M. Tech. Energy Management (Regular)

Year 2019-2021

Syllabus

School of Energy & Environmental Studies

Devi Ahilya Vishwavidyalaya,

Takshashila Campus, Khandwa Road,

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M. Tech. Energy Management (Regular)

Eligibility Graduate Degree in Engineering or M Sc. Physics with minimum 55% marks
Duration 4 Semesters
Seats 18

First Semester:

Code	Title	Credits (L-T-P)	Hours	Faculty
CORE COURSES				
EN7A-701	Solar Energy: Fundamentals, Devices and Systems	4 (3-1-0)	64	SPS
EN7A-702	New & Renewable Energy, Sources and Technologies	4 (3-1-0)	64	RNS
EN7A-703	Water and Waste Water: Pollution & Control Technologies	4 (3-1-0)	64	RNS
EN7A-704	Heat Transfer and Energy Conservation Laboratory	3 (0-0-3)	48	SPS
EN7A-705	Energy & Environment Software Application	3 (0-0-3)	48	DV
EN7A-706	Field Visit	1 (0-0-1)	16	SPS/RNS/RC
EN7A-707	Seminar	2		SPS/RNS/RC
ELECTIVE COURSES				
EN7A-708	Electrical Power Generation, Instrumentation, Measurements, Transmission and Distribution	3 (2-1-0)	48	VF
EN7A-709	Comprehensive Viva-vice	4		
	Total Credit	28		

Second Semester:

Code	Title	Credits (L T P)		
CORE COURSES				
EN7A-710	Engineering Thermodynamics, Heat Transfer and Process Integration	4 (3-1-0)	64	SPS
EN7A-711	Air and Noise Pollution: Effects and Control Technologies	4 (3-1-0)	64	RC
EN7A-712	Bio and Solid Waste Management	4 (3-1-0)	64	RNS
EN7A-713	Green Building Technologies	4 (3-1-0)	64	SPS
EN7A-714	Solar Thermal and Photo - Voltaic Laboratory	3 (0-0-3)	48	DV
ELECTIVE COURSES				
EN7A-715	Energy Modeling and Project Management	3 (0-0-3)	48	RNS
EN7A-716	Comprehensive Viva-vice	4		
	Total Credit	26		

Third Semester:

Code	Title	Credits (L T P)		
CORE COURSES				
EN7A-801	Energy Management (Thermal System)	4 (3-1-0)	64	SPS
EN7A-802	Energy Management (Electrical System)	4 (3-1-0)	64	DV
EN7A-803	Efficient Lighting: Sources, Systems and Design Aspects	4 (3-1-0)	64	DV
EN7A-804	Biomass and Environmental laboratory	3 (0-0-3)	48	RNS/RC
EN7A-805	Minor Project	4 (0-0-4)	64	SPS/RNS/RC
ELECTIVE COURSES				
EN7A-806	Sustainable development, Environmental Auditing and Environmental Impact Assessment	3 (0-0-3)	46	RC
EN7A-807	Comprehensive Viva-vice	4		
	Total Credit	26		

Fourth Semester:

Code	Title	Credits (L T P)		
CORE COURSES				
EN7A-808	Major Project	12 (0-0-12)		
EN7A-809	Comprehensive Viva-vice	4		
	Total Credit	16		

10 seats are available for GATE qualified candidates. * Scholarship @Rs.12, 400/ month for GATE qualified candidates

EN7A-701: Solar Energy: Fundamentals, Devices and Systems

Credits: 4 (64 Hours)

UNIT I: Earth & Sun Relationship

Earth & Sun Relation: Solar Angles, Day length, Angle of Incidence on Tilted Surface, Sun path Diagram, Shadow Determination.

Available Solar: Extraterrestrial Characteristics, Effect of Earth Atmosphere, Measurement and Estimation on Horizontal and Tilted Surface.

Solar Radiations Characteristics Coating: Transparent and Opaque Materials, Selective

UNIT II: Solar Collectors

Flat Plate Collectors: Effective Energy Losses, Thermal Analysis, Heat Capacity Effect, Evacuated Tubular Collectors; Air Flat Plate Air Collectors: Types, Thermal Analysis.

Concentrating Collectors: Designing and types, Thermal Analysis, Single Axis and Two Axis Solar Tracking; Evacuated Tubular Collectors: Types, Thermal Analysis

Solar Cookers: Types, Thermal Analysis, and Testing Methods; Sensible Storage (Water, pebble bed and ground storage) Latent Heat Storage.

UNIT III: Thermal Energy Storage

Solar Water Heating System: Components, Natural Flow, Forced Flow & Load Estimation Gravity Flow Systems, Mathematical Modeling.

Solar Air Heating Systems: Space Heating, Solar Drying, Load Estimation.

Solar desalination system: Design and type, Solar still, performance analysis.

UNIT IV: Solar Refrigeration and Desiccant

Cooling: Vapor Absorption Refrigeration cycle, Water ammonia and Lithium bromide – water absorption refrigeration systems, Solar Operated Refrigeration Systems, Solar Desiccant cooling.

UNIT V: Solar Power Generator

Solar Thermal Power Generation: Basic Operating and applications, Parabolic trough Systems, Parboloidal Dish Systems, Heliostat system, Central Receiver Power Plants, Solar Furnace.

Solar Photovoltaic System: Basic Semiconductor Theory, Photovoltaic Principles, and Solar Cells: Characteristics, Types and Production Methods, Series parallel combination, Storage Batteries, Modules.

Stand Alone, Grid Connected Hybrid System, DV Arrays, Energy Storage Devices, Power Conditioning, DC Bus Voltage, Power Distribution Devices and Guidelines

Solar Pond: Working principles & System, Application

Recommended Books:

1. Duffle and Beckman, Solar Thermal Engineering Process, John Wiley & Sons, New York
2. J.S. Hsieh, Solar Energy, Prentice Hall Inc. New Jerssey
3. A.B. Meinel and M.B. Meinel, Applied Solar Energy, Addison – Wiley Pub. Co., Reading
4. P.J. Lunde, Solar Thermal Engineering, John Wiley & Sons, New York
5. N.C. Harris, C.E. Miller and I.E. Thomas, Solar Energy Systems Design, John Wiley & Sons, New York
6. H.P. Garg, Advanced in Solar Energy Technology, D. Reidel Publishing Co., Drdricht.

7. S.P. Sukhatme, Solar Energy, Tata McGrew Hill Company Ltd., New Delhi
8. M.A. Greaen "Solar Cells – Operating Principles, Technology, and System Applications", 1983 Prentice Hall, Inc. New Jersey.
9. Markvart, Solar Electricity, John Wiley
10. F. Kreith and J.F. Kreider, Principles of Solar Engineering Hemisphere Publishing Coro.
11. G.N. Tiwari and S. Suneja, Solar Thermal Engineering Systems, Narosa Publishing House.
12. Goden – Solar Energy
13. M P Agrarwal - Solar Energy
14. W H Blass, F. Pfisterer – Advance in Solar Energy Technology
15. Mathur and Methaf - Solar Energy

EN7A-702: New and Renewable Energy Sources and Technologies

Credits: 4 (64 Hours)

Unit I: Energy Scenario

World Energy Scenario: Use and their availability and overall energy demand. Energy Consumption in various sectors and its changing pattern, exponential increase in energy consumption and projected future demands. Sustainable Development, Role of Renewable Energy sources in Sustainable development, Energy Consumption and its impact on environmental climatic change.

