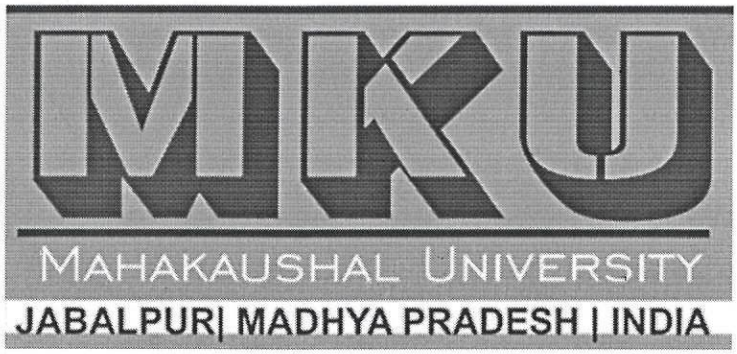
Mahakaushal University, Jabalpur (M.P.)



Scheme & Syllabus

For

M.Tech

in

Energy Technology

2021-2022 onwards

Duration of Course: 2 Years

Examination Mode: Semester

Examination System: CBCS

Mahakaushal University
Village-Aithakheda, Mukunwara Road, Post- Tilwara Jabalpur (M.P.) 482003

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

APPLIED MATHEMATICS

UNIT 1

Applications of Laplace Transform in solving Ordinary Differential Equations, Simultaneous Differential Equations, Difference Equations, Integral Equations.

UNIT 2

The Z- Transform: Some Elementary Concept, Defination, Properties, Inverse Z-Transform, Convolution Theorem. Fourier Transforms: (Sine, Cosine) & Properties

UNIT 3

Numerical Solution of an Ordinary Differential Equations, Numerical solutions of Partial Differential Equations (Laplace, Heat & Wave Equations), Gauss's Quadrature Formula.

UNIT 4

Probability Distributions: Binomial, Poisson & Normal; Sampling (Large Sampling): Types of Sampling, Mean and Standard Deviation in simple Sampling of Attribues,, Tests of Significance of Large Samples, Standard Error, Probable error, Comparison of Two Large Samples.

UNIT 5

Mathematical Modeling : Modeling through Ordinary Differential Equations of First Order – Linear Growth and Decay (Population Growth Models, Effects of Immigration and Emigration on population Size),Non-linear Growth and Decay (Logistic Law of population Growth, Spread of Technological Innovations and Infectious Diseases).

Reference Books:

1. Sastry, S.S. (2006). *Introductory methods of numerical analysis.* Prentice-Hall of India Pvt.Ltd
2. Kanti B. Datta(2012) Mathematical Methods of Science and Engineering, Cengage Learning.
3. Mathematical Modeling by J.N. Kapur , Wiley Eastern Limited .
4. Ray,Sharma,Chaudhary, Mathematical Statistics, Ram Prases & Sons.
5. Ramana, B.V. *Higher Engineering Mathematics.* Tata McGraw-Hill Publishing Company
6. Kreszig, Ervin.(1998) *Advance Engineering Mathematics(8th ed.)*. Wiley publication.
7. Engineering Mathematics By Babu Ram, Pearsons
8. Fourier Transforms by J. N. Sheddon
9. A. G. Hamilton: Linear Algebra, Cambridge University Press
10. B.S. Grewal "Numerical Methods in Engineering & Science".
11. V. Rajaraman "Computer Oriented Numerical Methods".
12. Iyenoyr M.K. Jain & R.K. Jain "Numerical Methods for scientific and engineering

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Power Generation, Transmission & Distribution

UNIT 1

Electrical Energy Generation, concepts, various types of generating stations and their locations. Study of Thermal, Hydel, Nuclear and Non Conventional energy generation schemes. Block diagram of various power stations- schemes and sub systems.

