

SREENIVASAINSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(Autonomous)

Minor - ENERGY SYSTEMS - Offered by EEE Department

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	23MREGS1	Energy Audit and Management	3	-	-	3	30	70	100
2	23MREGS2	Energy Management in Building	3	-	-	3	30	70	100
3	23MREGS3	Energy Storage Technologies	3	-	-	3	30	70	100
4	23MREGS4	Energy Scenario and Energy Policy	3	-	-	3	30	70	100
5	23MREGS5	Waste Energy Management	3	-	-	3	30	70	100
6	23MREGS6	Project in Energy Systems	-	-	3	1.5	30	70	100

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EEE Department
Minor- ENERGYSYSTEMS
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23MREGS1	ENERGY AUDIT AND MANAGEMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Able to understand the basic concepts of Energy Audit and Management, Principles and objectives of Energy management and Basics of Thermal, Electrical energy management
- Able to apply the fundamental concepts for development of energy management systems
- Able to Design Energy Audit reports
- Able to analyze designed energy management systems

UNIT –1: Introduction:

(9)

Basic elements and measurements – Mass and energy balances – Scope of energy auditing industries – Evaluation of energy conserving opportunities.

UNIT –2: Energy Audit Concepts:

(9)

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

UNIT –3: Principles and Objectives of Energy Management:

(9)

Design of Energy Management Programs - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Some case study and potential energy savings.

UNIT –4: Thermal Energy Management:

(9)

Energy conservation in boilers –steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery - Thermal insulation - Heat exchangers and heat pumps - Building Energy Management.

UNIT –5: Electrical Energy Management:

(9)

Supply side Methods to minimize supply – demand gap – Renovation and modernization of power plants - Reactive power management – HVDC - FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors. Demand side management.

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Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Understanding the Fundamentals of Energy Auditing and Conservation. - L2	
CO2	Analyzing Energy Audit Concepts and Techniques - L3	
CO3	Designing and Implementing Energy Management Programs - L5	
CO4	Managing Thermal Energy and Implementing Energy Conservation Techniques L4	
CO5	Implementing Electrical Energy Management and Conservation - L4	

TEXT BOOKS:

1. Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980.
2. Energy Management: W.R.Murphy, G.Mckay

REFERENCE BOOKS:

1. Energy Management Principles: C.B.Smith
2. Efficient Use of Energy: I.G.C.Dryden
3. Energy Economics A.V.Desai
4. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com).

REFERENCE WEBSITE:

Online Learning Resources: <https://nptel.ac.in/courses/108106022>

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23MREGS2	ENERGY MANAGEMENT IN BUILDING	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

- Able to understand the significance of energy management in buildings, Ventilation and Air conditioning aspects, Climate influence, energy usage estimation and technological options for energy management
- Able to apply the Energy management concepts for building designs
- Able to analyze different conditions for preparation of efficient energy management system for a building
- Able to design efficient energy management systems for buildings

UNIT –1: Overview of the Significance of Energy use and Energy Processes in Building: (9)

Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management – Macro aspect of energy use in dwellings and its implications – Concepts of energy efficient building.

UNIT –2: Indoor Environmental Requirement and Management: (9)

Thermal comfort – Ventilation and air quality - Air-conditioning requirement - Visual perception – Illumination requirement –Auditory requirement –Concept of sick building syndrome – Significance in energy management in buildings.

UNIT –3: Climate: (9)

Solar radiation and their influences – The sun –earth relationship and the energy balance on the earth's surface – Climate – Wind - Solar radiation - Temperature – Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings

UNIT –4: END-USE: (9)

Energy utilization and requirements – Lighting and day lighting – End-use energy requirements – Status of energy use in buildings – Estimation of energy use in a building - Heat gain and thermal performance of building envelope – Steady and non steady heat transfer through the glazed window and the wall – Standards for thermal performance of building envelope – Evaluation of the overall thermal transfer – Concepts of window management.

UNIT –5: Energy Management Options: (9)

Energy audit and energy targeting – Technological options for energy management – Modifications for energy efficient buildings for Indian conditions. Energy Management for large tower buildings.

Total Hours: 45

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COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
C01	Understanding the Fundamentals of Energy Use in Buildings Apply the Energy management concepts for building designs - L2	
C02	Analyzing Indoor Environmental Requirements and Their Impact on Energy Use - L3	
C03	Examining the Role of Climate and Environmental Factors in Building Energy Use - L3	
C04	Evaluating Energy Utilization and Heat Transfer in Building Envelopes L4	
C05	Implementing Energy Management Strategies for Buildings - L5	

TEXT BOOKS:

1. Heating and Cooling of Buildings – Design for Efficiency, J.Krieder and A.rabl, McGrawHill, 1994.
2. Mechanical and Electrical Equipment for Buildings, S.M.Guinness and Reynolds, Wiley, 1989

REFERENCE BOOKS:

1. Energy Design for Architects, Shaw, Aee Energy Books, 1991.
2. Energy Conservation in Buildings – Royal Institute of Architecture, Canada.
3. Publication of CBRI, Roorkee – Energy Management in Buildings.

