UNIT IV IMPLEMENTATION & CONTROL 7

Control & testing - Detection of error – validating – Cost Benefit Analysis – Assessing the value & risk of Information System – Outsourcing – benchmarking.

### UNIT V SYSTEM AUDIT 10

Software engineering qualities – Design –Production & Service – Software Specification – Software metrics – Software quality assurance – systems methodology – objectives – time & logic – Knowledge & Human Dimension – Software lifecycle models – Verification & Validation.

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Michael E Whiteman, “The handbook of Information systems research”, (2004), Idea group Inc (IGI), U.S.A.
2. Hossein Bidgoli, “Intelligent Management support systems’, (1998), Quorum, Greenwood. UK.

## REFERENCES

1. Mark Rowh, “Careers in R.E, 2002, Mc – Graw hill professional, NT.
2. Peter Wyatt, “GIS in land & property management, 2003, Taylor & francis.
3. Jmaes. O’ Brien, “M.I.S” (2008) Mc. Graw Hill , USA.

RE7204

VALUATION AND ARBITRATION IN REAL ESTATE

L T P/S C  
3 0 0 3

## AIM:

Build up a cadre of professional Architects for valuation and arbitration in the long run.

**OBJECTIVES:**

- To teach the techniques of valuation of properties.
- To provide the required input to create space for specialization in this area.
- To strengthen the defence in presenting the procedural rules, dispute resolution.

**UNIT I FUNDAMENTAL PRINCIPLES AND CONCEPT OF VALUE 7**  
Open market value – Property and Property Market – Property as an Investment.

**UNIT II NATURE AND SCOPE OF VALUATION 9**  
Valuation function – Role and functions of valuer – Scope – Value Theory – Process.

**UNIT III DETERMINATION OF VALUES 9**  
Techniques to determine the values for loan, sale and insurance – Professional standards – report writing – Leasehold Valuation – different methods.

**UNIT IV EVALUATION OF INCOME AND PROPERTY 10**  
Discounting and compound interest – Income Estimation and forecasting – debt financing – capitalization and discount rates – tax considerations – introduction to mortgage equity analysis – financial residual techniques.

**UNIT V ARBITRATION 10**  
Arbitration agreement – statement of defense – proceedings – Arbitral Body – Multi – party Arbitration – Independence of arbitrators – acceptance – forwarding act – procedural rules – disputes – settlements – arbitral award – Time Limit – Contents of award – Costs of Proceedings.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. “Valuation of Immovable properties” (Under Direct Taxes) edn(2002), Grish Chand Gupta, Bharath Law House, New Delhi-83.
2. “Law Relating to Arbitration and A.D.R, New Edn(2002), N.K. Acharya’s Asia Law House, Hyderabad, India.

**REFERENCES**

1. Ko Wang, Real estate valuation theory, (2001) Kluwer Academic publishers, S. America.
2. Howard C Gelbtuch, “Real estate valuation in global markets”, (1997), Appraisal institute.
3. Aswanth Damodaran, Investment Valuation (2002), John Wiley & Sons, UK.

**RE7211 PROJECT – II (MEGA PROJECT TOWNSHIP L T P/S C**  
**LAND AND BUILDING) 0 0 12 6**

Large scale corporate, commercial & mixed use of development including issues involved in various stages of construction, financial implications and saleability.

**TOTAL: 180 PERIODS**

**INTERNSHIP**

During the summer, students are placed into an internship / practical experience. This provides a unique opportunity for the students to gain hands- on work experience in the real estate industry, with a company in the same area as their desired career path. The Real Estate Internship Program aims to provide real world learning experience of both the private & public real estate organizations. Industry specialization areas include development activities, professional consultancy services, fund management as well as policy exposure in Government agencies

**AIM:**

To create a platform for encoring qualified professionals to take up Turkey developments.