UNIT 2

Steam Power Plants: Types of power plants, steam power plant: Design Operation & Thermodynamic Analysis, steam turbine power output, Power Plant Performance Monitoring & Testing, Heat Rate, Efficiency, Optimization of Performance

Steam Generators: Boiler and steam Generator construction types, Energy Balance and efficiency of steam Generator, Furnace & burners, steam Generators with fluidized based Combustion (FBC): fluidized bed types; emissions reduction in Fluidized bed furnaces, Steam turbines, Condensers, feed Water Heaters and Cooling Water systems

UNIT 3

Gas Turbine Power Plants: Air standard joule Cycle, Actual efficiency of the Gas Turbine Power Plant, Enhancing the Gas Turbine Plant Performance: increasing the compression Pressure Ratio and Turbine inlet Temperature

Hydro Power Generation, Hydro Turbine, Large medium and small hydro power station, Micro Hydel Nuclear power generation and peaceful uses of nuclear energy.

UNIT 4

Generation: synchronous generator, operation, power angle characteristics, and the infinite bus concept, dynamic analysis and modeling of synchronous machines, excitation systems, prime mover governing systems, automatic generation control, auxiliaries.

AC transmission: Over head cables, transmission line equations, regulation & transmissionlosses, performance estimation, reactive power compensation, flexible AC transmission, skin, proximity and Ferranti effects, corona phenomena, critical voltages and power loss. HVDC transmission.

UNIT 4

Distribution system: distribution system, conductor's size, Kelvin's law performance calculations and analysis, distribution inside industrial & commercial buildings entrance terminology, substation & feeder circuit design considerations, distribution automation.

References:

1. Power Generation Technology-Dr.V.K.Sethi, Sudit Publication
2. Thermal Power Technology - Dr.V.K.Sethi, Sudit Publication
3. Generation, distribution and utilization of electrical energy by C.L. Wadhwa, New Age International.
4. Elements of power system analysis- William Stevenson Mc-Graw Hill
5. Modern power system analysis- I..S. Nagrah and D.P. Kothari, Tata Mc Graw Hill.
6. Power system analysis- John Grainger and willian Stevenson, Mc- Graw Hill.
7. Electrical power transmission system: Analysis and Design- Turan Gonen, John Wiley & sons.

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Solar Power Generation

UNIT 1

Solar Power: Introduction, Solar Photovoltaic, History and projection,Advantage & disadvantage of Photovoltaic Systems, Application of Photovoltaic Systems, Overview of SPV programme in India, Solar potential, solar mission of GoI,Role of MNRE, IREDA etc,. Energy from Sun,Insolation available on earth; Global Radiation distribution on an inclined plane.

UNIT 2

Solar Photovoltaics: Basic principle of power generation in a PV cell ; Band gap and efficiency of PV cells ;Component of PV System, Solar Cells; Types; Working; I-V characteristics; losses. Solar PV panel; Balance of Systems; Fabrications of Modules; Economics of PV Systems; Future prospects; Applications of Photovoltaic: Domestic lighting Systems; Remote Applications; Hybrid; Grid linked PV Systems.

UNIT 3

Designing of Solar Photovoltaic Systems: Designing of PV systems, Need for different cell design, The technology route for making solar cells, costing of PV systems, Operation & Maintenance of PV Systems; Battery Storage: Types and Properties of monocrystalline, polycrystalline and multicrystalline cells,Amorphous silicon thin film cells; Photovoltaic materials.

UNIT 4

CSP technologies: Parabolic trough collector technology, Linear Fresnel collector technology, solar tower technology and Stirling dish technology; the solar resource, CSP plant design and performance; Solar field sizing, latest trends in design of Mega Solar Power Plants.

UNIT 5

Solar Thermal: thermal storage; Solar thermal applications - water and space heating; solar ponds; dryers; distillation; solar cooker; Passive solar design; solar thermal collectors - Glazing, evacuation, selective surfaces, concentrators; case studies of solar power plants.

References:

1. Solar Energy fundamentals & applications; by H.P. Garg, J Prakash
2. Solar Energy Technologies; by Chetan Solanki, IIT, Bombay
3. Solar Electricity; by Wiley
4. From Sunlight Electricity by Shirish Sinha Teri
5. Concentrating Solar Power: RENEWABLE ENERGY TECHNOLOGIES: COST ANALYSIS SERIES, *Volume 1: Power Sector,* Issue 2/5 IRENA 2012

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

HYDRO & NUCLEAR POWER GENERATION

UNIT 1

Fundamental of Hydraulic Engineering – Water resource and its potential. Hydrology- Hydrological cycles, hydrograph, steam flow characteristics, flow duration curve, mass curve storage, pond age, site selection. Environmental Impacts and its mitigation- Burdens and impacts identification, impacts in the construction phase; Hydropower Economics.

