VEERMATA JIAJABAI TECHNOLOGICAL INSTITUTE, MUMBAI

Circular / Open Elective / Semester VII/ AY 2024-25 /01 Date 23rd July 2024

Course Name, Detail Curriculum and Eligibility criteria of Open Elective Courses to be offered for VII semester of the Academic Year 2024-25 are given below. Students are requested to submit google form for open elective of semester VII (from 23rd July 2024 to 26th July 2024).

Link of Google form: https://forms.gle/gctrdcAMhfcZmW9m9

Rules:
1. Once selected, the course will not be changed under any circumstances. Therefore students should be careful while selecting the course
2. In case number of students opting for a particular course is less than 25, the course will be not being offered.
3. Opting open elective from other department is mandatory.
4. Students should not study same course as core course/programme elective and open elective.

Dr. Arvind Deshpande
Associate Dean Academics

Open Elective at Institute Level
(B. Tech VII Semester AY 2024-25)

Sr. No	Course Title	Department Offering Elective Course
1	Internet of Things	Computer
2	Software Engineering	Computer
3	Sustainable Development	Civil
4	Signal Processing & applications	Electronics
5	Introduction to Nano Electronics	EXTC
6	Electric Vehicles	Electrical
7	Energy Conservation & Management	Mechanical
8	Entrepreneurship Development	Production
9	Structural Composites	Textile

Course Code R4ET4601S   **Course Title: Introduction to Nano Electronics**
Prerequisite: NIL

COURSE OUTCOME

1. The student should be familiar with certain nano electronic systems and building blockssuch as: low-dimensional semiconductors, hetero structures, carbon nanotubes, quantumdots, nanowires etc.
2. Design of electronic nano systems like memory elements & Logic devices.
3. Finally, a goal is to familiarize students with the present research front in Nano electronicsand to be able to critically assess future trends.

COURSE CONTENTS:

Module 1	Introduction
	CMOS Scaling, Scaling Issues, Limit to Scaling, System Integration limit, Interconnect Issues, Shrink down approach, Strained Silicon, High k dielectric, Advance MOSFET concept, UTB – Ultra Thin Body, and Metal Gate
Module 2	**FINFET**
	Structure, working, power optimization, logic design using FINFET, modes of operation, TCMS circuit, logic design using TCMS, FINFET SRAM Design
Module 3	**Resonant Tunneling Diode (RTD)**
	Electron Tunneling, Coulomb blocked RTD Structure, working, V-I characteristics, equivalent circuit ,programmable logic gates, multi Valued logic gates and MOBILE circuit.
Module 4	**Single Electron Devices**
	Single Electron BOX, Single Electron Transistor (SET), and Application of Single Electron Devices for logic circuit
Module 5	**Module 5. Quantum dots**
	Electronics properties, structure, Quantum Cellular Automata (QCA) , and Circuit Design using QCA
Module 6	**Carbon Nano Tubes**
	Physical Properties, Band Structure, Band Modulation, Electrical properties of CNTs, CNT Transistor, CNT based Electronics Devices, Field Emission Devices, MEMS, Electrical Sensor, and SRAM Cells
Module 7	**Spintronics**
	Physical properties of Spintronic Devices, Spin Relaxation Mechanisms, Spin Injection, Spin Detection. Spintronic Devices, Spin Filter, Spin Valves, Spin Pumps, Spin Diodes, Spin Transistors, Spin-Based Optoelectronic Devices, Spintronic Computation
Module 8	**Molecular Electronics Devices**
	Electrical Conduction of Molecules, Molecular Electronics Devices, Molecular Architectures for Nano electronics, Molecular-Based Optic and Optoelectronics Devices, Molecular Computing Devices

Text Books:	Introduction to nanotechnology, C.P.Poole JV, F.J.Owens, Wiley (2003). Nano electronics and information technology (Advanced electronic materialsand Novel Devices Waster Ranior, Wiley VCH (2003)
References :	Nano electronics: Principles and Devices, 2nd Edition, M. Dragoman, D.Dragoman,Artech House – 2008 Nano electronic Circuit Design, Niraj K. Jha, Deming Chen, Springer - 2010.