**OBJECTIVES:**

- To acquire additional skills from being a mere designer to negotiator and a person capable of conflict resolutions.
- Adequately equipped to manage properties and provide advice on strategic planning of real estate investment.
- To get know about the leverage the real estate could provide in the overall development process.

**UNIT I****9**

Real Estate Marketing & Negotiation – Fundamentals of Real Estate Marketing & Negotiation – concepts - Principles & Practices in marketing & testing of various types of real estate developments. Nature of real estate conflicts – disputes - negotiation theory - principles - skills - Practice & application of negotiation skills.

**UNIT II****8**

Real Estate Management – Basic concepts and fundamental principles of property & facility management – tenure arrangements – Relevant Legislations – Ownership – Management of different types of Property developments

**UNIT III****10**

Real Estate Practice & Ethics – Exploring common business forms – development of real estate practices – legal - ethical duties of a real estate professional – strategic planning – marketing professional services – professional liability – ethical theory – ethical issues in real estate business – expert witness in court testimonies.

**UNIT IV****10**

Real Estate Investment – Skills to analyse a real estate investment problem – real estate investment objectives – leasing structure – property income analysis – characteristics of real estate returns and risks – financial leverage – after tax returns – diversification – equity versus debt investment – analysis of real estate asset – portfolio performance – real estate equity investment strategies.

**UNIT V****8**

Turnkey Approach – System - contractual actions – testing - training – logistical - operational support – procurement process – management contract –licensing

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. David M Geltener - Commercial Real estate Analysis & Investments (2000), South western Educational Publication.
2. CT. Walker, "Privatised infrastructure: The Build, Operate, Transfer approach", (1995), Thomas Telford, Publishing, Westminster, London..

**REFERENCES**

1. JW Rully, "The language of Real estate, ", (2000), Dearborn Real estate education, Chicago.
2. Mathew S Chan, Real estate partnership & alliance, Ascend beyond Publishing, Columbus, USA.
3. Robert Alan Corporate Real estate Development (1976), Rovwan & Littlefield Publication.

**AIM:**

To be capable of appreciating the construction related issues that are to be kept in mind while in the business of real estate.

**OBJECTIVES:**

- Knowledgeable enough to advise clients on selection of professional services.
- Operationalising the design and construction through scheduling the construction activity.
- Be clear about cost control methods and their implication in reality market.

**UNIT I****9**

The Owner's Perspective – Introduction – project life cycle – major types of construction – selection of professional services – construction contractors – functioning of constructed facilities - legal and regulatory requirements – the changing environment of the construction industry – the role of project managers

**UNIT II****9**

Organising for Project Management – What is project management – trends in modern management – Strategic planning and project programming – Effects of project risks on organization – organisation of project participants – traditional designer – constructor sequence - professional construction management – Owner – builder – operation – turnkey operation – leadership and motivation for the project team – Interpersonal behaviour in project organisation – perceptions of owners and contractors

**UNIT III****9**

The design and construction process – design and construction as an integrated system – innovation and technological feasibility – design methodology – functional design – physical structure – geotechnical engineering – investigation – construction site environment – value engineering – construction planning – Industrialized construction and Prefabrication – Computer aided engineering.

**UNIT IV****9**

Labour, Material and Equipment Utilization – Historical perspective – Labour production – factors affecting job site – Productivity – Labour relations in construction – Problems in collective bargaining – Materials management – Materials procurement and delivery Inventory control – Tradeoffs of cost in material management – Construction Equipment – Choice of Equipment – Standard production rates – Construction Processes – Queues and Resource Bottlenecks.