UNIT 2

Hydro Power: Potential, Hydropower Generation and Distribution, Mini and Microhydel Power (MHP) Generation: Classification of hydel plants, Concept of micro hydel, merits, MHP plants: Components, design and layout, Turbines - Classification and selection criteria, efficiency and performance characteristics, Status in India. Integrated Energy systems and their cost benefit analysis; case studies of hydro power plants.

UNIT 3

Nuclear Engineering:
Introduction, Why Nuclear Power for Developing Countries, Radioactivity and Radioactive Change Rate of Radioactive Decay, Irradiation of Medical products and other application of artificial radioactive, Mass – Energy Equivalence, Binding Energy, Release of Energy by Nuclear Reaction, types of Nuclear Reactions, Initiation of Nuclear Reaction, Nuclear Cross – section, Nuclear Fission, The Fission Chain Reaction, moderation, Fertile Materials and Breeding. Fick's law.

UNIT 4

Nuclear Materials: Introduction, Fuels, Cladding and Structural Materials Coolants, Moderating and Reflecting Materials, Control Rod Materials, Shielding Materials; Fuel rod design.
Safety Rules: Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, Late effect hereditary effect); Nuclear Safety regulation & Standards;

UNIT 5

Nuclear Reactors:
Introduction, General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR), Heavy Water – cooled and Moderated CANDU (Canadian Deuterium Uranium) Type Reactors, Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design, Location of Nuclear Power Plant, Nuclear Power Station in India, India's 3-stage Programme for Nuclear Power Development; Peaceful application of Nuclear Energy –Power Generation and Isotope application; case studies of Nuclear power plants.

Reference:

1. Layman's Guidebook on how to develop a small hydro site
2. Finn R. Forsund – Hydropower Economics
3. Hydro Power an Indian Perspective Author-Cum-Editor Dr. B.S.K. Naidu , Director General , NPTI.
4. Micro Hydroelectric Power Stations – By L.Monition, Power Stations- By L.Monition , Mle Nir, J.Roux translated by Joan Mc Mullan, John Wiley & Sons.
5. Nuclear Physics by J.B. Rajam
6. Introduction to Nuclear reactor theory, Wesley, 1966 by J.R. Lamrash

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Environmental Issues, Policy, Standards & Regulations

UNIT 1

Global environmental concerns: The Scenario, The Changing Global atmosphere &common concerns. United Nations Framework Convention on Climate Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Various Clean Development Mechanism (CDM), Prototype Carbon fund (PCF), Earth Summit, Sustainable development.

UNIT 2

Green Certificate
The Global Program for protected area management, Strategies for environmental improvement plan. Organizations working in the field of energy and environment - UNEP, IPCCC, CPCB etc. Basic features of ISO 14000.

UNIT 3

Water Quality: Parameters: Physical, Chemical and Bacteriological .Potable Water Standards,Waste Waster Effluent Standards. Minimal National Standards (MINAS).

UNIT 4

Environment Policies: Water Act 1974, The Air Act, 1981, Environmental (Protection) Act.-1986, M. P. State Environment Policy, Municipal Solid Waste (Management & Handling) Rules, 1998, Biomedical Waste (Management & Handling) Rules 1998.

References:

1. Environmental Issues and Polices, Prentice Hall—Stephon Ison, Stephen Peake, Stuart Wall
2. ISO 14000 Environmental Management by Goetsch, Davis. Prentice Hall
3. Standard methods for the Examination of Water and Wastewater. (1989).17thEd. APHA, Washigton. D.C., 2-12
4. Energy Management by Paul O'Callaghan –McGraw Hill
5. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
6. Training material on 'Environmental concerns' prepared by National Productivity Council
7. Parivesh, October 2002 – Central Pollution Control Board
www.epa.org
www.uneptie.org
www.cpcb.nic.in
www.wri.org
www.safeclimate.net
www.globalwarming.org, Bureau of Energy Efficiency 186

