Mandsaur University

M. Tech – Energy Technology
Semester-III

L-3 T-1 P-0 C-4

EEE311: Instrumentation & Control in Energy System

Course Objectives

This course will expose students to –

- Define basics of the measurement system and its elements
- Understand the different signal conditioning elements.
- Define the basics of industrial instrumentation system.
- Develop the concepts about control systems.
- Learn about frequency domain analysis of control system.

Course Outcomes (COs)

- Understand the concepts of measurement system and transducers.
- Identify the different types of signal conditioning elements.
- Examine the working of different industrial measurement systems.
- Analyze the working of control systems.
- Design and examine of stability in frequency domain of control systems.

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	2	-	1	-	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	1	-	1	-	-
CO5	1	3	2	-	-	-	-	1	-	-	-	-

High-3 Medium-2 Low-1

Unit I **12 Hours**

Elements of a Measurement System; Basic Instrumentation System; Errors and Uncertainties; Mechanical Transducers: Temperature- Bimetallic Element and Fluid Expansion Type Thermometers; Pressure- Manometers and Bourdon Gauges; Load Cells and Elastic Force Devices; Electrical Transducers: Resistive Transducers; Inductive Transducers; Capacitive Transducers; Thermoelectric Transducers and Photoelectric Transducers; Piezoelectric Transducers.

Unit II **12 Hours**

Basic Signal Conditioning Elements: DC Bridges, AC Bridges, Wheatstone Bridge, Balance & Deflection Measurements - Amplifiers- Non Electrical and Electrical Types; Op Amps- Summing, Differential, and Charge Amplifiers; Differentiating and Integrating Elements; Filters; Data Transmission Elements- Electrical, Pneumatic, Position and Radio Frequency Transmission Types, Basic Display Elements.

Unit III **12 Hours**

Industrial Measurements:- Velocity Measurement – Contact Type: AC-DC Tachometers Non Contact Type: Magnetic, Photoelectric & Stroboscopic Methods Acceleration Measurement – Seismic Accelerometer & Piezoelectric Accelerometer Measurement of Force – Different Methods; Strain Gauge Load Cell Method Measurement of Torque – Strain Gauge Method Radiation Measurement – Radiation Fundamentals; Radiation Detectors; Optical Pyrometer.

Unit-IV **12 Hours**

Control Systems: Open & Closed Loop Systems, Linear Time-Invariant Systems, Transfer Function Analysis, Mason's Gain Formula, Transient Response Analysis, Stability Analysis, RH Criterion, Relative Stability.

Unit-V **12 Hours**

Frequency Response Analysis: Bode Plots, Nyquist Stability Criterion, Gain Margin & Phase Margin (Simple Problems Only)-Introduction to State Space Analysis (Elementary Treatment Only – No Numerical); Concept of State, State Variables & State Models; State Transition Matrix.

Total: 60 Hours

Reference(s)

1. Albert D Helfrick and William D Cooper; Modern Electronic Instrumentation and Measurement Techniques; 2004, PHI
2. BC Nakra, and KK Chaudhry; Instrumentation, Measurement and Analysis; 2 ed, 2004, Tata McGraw-Hill
3. DVS Murthy; Transducers and Instrumentation; 2003, PHI
4. Automatic Control Systems by B.C.Kuo, John Wiley, 2009
5. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Mandsaur University, Mandsaur

MANDSAUR UNIVERSITY
MAKING FUTURE READY

M.Tech Electrical & Electronics Engineering
Semester-III

L-3 T-1 P-0 C-4

EEE312: Economics & Planning of Energy System

Course Objectives:

The course Objective is to equip the student with technology, economics and policy involving energy systems and supply with renewable energy sources.

- Understand the economics and planning of energy supply demand chain.
- Articulate environmental sustainability of energy supply system.
- Appreciate the policy, financing and regulatory frameworks within which decisions on energy future are made.