**UNIT V****9**

Cost Estimation – Costs associated with construction facilities – Approaches to cost estimation – Type of construction – Cost estimates – Effect of scale on construction cost – Unit cost – Method of Estimation – Methods for allocation of Joint costs – Historical cost data – Cost indices – Applications of Cost Indices to estimating – Estimate based on Engineers List of Quantities – Allocation of Construction costs over time – Computer aided Cost estimation - Estimation of Operating costs.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Frank Haris, Modern Construction Management (1988), Vlackwell Publications, U.K.
2. Richard H Clough Construction Project Management (2000), John Wiley & Sons, U.S

## REFERENCES

1. Denny Mc George & Angela Palmer, "Construction Management", (2002), 2<sup>nd</sup> ed. Blackwell science, Oxford.
2. P.K. Joy Construction Management (2005) Macmillan, New Delhi.
3. B. Sengupta & H Guha Construction management and Planning (1995), Mc Graw Hill publishing company ltd, New Delhi.

RE7303

## CONTRACT LAW AND REGULATION

L T P/S C  
3 0 0 3

### AIM

To develop understanding and skills to provide advise to the client in this area.

### OBJECTIVE

- Construction contracts, bidding evaluation.
- Legal requirements of land and its development.
- Adequately informed to overcome labour related issues.

### UNIT I

9

Construction Contracts – Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents- International Contract document - Standard Contract Document – Law of Torts.

### UNIT II

9

Tenders – Prequalification – Bidding – Accepting – Evaluation of Tender Form – Technical – Contractual – Commercial points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines

### UNIT III

9

Arbitration – Comparison of actions and laws – Agreements – Subject Matter - Violations – Appointment of Arbitrators - Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Endorsement of Award – Costs.

### UNIT IV

9

Legal Requirements – Insurance and Bonding – Laws governing sale- Purchases and use of Urban and Rural land – Land revenue codes- Tax Laws – Income tax – Sales tax – Excise and customs duties and their influence on construction –costs – Legal Requirements of Planning – Property Law – Agency Law – Local Government laws for Approval – Statutory Regulations

### UNIT V

9

Labour Regulations – Social Security – Welfare Legislation – Laws relating to wages – Bonus and Industrial disputes – Labour Administration – Insurance and safety Regulations – Workmen's Compensation Act – Other Labour Laws.

**TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Barlow Burke, "Law of R.E brokers", 1992, Aspen Publications.
2. James Karp, RE law, 2003, Dearborn Real estate education.

### REFERENCES

1. Catherine Ellioth, Contract Law (2003) Longmen Publications.
2. Richard Willmot Constructions Contracts – Law & Practice (2006), Oxford University Press, U.S.A.
3. Daniel F Hinkel, "Practical R Elano", 2003, Thomas Delimar Learning.

**AIM**

Confidence building for making the projects saleable, ultimately.

**OBJECTIVES**

- To prepare projects based on realizable cost and targets within the stipulated time.
- To develop skills for the smooth implementation.
- To be capable of appraising the project proposals from the financial cost and benefit angles of the concerned company / organisation.

**UNIT I****9**

Project Formulation / Planning – Methodology for project identification & formulation, detailed project report, feasibility studies, techniques of financial appraisal, payback period, IRR, DCF, NPV, CBR, financial cost – benefit analysis – economic cost benefit analysis.

**UNIT II****6**

Pre – Implementation Planning Phase – Work breakdown structure – network analysis – CPM, PERT, resource leveling and allocation, time – cost trade –off aspects.

**UNIT III****9**

Introduction to project management – Importance of project management – reasons for shortfall in performances – scientific management – life cycle of a project.

**UNIT IV****12**

Project Management – Planning & Control, Human Aspects – Development of project networking-critical path, PERT & CPM, Project organization, contracting, Procurement and recruitment Budget,, Fund flow statement, stabilization & finish. Organisation of project , matrix organization, task forces, project teams, monitor & control of project, Project management strategies, tools & techniques, Classical persuasive & non- persuasive techniques. New techniques of management by Objectives (MBO). Integrated reporting system, flow diagrams, bar charts, milestone charts, CPM & PERT.LOB... Techniques of monitoring of development works – standard oriented cost control, turn key system, vertical production method, inventory cost control techniques & unified status, index techniques. Project monitoring – Management Information Systems, Environmental care, Safety.