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Energy – I LAB

- Study of Solar Radiation Measurement using Pyranometer and Solarimeter
- Determination of Solar Panel Efficiency
- Study of Wind Energy: Measurement of Wind Speed and Power Generation
- Performance Test of Solar Water Heater
- Study of Photovoltaic (PV) Cell Characteristics (I-V and P-V curves)
- Load Test on Photovoltaic Module
- Determination of Efficiency of Biogas Plant
- Study of Biomass Gasification and Gas Calorific Value
- Experiment on Fuel Cell Performance (Hydrogen/Oxygen Fuel Cell)

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Environment-I LAB

- **Determination of pH of Water Samples** (using pH meter or indicators)
- **Measurement of Dissolved Oxygen (DO)** in water samples
- **Estimation of Biological Oxygen Demand (BOD)** of water
- **Estimation of Chemical Oxygen Demand (COD)** of water
- **Analysis of Total Dissolved Solids (TDS)** and Total Suspended Solids (TSS)
- **Determination of Hardness of Water** (Total, Temporary, and Permanent)
- **Estimation of Chlorides in Water**
- **Estimation of Nitrates and Phosphates** in water
- **Determination of Turbidity** of water samples
- **Analysis of Heavy Metals** (Lead, Cadmium, Mercury) in water/soil

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Clean Coal & Green Power Technology

UNIT 1

Clean Coal Technologies- Super Critical Power cycles, Integrated Gasification Combined Cycles, Circulating fluidized bed combustion and gasification, Gas cleaning systems and environmental issues, Principles of Waste Heat Recovery and Co-Generation, Analysis of Heat Recovery Systems, Regenerators & Recuperators for waste Heat Recovery, Condensate and Back Pressure Steam Turbines, Design of Waste Heat Recovery Boilers, Combined Cycle Power Plants based on waste Heat Recovery

UNIT 2

Zero Emission Technology

CO_2 Capture – Flue Gas Approach, Oxygen combustion Approach, Hydrogen/Syngas Approach.

UNIT 3

Green Productivity: New Power cycles, Dry Ice co- generation, Biological CO_2 fixation with Algae, Zero Emission Technologies, Recycling of CO_2., Carbon Credits.

CO_2 Transportation, CO_2 Utilization & Storage:- Deep Saline Aquifers, Cost Considerations, CO_2 Capture, CO_2 Transportation, CO_2 Storage, Legal Issues, Environmental Health & Safety.

UNIT 4

Advanced Energy Systems, Fluidized Bed Combustion, Atmospheric Fluidized Bed Combustion (AFBC), Pressurized Fluidized Bed Combustion (PFBC) and Circulating Fluidized Bed Combustion (CFBC),Clean Coal Technologies-Supercritical Cycles, Integrated Gasification Combined Cycle (IGCC), IGCC Power Plants, Flue Gas De-Sulfurization and Coal Beneficiation, IGCC Power Plant Cycle Efficiency, Cold and Hot Gas Clean-Up

UNIT 5

Hydrogen, Fuel Cell, Thermoelectric Generator, MHD-generator, Fusion reactor: Hydrogen Production & Utilization as Energy Source ;Fuel Cells; Types of Fuel cells; Fuel Cell Power Plant concepts.

References:

1. Power Generation Technology-Dr.V.K.Sethi,Book Paradise
2. Solar Energy Thermal Processes, J. A. Duffire and W. A. Beckmen .
3. Applied Solar Energy, A. B. Meinel .
4. Wind Power, V. D. Hunt.
5. Energy and Environment, Himalya Publishing House, Mumbai, H.V. Jadhav.
6. Biomass, Energy and Environment Oxford University Press, NH Ravindranath and DO Hall.
7. Power Plant Engineering by Domkundwal
8. A Rationale on Adoption of IGCC Technology for Indian Coals... By Dr V K Sethi & Dr D N Reddy
9. Green Engineering (Environmental Conscious Design of Chemical Processes) by Allen & Shonnard
10. Green Power : The Eco-friendly Energy Engineering by Nikolai V Khartchenko
11. Power Plant Performance Monitoring by Gay, Palme,r Erbes\
12. TEDDY: TERI Year book Solutions for the 21st Century IEA Publications & TSR,USA

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Wind Power Generation

UNIT 1
The Wind Energy Resource :

Nature of atmospheric winds ; wind resource characteristics and assessment; anemometry; wind statistics; speed frequency distribution, effect of height, wind rose, weibull distribution, atmospheric turbulence, gust wind speed, effect of topography.