Course Code R4CE4106S   **Course Title: Sustainable Development (Open Elective)**
Prerequisite: NIL

COURSE OUTCOME
After completion of course students will be able to
1. Describe sustainable development, development processes and relate impact of various levels ofdevelopment
2. Formulate the methodology for assessment ofsustainability of project using various indicators.
3. Apply environmental legislations to various development processes and projects

COURSE CONTENTS:

Module I	Development Goals and means of development, MDG's and SDG's sustainable development, Comparing levels of development, GDP, GNP, global development level
Module II	Industrialization and Post-industrialization era Major structural shifts, knowledge revolution, implications for development sustainability
Module III	Environmental episodes Ozone depletion, global warming, greenhouse effect, Bhopal gas tragedy etc.
Module IV	Pollutions Major sources, permissible standards and controls of urban air pollution, water pollution, Solid and hazardous waste disposals
Module V	Climate Change The Risk of Global Climate Change
Module VI	Environmental legislation Legislative provisions and measures towards sustainability
Module VII	Indicators of Development Sustainability Composition of National wea1th,Accumu1ation of National Wealth as an Indicator of Sustainable Development, Development Goals and Strategies, Gross happiness index, Millennium Development Goals, Role of National Development Policies, Life cycle assessment, Carbon foot print
Text Books:	Tatyana P. Soubbotina, Beyond Economic Growth: An Introduction to Sustainable Development, World Bank Institute Learning Resources Series, 2nd edition, 2004. (ISBN: 0-8213-5933-99) P. P. Roger, F. J. Ja1a1 and J. A. Boyd, An Introduction to Sustainable Development, Earthscan Publications, 2nd edition, 2008. (ISBN: 9781844075201/1844075206)
Reference Books:	T. Strange and A. Bayley, Sustainable Development: Linking Economy, Society, Environment, 2008. (ISBN: 9789264047785) H. G. Brauch, Sustainable Development and Sustainability Transition Studies, Series: Springer Briefs in Environment, Security, Development and Peace,Series Ed. G. Marletto, S. Franceschini, C. Ortolani and C. Sillig, Mapping Sustainability Transitions: Networks of Innovators, Techno-economicCompetencesand Political Discourses, SpringerBriefs in Business, 2016. (ISBN: 9783319422725/9783319422749)

Course Code R4PE4601S   **Course Title: Entrepreneurship Development**
Prerequisite: NIL

Course outcomes

On the completion of this course, the learner will able to
1. Describe what it takes to be an entrepreneur
2. Analyze business opportunities and the basics to create, launch and manage new businesses
3. Develop Business Model for their Idea/Problem
4. Create MVP (Minimum Viable Product).

COURSE CONTENTS:

Module I	**Introduction**
	Discover yourself – Find you Flow, Effectuation, Identify your entrepreneurial style
Module II	**Problem Identification and Idea generation**
	Identify Problems worth Solving, Introduction to Design Thinking, generate ideas that are potential solutions to the problem identified, GOOTB: Run problem interviews with prospects, Class Presentation: Present the problem you "love", Team Formation.
Module III	**Customer Study and Value Proposition**
	Identify Your Customer Segments and Early Adopters - Market Types, Segmentation and Targeting, Defining the personas; Understanding Early Adopters and Customer Adoption Patterns, Customer identification, Market, Creative solution; Craft Your Value Proposition - Come up with creative solutions for the identified problems, Deep dive into Gains, Pains and "Jobs-To-Be-Done" (using Value Proposition Canvas, or VPC), Identify the UVP of your solution using the Value Proposition section of the VPC, Outcome-Driven Innovation.
Module IV	**Business Model Canvas**
	Get Started with Lean Canvas - Basics of Lean Approach and Canvas; Types of Business Models (B2B; B2C), Sketch the canvas- "Document your Plan A", Intro to Risks; Identify and document your assumptions (Hypotheses); identify the riskiest parts of your Business Plan, Risk identification, Class Presentation: Present your Lean Canvas.
Module V	**Validation**
	Develop the Solution Demo - Build solution (mock-ups) demo, How to run solution interviews, GOOTB: Run Solution interviews, Does your solution solve the problem for your customers: The problem-solution test. Sizing the Opportunity - Differences between a Start-up venture and a small business; Industry Analysis: Understanding what is Competition and its role, Analyse competition; Building an MVP - Identification of MVP, Solution development, building products/services, Build- measure-learn loop for development
Module VI	**Money**
	Revenue streams, Pricing and cost, Financing Your New Venture - Venture financing, Investor expectations
Module VII	**Team building**
	Shared leadership, role of good team, how to pitch to candidates to join your startup Collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board, #Slack
Module VIII	**Marketing and sales**
	Positioning of Product/Services, Channels and strategies, Building Digital Presence and leveraging Social media, Budgeting and planning. Sales planning - Buying decisions, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customers' needs, not on product features), Follow-up and closing a sale; Asking for the sale.