Indian Energy Scenario:

Commercial and non-commercial forms of energy, Fossil fuels, Renewable sources including Bio-fuels in India, their utilization pattern in the past, present and future projections of consumption pattern, Sector wise energy consumption.

UNIT – II: Wind Energy

Wind potential in India and world, basic principle of wind energy Conservation characteristics of wind power, Extractable wind power, Site selection, wind data analysis and predictions, Use of statistical tools, Different types of Wind Machines Electricity generating stand alone systems & grid connected systems, Performance Estimation of Wind turbines, Aerodynamic construction of rotor blades, Wind Farms, wind mills & their applications, Cost economics, case studies.

Air Borne Wind Turbine, Types of Airborne Wind Turbines, Ground Gen System & Fly gen system, their working, Advantages & Disadvantages of technologies, Future Scope of Technology, Wind Stalk, Working of Wind Stalk, Advantages & Disadvantages of Wind Stalk.

UNIT – III : Small Scale Hydroelectric (Mini & Micro Hydel)

Classification of Small Hydro Power Stations, Components of a Hydroelectric Scheme, Civil Works Design Considerations for Mini and Micro Hydel Projects, Turbines and Generators for Small Scale Hydro Electric, Protection, Control and Management of Equipments, Advantages and Limitations of Small Scale Hydro-Electric, Hybrid Systems, Hydrolic Ram and its Applications

UNIT – IV Geothermal Energy

Potential Sites, Estimations of Geothermal Power, Nature of Geothermal Sites, Hot-Dry Rocks Resources, Magma Resources, Systems for Energy Generation, Applications of Geothermal Energy, Environmental Issues.

Ocean Energy: Basic Theory of OTEC, Potential and application of Technologies, Basic Theory of Wave Energy, Potential and Technologies, Basic Theory of Tidal Energy, Potential and Technologies.

UNIT – V Hybrid systems

Wind-PV systems, Wind-DG systems, Wind-Hydel systems, Gasifier DG- Wind systems

UNIT – VI Direct Energy Conversion

Fuel Cells: Basic Principle of working, potential, classification of Fuel Cells, Types of Fuels cells, Advantages & Disadvantages, Conversion efficiency of fuel cells, Types of Electrodes, Applications, Thermo – Electric Generators and Refrigeration.

Hydrogen Energy: Production, Electrolysis, Thermo-chemical methods, Fossil fuel methods, Solar Energy Methods, Storage, Transportation, Applications.

Recommended Books

1. Twidell & AW. Wier, Renewable Energy Resources, English Language book, Society *I* E & FN Spon (1986).
2. Grey & O.K. Ganhus, Tidal power, Plenum Press, New York (1972).
3. Goswami. Alternative energy in agriculture, Vol. II CRC Press Inc. Florida, 1986.
4. E.R. Berman, Geothermal Energy; 'Noyes DATA Corporation, New Jersey, 1975.
5. D.A Stafford. & D.L. Hawkee & R Horton, CRC Press Inc., Florida.
6. N.K. Bansal., M. Kleeman & M. Mielee, Renewable conversion technology, Tata McGraw Hill, New Delhi.
7. S.S.L. Chang, energy Conversion, Prentice Hall Inc., 1963
8. V.D., Hunt, Wind power: A handbook on Wind energy Conversion systems. Van Nostrand Reinhold Company, 1981.
9. D.A. Stafford, D.A, Hawkees, D.L. & R. Hoston, Methane production from waste organic matter, CRC Press, Boca Raton, 1980
10. Kreith Goswami – hand book of Energy Efficiency and Renewable Energy
11. Leon freris- Renewable energy
12. Da Rosa – Fundamental of renewable energy
13. TERI Energy Data Year Books.
14. Planning commission statistics
15. www.bp.com/centres/energy
16. www.eia.doe.gov
17. www.epa.org
18. Bureau of Energy Efficiency- Volume 1

EN7A -703: Water and Waste Water: Pollution and Control Technologies

Credits: 4 (64 Hours)

UNIT I : Fundamentals: Definition, Classification, Sources Water quality Standards.
Water Chemistry: Theory of Acid Base Equilibrium, Water Pollution And Control: Indicators, Hardness & Determination of DO BOD, COD of Water, and Water Pollution due to heavy metals and Organic Pollutants.
Surface Water Treatment: Water Purification, Processes in Natural Systems (Physical, Chemical, Bio-Chemical Processes) and Its Application, Response of Stream to Bio-Degradable Organic Wastes.

UNIT II: Water Treatment Methods: Principles and Design, Aeration Systems, types of settling and settling equations, design criteria and design of settling tanks.
Coagulation and Flocculation – types of coagulants, coagulant aids, coagulation theory, optimum dose of coagulant, jar test method, design criteria and numerical examples.
Filtration – theory, types, filter backwash, operational problems and trouble shooting.

UNIT III: Unit processes, Water Softening- Principles and design- Ions causing hardness, various methods.
Waste Water Treatment: Principles and Design, Objectives of wastewater treatment, characteristics, flow variations, types of reactors and reactors analysis. Mass Loading Factors, Impacts, Estimation and Their Unit Loading.

UNIT IV: 'Principle of Biological Treatment; Microbial Growth Rates, Treatment Kinetics, Food/Micro Organism Ratio, Substrate Removal Efficiency.
Theoretical principles and design : Aerobic Suspended Growth Systems, Activated Sludge, Aerated Lagoon, Principles and design of stabilization ponds, Aerobic Attached Growth, Trickling Filters,

UNIT V: Anaerobic - UASBS, Sludge Digesters, Anaerobic Ponds. Different Types of Industrial Effluent Treatment Plants
Sludge Processing: separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic. Numerical problems and Case Studies

Recommended Books

1. Environmental Pollution and Its Control Jeffrey J. and P.A. Vesilind.
2. Chemistry for Environmental Engineering Clair N. Sawyer & McCarty, TATA McGraw Hill International Publication IIIrd Edition.1986
3. Environmental Engineering - Howard S. Peavy et.al, TATA McGraw Hill International Publication 1st Edition. 1986
4. Environmental Engineering – Ruth F. Weiner and Robin Matthews fourth edition.
5. Water & Waste Water Technology - Marle J. Hammer, Prentice Hall of India Ltd. New Delhi 2nd
6. Waste Water Treatment, Disposal & Reuse - Metcalf & Eddy, TATA McGraw Hill Publication New Delhi 3rd Edition.
7. Waste Water Treatment for Pollution Control – Soli J. Arceivala, TATA McGraw Hill Publication New Delhi 2nd Edition.
8. Energy Conservation in water and wastewater facilities.
9. Water Treatment Handbook, Vol. 1& 2

10. "Manual on water supply and Treatment ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999.