UNIT 2
Aerodynamics:

Velocity and force vector diagrams of wind turbine blades, Aerodynamics of aerofoil, lift forces, drag forces , stall, effect of Reynolds's number, actuator disc, momentum theory and Betz coefficient. Coefficient of power optimal choice of cut- in, rated and cut- out wind speeds, blade element theory, Residual velocity capture-Contour Rotation.

UNIT 3
Design Features:

Vertical and horizontal axis turbines, design characteristics, multiple stream tube theory, vortex wake structure, tip losses, rotational sampling, wind turbine design programs aerodynamics loads, tower shadow, wind shear blade coning gyroscopic, transient and extreme loads.

UNIT 4
Operation and Controls Mechanisms:

Power performance, pitch control, yaw control, aerodynamic braking, teeter mechanism, control policies and their effect on energy capture and mechanical stress on wind turbine components. Wind turbine dynamics with induction and synchronous generators. Power electronics interfaces for variable speed operation wind farm electrical design.

UNIT 5
Economic, Environmental and Social issue:

Planning/ Economic considerations for wind power generation, Environmental impact and assessment, noise impact electromagnetic interface. Site selection for wind farms, maintenance and operation. Case studies of wind power generation plants.

Books and References :

1. Wind Energy Technology – John F. Bakar & Jenkins .
2. Paul Gipe, wind Energy Comes of Age, John Wiley & Sons Inc.
3. L.L. Freris, Wind Energy conversion System, Printice Hall.
4. Tony Burton et al, wind Energy Hand Book, John Wiley & Sons Inc.
5. Directory, Indian Wind power 2004, CECL, Bhopal .
6. Wind Energy.Theory & Application-Sirai Ahmed .

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

FUEL TECHNOLOGY & AIR POLLUTION

UNIT 1

Introduction: Types, composition, properties, resources and classification of solid fuels, Principal of combustion: Solid, Liquid, and gaseous fuels, coal as a source of energy and chemicals in India. Classification of coals, analysis of coal, Coal carbonization – Mechanism, Low temperature carbonization high temperature carbonization, Coal preparation, Natural Gases and its derivatives, Sources and potential,Combustion appliance for solid and gaseous fuels.

UNIT 2

Origin of Petroleum: Production, Composition classification of petroleum, Indian Petroleum resources and their nature, Petroleum processing distillation cracking thermal and catalytic coking reforming. Fuel Oils, Octane number, properties and testing of petroleum and petroleum products, Liquefaction of coal, oil burners.

UNIT 3

Gasoline: Production, Composition properties, knocking and Octane Number, Diesel fuels, Kerosene. Types of Gaseous Fuels, composition and calorific values, Natural gas, Liquefied petroleum gas, cleaning and purification of gaseous fuels; CNG, Nuclear fuel.

UNIT 4

Biofuels: Introduction, classification, Importance, Production and applications; Production processes and technologies; Production of alcohol and biogas. Bio-diesel: Fundamentals; Trans-esterification of vegetable oils for biodiesel production; Characterization of biodiesel; **Biomass based Power Generation**, Combustion & Gasification Routes, Co-generation; Bagasse based Power Generation, BIG-GT system.

UNIT 5

Air Pollution: Air Pollution and Air Pollutants – Classifications and Sources. Effects of Air pollutants on man, material and vegetation, Global effects of air pollution; Generation, transport and decay of air pollutants; Air pollution indices; air-fuel ratio; Control of particulates, Control Equipment, Sampling and monitoring methods.

References:

1. Coke, Cake and Coal Chemicals, by Wilson, P.J., Wells, G.H.-- McGraw Hill
2. Fuels and Fuel Technology, by Francis– Vol. I and II Pergamon Press
3. Fuels, Solid, liquid and Gaseous, by Brame, J.S. and King, J.C. -- St. Martin Press
4. Fuels and their combustion, by Haslam, R.T. Russal, R.P. -- .McGraw hill
5. Fuel & Combustion, 2nd by Samir Sarkar.– Orient Longman.
6. Air pollution By M.N.Rao and H.V.N.Rao – Tata Mc.Graw Hill Company.
7. Air pollution by Wark and Warner.- Harper & Row, New York.
8. An introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S. Publications.
9. Biomass as Fuel – L.P.White (Academic press1981)

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Energy Conservation, Management & Audit

UNIT 1

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change, Energy Conservation Act-2001 and its features.