**UNIT V****9**

Project Appraisal Techniques –Technical, Financial, Organisational criteria. Appraisal Criteria (NPV/B/C. Ratio / I.R.R – Financial Analysis –Capital Costs, Financial plans, Operation costs, Projections of costs & revenues, Financial Viability, Debt servicing, Tariff & Revenues, Income & Expenditure Statements, Project balance sheets, Rate of returns. Special Cost benefit Analysis – Rationale for SCBA, UNIDO Approach.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. GE Greer, "Investment analysis for R E decision", (2003), Dearborn R E education.
2. K.Lyons, Impact assessment & project appraisal, (2001), Beach tree publishing, England.

**REFERENCES**

1. UNIDO (1972) "Guidelines for project evaluation", UN, New York.
2. N. Imboden, A Management appraisal to Project Appraisal & Evaluation (1978), Development centre, Paris.
3. Punekar S.D, Aspects of evaluation & Project Appraisal, Popular Prakashan Pvt. Ltd.

**RE7311**

**DISSERTATION**

**L T P/S C**  
**0 0 6 3**

The dissertation provides scope for independent study opportunity to explore specific areas of interest pertaining to Real Estate Development. The scholar shall select a topic of his / her choice with the approval of the HOD and write a comprehensive discourse.

**TOTAL: 90 PERIODS**

**RE7312**

**PROJECT – III (SPECIALIZED ACTIVITIES  
SPV – INFRA STRUCTURE / SEZ)**

**L T P/S C**  
**0 0 12 6**

A project on specialized activities, SPV (Special Purpose Vehicle) – Infrastructure and the Special Economic Zone (SEZ) is to be undertaken

**TOTAL: 180 PERIODS**

**RE7411**

**THESIS**

**L T P/S C**  
**0 0 22 11**

Thesis gives an opportunity to the scholar to showcase his / her prowess in the genesis and conceptualisation of the all round competence in real estate design. It is a normal seminal work culminating into a comprehensive real estate design and development. The integration of the implementation process, shall be demonstrated in the ultimate analysis.

**TOTAL: 240 PERIODS**

**RE7412**

**SEMINAR / WORKSHOP (ON SELECTED THEME  
FOR EACH SCHOLAR)**

**L T P/S C**  
**0 0 2 1**

A seminar / project on any one of the following topics is to be presented

**TOTAL: 30 PERIODS**

**(Any one)**

**1. NEW TOWN & INFRASTRUCTURE PROJECT**

**UNIT I**

**9**

Rationale for Planning for New Communities – location criteria for Township and New towns – Concept of Townships and Newtown Plans – Exposure to international examples, planning standards and norms

**UNIT II**

**9**

Planning for communication – Telecommunication – cable T.V., -Wireless – digital – inter and intranet facilities – outline of transportation and networking in urban areas.

**UNIT III**

**9**

Planning for Social Infrastructure – Health – Education – Religion – Recreation – Cultural – Planning standards – spatial standards – Hierarchy of provisions – Types of Units and scales - Critical issues in Public and private development – ownership – management and maintenance

**UNIT IV** 9  
Economics of services and networks – Infrastructure pricing and financing – tax and grant – user charges – public – private partnership – BOT, BOLT, BOOT etc. – Municipal bonds – subsidies

**UNIT V** 9  
Capacity building - Environmental issues –Sustainability concerns Review of programs of DFID, WORLD BANK in India

### **3. PRINCIPLES OF INSURANCE AND LOSS ASSESSMENT**

**UNIT I** 10  
Introduction to Financial Planning – Communication and Internal Analysis

**UNIT II** 12  
Risk – The problem of risk – Introduction to risk management – Risk management application – managing personal and property based risks - Risk assessment: rating and underwriting.

**UNIT III** 10  
The impact of competition on pricing; the impact of legislation.

**UNIT IV** 7  
Insurance – the insurance device – introduction to private insurance – insurance on the person – Personal property and Liability insurance – Social insurance – insurance programs.