EN7A– 704: Heat Transfer and Energy Conservation Laboratory

Credits 3 (48 Hours)

1. Determine the percentage of excess air required for given fuel.
2. Determination of Stack Gas Composition by flue gas analyzer:
    a) Percentage of CO_2 or O_2 in flue gas.
    b) Percentage of CO in flue gas
    c) Temperature of flue gas.
3. Determine the radiation, convection loss and opening in boiler or furnace
4. Determine the Efficiency and loading of motor
5. Determine the Efficiency of the given Blower, fan and Pump.
6. Determine the performance of Air Compressor System
7. Calculate the Coefficient of performance (COP), EER, SPC for given Air condition units (Window AC Conventional, Split AC Conventional), Split AC Energy Efficient. 8.
8. Determine the Installed Load Efficacy Ratio (ILER) for given areas.
9. Determine the efficacy of the given Incandescent v/s compact florescent lamp.
10. Determine the energy consumption of the different electrical appliance for 8, 12 and 24 hour.
11. To determine the heat transfer coefficient in natural convection and forced convection.
12. To determine temperature distribution, heat transfer and fin efficiency of a pin fin in natural and forced convection.
13. To determine and compare LMTD, Overall Heat transfer coefficient, efficiency and effectiveness of a heat exchanger in parallel flow and counter flow mode (Water to water).
14. To determine and compare LMTD, Overall Heat transfer coefficient, efficiency and effectiveness of a heat exchanger in parallel flow and counter flow mode (Water to air).
15. To determine and compare LMTD, Overall Heat transfer coefficient, efficiency and effectiveness of a heat exchanger in parallel flow and counter flow mode (Shall & Tube).
16. To determine heat transfer coefficient for drop and film wise condensation.
17. To determine the performance of heat pipe.
18. To determine thermal conductivity of an insulating power.
19. To determine thermal conductivity and temperature distribution across the width of the composite wall.

EN7A -705: Energy and Environment Software Applications

Cr. 3 (48 Hours)

S. No.	List of Experiments
1.	Create a letter which you intent to print or e-mail multiple times, sending each copy to a different recipient (use of mail merge).
2.	Hyperlink your word document to (i) Link other word file in the existing word document. (ii) Link word/phrase to another word/phrase within the same document. (iii) Create a link to a web page in the existing document.
3.	Create bookmarks in word document by Name as well as by Location.
4.	Insert page numbers in word document such that first five pages carry Roman numbers and rest of the pages are numbered 1,2,3 and so on.
5.	Create a basic spreadsheet by entering numbers, text, apply formulas, functions, special formatting, sorting, filtering and demonstrate the ease of creating charts, trend line fitting etc.
6.	Create a 2 storey building 20*30 m with pitched roof. Add a dormer window in the middle of sloping roof using an outline block. Set the vertical walls of the dormer window at 1.5 m and make the sloping roof 1.5 m long at 45 degrees. Convert the dormer window outline block to a building block and add a window 1m * 1m. Now cut a hole in the sloping roof of the main roof block and merge the two blocks. Visualize the building and look inside.
7.	Design simple 10*30 m building with long dimension running North to South. Divide building into 4 zones. Set the activity at building level as Office_OpenOff. Set activity for Zone 3 as Office_Reception. Set the activity for Zone 4 as Office_Store. At building level select the lighting template as T8 Fluorescent, triphosphor high frequency control gear. Set the lighting energy as 16 W/m^2. Note schedule Office_OpenOff_Light has been inherited from the activity. Select luminaries type as surface mount. Turn on lighting control and set control type to linear and % area covered by lighting area1 to 40%. Now go to Zone 3, reception. Select lighting template as fluorescent compact. Accept default 23 W/m^2 and set luminaire type as recessed. Turn off lighting control. Now go to zone 4, store. Select lighting template as metal halide. Set luminaries type to suspend. Turn off lighting.
8.	Design a 2 storey building and create openings such as Windows, vents, doors, holes etc.
9.	Create a project for a location and a create a new building using default options and draw a block 20m * 10m with the longer façade facing North and South. Keep the default Office _Open Off activity and use defaults for constructions, openings and lighting. At building level go to the HVAC tab and Load the Packaged Direct Expansion HVAC template. Set the Mechanical ventilation Outside air definition method to 1-By Zone. Set the Mechanical ventilation Outside air delivery to be 2 ac/h. Leave the Mechanical ventilation Operation schedule to be Office _Open Off_Occ. At building level go to the Activity tab and open the Environmental Conditions header and leave the heating setpoint at 22° C and the cooling setpoint at 24° C. Click on the simulation tab and select hourly and daily results in the Simulation Options dialog and press O.K. to start the simulation. Analyze the results.
10.	Create an input file using text editor in trnsys environment to calculate the collectors useful energy gain and the required auxiliary heat input for a Solar Water Heating System. The system consists of a flat-plate collector, a pump, a constant temperature water supply, and an auxiliary heater designed to supply 60° C water at all times.
11.	Create an input file using graphical user interface in trnsys environment to calculate the collector's useful energy gain and the required auxiliary heat input for a Solar Water Heating System. The system consists of a flat-plate collector, a pump, a constant temperature water supply, and an auxiliary heater designed to supply 60° C water at all times.
12.	Determine the environmental score of a project/plan by considering environmental components in each of four categories using RIAM software.
13.	Evaluate the energy production; life-cycle costs and greenhouse gas emissions reduction for solar water heating system (SWH) using RET Screen software.
14.	Evaluate the energy production, life-cycle costs and greenhouse gas emissions reduction for PV applications using RET Screen software.

Recommended Books

1. Using MS – Office 2000- Woody Leonhard
2. The complete guide to MS – Office –Ron Monsfield
3. Turba, Information Technology, Wiley & Sons
4. A Handbook to EMIS, Published by the Office of Energy Efficiency of Natural Resources Canada
5. Manuals of TRNSYS
6. Manuals of Design Builder
7. SCREEN3 Model User's Guide
8. RIAM Model User's Guide

EN7A-706: Field Visit

Credits: 1 (16 hours)

In this course, student (s) would be live demonstrated the technologies related to Energy and Environment in the Field, which is already, discussed in the theory classes. At the end of semester student (s) suppose to submit his/her Field Visit report in the form of spiral binding, to the Examination In charge and present it (through PPT) in front of the Examiner (s). His/ Her work would be evaluated orally by panel of 02 or more than 02 Examiner.

EN7A- 707: Seminar

Credits: 2 (32 hours)

In this course, students have to collect and compile the latest information/development on the new technologies/System/ Methods related to Energy and Environment with help of allotted supervisor. Prepare the report and submit to the Examination In charge. At the end of semester he/she has to present his/her Seminar report (through PPT) in front of the Examiner (s).

EN7A - 708: Electric Power Generation, Instrumentation, Measurements, Transmission and Distribution

Cr. 3 (48 Hours)

Unit I

Generation:

Various Method of Electrical Generation, Thermal Power Plants, Hydroelectric Power Plants, Hydro Turbines, Gas Turbines, Intergraded Gasification- Combustion Power Cycle Plant, Nuclear power plant.

Unit - II

Measurement & Instrumentation, classification, static and dynamic characteristics of instruments, sensors and transducer,

Classification of transducers:

Displacement transducer, Strain gage, LVDT, piezoelectric transducers, capacitive and Inductive transducer, selection of transducers

Pressure measurement: manometers; diaphragm, below elements, vacuum gases, Bendron tube.

Unit - III

Temperature measurement: Thermocouples, RTCs, Thermist ors, Radiation and optical pyrometer,

Flow measurement: pilot tubes, turbo magnetic and electromagnetic flow meters, ultrasonic, velocity flow meter.

Anemometers, level measurement: Floats, displayer, hydrostatic and thermal electrical methods, Humidity and moisture measurement.