UNIT 2

Electrical Billing, Power Factor & Capacitors, Load Management, Energy Conservation in Motors & Transformers (Types, Characteristics), Pumps, Compressors, Blowers, Fan Cooling Towers.

UNIT 3

Energy Conservation Opportunities in Compressed Air Distribution System, Lighting System, Energy Conservation through: Variable Speed Drives.

UNIT 4

Energy Audit, Need, Types of Energy Audit, Energy Management Audit Approach,- Understanding Energy Costs, Matching Energy Use to Requirement, Maximizing System Efficiencies, Optimizing the Input Energy Requirements, Energy Audit Instruments.

UNIT 5

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.

References:

1. Energy Conservation in Process Industry, Kenny W.F.
2. Energy Conservation & Utilization, Krenz H. Jerrold
3. Waste Energy Utilization Technology, Kiang, Yen Hsiung
4. Waste less Chemical Processing, Kafarov, V.V.
5. Electrical Energy Utilization & Conservation, Tripathy, S.C.
6 Efficient Electrical use by C.B. Smith
7 Savings Electricity in Utility Systems of Industrial Plants by B. G. Desai, B.S. Vaidya D.P. Patel &R. Parman
8 Efficient Use of electricity in industries by B.G. Desai, B.S. Vaidya, M.P. Parmarad R. Parman
9 Pump application desk Book by P.N. Garagy
10 Electrical Power Distribution in Industrial plants by M.D. Parmar
11 Electronic Energy Utilization and Conservation by S.C. Tripaths
12 Industrial Energy Management & Utilization, Hemisphere Publishing Corporation,

MAHAKAUSHAL UNIVERSITY JABALPUR (MP)

Clean Development Mechanism

UNIT 1

Major objective of CDM, Projects for benefit from CDM finance, CDM methodology, CDM opportunities & priorities in India, flow of fund in Kyoto protocol.

UNIT 2

Status of CDM today, Technology assimilation, Transfer of technology, Flow of fund under CDM, Competitors and major developers in India.

UNIT 3

Technology & Market Assessment of various Power plants- IGCC, Super Critical, Combined Cycle, CFBC and Novel Energy devices.

UNIT 4

Analysis of selected CDM options: Micro- Hydro Power Generations, Biomass Power Generation, Wind Power Generation, Clean Coal Technology, Indicative Simplified Baseline and Monitoring Methodologies for selected Small Scale CDM project activity Categories.

UNIT 5

Case Studies, Typical Case studies of BOF Gas Waste Heat Recovery, Optimal Utilization of clinker and Conversion, Example of Calculation.

References:

- **CDM and JI in Charts:** IGES-Institute for Global Environmental Strategies, Ver-1.0 and Ministry of the Environment, Japan
- **A Rational on CDM:** Dr. V. K. Sethi, Prof & Head (Energy Deptt.) RGTU, Bhopal

Energy – II LAB

- Study of Thermal Energy Storage Systems
- Performance Analysis of Wind Turbine
- Study of Battery Characteristics (Lead-Acid, Lithium-Ion)
- Experiment on Energy Conversion in Micro-Hydro System
- Study of Combined Heat and Power (CHP) Systems
- Experiment on Energy Audit of a Small Plant or Building
- Determination of Efficiency of Heat Pumps and Refrigeration Systems
- Study of Tidal and Wave Energy Devices
- Measurement of Electrical Energy from Renewable Sources
- Mini Project: Simulation or Performance Analysis of a Renewable Energy System

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Environment-II LAB

- **Determination of Air Quality Parameters** (SO_2, NO_2, CO)
- **Study of Noise Pollution Levels** in urban and rural areas
- **Measurement of Particulate Matter (PM2.5 and PM10)** in air samples
- **Analysis of Soil Samples** for pH, Moisture, Organic Matter
- **Determination of Biological Indicators** (Coliform count in water)
- **Study of Renewable Energy Impact on Environment** (e.g., solar, wind)
- **Measurement of Carbon Footprint** of a small laboratory or campus
- **Water Quality Index (WQI) Calculation** for a given water body
- **Mini Project**: Environmental Impact Assessment (EIA) of a local site

Water and Waste Water Treatment

UNIT 1

Waste Water: Primary Treatment; Equalization Basin, Screening, Comminuting, Grit Removal, Grease Removal & Skimming, Flow Measurement, Primary Sedimentation.