**UNIT V** 6  
Legal principles of contracts: insurance contracts

### **3. ADVANCED CONSTRUCTION TECHNIQUES**

**UNIT I** 12  
Substructure Construction – Box Jacking – Pipe Jacking – Underwater Construction – Construction of Diaphragm walls and basement – Tunneling techniques – piling techniques – driving well and caisson – sinking cofferdam – cable anchoring and grouting – driving diaphragm – sheet piles – laying operations for built – up offshore system – shoring for deep cutting – large reservoir construction with membranes and earth system – well points – dewatering and stand by plant equipment for underground open excavation

**UNIT II** 9  
Superstructure Construction – Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction – for continuous concreting operation – in tall buildings – of various shapes – and varying sections – launching techniques – suspended formwork

**UNIT III** 9  
Erection techniques of tall structures – large span structures – launching techniques for heavy decks – in situ pre - stressing in high rise structures – aerial transporting – handling – erecting light weight components on tall structures – erection of lattice towers - rigging of transmission line structures – construction sequences in cooling towers – silos – chimneys – skyscrapers – bow string bridges – cable stayed bridges



**UNIT IV** **9**  
 Advanced techniques in offshore construction practice – construction sequences and methods in domes and pre - stressed domes - support structure for heavy equipment and conveyor machinery in heavy industries – erection of articulated structures – braced domes and space decks.

**UNIT V** **6**  
 Repair Construction – Mud Jacking grout thro’ slab foundation – micro piling for strengthening floor and shallow profile - pipeline laying – protecting sheet piles – screw anchors – sub grade waterproofing – advanced techniques and sequence in demolition and dismantling.

**RE7001** **ELEMENTS OF SOCIOLOGY AND ECONOMICS** **L T P/S C**  
**3 0 0 3**

**AIM:**  
 To look at the real estate development within social, economic frame work of the community it serves.

- OBJECTIVES:**
- Understanding the social values and life styles.
  - Urbanization and socio – economic issues of employment, demand for space in human settlements.
  - Appreciating the formal and informal mechanism in real estate resulting out of socio economic characteristics.

**UNIT I** **DEFINITION AND SCOPE OF SOCIOLOGY** **10**  
 Basic concepts in the study of the society – ethnic groups – social groups – social institutions – social stratification - order and change – social control - Effects of physical environment on behavior. Sociology of India – Basic features of the Indian Society and culture – language, religion, caste and tribes. Social problems of the urban community – crime, delinquency and violence.

**UNIT II** **URBAN AND RURAL VARIATION** **6**  
 Rural community and relationship with the urban community. Neighbourhood concepts – implications & limitations in the Indian context.

**UNIT III** **URBAN AND INDUSTRIAL SOCIOLOGY** **9**  
 Urbanisation and its social aspects – rural – urban migration, Concept of industrial society, social aspects of industrialization.

**UNIT IV** **DEFINITION & SCOPE OF ECONOMICS** **10**  
 Central problems of economics, micro and macro economic decisions. Production – theory, factors and the scale of production. Internal – external economics – division of labour, Theory of demand – supply – market mechanism – imperfection of competition.

**UNIT V** **ECONOMIC DEVELOPMENT & ROLE OF THE GOVERNMENT** **10**  
 Theory of income, employment, money, national income (GNP, NNP), -Fiscal policy – inflation – Indian financial institutions. Problems of economic growth, development, characteristics of under – developed economics, balanced growth and industrialization, population problems, technological change and innovations, long term economic plans, economics of urbanization and real estate.

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. Jens Beckert, “International Encyclopedia of economic sociology”, (2006), Routledge, Oxford, U.K.
2. Raghbendra Jha, “Modern Public Economics”, (1997), Routledge, Oxford, U.K.