Unit IV: **Transmission**

Basic Concept, Power in Single Phase, AC Circuits, Complex Power, Power Triangle, Phase Diagram Power in Balanced, Three-Phase Circuit. Basics of Transmission & Distribution System, Impedance of Transmission Lines, Performance of Short, Medium and Long Transmission Lines, Transmission Line Losses, Underground Cables, Voltage Regulation, Power grid.

Unit V: Distribution

Radial and Ring Type Distribution Systems, Kelvin's Economic Law, Distribution Network. Distributions and Feeder, Voltage Regulation Distribution Losses. Depreciation and Tariffs, Economics of Generation, Power Factor Improvement.

Recommended Books

1. I.J. Nagrath and D.P. Kothari, Modern Power System Analysis Tata McGraw Hill, New Delhi (1983)
2. T. Gonen, Electric Power Distribution System Engineering, McGraw Hill Book Co. (1988)
3. Soni, Gupta, and Bhatnagar, A course in Electrical Power, Danpat Rai and Sons. .
4. Wadhwa, C.L. Generation, Distribution and Utilization of Electrical Energy, Coiley Eastern Ltd. (1989).
5. William D. Stevenaon, Elements of Power System Analysis, Mc Graw Hill, London (1982)
6. Basic Electrical Engineering by J. B. Gupta, 3rd Edition (2006)
7. Nuclear Energy By Raymond L. Murray 6th Edition (2008).
8. W. D. Cooper and A.D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, New Delhi (1989).
9. D. Patranabis, Principles of Industrial Instrumentation, Tata McGrew-Hill publishing Company Ltd., New Delhi (1990).
10. Doeblin – Measurement System McGrew Hill Book Co., (1981).
11. T. R. Padmanabhan, Industrial Instrumentation: Principles and Design, Springer.
12. J.P. Homan, Experimental Methods for Engineering, 6th edition McGrew Hill Inc.
13. Instrumentation methods by Chatwal Anand, 3rd edition, Meerut publication house, Meerut
14. Instrumentation, Measurement and Control – D S Kumar

EN7A-709: Comprehensive Viva-Voce

Credits: 4 (64 hours)

Comprehensive Viva-Voce: At the end of semester student (s) knowledge gain during the semester would be evaluated orally by panel of 04 Examiner, which include 01 External and 3 internal Examiner.

EN7A -710: Engineering Thermodynamics, Heat Transfer & Process Integration

Credits: 4 (64 Hours)

Unit I: Basic Heat Transfer Concept and Terminology:

Basic Concepts Terminology, Heat Transfer Coefficients, Thermal Resistance, Overall Heat Transfer Coefficient.

Conduction: Conduction Equation, Steady State Conduction in simple geometries, Thermal; Contact Resistance ,Critical Thickness of Insulation, Multidimensional Steady State Heat Conduction (Shaper Factor), Types of Fins, Effectiveness and Efficiencies of Fins Area Weighted Fine Efficiency, Transient Heat Conduction ,Lumped Heat Capacity Analysis, Heiler's Charts for Semi-Infinite Medium, Slab Cylinder and Sphere, Periodic Heat Conductions.

Unit II: Convection: Similarity Principle, Mass moments and Energy Balance equations, Evaluation of Dimensionless Parameters, Forced Flow Convection (Laminar, Turbulent &Mixed) Thermal and Velocity Boundary Layer Thickness Convective Heat Transfer Coefficient ,Drag Coefficient for Flat Plate, Inside tube , Cylinder, Sphere and banks of tubes, Free convection (Laminar, Turbulent &Mixed) on horizontal Verticals and Inclined Plates, Inclined Parallel Plates, Horizontal, Verticals, Cylinder and Sphere ,Two Phase Convection :Phase Condensation on vertical and Single Tube, Bank of Tube Boiling.

Unit III: Radiation: Blackbody Radiation, View Factor Algebra, Enclosures with Black Surfaces and Grey Surfaces, Radiosity, Heat Exchangers and its Types, Effectiveness, LMTD and NTU Methods.

Unit IV Pinch Technology and Process Integration

Principle of pinch Technology , Stream Network, Design of Energy Recovery System, Selection of Pinch Temperature Difference: Graphical and Tabular Methods, Stream Splitting, Process Retrofit Application, Installation of heat pump and engines, Grand Composite Curves.

UNIT V Engineering Thermodynamics: Quantity and Quality Aspects

Properties of Pure Substances: Ideal gas, Equation of State and corresponding state correlations for PVT Systems, Fundamental Concepts and basic Principles

The First Law of Thermodynamics: Fundamentals, Closed Systems, first Low Analysis of Control Volumes, Steady Flow Process, Steady Flow Engineering Devices, Reversible Work, Irreversibility energy, Exergy

Second Law Efficiency of Thermodynamics: Fundamentals, Carnot Cycle, Availability Analysis of Closed Systems, Analysis of Steady Flow Systems, and Analysis of unsteady Flow Systems.

Sterling Engine: Principle, working and efficiency

Thermodynamics Of Flow Process: Nozzle, Throttling of Gases and Vapors, Mixing of gases, Compressors.

Chemical Thermodynamics: Chemical Reactions, Chemical and Phase Equilibrium, Thermodynamics Analysis of Process

Reference Books

1. M.N. Oziesik, Heat Transfer - A Basic Approach, McGrew Hill Book Co., New Delhi.
2. M. Becter, Heat Transfer: A Modem Approach
3. S.P. Shukatme, Heat Transfer, Orient Longman, New Delhi.
4. W.H. Giedt, Principles of Engineering Heat Transfer, D.Van Norstand Company Inc.(1961)
5. F. Kireth, Radiation Heat Transfer, International Text book Co., Semton, USA (1962).
6. Process Integration, Chapter of Energy Efficiency, By Eastop.
    - Bejan Adrian – Heat Transfer
    - Y. Bayazitoglu – Element of Heat Transfer
    - Karlekar – Heat Transfer
    - J.P. Holman – Heat Transfer
    - Robin Smith -- Chemical Process (Design and Integration)
7. Yunus A. Cengel, Introduction to Thermodynamic and Heat Transfer, McGrew Hill Company, Inc. (1997).
8. Frank W. Schmidt. Robert E. Henderson and Carl H. Wolgemuth, Introduction to Thermal Sciences: Thermodynamics, Fluid Dynamics, Heat Transfer, John Wiley and Sons Inc. (1993).
9. William L. Haberman and Jems E.A. John. Engineering Thermodynamics with Heath Transfer (2nd edition), Allyn.;'imC:i:Bacon (1989).
10. Process Integration, Chapter of Energy Efficiency, By Eastop.
11. S.E Jorgensen – Eco Exergy as Sustainability

EN7A -711: Air and Noise Pollution: Effects and Control Technologies

Credits: 4 (64 Hours)

UNIT I: Noise Pollution and Control

The Decibel Scale, Sound Intensity Level. Classification of Noise, Noise Standards. Effects of Noise, Noise Control Methods, Acoustical Materials, Acoustical Enclosures, Silencers and Muffle Reverberation Control, Personal Hearing Protection Devices, Role of Vegetation in Noise Control.

UNIT II: Air Pollution & Control: Definition, Air Quality, Classification of Air Pollutants, Air Pollution Episodes.

UNIT III: Air Pollution Monitoring

Collection of Gaseous Air Pollutants, Collection of Particulate Pollutants, Measurement of SO_x, NO_x, CO, Oxidants and Ozone.