UNIT 2

Secondary Treatment; Waste Water Microbiology: Growth & Food Utilization Activated Sludge Process, Extended Aeration, Trickling Filter, Ponds & Lagoons, Secondary Clarification.

UNIT 3

Sludge Treatment & Disposal; Sludge Characteristics, Sludge Thickening, Sludge Digestion, Sludge Disposal: Sludge Incineration, Air Drying, Composting, ASTE Water Reuse & Application.

UNIT 4

Advanced & Tertiary Treatment, Nutrient Removal, pH Control System, Neutralization Agents & Processes.

References:

1. Waste Waster Treatment by Hammer & Hammer
2. Design of Water Treatment Plants by Dr. A.g. Bhole- IWWA Nagpur centre
3. Hand book of Environmental Engineering Vol2, Lawrence K. Wang and Worman C. Pereira, The Human Press, Clifton, New Jersey (1980)
4. Handbook of Environment Engg, Vol. I Liptak
5. Environmental Engineering by Peavy , Rowe, Tchobanogolous
6. Waste Waster Treatment by Steel & Meghee
7. Waste water Treatment , Disposal & Reuse , Metcalf & Eddy
8. Manual on Water Supply & Treatment, CPHEEO, Ministry of Urban development, New Delhi, GOI.
9. Environmental Pollution Control Engineering, By C.S. rao
10. Theory & Practice of Industrial Waste Treatment, Addison Wesley Publishing Co. NY
11. Water & Waste Water Technology, Marle J. Hammer & Hammer
12. Waste Water Treatment by Liu, Liptak , Lewis

Instrumentation and Control in Energy System

UNIT 1

Basic measurement concepts, measurement errors. Transducer classification , Static and dynamic Characteristics of transducers,Instruments for measuring temperature, pressure, velocity and flow, heat flux, liquid level and concentration in energy systems, characterization of combustors, flue gas analysers, Exhaust gas analysers.

UNIT 2

Solar energy measurement requirements, Solar radiation measuring instruments, Meteorological data measurements, Energy auditing instruments,
Probe measurements in plasmas, general plasma spectroscopy, Laser interferometery developments, Plasma density and temperature measurement, Mass spectroscopy for plasma species.

UNIT 3

Characterization of electrical power systems, Instruments for monitoring electrical parameters, analysis of power system measurements.

UNIT 4

Analog signal conditioning, A/D and D/A converters, Digital data processing and display, Computer data processing and control.Feed back control system Stability and transient analysis of control systems, Application of PID controllers, General purpose control devices and controller design.

UNIT 5

Air pollution sampling and measurements of particulates, SOx, NOx, CO, O3, hydrocarbons, Waste water sampling, determination of organic and in-organic and in-organic substance, Physical Characteristic and bacteriological measurements, Solid waste measurements and disposal.

References:

1. Electrical Measurements & Measuring instruments by F W Golding
2. Principles of Measurements of Instrumentation by A S Morris
3. Instrumentation Measurement & Feedback by E Barry jones
4. Instrumentation Measurement & Analysis by B C Nakra

Energy Efficiency in Electrical Utilities -

UNIT 1

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Energy audit in Electrical Systems

UNIT 2

Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT 3

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities

HVAC and Refrigeration System: 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.

UNIT 4

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

Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.

UNIT 5

Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities assessment of cooling towers.

Lighting System: Light source, choice of lighting, luminance requirements, and energy conservation avenues.

Diesel Generating system: Factors affecting selection, energy performance assessment of diesel conservation avenues. Energy audit in Mechanical Systems – Fans, Blowers, Compressors & Pumps.