Course Outcomes:

- Understand basic economics and costs of energy infrastructure investments.
- Be engaged in continuously learning the new practices, principles and techniques of the electrical power industry.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	-	-	1	-	1	-	1	1	-
CO2	2	3	1	-	1	-	-	1	-	-	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	1
CO4	3	2	2	1	-	-	1	1	-	-	-	-
CO5	2	3	2	1	-	-	1	-	1	-	1	1

High-3 Medium-2 Low-1

Energy Theory of Value: Principles and Systems of Energy Flows, Methods of Energy Analysis.

Energy Intensity Method, Process Analysis Input –Output Method Based Energy Accounting.

Energy Cost of Goods and Services Energy to Produce Fuels; Coal, Oil, Natural Gas, Energy Cost of Various Modes of Passenger & Freight Transportation.

Industrial Energy Analysis; Aluminum, Steel, Cement, Fertilizers. Energetic of materials Recycling, Energetic of Renewable Energy Utilization.

Energy and Energy Analysis of Thermal & Chemical Plants.

Total: 60 Hours

References:

1. Electrical Energy Systems: Theory & Introduction by L Olle Elgerd
2. Industrial Organization &Engineering Economics by T R Banga
3. Engineering Economics by R Pannersewan
4. Managerial Economics by Joel Deal

List of e-Learning Resources:

1. nptel.ac.in
2. coursera.org

Department of Electrical & Electronics Engineering

Mandsaur University

M.Tech. Energy Technology
Semester-III

L-3 T-1 P-0 C-4

EEE313: Industrial & Commercial Application of renewable Energy Source

Course Objectives

This course will expose students to –

- Understand the safety measures for various electrical equipments.
- Understand the scientific operating principles of compressed air system, HVAC and refrigeration system.
- Develop the knowledge of vapour absorption refrigeration system and fans & blowers.
- Assessment of the performance of pumping system with cooling tower and lighting system.
- Emphasize the role of electrical utilities in industrial operations and the scope of electrical energy savings.

Course Outcomes (COs)

- Understand and be aware of the importance of renewable energy.
- Understand the water heating system by different types of methods.
- Apply the renewable energy generation system with different types of connections.
- Apply the renewable in commercial and industrial buildings for various load areas.
- Analyze the case study for economics of renewable energy based commercial and industrial installations.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	-	-	1	-	1	-	-	-	-
CO2	3	2	1	-	1	-	-	-	1	-	-	1
CO3	2	3	2	1	-	-	-	1	1	1	-	-
CO4	3	2	2	1	-	-	-	-	-	-	1	-
CO5	2	3	2	1	-	-	1	1	1	-	-	-

High-3 Medium-2 Low-1

UNIT I: **12 Hours**

Introduction, Commercial and Industrial Energy Demand; Qualitative and Quantitative Features and Characteristics, Renewable & Electricity for a Growing Economy.

UNIT II: **12 Hours**

Water Heating, Process Heating and Drying Applications, Solar, Biomass and Geothermal Energy Based Systems, Combined Space and Building Service Hot Water Systems.

UNIT III: **12 Hours**

Electricity Generation from Renewable to Meet Commercial and Industrial Power Requirement, Stand Alone and Grid Connected Systems, Ethanol and Methanol from Cellulosic Biomass.

UNIT IV: **12 Hours**

Use of Renewable in Commercial and Industrial Buildings for Load Leveling, Lighting and Space Heating and Cooling.

UNIT V: **12 Hours**

Economics of Renewable Energy Based Commercial and Industrial Installations Case Studies, Thermal Low and Medium Energy Requirements of Different Industries.

Total: 60 Hours

Reference(s)

1. Solar Applications in Industry and Commerce, First Edition, 1984, by JD Myers, Prentice-Hall Inc.
2. Fundamentals of Renewable Energy Processes, Second Edition, 2009, by Aldo V da Rosa, Academic Press.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Mandsaur University

M.Tech M Tech: Energy Technology
Semester-III

L-3 T-1 P-0 C-4

EEE321: Bio and Solid Waste Management

Course Objectives

1. To enable students to understand of the concept of Waste to Energy.
2. To link legal, technical and management principles for production of energy form waste.
3. To learn about the best available technologies for waste to energy.
4. To analyze of case studies for understanding success and failures.
5. To facilitate the students in developing skills in the decision making process.