UNIT IV: Meteorology & Dispersion of pollutants:

Wind Circulation, Lapse Rate, Stability Conditions, Maximum Mixing Depths.

Air pollution control technologies for particulates and gaseous contaminants.

Gravity settlers, Electrostatic precipitators, bag Filters Scrubbers Cyclone, control for moving sources

UNIT V: Global Concerns, Light Pollution and Thermal Pollution

Recommended Books

1. Understanding Environmental Pollution Marquita K.
2. Environmental Pollution And Its Control, COGENT International, 1st edition 1998 S.A. Abbasi
3. Environmental Noise Pollution And Its Control, Anmol Publication 1st edition 1992 Chhatwal G.R.et al
4. Environmental Pollution And Its Control Jeffrey J. and P.A. Vesilind
5. Air Pollution: M. N. Rao & HVN Rao, TATA McGraw Hill Publication, New Delhi, 12th edition, 1998
6. Chemistry for Environmental Engineering Clair N. Sawyer & McCarty, TATA McGraw Hill International Publication IIIrd Edition.1986
7. Environmental Engineering - Howard S. Peavy et.al, TATA McGraw Hill International Publication 1st Edition. 1986.
8. T K Ray, Air Pollution Control in Industries , Vol-1,2
9. J.N.B, Air Pollution and Plant Life.
10. Robert Jennings Heinson, Air Pollution.

EN7A - 712: Bio and Solid Waste Management

Credits: 4 (64 Hours)

Unit I: Biomass & Biomass management

Biomass availability, Characteristics of biomass or organic wastes, Energy Plantation, Waste Biomass/Organic utilization Technology options, Potential, Process and technologies, characteristics of Briquettes and their use.

Unit II: Biochemical Process

Aerobic and Anaerobic Bioconversion process, Biogas production process, Effect of feed and operational parameters, Types of digesters and their suitability, Applications. Design criterion of some Bio-methanation Plants, optimum sizing of landfill digesters & gas storage systems.

Unit III: Thermo Chemical Process

Biomass Gasification Process: Types of Gasifiers and their working, Feed and operational parameters on output gas production, properties of output gases (mainly producer gas), Design of a Gasifier.

Biomass Pyrolysis: Process of slow and fast Pyrolysis for solid and liquid fuel Production, Technologies, Applications.

Unit IV: Bio-oils and Composting

Characteristics of Bio-diesel, Materials and Methods, and its applications, Alcoholic Fermentation Process, Technologies and its applications.

Composting: Process Material and operational, Parameters, characteristics of manure, applications. Vermi-composting: Process, Types of Species, Materials and Methods,

Characteristics of Manure, Applications.
Unit V: Characterization of Different Types of Solid Waste, Municipal Solid Waste, Agro Waste, Others.

Hazardous Waste:
Characterization, Collection, Transportation, Treatment, Storage and Disposal.

Waste Management
Different Option, Integrated Waste Management Strategies, Collection, Transportation and Environmental Impact.

Unit VI: Waste Control Technologies

Issues, Techniques and Economics, Sources Reduction, Recycling, Non-incineration technology, Incineration, Landfill, Refused Derived Fuels.

References:

1. Biomass – Thermo-chemical Characteristics Edited by PVR Iyer; T R Rao; P D Grover and N P Singh, Published by Biomass gasifier Action Research Centre, Dept of Chemical Engineering , IIT Delhi
2. Kaup and Goss (1984) "Small Scale Gas Producer Engine System" Published by Friedr, Vieweg & Sohn Braunschweig/ Wiesbaden.
3. ABETS, IISc, Bangalore (2003) "Biomass to Energy – The science and technology of the IISc Bio-energy systems" Published by Science & Technology of the Indian Institute of Science, Bangalore
4. Reed, T. B. and Das, A. (1988) "Hand book of biomass down draft gasifier engine systems". Published by Solar Energy Research Institute, U.S. Dept. of Energy
5. K M Mital ,Biogas System - Principles & Applications Published by new Age international (p) Ltd, New delhi
6. Klaus von Mitzlaff, "Engines for biogas- theory, modification & economic operation" Published by friedr. Vieweg & Sohn Braunschweig/ Wiesbaden
7. Orion Polinsky "A Bio-fuels Handbook" Published by Oasis Publishing 2002.
8. S.P. Sharma & Chander Mohan, Fuels & Combustion, Tata McGraw Hill Publishing Co. Ltd. 1984
9. J. D. Gilchrist, Fuels, Furnaces & Refractories, Pergamom Press,
10. Blokh A.G, Heat Transmission in Steam Boiler furnaces, Hemisphere Publishing Corpn, 1988
11. Gupta O.P, Elements of Fuels, Furnaces & Refractories, 3rd edition, Khanna Publishers, 1996.
12. Samir Sarkar, Fuels & Combustion, 2nd Edition, Orient Longman, 1990
13. Bhatt, Vora, Stoichiometry, 2nd Edition, Tata McGraw Hill, 1984
14. K.L. Wang & N.C. Periera, Handbook of Environmental Engineering, Vol. 2, Solid waste processing & recovery. The Humane press, Cliton, New Jersey.
15. N.C. Cheremenisoff, P.N. Cheremenisoff & F. Ellurbrush, Biomass- Application, technology & production, Marcel Dekker, New York, 1980.
16. W. Salonas & Frostner D., Environmental Management of Solid waste- dredged material & tail minings. Springer_Yedag,New York, 1988.

17. G. Technobanogalous, H.Vigil. & T. Theilsein, Integrated Solid waste management collection, disposal & reuse, McGraw Hill, 1994
18. Handbook of solid management" Frank Kerith, McGraw Hill, Inc. USA (1994).
19. Hazardous Waste Management – Charles A. Wentz
20. T V Ramchandra- Management of Municipal Waste

EN7A - 713: Green Building Technologies

Credits: 4 (64 Hours)

Unit I: Green Building Design Strategies and Building Codes

Energy use in Buildings, Factors effecting Energy use, Energy Conservation options. External Factors – Climate, Building Orientation, Shading, types of shading devices.

Unit II Thermal Comfort:

Criteria and various Parameters, Psychometric Chart, Thermal Indices. Indoor air quality; Requirements in residential, Commercial, Hospital Buildings.

Unit III Heating Cooling Concepts

Passive heating concepts: Direct gain, indirect gain, isolated gains and suspense
Passive cooling concepts: Evaporative Cooling, Evaporative Air and Water Coolers, Radiative Cooling, Application of Wind, Water and Earth for Cooling ,use of isolation, Shading, Paints and cavity walls for cooling;
Passive heating and cooling concepts: Roof pond/sky therm, roof radiation trap, vary-therm wall, earth sheltered or earth based structures and earth air tunnels; selective ventilation, components- windows and thermal storage

Unit IV Heat Transmission in Buildings:

Surface Coefficient, Air cavity, Internal and External Surface, Overall Thermal Transmittance Walls and Windows, and Packed Roof-thatched Heat Transfer due to ventilation/ infiltration, Building loss coefficient Internal Heat gains, Solar Temperature, Steady State Method (for Trombe Wall, Water wall and Solarium), Degree Day method

Unit V Modeling of Building:

Correlation methods - solar load ratio, load collector ratio, thermal time constant method, Analytical methods - thermal circuit analysis, admittance procedure of metrics. The periodic solutions - thermal modeling of AC / Non AC buildings, software application. ASHRAE Methods and standards for estimates of Heating and cooling and Ventilation, Requirements of Different use Buildings, Air Quality control Equipments, Typical Designs of Selected Buildings in various Climatic Zones, Thumb Rules for Design of Building systems.