References:

1. Energy Auditing Made Simple by P Balsubramaniam
2. Power Plant Performance by A B Gill
3. An Introduction to Thermodynamics by Y V C Rao
4. Energy Management by W K Murphy & G Mckay
5. Energy Reduction through improved Maintenance Practices by Bannister
6. Energy Efficiency in Electrical Utilities by BEE

Environmental Audit & Impact Assessment

UNIT 1

Introduction: Origin and Development of Environmental Impact Assessment. (EIA), Current Status of EIA.

UNIT 2

Essential Components of EIA: Concepts, EIS, Disaster Management Plan Baseline Study, Impact Prediction, Mitigation & Enhancement, Monitoring, and Conclusion.

UNIT 3

National environmental policy, Methodology of environmental impact studies, Methods of impact identification, Environmental setting, Production and assessment of impacts on the air environment, Prediction and assessment of impacts on surface water, soil and ground water environment, Socioeconomic environment, Evaluation alternatives, Public participation in environmental decision making. EIA Legislation.

UNIT 4

Environment Impact Statement & Environmental Management Plan for Selected Industries-Case Studies on power plants, Cement industry, Iron & Steel, Chemical & Refinery.

UNIT 5

Guidelines for Environmental Audit :Concepts and definitions of Environmental Audit, Audit objectives , Scope, Types of Audit, Need for Environmental Audit , Application.
Key steps to Environmental Audit: Pre , Onsite & Post Environment audit activities. Audit Procedure, Format of Environmental Audit.

References:

1 Environmental Impact Assessment- Larry W. Canter, University of Oklahoma- McGraw Hill Company
2. Environment Impact Assessment, Clark D. Brain, Biesel Donald
3 EIA for Developing Countries, Biswas Asit K.
4 Environment Impact Assessment, W. Canter (II Edition)
5 EIA Guidelines 1994, Notification of Govt. of India Impact Assessment Methodologies Publications Ltd. (1995)
6. Guidelines for environmental audit. By Central Pollution Control Board. DELHI, Place and Publisher: Delhi : CPCB
7. Environmental audit and business strategy: Total quality approach by G. Ledgerwood, TERI
8. A-Z organization of environmental audit by by A. Mehrotra, mpIIFM
9. Environmental audit (an overview), , Ashok Keshav Mhaskar, CSE
10. An outline of environmental audit by K. V. Bengeri, CSE
11. Environmental audit (an overview) by A. K. Mhaskar, CSE
12. Clarck KC Parks, B O, Crane ,MP "Geographic Information Systems and environmental Modeling" Prentice Hall of India Pvt Ltd.2002.
13. Reddy, MA "Text book of remote sensing & GIS", BS publications 2001.

Seminar

you should actively participate by contributing to discussions, preparing beforehand by completing readings, and engaging with complex ideas. Be ready to present your work, ask clarifying questions, and build on the points made by others to gain a deeper understanding of the subject.

Dissertation Part- I

In the dissertation part-I you have to select a topic, write a research synopsis including a problem statement and objectives, and present it to a panel. The synopsis will introduce the research area, discuss the literature review, and outline the problem you plan to solve, along with the methodology you will use. This part concludes with a presentation, where your supervisor and a panel of faculty will evaluate your synopsis, which will be graded.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Dissertation Part- II

The objectives of the course 'dissertation part-II' are

- To provide students with a comprehensive experience for applying the knowledge
- gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on
- solutions of small industrial problems.
- To give students an opportunity to do some thing creative and to assimilate real life
- work situation in institution.
- To adapt students for latest developments and to handle independently new situations.
- To develop good expressions power and presentation abilities in students.
- The focus of the Major Project is on preparing a working system or some design or
- understanding of a complex system using system analysis tools and submit it the same in the
- form of a write-up i.e. detail project report. The student should select some real life problems
- for their project and maintain proper documentation of different stages of project such as need
- analysis, market analysis, concept evaluation, requirement specification, objectives, work plan,
- analysis, design, implementation and test plan. Each student is required to prepare a project
- report and present the same at the final examination with a demonstration of the working
- system (if any).
- The faculty and student should work according to following schedule:
    - Each student undertakes substantial and individual project in an approved area of the
- subject and supervised by a member of staff.
    - The student must submit outline and action plan for the project execution (time schedule)
- and the same be approved by the concerned faculty.
    - At all the steps of the project, students must submit a written report of the same.