Module IX	**Support**
	Planning and tracking - Importance of project management to launch and track progress, Understanding time management, workflow, and delegation of tasks.
	Business Regulation - Basics of business regulations of starting and operating a business; Importance of being compliant and keeping proper documentation; How to find help to get started.

Text Books	1. Roy R.: Entrepreneurship, Oxford University Press.
	2. Maurya A.: Running Lean: Iterate from Plan A to a Plan That Works. O'Reilly Media
References	1. Jeffry A: New venture creation, Tata McGraw Hill
	2. Osterwalder, A and Pigneur Yves: Business Model Generation: A Handbook for Visionaries,Game Changers and Challengers.
	3. Gupta T. S: Intellectual Property Law in India, Kluwer Law International.
	4. Saraswathi S.D: Effectuation: Elements of Entrepreneurial Expertise. Edward Elgar Publishing.
	5. Kim W. C. and Mauborgne R: Blue Ocean Strategy, Harvard Business School Press.
	6. Ries, E.: The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to CreateRadically Successful Businesses, The Crown Publishing Group

Course Code R4TT3602T   Course Title: Structural Composites
Prerequisite: Basic knowledge of Engineering Physics and Engineering Chemistry.

Course Outcome

After attending this course, students will be able to:
1. Understand the composite materials and impact of aggregation of constituent materials.
2. Depict the approach and methodology of fabrication of such aggregate.
3. Schooled various models analyzing the design and performance of composite materials.
4. Understand the composite modulus, strength and fracture behavior for structural applications.

Course Content

Module I	Introduction: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Interphases, Distribution of constituents, Nano-composites.
Module II	Performance of Structural Composites: Combination effects (Summation, Complementation and Interaction), Basic analytical concepts. Performance analysis by various models (Law of Mixtures, Shear lag model, Laminated plate model – the rmoelasticity, plasticity and creep), Strengthening mechanisms, Stress distribution in fibre and the matrix (shear stress and axial tensile stress in the fibre along its length), critical length of fibre for full strengthening, Analysis of uniaxial tensile stress-strain curve of unidirectional continuous and short fibre composites, Estimation of the required minimum amount of fibre and critical amount of fibre to gain a composite strength, Analysis of strength of a composite during loading at an angle to the fibres, Nano-structured composites.
Module III	Performance of Composite in Nonstructural Applications: Composites in Electrical, Superconducting and Magnetic Applications, Nano-composite devices.