## REFERENCES

1. C.N. Shankar Rao - Sociology – An Introduction to Social Thought (2002) Chand & Co. New Delhi
2. Introduction to Sociology, Kitab Mahal New Delhi, Vidya Bhusan & D.R.Sachadew (2005).
3. K.K DEWETT, Modern Economic Theory (2002), Shyamal Charitable Trust, New Delhi.

RE7002

DEVELOPMENTAL ECONOMICS

L T P/S C  
3 0 0 3

### AIM:

To see the links between macro economic non spatial decisions on property development and the demand spectrum.

### OBJECTIVES:

- Inputs in Development economics.
- Poverty as an inevitable aspect of development spectrum.
- Human development factors at national and international level and economic growth.

### UNIT I BASIC PRINCIPLES AND CONCEPTS 10

The Meaning and Measurement of Economic Development - Economic Development in Historical Perspective - Characteristics and Institutions of Developing Countries – global change - Theories of Economic Development

### UNIT II POVERTY ALLEVIATION & INCOME DISTRIBUTION 7

Poverty, Malnutrition, and Income Inequality - micro enterprises, policies and schemes of poverty alleviation under five year plans.

### UNIT III FACTORS OF GROWTH 10

Population and Development - Employment, Migration, and Urbanization - Education, Training, and Human Capital - Capital Formation, Investment Choice, Information Technology, and Technical Progress - Entrepreneurship, Organization, and Innovation - Natural Resources and the Environment: Toward Sustainable Development.

### UNIT IV THE MACROECONOMICS AND INTERNATIONAL ECONOMICS OF DEVELOPMENT 9

Monetary, Fiscal, and Incomes Policy, and Inflation - Balance of Payments, Aid, and Foreign Investment - External Debt Crisis - International Trade

### UNIT V DEVELOPMENT STRATEGIES 9

Development Planning and Policy Making: The State and the Market - Stabilization, Adjustment, Reform, and Privatization

**TOTAL: 45 PERIODS**

### TEXT BOOKS

1. James M Cypher, "The Process of economic development", (2004), Routledge, U.K.
2. David Boyce Hamilton, "Evolutionary economics a study of change in economic thought", (1991), Transaction publishers, U.S.

### REFERENCES

1. Hollis Burnley, T.N. Srinivasan & Jere. R. Behrman, "Handbook of development economics, (1995), Elsevier, Amsterdam.
2. Gerald. M. Merier & Joseph M. Stiglitz, "Frontiers of development economics", 2001, Oxford University press, New York.
3. John.F. Mc Donald & Daniel P. Mc Millen, "Urban economics & real estate – Theory & Policy", (2007) – Blackwell Publishing, U.K.

<b>RE7003</b>	<b>CAPITAL MARKETS AND REAL ESTATE</b>	<b>L T P/S C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>		<b>9</b>
Globalization of capital markets – impact on real estate finance and investment – institutional investors – portfolio investment		
<b>UNIT II</b>		<b>9</b>
Capital theory and trade-offs over time – financial markets and economic efficiency – discounting – present value – compound interest arithmetic		
<b>UNIT III</b>		<b>9</b>
Financial Markets – Investment strategies – market hypothesis – innovations – Tobin’s Q – Portfolio selection. Investment Criteria – Present value – internal rate of return		
<b>UNIT IV</b>		<b>9</b>
Capital asset pricing theory – Asset allocation strategies – risk diversification – multi asset portfolios – benefits of capital market integration		
<b>UNIT V</b>		<b>9</b>
Development of real estate investment trusts (REIT) industry – development of market for real estate debt securities.		

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Nathan S. Collier, Courtland, A Collier, Don A Halperin, Construction Funding, John Wiley & Sons, Inc. 2007
2. Richard B Peiser with Anne B Frej, Professional Real Estate Development, ULI-The Urban Land Institute 2007
3. Gary W Eldred, The Beginner’s Guide to Real Estate Investing, John Wiley & Sons, Inc. 2008.