Course Outcomes (COs)

1. Learn basic concepts of solid waste management, beginning from source generation to waste disposal in a system of municipality organizational structure.
2. Develop understanding on various technological applications for processing of waste and their disposals in various ways.
3. Acquire knowledge on waste to energy productions in the perspectives of sustainable development.
4. Apply basic concepts in hazardous waste management and integrated waste management for urban areas.
5. To acquire a fair amount of knowledge on waste characterization and its management practiced in various cities of India. To achieve this objective, students will be taught different case studies reported by previous researchers and technical bodies.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	POS2	POS3	PSO4	PSO5	PSO6	PSO7
CO1	2	3	2	1	1	-	-	1	-	-	-	-	-	-
CO2	2	1	3	1	1	-	-	1	-	-	-	-	-	-
CO3	2	2	3	1	1	-	-	1	-	-	-	-	-	-
CO4	3	2	1	1	1	-	-	1	-	-	-	-	-	-
CO5	2	3	1	1	1	-	-	1	-	-	-	-	-	-

High-3 Medium-2 Low-1

Unit I **12 Hours**

Solid Wastes, Types of Solid Wastes, Sources - Industrial, Mining, Agricultural and Domestic, Characteristics. Solid Waste Problems, Impact on Environmental Health, Concepts of Waste Reduction, Recycling and Reuse.
Handling and Segregation of Wastes at Source, Collection and Storage of Municipal Solid Wastes; Analysis of Collection Systems. Transfer Stations: Labeling and Handling of Wastes.

Unit II **12 Hours**

Solid Waste Processing Technologies. Mechanical and Thermal Volume Reduction. Biological and Chemical Techniques for Energy and Other Resource Recovery: Composting, Vermicomposting, Term gradation, Fermentation. Incineration of Solid Wastes. Disposal in Landfills: Site Selection, Design, and Operation of Sanitary Landfills; Leachate and Landfill Gas Management; Landfill Closure and Post-Closure Environmental Monitoring; Landfill Remediation. Regulatory Aspects of Municipal Solid Waste Management.

Unit III **12 Hours**

Sources and Characteristics: Handling, Collection, Storage and Transport, TSDF Concept. Hazardous Waste Treatment Technologies - Physical, Chemical and Thermal Treatment of Hazardous Waste: Solidification, Chemical Fixation, Encapsulation, Pyrolysis and Incineration. Hazardous Waste Land Fills - Site Selections, Design and Operation. HW Reduction, Recycling and Reuse, Regulatory Aspects of HWM.

Unit IV **12 Hours**

Biomedical Waste: Definition, Sources, Classification, Collection, Segregation Treatment and Disposal. Chemical Treatment Processes for MSW (Combustion, Stabilization and Solidification of Hazardous Wastes); Physicochemical Processes for Hazardous Wastes (Soil Vapour Extraction, Air Stripping, Chemical Oxidation); Ground Water Contamination and Remediation.

Unit V **12 Hours**

Composting; Bioreactors; Anaerobic Decomposition of Solid Waste; Principles of Biodegradation of Toxic Waste; Inhibition; Co-Metabolism; Oxidative and Reductive Processes; Slurry Phase Bioreactor; In-Situ Remediation.

Total: 60 Hours

References:

1. Hazardous Waste Management Charles A. Wentz. Second Edition 1995. McGraw Hill International.
2. Integrated Solid Waste Management George Tchobanoglous, Hilary Theisen & Sammuel A. Vigil.
3. Criteria for Hazardous Waste Landfills – CPCB Guidelines 2000.
4. Hazardous Waste Management by Prof. Anjaneyulu.
5. Environmental Sciences by Daniel B. Botkin and Edward A. Keller, Wiley Student, 6 th Edition- 2009.
6. Standard Handbook of Hazardous Waste Treatment and Disposal by Harry M. Freeman, McGraw Hill 1997.
7. Management of Solid Waste in Developing Countries by Frank Flintoff , WHO Regional Publications 1976.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Mandsaur University