Module IV	Fabrication Composites : Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites - XD process, Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes. Fabrication of Polymer Matrix Composites – Commonly used Matrices Basic Requirements in selection of Constituents, Moulding method, Low pressure closed moulding, pultrusion, Filament winding, Fabrication of ceramic matrix composites - Various techniques of vapour deposition, Liquid phase method and Hot pressing etc., Fabrication of nano-composites.
Module V	Characterisation of Composites : Control of particle/fibre and porosity content, particle/fibre distribution, Interfacial Reaction of matrix-reinforcing component, Coating of reinforcing component, Strength analysis.
Module VI	Secondary Processing and Joining of Composite : Forging and extrusion of composites – critical issues, dynamic recovery and dynamic recrystallization, mechanical properties; Induction Heating, Fusion Bonding, Ultrasonic welding, Gas tungsten arc welding, Gas metal arc welding, Resistance spot & seam welding, Resistance brazing, Resistance spot joining, Resistant spot brazing, Resistance welding of thermoplastic graphite composite, Weld bonding, Brazing of MMC.
Module VII	Industrial Application of Composite Materials : Civil constructions of structures/pannels, Aerospace industries, Automobile and other surface transport industries, Packaging industries, House hold and sports components etc.
Module VIII	Fracture & Safety of Composite : Fracture behaviour of composites, Mechanics and Weakest link statistics, Griffith theory of brittle fracture and modification for structural materials, Basic fracture mechanics of composite (Fracture toughness, COD and J- integral approaches, Fatigue crack growth rate), Fracture Mechanics of brittle matrix fibre composite, Fracture mechanics of metal matrix fibre composite, Experimental evaluation (composite), Elementary reliability analysis.

Recommended Readings:	1. Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003),Wiley-VCH Verlag GmbH Co. KGaA, Weinheim. 2. Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, (2001),Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK. 3. Ceramic matrix composites, K.K. Chawala, 1st ed., (1993) Chapman & Hall, London.
Reference Books:	1. Sanjay Mazumdar, Composites Manufacturing-Materials, Product and Process Engineering, 2002, CRC Press, ISBN 0-8493-0583-3. 2. Fibrous and composite materials for civil engineering applications, edited by R. Fangueiro, 2011, WPI, ISBN 978-1-84569-558-3. 3. Textile advances in automotive industry, edited by R. Shishoo, Woodhead Publishing inTextiles: No. 79, ISBN 978-1-84569-331-2.

Course Code R4CO4601S   **Course Title: Internet of Things**
Prerequisite: NIL.

Course Outcome

After attending this course, students will be able to:
1. Understand digital transformation.
2. Apply the IoT infrastructure and its applications.
3. Analyze the system and use appropriate architecture, and protocols for a given scenario.
4. Demonstrate the use of cloud platform and its framework for the development of IoT applications.

Course Content

Module I	Introduction to Digital Transformation: What is digital disruption? Examples of Digital Disruption. Waves of Digital Disruption, Why Digital Disruption, examples, what are the emerging digital technologies? 2016 Top 10 Tech Trends, The Digital Technology Stack, Digital Innovation. The SMAC (Social, Mobile, Analytics, Cloud) Stack.
Module II	Introduction to IoT Future of IoT, Some Interesting IoT Projects, IoT Applications Retail, Healthcare & Agriculture, IoT Challenges, IoT Reference Architecture.
Module III	IoT Physical Devices & Endpoints: Hardware and software concepts of Microcontrollers and Microprocessors. Study and usage of Prototyping boards like - Arduino, Intel Edison, Raspberry pi etc (from software and hardware perspective). Study and usage of various types of sensors and actuators such as temperatures sensor, light sensor, Rotary angle sensor, buzzer, LED etc, IoT devices, IoT gateways.
Module IV	Programming of IoT Devices: Basic study of programming languages like C & Python used for programming IoT devices. Other programming languages used for IoT.
Module V	Different aspects of IoT system: Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT levels, IoT and M2M, A generic design methodology for Internet of Things.
Module VI	IoT Servers and Cloud: An introduction to the use of cloud platforms and frameworks for developing IoT applications, Data Analytics for IoT.

Recommen ded Readings:	Stephanie Moyerman, "Getting Started with Intel Edison", Published by Maker Media, Inc., San Francisco, 2016. CA 94111.
Reference Books:	Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015. 2. John Boxall, "Arduino Workshop A Hands-On Introduction with 65 Projects", No Starch Press, Inc. San Francisco, CA USA, 2013.

Course Code R4IT4603S   **Course Title: Software Engineering**
Prerequisite: NIL.

Course Outcome

After attending this course, students will be able to:
1. Demonstrate basic knowledge in Software Engineering.
2. Plan, gather requirements for, analyze, design, develop and test the software development project
3. Estimate cost, effort & time, manage risk, prepare project schedule and track it for a software development project.
4. Analyze the quality of a software & manage its configuration..