<b>RE7004</b>	<b>ECOLOGY AND LANDSCAPE</b>	<b>L T P/S C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>		<b>9</b>
Ecology – Fundamentals of ecology - ecological processes – ecology of growth – ecological communities – limiting factors – ecosystem inertia and resilience		
<b>UNIT II</b>		<b>9</b>
Landscape Planning & Developmental Projects – Impact of human activities – Introduction to EIA – Application of the techniques to large scale developments		
<b>UNIT III</b>		<b>9</b>
Landscape planning and Recreation - National parks – protective designations – bio-diversity – biosphere reserves – concepts of eco-tourism – sustainable tourism		
<b>UNIT IV</b>		<b>9</b>
Landscape assessment techniques – Basic quantitative methods of collecting, analyzing – projecting and presenting data – landscape planning – visual assessment – aesthetic dimension		
<b>UNIT V</b>		<b>9</b>
Landscape Conservation – Reclamation – restoration of derelict areas – conservation and preservation of fragile and eco-sensitive areas – case studies.		

**TOTAL: 45 PERIODS**

**REFERENCES:**

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

**RE7005 SERVICE IN HIGH RISE BUILDING DEVELOPMENT L T P/S C  
3 0 0 3**

**UNIT I INTRODUCTION 6**  
Standards of high rise buildings – aspects and integration of services – relative costs – Concepts of intelligent architecture and building automation.

**UNIT II WATER COLLECTION SYSTEMS 10**  
Water storage and distribution – planning and design – selection of pumps – rainwater harvesting – sewage collection systems – recycling of water – solid waste disposal.

**UNIT III HVAC, ELECTRICAL AND MECHANICAL SYSTEMS 10**  
Natural and Mechanical ventilation systems – Air Conditioning – load estimation – planning and design – energy efficiency – automation – elevators – system – services – escalators – services – safety aspects.

**UNIT IV SAFETY AND SECURITY 9**  
Access – control – perimeter protection – CCTV -intruder alarms – passive fire safety – detection and alarm – planning and design – codes –NBC.

**UNIT V CASE STUDIES 10**  
Case based learning - High rise buildings and skyscrapers thro' appropriate examples.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. H. Vishwanath, "Multipurpose high – rise towers & tall buildings", (1998), Taylor & Francis, U.K.
2. Eisele, Johann, "High rise manual", (2003), Birkhavser.

**RE7006 HERITAGE PROPERTIES AND CONSERVATION PRACTICES L T P/S C  
3 0 0 3**

**UNIT I INTRODUCTION TO HERITAGE AND CONSERVATION 7**  
Understanding heritage – heritage conservation – need – debate and purpose – defining conservation – preservation and adaptive reuse – International agencies – ICCROM, UNESCO and their role

**UNIT II CONSERVATION IN INDIA 8**  
Museum – monument conservation – role of ASI – INTACH – Central and State Govt. – Policies – legislations – inventories – Projects – selected case studies – conservation project management

**UNIT III CONSERVATION PRACTICE 12**  
 Listing of monuments – documentation of historic structures – assessing character – report-guidelines for conservation – seismic retrofit – disabled access – historic site management.

**UNIT IV URBAN CONSERVATION 10**  
 Understanding the character, history of cities and historical sites – select case sties – historic districts – heritage precincts – financial incentives.

**UNIT V PLANNING TOOLS 8**  
 TDR-urban conservation and heritage tourism and national and international policies pertaining Heritage Conservation.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Gerald Glenn, "Presentation & Rehabilitation", (1996), ASTM International.
2. A History of Architectural Conservation, (1'st Pub.1999, Reprint 2005)–Elsevier Butterworth, Oxford, UK.

**RE7007 ENVIRONMENTAL IMPACT ASSESSMENT TECHNIQUES L T P/S C**  
**3 0 0 3**

**UNIT I INTRODUCTION 6**  
 EIA – Environmental Impact Assessment – EIS - – Environmental Impact Statement \_– Environmental Risk Assessment (ERA) – Legal and regulatory aspects – types and limitations – terms of reference – issues – national – cross-sectional – social and cultural in EIA.