M Tech: Energy Technology
Semester-III

L-3 T-1 P-0 C-4

EEE322: Environmental Audit & Impact Assessment

Course Objectives:

The students should be able to:

- Environmental impact assessment (EIA) and auditing with an exposure to important aspects involved in it.
- From the initial phase of project proposal to the actual project establishment, students will be introduced to various processes of EIA.
- Students will gain an insight into the development and fundamental concepts of EIA in national and international context, including the environmental, cultural, legal and institutional framework that has shaped EIA's implementation in "real world" settings.
- Useful concepts complemented with case-studies will equip the students to effectively communicate with other EIA practitioners and provide quality information to decision-makers through the use of project alternatives designed to avoid, minimize, and mitigate negative impacts to the environment.

Course Outcomes:

At the completion of this course, students will be able to:

- Understand in depth knowledge of the processes associated with EIA and environmental audit.
- Analyze and Design the interpret and critically reflect on a range of assessment (environment, social- economics; traffic; landscape; ecology) tasks employed in EIA.
- Analyze the potential impacts of proposed developments and propose solutions to address these impacts in a range of contexts.
- Evaluate Critically the EIA process and the regulatory frameworks in which EIA operates in a range of countries.
- Analyze the importance of environmental audit impact to the principle of sustainable development.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO
CO1	1	2	1	2	3	-	1	1	1	2	2
CO2	2	3	2	1	2	-	2	2	1	2	2
CO3	2	2	2	1	3	-	2	2	1	2	2
CO4	3	3	1	2	3	-	2	2	3	2	2
CO5	2	2	1	2	2	-	3	1	2	2	3

High-3 Medium-2 Low-1

Unit I: **12 Hrs**

Introduction

The Rationale for EIA, Nexus between Development and Environment, Evolution of EIA, Relationship of EIA to Sustainable Development, Different Types of Impact Assessment: Project Level Impact Assessment, Regional Level Impact Assessment, and Strategic Environmental Assessment, Comprehensive and Rapid EIA. QCI/NABET Requirement for EIA Consultant.

Unit II: **12 Hrs**

Methods for Impact Assessment

Planning and Management of Environmental Impact Studies, Impact Indentation Methodologies: Baseline Studies (Primary and Secondary Data Collection), Screening, Scoping, Impact Analysis,

Prediction and Evaluation of Impacts.
Impact Analysis Techniques: Ad-hoc Method, Checklist Method, Matrix Method, Overlay Method, Network Method and GIS and Computer Expert Systems.

Unit III: **12 Hrs**

Prediction, Assessment and Mitigation of Impacts

Basic Information, Identification of Type and Quantity of Pollutants, Existing Quality and Applicable Standards, Impact Prediction, Assessment and ,Mitigation Procedures (Case Studies)- Air, Noise, Water and Biological Environment.
Cultural and Social-Economic Impact Analysis- Basic Information on Cultural Resources, Rules and Regulation on Cultural Resources like Archaeological, Historical Structures, Prediction and Assessment of Impacts and Mitigation. Description of Existing Socioeconomic Environment, Analysis of Social Impacts, Fiscal impact Analysis, Impacts of Economic profile of the Community, Mitigation. (Case Studies).

Unit IV: **12 Hrs**

The Legal and Policy Framework in India

Institutional framework of EIA, examples of national and international EIA legislation, Environmental Clearance (EC) process in India (Role of EAC and SEAC), project categorization, EIA Notification and directives (1994, 2006 etc. and amendments). Limitations of EIA, Guidelines of preparation of project report and its evaluation, Terms of Reference (TOR's), participation of public (public hearing and its relevance) and non-governmental organizations in environmental decision making. Validity of EC process, post EC monitoring, costs and benefits of EIA.

Unit V: **12 Hrs**

Environmental Audit

Definition of Environment Audit and Its Importance, Types of Audits, General Audit Methodology and Basic Structure of Audit. Elements of an Audit Process and Its Importance, Concept of ISO Management Standards.