Evaluation methods: LEED methodology, BEE star rating, GERRHA Methodology
Case Studies

Recommended Books

1. M S Sodha, N.K. Banaal, P.K.Bansal, A.Rumaar and M.A.S. Malik, Solar Passive: Building Science and Design, Pergamon Preen (1986).

2. Jamee; L. Threlked, Thermal Environment Engineering, Prentice Hall, INC-, Raglevood Cliffs, New Jersey (1970)
3. T.A. Markus and R.N. Morris, Building, Climate and Energy Spottwoode Ballantype Ltd-, London U.K. (1980)
4. Solar Thermal Energy Storage, H. P. Garg et.al, D. Reidel Publishing Company (1985)
5. Mathematical Modeling of Melting and Freezing Process, V Alexiades & A.D. Solomon, Hemisphere Publishing Corporation, Washington (1993)
6. Energy storage technologies, a reading material prepared by Dr. D. Buddhi, School Of Energy And Environmental Studies, DAVV, Indore.

EN7A - 714: Solar Thermal and Photovoltaic Laboratory

Cr. 3 (48 Hours)

1. Determination of Thermal Efficiency of Flat Plate Collector.
2. Determination of Heat Loss Factor and Heat Removal Factor of a Flat Plate Solar Collector.
3. Study of Thermal Performance of a Built in Storage Solar Water Collector.
4. Determination of Tim Constant of a Flat Plate Solar Collector.
5. Thermal Testing of a Box Type Solar Cooker (First and Second Figure of Merit).
6. Performance Evaluation of a Single Basin Solar Still.
7. Thermal Testing of Concentrated Solar Cooker (F0 and FUl.)
8. Study of Thermal Performance of an Air Heater.
9. Drying Performance of a Solar Dryer.
10. Power Load Characteristic of a Photovoltaic Cell.
11. Power Output Vs Exposed Area.
12. Power Output Vs Azimuthal and Tilt Angle
13. Spectral Response of a PV Cell.
14. PV System Performance
15. Study the Effect of Solar Irradiance and ambient air Temperature on Module Output.
16. Calibration of Thermocouples and RTD.
17. Calibration of Pyranometers.
18. Determination of geographical N-S direction.

EN7A – 715: Energy Modeling & Project Management.

Cr. 3 (48 Hours)

Unit I: Introduction:
Role of modeling and project management in energy project

Unit II
Energy Markets: Monopoly, oligopoly and competitive markets, behavior of markets with price change of energy, balance payment problems.
Basic Pricing: Basic Pricing Principles, Growing Demands and Dynamic effects, Short Run versus Long Run Marginal Cost Pricing, Peak load and seasonal pricing, Pricing of Nonrenewable energy resources. Subsidized Prices and life line rates,

Unit III : Energy Planning: Planning and Role of Demand Management, Integrated National Energy Plan, Supply and Demand analysis, Energy action planning, Energy Balance, Perfect competitive economy, economic second best considerations, life line rates for poor consumers, Decentralized Energy Planning, Energy Modeling, Date Analysis & Demand management, LP models, Application of LP model in transportation, Types of Transportation problem, Balanced Transportation Problem, Unbalanced Transportation Problem, Method for solving Transportation Problems using LP Model: North-West Corner Method, Row Minima Method, Column Minima Method, Least Cost Method, Vogel's Approximation Method est.
Case studies, Force Field Analysis, Energy Policy Purpose, Perspective, Contents, Formulations and Ratification.

Unit IV: General Management: Organizing, Location of Energy Management, Top Management Support, Managerial Functions, Roles and Responsibilities of Energy Manager, Accountability, Motivating – Motivation of Employees.
Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs, and Case Studies. Concept and purpose of projects management, functions of project manager, project feasibility analysis, project appraisal criteria, monitoring and control of a project. True Cost of Non- Renewable Energy Production.

Unit V: Project Management: Definition and scope of project, Technical Design, Financing, Contracting, Implementation and Performance Monitoring, Implementation Plan for top management, Planning Budget, Procurement procedures, Construction, Measurement and Verification. Investment needs Appraisal and Criteria, Financial Methods of Projects evaluations, Case Studies.

Network Analysis: PERT and CPM network

Recommended Books:

1. D. Deo, S. Modak and P. R. Shukla, Decentralized Energy Planning Oxford and IBH Publishing Co. Pvt. Ltd.,
2. B. Bukhootaeo et al. Energy, Planning and Policy
3. J.K. Parikh,Modeling Approach to long term de and Energy Implications.
4. Markdias, Forecasting Methodologies.
5. Koontz,O.Donnel and We@ich,Managewnt Kogakuj3ha.Tokyo.

6. R.D. Agrawal, Organization and Management, Tata McGrew Hill, New Delhi.
7. Newman and Warren, The Process of Management, Concepts, Behavior and Practice, Prentice Hall of India, Mm Delhi.
8. J.A.F.Stoner and R- E. Ferrman, Management, Prentice Hall of India, New Delhi.
9. R. Srinivamm and S.A. Chunavala, nt Principles and Practices, Himalaya Publishing House, Delhi.
10. Prasana Chandra, Project Management, Appraisal and Implementation, Tata McGrew Hill Publishing Company.
11. M. Mohain, Project Planning and Control, Vikas Publishing House, New Delhi.
12. Akalank's Descriptive Law on Pollution and environment. Both editions Akalank Pub.
13. Leonard Ortolano, Environmental Regulation and Impact Assessment, John Wiley & Sons Inc.(1997)
14. TERI Energy Data Year Books.
15. Energy Management Hand Book, Chapter 2, Milton A. Williams
16. Energy Conservation in Industries, Center of Plant Engineering Services, Hyderabad. P
17. Productivity Vol.31 Jan-March,1991 No.4,Energy Policy Perspectives in India, Stephen Paulus.
18. Manual on Industrial Energy Audit, Energy Management Centre
19. Financial Management, Tata Mc-Graw Hill – Prasanna Chandra.
20. Principles of Project Management, NPC publication
21. Project Management, Tata McGraw Hill – S.Choudhury
22. Projects: Planning, Analysis, Selection, Implementation and Review, Tata McGraw Hill – S.Choudhury
23. Encyclopedia of Energy – McGraw Hill Publication
24. Handbook of Energy Engineering , The Fairmont Press Inc – Albert Thumann
25. Energy Handbook, Von Nostrand Reinhold Company - Robert L. Loftness
26. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council

EN7A-716: Comprehensive Viva-Voce

Credits: 4 (64 hours)

Comprehensive Viva-Voce: At the end of each semester student (s) knowledge gain during the semester would be evaluated orally by panel of 04 Examiner, which include 01 External and 3 internal Examiner.

EN7A - 801: Energy Management (Thermal System)

Credits: 4 (64 Hours)

UNIT I: Fuel Analysis: Proximate Analysis, Ultimate Analysis, and Calorific Value. Combustion: Theoretical Air Requirement, Efficiency Estimates, Combustion Control, Stability in Flames.

Furnaces: Classification, General Fuel Economy Measures in Furnaces, Excess Air and Heat Distribution Losses, Temperature Control, Draft Control, Case Studies.