**UNIT II COMPONENTS AND METHODS 12**  
 Components – screening –setting – analysis- prediction of impacts – mitigation. Matrices – networks – checklists – important assessment techniques – cost benefit analysis – analysis of alternatives – methods of prediction and assessment of impacts – air – water – soil – noise – biological –social – cultural – standards and guidelines foe evaluation – public participation in environmental decision making.

**UNIT III QUALITY CONTROL 9**  
 Trends in EIA practice and evaluation criteria – capacity building for quality assurance – expert systems in EIA – use of regulations and AQM.

**UNIT IV DOCUMENTATION AND MONITORING 10**  
 Document Planning – collection and organization of relevant information – use of visual display materials – team writing – remainder checklists – environmental monitoring – guidelines – policies – planning of monitoring programmes – environmental management plan – post project audit.

**UNIT V CASE STUDIES 8**  
 Case studies of EIA – developmental projects.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Environmental Impact Assessment Techniques for developing countries in Asia, Vol 1 Overview Asian Development bank (2000).
2. D.H Carson (1976) Man & Environment Internactions, Halsted Press. UK.

**OBJECTIVE:**

- To investigate the simulation and audit techniques for assessing the energy performance, environmental response and impact of built form.

**UNIT I INTRODUCTION TO BUILDING PERFORMANCE EVALUATION 3**

Emerging role of performance evaluation in building design and master planning- Performance audit and rating systems- GRIHA, LEED IGBC and BREEM – Architectural Computation and performance audit- Introduction to ECOTECT.

**UNIT II PRINCIPLES OF SUSTAINABLE DESIGN 12**

E's of sustainability - Integrated approach to environmental design – Case studies – Comparative analysis of green rating systems, LEED, BREEM and GRIHA – Cognitive , analytical and simulated modeling and design of buildings. Zero Carbon Footprint Building.

**UNIT III ENVIRONMENTAL ASSESSMENT METHODS AND MODELING FOR PASSIVE SYSTEMS. 12**

Modelling and experimental techniques for building assessment/ evaluation and design – Basics of thermal comfort, solar shading/access/ control, day lighting, acoustics air movement etc. – issues and opportunities with current assessment modes/ evaluation tools- Evaluation and assessment based on Building type/ function and program – Building performance with respect to function, program, micro climate, urban planning, envelope design, material – Computer studio and simulation-Mathematical models of heat and mass transfer phenomena through building components: transfer function methods and numerical methods – Models of radiative and convective heat transfer phenomena within buildings

**UNIT IV ADVANCE ECOTECT AND ENERGY MODELLING 12**

Integration of ECOTECT with BIM, RAPID ENERGY MODELLING- Modelling and performance simulation of existing buildings – residential-institutional- design of a new residential building with ECOTECT

**UNIT V SEMINAR AND CASE STUDY PRESENTATION 6**

Case study presentation of students on performance evaluation of a building identified by them and approved by the course faculty – Seminar on topics approved by the course faculty.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will gain knowledge on environmental assessment methods, audit and simulation techniques.
- Will add value to architectural design processes and equip students with energy modeling skills.

**REFERENCES:**

1. Energy Audit of Building Systems – Moneef Krarti (Ph.D) – CRC Press 2000
2. Clarke, J.A., “Energy simulation in building design”, Adam Hilger Ltd, Bristol, 1985
3. ESRU,. “ESP-r A Building Energy Simulation Environment; User Guide Version 9 Series. “ESRU Manual U 96/1, University of Strathclyde, Energy Systems Research Unit, Glasgow, 1996.
4. Kabele, K., “Modeling and analyses of passive solar systems with computer simulation”, in Proc. Renewable energy sources, PP. 39 – 44, Czech Society for Energetics Kromeriz 1998 (in Czech)