Course Content

Module 1	Introduction: The Product: Software Characteristics, Applications. The Process: Software Process, Software Process Models, Linear Sequential model, Prototyping model, RAD model, Evolutionary models - Incremental model, Spiral model.
Module 2	Software project management concepts: Important factors of project managementPeople, Product, Process, Project.
Module 3	Software Process and Project Metrics: Measures, Metrics, Indicators. Metrics in the process and project domains, Software measurement. Metrics for Software Quality. Integrating metrics
Module 4	Software Project Planning: Software Scope, Resources, Software project estimation - cost/effort estimation, Decomposition techniques, Empirical estimation models.
Module 5	Risk Analysis and Management: Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk mitigation-monitoring-management, RMMM plan.
Module 6	Project Scheduling and Tracking: Defining a task set for the software project, Gantt Chart, Defining a task network, Scheduling.
Module 7	Software Quality Assurance: Software quality assurance, Software reviews, Formal technical reviews, SQA plan
Module 8	Software Configuration Management: SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting.
Module 9	Analysis Concepts and Principles: Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Requirements Specification
Module 10	Analysis Modelling: Data modelling, Functional modelling and information flow, Behavioural modelling.
Module 11	Design Concepts and Principles: Software design process, Design principles, Design concepts, Effective modular design.
Module 12	Design Modelling: Data Design. Architectural Design: Software architecture, Mapping requirements into a software architecture. User Interface Design: Human Factor, User interface design process. Component-Level Design: Structured programming design notations.
Module 13	Software Testing Techniques & Strategies: White-box & Black-box testing techniques. Strategic Approach to Software Testing.

Recommended Readings:	1. James Peter," Software Engineering an Engineering approach", John Wiley, 1 st Edition 2. W. S. Jawadekar, "Software Engineering", TMH. 1 st Edition 3. R. Mall, "Fundamentals of Software Engineering", Prentice Hall of India, 2nd Edition
Reference Books:	Roger Pressman, "Software Engineering", McGraw Hill, 5 th Edition. Ian Sommerville, "Software Engineering", Pearson Education, 6 th Edition

Course Code R4IT4603S   Course Title: Software Engineering
Prerequisite: NIL.

Course Outcome

After attending this course, students will be able to:

5. Demonstrate basic knowledge in Software Engineering.
6. Plan, gather requirements for, analyze, design, develop and test the software development project
7. Estimate cost, effort & time, manage risk, prepare project schedule and track it for a software development project.
8. Analyze the quality of a software & manage its configuration..

Course Content

Module 1	Introduction: The Product: Software Characteristics, Applications. The Process: Software Process, Software Process Models, Linear Sequential model, Prototyping model, RAD model, Evolutionary models - Incremental model, Spiral model.
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Module 3	Software Process and Project Metrics: Measures, Metrics, Indicators. Metrics in the process and project domains, Software measurement. Metrics for Software Quality. Integrating metrics
Module 4	Software Project Planning: Software Scope, Resources, Software project estimation - cost/effort estimation, Decomposition techniques, Empirical estimation models.
Module 5	Risk Analysis and Management: Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk mitigation-monitoring-management, RMMM plan.
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Module 7	Software Quality Assurance: Software quality assurance, Software reviews, Formal technical reviews, SQA plan
Module 8	Software Configuration Management: SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting.
Module 9	Analysis Concepts and Principles: Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Requirements Specification
Module 10	Analysis Modelling: Data modelling, Functional modelling and information flow, Behavioural modelling.

Module 11	Design Concepts and Principles: Software design process, Design principles, Design concepts, Effective modular design.
Module 12	Design Modelling: Data Design. Architectural Design: Software architecture, Mapping requirements into a software architecture. User Interface Design: Human Factor, User interface design process. Component-Level Design: Structured programming design notations.
Module 13	Software Testing Techniques & Strategies: White-box & Black-box testing techniques. Strategic Approach to Software Testing.