UNIT II: Insulation and Refractory: Insulation Type and Application, Economic Thickness of Insulation, Heat Savings and Application Criteria, Refractory-Types, Selection and Application of Refractory, Case Studies.

UNIT III : Boilers: Types, Analysis of Losses, Performance Evaluation, Feed Water Treatment, Blow Down, Energy Conservation Opportunities, Case Studies.

FBC Boilers: Introduction, Mechanism of Fluidized Bed Combustion, AFBC, CFBC, PFBC Boilers, Condensing Boilers, Saving Potential, Case Studies.

UNIT IV: Steam System: Properties of Steam, Assessment of Steam Distribution Losses, Steam Leakages, Steam Trapping, Condensate and Flash Steam Recovery System, Identifying Opportunities for Energy Saving, Case Studies.

Cogeneration: Need, Applications, Advantages, Topping Cycles, Bottoming Cycles, Combined Cycles, Steam Tracking Mode, Electricity Tracking Mode, Saving Potential, Case Studies.

UNIT V: Waste Heat Recovery: Availability and Reversibility, First and Second Law Efficiencies, Classification, Advantages and Applications, Commercially Viable Heat Recovery Devices, Saving Potential, Case Studies.

HVAC and Refrigeration System, Vapor compression Refrigeration Cycle, Refrigerants, Factors Affecting Refrigeration and Air Conditioning System Performance and Savings Opportunities.
Vapor Absorption Refrigeration System: Working Principle, Types and Comparison with Vapor Compression System, Saving Potential, Distribution systems for conditioned air

Cooling Towers

Types and Performance Evaluation, Efficient System Operation, Flow Control Strategies and Energy Saving Opportunities, Case Studies.

Recommended Books

1. G. L. Witte, Phillips S.Scbmidt and Daid R. Brown, Industrial Energy Management and Utilization, Hemisphere Publishing Corporation, Washington.
2. Carig,B. Saith, Energy Management Principles, Applications, Bnefit and Saving, Per n Press, New York.
3. F. W. Pyne, P *gm* Energy Conservation Manual, Fairmont Proem, INC.P.O. Box 14227 Atlanta,GA 30224
4. D. Patrick and S.W. Fardo, Energy U-sent and Conservation, Prentice Hall, INC Engleweek Cliffs (NJ) 7632.
5. Davida , Fuels Of Opportuniy , Characteristics And Uses In Combustion Systems, Edition-2004 Publisher- ELSEVIER LTD. UK
6. O.P. Gupta, Element Of Fuel Furnaces And Refractories, Edition-Second
7. Gunnar, Anderlind, A Theoretical Analysis Of Thermal Insulation
8. E.R. Berman, Geothermal Energy.
8. Threlked, Thermal Environmental Energy.

EN7A - 802: Energy Management (Electrical System)

Credits: 4 (64 Hours)

UNIT I

Energy Auditing Techniques: Definition, Energy audit- need, 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, Fuel and energy substitution, Energy audit instruments.

Material and Energy Balance: Process Flow Diagram, Material and Energy Balance, Energy Use and Cost Profile of each Fuel Used, Energy Balance Diagram for each Energy Type Used,

Methodologies of Conducting Energy Audit: Preliminary & Detailed Energy Audit Methodology: Preliminary Questionnaire, Review of Previous Records, Introductory Meeting, Walk through Tour, Flow Chart Construction for Detail Energy Audit, Identification of Required Audit Instruments, Finalization of Audit Schedule with the Company, Getting Detailed Data.

Energy Audit Report: Outlines of Energy Audit Report Format, Identification and Techno-economic Analysis of Energy Conservation Measures, Classification of Energy Conservation Measures,

Government Notification & Scheme: Energy Audit Subsidy Scheme of PCRA, IDBI and IREDA, Useful Forms for Data Collections, Useful Charts for Quick Estimations, Checklists for each Devices and Distribution Lines, Thumb Rules and Specific Energy Indices for Devices and Processes

UNIT II

Basic Electrical Systems: Basis of Energy and its various forms: Electrical Basis-DC & AC, currents active power, reactive power and apparent power, star, delta connection.

Bill Analysis: ECO (Energy Conservation Opportunities)

Electricity tariff and components, load Management & Demand Side Control, power factor improvement & its benefit, selection and location of capacitors, Performance Assessment of capacitors & Capacitor Bank.

Lighting Systems: Light source, Choice of Lighting, Luminance requirements, Energy conservation avenues.

Transformers and Electric Distribution: Types of transformers, Transformer losses, Energy efficient transformers, Factor affecting the performance of transformers and Energy Conservation Opportunities, Cables, Switch Gears, Distribution Losses, and energy conservation opportunities in-house electrical distribution system.

UNIT III: Electric Motors: ECO

Introduction, Types, Motor characteristic, Motor Efficiency, losses in induction motors, , factor affecting motor performance, Motor Load Survey: Methodology, Rewinding motor and replacement issues, Energy Saving Opportunities in Motors, Motor Selection, Energy Efficient Motors, , Speed Control of AC Induction Motors ,Soft starter with energy savers, Variable Speed Drives(VFD).

Compressed Air Systems: ECO

Introduction, Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, and leakage test, factors affecting the performance and Efficiency, energy savings opportunities.

UNIT V : HVAC and Refrigeration System: ECO

Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, saving potential

Cooling Tower: Types and performance evaluation, efficient system operation, Flow control strategies and energy saving opportunities, Assessment of cooling towers

UNIT VI

Fans & Blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities

Pumps and Pumping System: ECO

Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Agricultural pumps

Diesel Generating System: Factors affecting selection, Energy performance assessment of diesel conservation avenues

Case studies

Recommended Books

1. Efficient Electrical Use by C.B. Smith.
2. Savings Electricity in Utility Systems of Industrial Plants by B.G. Desai, B.S. Vaidya D.P. Patel and R. Parman.
3. Manual of variable speed drines by CII
4. Efficient use of electricity in industries by B.G. Desai, B.S. Vaidya, M.P. Parmarad R. Parman.
5. Pump Application Desk Book by P.N. Garagy.
6. Electrical Power Distribution in Industrial Plants by M.D. Parmar.
7. Electronic Energy Utilization and Conservation by S.C. Tripaths.
8. Energy Conservation in electrical systems, a reading material prepared by D. Buddhi.
9. Smalensky , Electrical Machines , Vol-3, MIR Publishers MOSCOW
10. Igor J. Karassik , Pump Hand Book , Third Edition 2001 , Mcgrawn-Hill
11. B.R. Gupta, Generation Of Electrical Energy Edition 2005, Eurasia Publishing House (PVT.) LTD. Ram Nagar
12. Karassik , Pump Hand Book
13. Energy Conservation in Water and wastewater facilities
14. Instructions to Energy Auditors, Vol. - I & Vol. - II –
15. National Technical Information Services U. S. Deptt. Of Commerce Springfield, VA 22161.
16. Energy Auditing, The Fairmont Press Inc. Published by Atlanta, Georgia
17. Albert Thumann, P.E., C.E.M. , Plant engineers & Managers Guide To Energy Conservation 8th edition-2002, Published By The Fairmont Press , Inc 700 Indian Trail Liburn, GA30047
18. BEE VolumeI –Second Edition 2005
19. G.G. Ranjan: Optimizing Energy Efficiencies in Industry ,Edition-2003 McGraw Hill

EN7A – 803: Efficient Lighting: Sources, Systems and Design Aspects

Credits: 4 (64 Hours)

Unit I : Lighting

Terms, Definitions Illuminance, Luminance Intensity Luminous Flux, Luminance Existence, Luminous efficacy, Luminous efficiency, Photometric Calculation: Point by Point Method.