Total: 60 Hours

Reference Books:

1. Environmental Impact Assessment, L. W. Canter, Mc Graw Hill, New York, 1996.
2. Handbook of Environmental Impact Assessment Vol I and II, J. Petts, Blackwell Science, London, 1999.
3. The Theory and the Practice of Environmental Impact Assessment, S. A. Abbasi and N. Ramesh, DPH, New Delhi, 2003.
4. Complete Guide to ISO 14000, R. B. Clements. Simon & Schuster, 1996.
5. Environmental Management, Kulkarni, V. and Ramachandra T.V., Capitol Pub. Co., New Delhi. 2006
6. Environmental Risks and Hazards, Cutter, S.L. Prentice Hall of India, New Delhi. 1999
7. Handbook of Environmental Impact Assessment, Petts, J. - Volume 1 and 2. Blackwell Publishers, UK 2005.
8. Introduction to Environmental Impact Assessment, Glasson, J. Therivel, R. and Chadwick, A. Routledge, London. 2006

List of e-Learning Resources:

1. https://www.fao.org/3/v9933e/V9933E02.htm
2. https://www.drishtiias.com/to-the-points/paper3/environmental-impact-assessment-1
3. https://onlinecourses.nptel.ac.in/noc22_ar07/preview
4. https://nptel.ac.in/courses/124107160

Mandsaur University

M Tech: Energy Technology
Semester-III

L-3 T-1 P-0 C-4

EEE323: Project Evaluation & Management

Course Objectives:

1. To understand Project Planning and Scheduling
2. To understand the important risks facing in a project.
3. To understand and analyze inventory-implementation of the project management and computer based project management tools.

Course Outcomes(COs):

1. Apply appropriate approaches to plan a new project and develop project schedule and Evaluate and select the most desirable projects.
2. Analyze project planning and scheduling techniques and apply the steps that must be taken to complete projects on time and on budget.
3. Analyze the important risks facing in a new project.
4. Analyze to implement project management knowledge, processes and the embodied concepts, tools and techniques in order to achieve project success.
5. Analyze the use of computer based project management tools.

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	-	-	-	3	-	-	-	-	-
CO2	1	2	3	-	-	-	3	-	-	-	-	-
CO3	2	2	3	-	-	-	3	-	-	-	-	-
CO4	2	2	3	-	-	-	3	-	-	-	-	-
CO5	1	2	3	-	-	-	3	-	-	-	-	-

High-3 Medium-2 Low-1

Unit-I **12 Hours**

Construction Administration, Control of Quality in Construction, Organizational Structure, Responsibility for Co-Ordination of the Trade-Introduction to Project Planning and Scheduling-Processes of Project Planning- Project Scheduling- Progress Control.

Unit-II **12 Hours**

Project Planning and Scheduling Techniques- Network Scheduling Techniques. Project Planning Using Computer Based Models- Principles of Project Management.

Unit-III **12 Hours**

Certainty, Risk and Uncertainty, Risk Management, Identification and Nature of Construction Risks, Contractual Allocation of Risk, Types of Risks, Minimizing Risks and Mitigating Losses, Use of Expected Values, Utility in Investment Decisions, Decision Trees, Sensitivity Analysis.

Unit-IV **12 Hours**

Resource Management and Inventory-Implementation of Project Planning Management.

Unit-V **12 Hours**

Analysis and Design of Planning and Control System- Disputes and Claims Management-Use of Computer Based Project Management Tools.

Total: 60 Hours

Reference(s)

1. Callahan, M.T., Quackenbush, D.G., and Rowing, J.E., Construction Project Scheduling, McGraw Hill ,New York,1992.
2. Cleland, D.I .and Ireland, L.R., Project Management: Strategic Design and Implementation,4th Edition, McGraw-Hill, New York,2002.
3. Fisk, D.R. 2000 Construction Project Administration, Prentice Hall International, London.
4. K Wakye, A.A 1997, Construction Project Administration: Adisson Wesley Longman, London.

List of e-Learning Resources:

https://www.youtube.com/watch?v=RQNZWCl6eXI&list=PLBd76GK9sWTwVXm9FlVHOTXXbGY2vZR8z