REFERENCE WEBSITE:

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23MREGS3	ENERGY STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

UNIT –1: Batteries: (9)

Types-battery characteristics - voltage, current, capacity, volumetric energy density, specific energy density, charge rate, cycle life, internal resistance, energy efficiency, shelf life, battery management system, SoC, SoH estimation techniques. Testing of batteries, battery charging method, Factors affecting the battery performance.

UNIT –2: Primary Batteries: (9)

Fabrication, performance aspects, packing and rating of alkaline manganese, silver oxide cells. Lithium primary batteries-Lithium/Manganese Dioxide, Lithium/Carbon Mono fluoride, Lithium/ Thionylchloride, Lithium/Sulfur Dioxide, Lithium / Iodine, Lithium - Aluminum/Iron Disulfide.

UNIT –3: Advanced Batteries: (9)

Advanced Lead Acid Battery -design, performance aspects, Pb-Acid batteries for transportation, nickel-metal hydride batteries, zinc- alkaline batteries, ZEBRA Battery (Na/NiCl₂) -NaS Battery-Lithium-Ion Battery-Lithium- Polymer Battery, Li-air batteries, Li-S batteries, Sodium-ion batteries.

UNIT –4: Storage for Renewable Energy Systems: (9)

Solar energy, Wind energy, pumped hydro energy, Energy storage in Micro-grid and Smart grid, Energy Management with storage systems, Battery SCADA, Increase of energy conversion efficiencies by introducing energy storage. Superconducting Magnetic Energy Storage (SMES), charging methodologies, Photo galvanic cells, semi conductor solar batteries (SC-SB), thermo-ionic converters, dye-sensitized solar cells (DSSC).

UNIT –5: Super capacitors and Fuel Cells: (9)

Fundamentals of electrochemical Super capacitors, electrode and electrolyte interfaces and their capacitances, charge-discharge characteristics, energy/power density, design, fabrication, operation and evaluation, thermal management. Super capacitors for transportation applications - aqueous and organic based super capacitors, Pseudo and asymmetric super capacitors. Advance battery-super capacitors hybrids for auto, space and marine applications. Fuel Cells working Principle and Construction.

Total Hours: 45

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COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Understanding the Basics of Batteries and Their Performance Characteristics -L2	
CO2	Analyzing Primary Battery Types and Their Applications -L3	
CO3	Exploring Advanced Battery Technologies and Their Applications -L4	
CO4	Assessing Energy Storage for Renewable Energy Systems - L4	
CO5	Understanding and Applying Supercapacitors in Energy Storage -L4	

TEXT BOOKS:

1. Dell, Ronald M. and David A.J., "Understanding Batteries", Royal Society of Chemistry, 2001.
2. Vladimir S. Bagotsky, Alexander M. Skundin, Yuriy VM. Volkovich., "Electrochemical power sources : Batteries, fuel cells, and supercapacitors", John Wiley & Sons, Inc., 2015.

REFERENCE BOOKS:

1. Lindon David, "Hand book of Batteries", McGraw Hill, 2002.
2. Kiehne H.A., "Battery Technology Handbook", Expert Verlag, Renningen Malsheim, 2003.
3. Aulice Scibioh M. and Viswanathan B., "Fuel Cells – Principles and Applications", University Press, 2006.
4. A.G. Ter-Gazarian, "Energy Storage for Power Systems", The Institution of Engineering and Technology (IET) Publication, UK, 2011.

REFERENCE WEBSITE:

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23MREGS4	ENERGY SCENARIO AND ENERGY POLICY	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

The student able to:

- Understand the basic concepts of Energy scenario and Energy policy
- Apply the concepts to strengthen energy system
- Analyze the different scenarios around the globe
- Implementation of suitable Energy policy for existing systems

UNIT –1: Global Energy Scenario:

(9)

Role of energy in economic development and social transformation - Energy and GDP - GNP and its dynamics - Energy sources and overall Energy demand and availability - Energy consumption in various sectors and its changing pattern - Depletion of energy sources and impact exponential rise in energy consumption on economies of countries

UNIT –2: Energy Polices

(9)

International Energy Polices of G-8 Countries - G-20 Countries – OPEC Countries -EU Countries –International Energy Treaties (Rio, Montreal, Kyoto) -INDO-US Nuclear Deal.