Unit II; Eye

Accommodation, Adaptance, Binocular Vision, Resolving Power, Scotopic, Mesopic and Phetopic vision.

Characteristic : Correlated Color Temperature Glare, Brightness, Contrast, Color Rendering, Photometric Analysis.

Unit III : Lamps

GLS, Halogen, Housecent Lamps, Low Pressure Sodium Lamps High Pressure Sodium Lamps, High Pressure Mercury Lamps, Metal Halide Lamp, LED's

Luminaries, Control Gears, Energy Efficient Sources Lighting Requirement

Unit IV: Day lighting

Solar Illuminance, Overcast and Clear Sky Illuminance, Lumen Method, Daylight Factor Method, Energy Saving by Day lighting, Interior Lighting, Commercial Lighting, Industrial Lighting, Exterior Lighting, Lighting and Air Conditioning, Lighting and Energy Conservation Standard.

Recommended Books

1. Illumination Engineering: From Edison's Lamp to the Laser by J.F. Murdocre.
2. Energy Sawing Lighting Systems by P.C. Sorcar.
3. Daylight: Design & Analysis by C.L.Robbine
4. Daylighting in Architecture, A European Reference Book, Published by James & James.
5. Lampa and Liabtins Edited by M.A. Cayleas and A.M. Paraden.
6. IES Lighting Handbooks, Published by Illuminating Engineering Society of North America
7. IRS Lighting Ready Reference Edited by J.E. Kaufran and J.F.Chria tereen
8. IES Lighting Hand Book Edited by J.B,.Kaufman and J.F,.Christersen

EN7A – 804: Biomass and Environmental Laboratory

Credits 3 (48 Hours)

1) Determination of proximate analysis (Moisture content, Ash, Volatile matter & fixed carbon) for a Given Biomass Sample.
2) Determination of Total solids, volatile Solids and calorific value for a given organic Biomass Sample.
3) Determination of elemental analysis (chemical method) for a Given Biomass Sample. Determination of C/N Ratio for a given organic Biomass Sample.

4) Determination of Chemical Oxygen Demand, BOD, Total dissolved solids (TDS) and pH for a Given Slurry or Liquid Sample.

5) Determination of Dissolved Oxygen & Biochemical in a Liquid Slurry Waste Sample.

6) Determination of Fats/oil Content and Carbohydrates in a given oil seed Biomass Sample.

7) Determination of Calorific Value of a solid and liquid Biomass Sample using Bomb calorimeter.

8) To study the Effect of Different Loading Rates, Total Volatile Solids and Hydraulic Retention time on Generation of Biogas in Batch Type Digesters.

9) To study the Completion Yield of Methane Generation from Different Feed Stock in Batch Type Digesters.

10) Estimation the calorific value of gaseous fuel using orsate apparatus and comparing your result with Junker gas calorimeter.

11) Determination of Lignin, Cellulose, Hemicelluloses in a Given Biomass Sample.

12) Determination of Potassium, Sodium and Phosphorous in a Given Waste Slurry Sample.

13) Determination of Crude Protein in a Given Biomass Sample.

14) Study of Gasifier and its performance evaluation with solid and loose biomass.

15) Characterization of liquid biomass (Viscosity, density, flash/fire point, cloud point) and its comparison with diesel

16) Preparation of bio-diesel and determination of it physical properties

17) Performance study of CI engine with different fuel

18) Preparation of alcohol and its Performance study with SI engine

19) Calibration of thermocouples

20) Estimation of Heavy Metals by AAS method from a given effluent

EN7A - 805: Minor Project

Credits: 4 (64 hours)

In this course, students suppose to work on Energy & Environment related issue under the supervision of Expert available in the department. At the end of semester student (s) has to submit his/her work report in the form of spiral binding, to the Examination In charge and present it (through PPT) in front of the Examiner (s). His/ Her work would be evaluated orally by panel of 02 or more than 02 Examiner.

EN7A –806: Sustainable development, Environmental Auditing and Environmental Impact Assessment

Cr. 3 (48 Hours)

UNIT I

Elements of Environmental Impact Assessment:

Principles, Origin and development of EIA Environmental Impact Analysis, Essential components of EIA, Project Screening , Baseline study , Impact Identification, Impact prediction, Evaluation and Mitigation. Methodology matrix method, Network, Overlay, Problems of EIA in developing countries, Future of EIA

UNIT II

The Interlinking: Positive and Negative Impacts, Primary and Secondary Impacts, Impacts on Physical, Chemical, Biotic and Social Environment, Environmental Impact Statement and Environmental Management Plan for Selected Industries.

UNIT III

Concepts of the Environmental Audit: Definition, Benefits, Objectives.

Legislation:

Rules and Regulation, Gazette, Notification on Environmental Statement, Latest Amendments, Need for Environmental Audit, Guidelines for Environmental Audit

UNIT IV

Methodology

i. Pre-audit activities; Preliminary Information, Audit Team.
ii. Activities at the site; Material Balance Waste Flow, Monitoring, Field Observations, Draft Report.
iii. Post-Audit Activities; Synthesis of Data Evaluation of Waste Treatment Facilities, Final report, Action plans, Follow up actions.
Material and Energy Flow Assessment, Preparation of Audit Report, Water Consumption, Guidelines to Environmental Safe Layouts to Minimize Losses & Waste, Control Mechanism, Waste water reduction, Air emission reduction, Preparation of Audit Report, Form V Case Studies

Case Studies

Recommended Books

1. Environmental Impact Assessment, Clark D. Brain, Biesel Donald
2. EIA for Developing Countries, Biswas Asit. K.
3. EIA Guidelines 1994, Notification of Govt. of India Impact Assessment Methodologies & Procedures.
4. Environmental Impact Assessment W. Canter(IInd Edition)
5. Auditing for Environmental Quality Leadership Willing, T-Johan
6. Environmental Audit Mhastear A. K.
7. Hugh Barton and Neol Brudes, A Guide to local Environmental Auditing, Earthscan Publications Ltd. (1995).

EN7B-807: Comprehensive Viva-Voce

Credits: 4 (64 hours)

Comprehensive Viva-Voce: At the end of each semester student (s) knowledge gain during the semester would be evaluated orally by panel of 04 Examiner, which include 01 External and 3 internal Examiner.

EN7A - 808: Major Project

Credits: 12 (192 hours)

In this course, students would be sent to industries for internship for about 06 months, where they would get in hand practical knowledge of industrial problems, handling it and working for it solution. At the end of semester student (s) suppose to submit his/her work report in the form of hard binding, submit it to Examination in charge and present it (through PPT) in front of the panel of Examiner (s). His/ Her work would be evaluated orally by panel of Examiner (s), in which one External Examiner is compulsory.

EN7B-809: Comprehensive Viva-Voce

Credits: 4 (64 hours)

Comprehensive Viva-Voce: At the end of each semester student (s) knowledge gain during the semester would be evaluated orally by panel of 04 Examiner, which include 01 External and 3 internal Examiner