Recommended Readings:	4. James Peter," Software Engineering an Engineering approach", John Wiley, 1 st Edition 5. W. S. Jawadekar, "Software Engineering", TMH. 1 st Edition 6. R. Mall, "Fundamentals of Software Engineering", Prentice Hall of India, 2nd Edition
Reference Books:	Roger Pressman, "Software Engineering", McGraw Hill, 5 th Edition. Ian Sommerville, "Software Engineering", Pearson Education, 6 th Edition

Course Code R4ME4602S   Course Title: Energy Conservation and Management
Prerequisite: NIL.

Course Outcome

The student should be able to –
1. Illustrate the current energy scenario, challenge of climate change & peak oil, importance of energy conservation and need for alternative energy resources.
2. Examine various parameters in energy systems and energy auditing.
3. Apply Energy Planning and forecasting techniques for performing energy analysis.
4. Integrate energy economics and relevance of sound energy policies for sustainable development.

Course Content

Module 1	Introduction Energy Scenario-world and India. Energy Resources Availability in India. Energy consumption pattern. Energy conservation potential in various Industries and commercial establishments. Energy intensive industries - an overview. Peak oil. Challenge of climate change - Energy conservation and energy efficiency – needs and advantages.
Module 2	Pollution from energy generation Coal and Nuclear based Power Plants – Fly Ash generation and environment impact, Fly ash utilization and disposal, nuclear fuel cycle, radioactive wastes – treatment and disposal Environmental pollution limits guidelines for thermal power plant pollution control Environmental emissions from extraction, conversion, transport and utilization of fossil fuels Green house effect- Global warming.
Module 3	Energy auditing Energy Conservation Act 2001. Energy auditing - Definition, need, types of energy audit methodologies, barriers. Role, Duties and responsibilities of energy managers and auditors. Energy audit questionnaire. Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, optimizing the input energy requirements; Fuel & energy substitution
Module 4	Energy conservation Energy Efficiency in relevant utilities Mechanical/Thermal – Boilers, Steam System, Furnaces, Insulation and Refractories, Cogeneration, Waste Heat Recovery, Heat Exchangers Electrical – Electrical Systems, Electric motors, Compressed air system, HVAC and refrigeration system, Fans and Blowers, Pumps and pumping system, Cooling Tower, Lighting system, Diesel/Natural Gas Power generating system Civil – Energy Conservation in buildings and ECBC Textile – Textile industry
Module 5	Energy economics Investment - need, appraisal and criteria, financial analysis techniques - break even analysis-simple pay back period, return on investment, net present value, internal rate of return, cash flows, DSCR, financing options, ESCO concept.

Module 6	Energy forecasting Energy forecasting techniques - Energy demand – supply balancing, Energy models, Simulation and forecasting of future energy demand consistent with macroeconomic parameters in India. Basic concept of Econometrics (OLS) and statistical analysis (Multiple Regression), Econometrics techniques used for energy analysis and forecasting with case studies from India.
Module 7	Energy policies National energy policy in the last plan periods, Energy use and Energy supply, Overview of renewable energy policy and the Five Year Plan programmes, Basic concept of Input-Output analysis, Concept of energy multiplier and implication of energy multiplier for analysis of regional and national energy policy- Carbon Trading- Renewable Energy Certification – CDM. The Sustainable Energy Utility (SEU) Model

Recommended Readings:	General Aspects of Energy management and Audit, Guide book for energy manager and energy auditor, Bureau of energy efficiency 2. Energy Efficiency in Thermal Utilities, Guide book for energy manager and energy auditor, Bureau of energy efficiency 3. Energy Efficiency in Electrical Utilities, Guide book for energy manager and energy auditor, Bureau of energy efficiency 4. Energy Performance Assessment for Equipment and Utility Systems, Guide book for energy manager and energy auditor, Bureau of energy efficiency
Reference Books:	YP Abbi and Shashank Jain, Handbook on Energy Audit and Environment Management, TERI Publications, 2009. 2. Steve Doty, Wayne C. Turner, Energy Management Handbook 3. Jason Houck, Wilson Rickerson, The Sustainable Energy Utility (SEU) Model for Energy Service Delivery, http://online.sagepub.co