UNIT –3: Indian Energy Scenario

(9)

Energy resources and Sector wise energy Consumption pattern Impact of energy on economy and development - National and State Level Energy polices and Issues - Status of Nuclear and Renewable Energy and Power Sector reforms. Energy policy 2030

UNIT –4 Energy Policy

(9)

Global Energy Issues – Energy Security – Energy Vision Energy Pricing and Impact of Global Variations Energy Productivity (National and Sector wise productivity).

UNIT –5: Energy Conservation

(9)

Act – 2001 and its features –Electricity Act –2003and its features – Energy Crisis –Future energy options-Need for use of new and renewable energy sources-Energy for Sustainable development.

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COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Understanding the Global Energy Scenario and Its Impact on Economic Development-L2	
CO2	Analyzing International Energy Policies and Treaties -L3	
CO3	Understanding the Indian Energy Scenario and Policy Framework -L2	
CO4	Evaluating Global Energy Issues and Energy Security -L3	
CO5	Exploring Energy Conservation and Sustainable Development- L4	

TEXT BOOKS:

1. Energy for a sustainable World: Jose Golden berg, Thomas Johan son, AKN. Reddy, Robert Williams (Wiley Eastern).
2. Energy Policy, B.V.Desai (Wiley Eastern)

REFERENCE BOOKS:

1. Modeling approach to long term demand and energy implication, J.K.Parikh
2. Energy Policy and Planning, B.Bukhootsow
3. TEDDY Year Book Published by Tata Energy Research Institute(TERI)World
Energy Resources, Charles E. Brown, 'International Energy Outlook' - EIA annual
Publication
4. BEE Reference book: no. 1/2/3/4

REFERENCE WEBSITE:

- Online Learning Resources: 1. <https://nptel.ac.in/courses/109106161>

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23MREGS5	WASTE ENERGY MANAGEMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES:

UNIT I

(9)

Characterization Of Wastes :

Agricultural residues and wastes including animal wastes; industrial wastes; municipal solid wastes. Waste processing types and composition of various types of wastes; Characterization of Municipal Solid Waste, Industrial waste and Biomedical Waste, waste collection and transportation; waste processing – size reduction, separation; waste management hierarchy, waste minimization and recycling of Municipal solid waste.

UNIT II

(9)

Thermo Chemical Conversion:

Incineration, pyrolysis, gasification of waste using gasifiers, environmental and health impacts of incineration; strategies for reducing environmental impacts. Energy production from wastes through incineration, energy production through gasification of wastes, Energy production through pyrolysis and gasification of wastes, syngas utilization.

UNIT III

(9)

Bio-Chemical Conversion:

Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion biogas production, and present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages. Energy production from wastes through fermentation and trans esterification. Cultivation of algal biomass from waste water and energy production from algae, Energy production from organic wastes through anaerobic digestion and fermentation.

UNIT IV

(9)

Energy Production From Waste Plastics, Gas Cleanup Waste, Heat Recovery:

Concept of conversion efficiency, energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices.

UNIT V

(9)

Environmental and Health Impacts-Case Studies:

Environmental and health impacts of waste to energy conversion, Industrial waste management – Hazardous waste management – E-waste management -EV Batteries – Mobile Chargers - case studies of commercial waste to energy plants, waste to energy- potentials and constraints in India, eco- technological alternatives for waste to energy conversions.

Total Hours: 45

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COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
C01	Understanding and Characterizing Different Types of Waste - L2	
C02	Analyzing Thermo-Chemical Waste Conversion Methods and Their Environmental Impacts -L3	
C03	Exploring Bio-Chemical Conversion Technologies for Waste to Energy-L4	
C04	Evaluating Energy Production from Waste Plastics and Waste Heat Recovery-L4	
C05	Analyzing Environmental and Health Impacts of Waste-to-Energy Conversion and Case Studies-L3	

TEXT BOOKS:

1. Parker, Colin and Roberts, "Energy from Waste – An Evaluation of Conversion Technologies", Elsevier Applied Science, 1985.
2. Khandel wal, K.C. and Mahdi, S.S., "Bio gas Technology-A Practical Hand Book", Vol.I & II, Tata Mc Graw Hill Publishing Co. Ltd., 1983.

REFERENCE BOOKS:

1. P. N. Rao- CAD/CAM: Principles and applications- 3/e- Tata McGraw-Hill- Delhi- 2017.
2. P. Radhakrishnan- S. Subramanyan & V. Raju- CAD/CAM/CIM- 3/e- New Age International Publishers- 2008.
3. Computer Aided Manufacturing- 3/e- TienChien Chang- Pearson- 2008.

REFERENCE WEBSITE:

- https://onlinecourses.nptel.ac.in/noc20_me44/preview
- <https://www.youtube.com/watch?v=EgKc9L7cbKc>
- <https://www.youtube.com/watch?v=KXFpTb9cBpY>
- https://web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1530947994.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_Lecture_NOTES.pdf

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23MREGS6	PROJECT IN ENERGY SYSTEMS	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES: