Mandsaur University, Mandsaur

MANDSAUR UNIVERSITY
MAKING FUTURE READY

M.Tech Electrical & Electronics Engineering

Semester-I

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

EEE030: Fuel & Combustion Technology

Course Objectives:

1- To build up knowledge of the concepts and theories of a of classical fuel combustion.
2- To develop understanding of the basic principles and concepts of advanced fuel combustion and control process
3- To provide students with the required skills for analyzing thermal cycles.

Course Outcomes:

- Apply the knowledge of basics of solid, liquid and gaseous fuels.
- Describe the different characterization techniques of fuels.
- select appropriate furnace for combustion and fuel.
- Differentiate between diffusion and premixed flame and their utilization in combustion devices.
- Describe the combustion process of fuels.

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

Unit-I **12 Hours**

Fuels & Fuel Analysis Combustion Stoichiometry, theoretical & actual combustion processes Air fuel ratio.

Unit-II **12 Hours**

Combustion Thermodynamics calculation of heat of formation & heat of combustion First law analysis of reacting systems.

Unit-III **12 Hours**

Heat Treatment Furnaces Industrial furnaces process furnaces Kilns Batch & continuous furnaces.

Unit-IV **12 Hours**

Flame, Flame Structure, Ignition and Igniters flame propagation deflagration detonations flame front Ignition self & forced ignition, Ignition temperature.

Department of Electrical & Electronics Engineering

Unit-V **12 Hours**

Combustion Appliances Gas burners Functional requirement of burners Gas burner Classification Stoker firing pulverized system of firing.

Total: 60 Hours

References:

1. S.P. Sharma &Chander Mohan, "Fuels & Combustion", Tata McGraw Hill Publishing Co.Ltd.,1984
Dr. Samir Sarkar, "Fuels & Combustion", Orient Longman, Second edition,1990.

List of e-Learning Resources:

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

Mandsaur University

M.Tech. Energy Technology

Semester-I

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

EEE040: Power Generation, Transmission & Distribution

Course Objectives

This course will expose students to –

- Design power system components for a specified system and application.
- Ability to discuss various power sources for generation of power Merit/Demerits.
- Ability to discuss functions of electrical transmission system.
- Formulate AC and DC distribution networks for necessary variable calculation.
- Ability to discuss functions of Substation.

Course Outcomes (COs)

1. Understand the different methods of power generation and different elements of the system.
2. Understand the steam generators and gas turbine power plants.
3. Apply the excitation systems of generators and operation of infinite bus.
4. Analyze different types of cables, their construction and properties for AC and DC transmission.
5. Analyze different parameters in distribution systems.

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

UNIT I: **12 Hours**

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.

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.

UNIT II: **12 Hours**

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.

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.

UNIT III: **12 Hours**

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.

UNIT IV: **12 Hours**

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

UNIT V: **12 Hours**

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.

Total: 60 Hours

Reference(s)

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.
8. Theory and problems of electric power systems by S. A. Nasqr

List of e-Learning Resources:

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

Mandsaur University

M. Tech – Energy Technology
Semester-I

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

Process Modeling & Simulation in Energy Systems (EEE050)

Course Objectives

This course will expose students to –

- Define basics of the modeling.
- Understand the different types of models.
- Define the strategies for lumped parameter models.
- Develop the strategies for distributed parameter models.

Course Outcomes (COs)

- Understand the concepts of modeling and its principles.
- Identify the different types of models based on various parameters
- Design and analyze the strategies for lumped parameter models.
- Analyze and examine the strategies for distributed parameter models.

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	2	3	1	-	-	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	2	-	1	-	-
CO4	1	3	2	-	-	-	-	1	-	2	-	-

High-3 Medium-2 Low-1

Unit I

10 Hours

Introduction to modeling of process systems: Systematic approach to model building, Classification of models. Conservation principles, thermodynamic principles.

Unit II

20Hours

Introduction to Development Based on first principles: Steady state and dynamic, Lumped and distributed parameter models, Block diagrams and computer simulation. Modeling of Process elements consisting of Mechanical (translational and rotational), Electrical, Electro-mechanical, Fluid flow, Thermal and Chemical reaction system elements. Development of Models (Examples.): Grey box models, Empirical model building, Statistical model calibration and validation. Population balance models; Examples.

Unit III

15 Hours

Solution strategies for Lumped parameter models: Solution methods for initial value and boundary value problems, Euler's method, R-K method, shooting method, Finite difference methods. Solving the problems using MATLAB /SCILAB.

Unit IV **15 Hours**

Solution strategies for Distributed parameter models: Solving parabolic, elliptic and hyperbolic partial differential equations. Finite element and Finite volume methods.

Total: 60 Hours

Reference(s)

1. K. M. Hangos and I. T. Cameron, "Process Modeling and Model Analysis", Academic Press, 2001.
2. W. L. Luyben, "Process Modeling, Simulation and Control for ChemicalEngineers",2nd Ed., McGraw Hill Book Co., New York, 1990.
3. Modeling and analysis of dynamic systems, by C.M .Close, D.H. Fredrick and J. C. Newell, John Wiley & Sons, 2002.
4. W. F. Ramirez, "Computational Methods for Process Simulation", (2nd Edition) Butterworth -Heinemann, 1995.

List of e-Learning Resources:

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

Mandsaur University

M.Tech- ET (EEE)

Semester-I

L-2 T-1 P-2 C-4

EEE010: Energy Scenario

Course Objectives:

The students should be able to:

- Understand the forms of energy and its resources.
- Learn the resources of energy and its consumption in global energy and Indian energy scene.
- Know the impacts of energy systems on environment and to know the basic concepts of climate change.

Course Outcomes:

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

1. Understand scientific and technological concept of energy and associated environmental issues.
2. Analyze the environmental impacts of energy technologies.
3. Analyze the global issues related to energy development, consumption and transformation.
4. Evaluate the Environmental Impact on energy

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	PSO 4
CO1	1	1	2	3	3	-	1	1	2	1	2
CO2	3	2	3	3	3	-	2	2	2	2	1
CO3	3	2	3	2	2	-	3	2	3	3	2
CO4	2	3	2	2	3	-	2	3	3	2	3

High-3 Medium-2 Low-1

Unit I

Introduction to Energy: **12 Hrs**

Definition and units of energy, power, Forms of energy, Conservation of energy, the second law of thermodynamics, Energy flow diagram to the earth. Origin of fossil fuels, the time scale of fossil fuels, Renewable Energy Resources, Role of energy in economic development and social transformation.

Unit II

Global Energy Scene: **12 Hrs**

Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear power and hydroelectricity, impact of exponential rise in energy consumption on global economy, future energy options.

Unit III

Indian Energy Scene: **12 Hrs**

Commercial and non-commercial forms of energy, energy consumption pattern and its variation as a function of time, energy resources available in India, urban and rural energy

consumption, nuclear energy - promise and future, energy as a factor limiting growth, need for use of new and renewable energy sources.

UNIT IV **9 Hrs**

Environmental Impact:

Environmental degradation due to energy production and utilization, Primary and secondary pollution, air, thermal and water pollution, depletion of ozone layer, global warming, biological damage due to environmental degradation. Pollution due to thermal power station and their control. Pollution due to nuclear power generation, radioactive waste and its disposal. Effect of hydroelectric power stations on ecology and environment. Effect of Hydro electric power stations on ecology and environment.

Total: 45 Hours

Practical List:

1. To study the generation of electricity by using Bio Energy & run the different applications using generated electricity.
2. Study of V/I, V/P and MPP Characteristics of Solar Module.
3. Study of DC to DC converter Module.
   a. BUCK Converter
   b. BOOST Converter.
4. Study of V-I characteristics of fixed Solar Panel, i.e. without tracking the Sun.
5. Study of V-I characteristics of Solar Panel according to the incident angle of rays of light keeping Light source at fixed position and moving the solar panel in manual mode.
6. Measurement of voltage and current of wind energy based DC supply with a change in angle of blades.
7. Determine the ABCD, H, Z and Image parameters of Short Transmission Line.
8. Measure the receiving end voltage of each line under no load or lightly load condition to understand Ferranti effect.

Reference Books:

1. Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N.Reddy, Robert Williams (Wiley Eastern).
2. Energy policy for : B. V. Desai (Weiley Eastern).
3. Modeling approach to long term demand and energy implication : J.K.Parikh.
4. Energy Policy and Planning : B.Bukhootsow.
5. TEDDY Year Book Published by Tata Energy Research Institute (TERI).
6. World Energy Resources : Charles E. Brown, Springer2002.
7. 'International Energy Outlook' - EIA annual Publication.
8. Heat and Thermodynamics – M.W. Zemansky (McGraw Hill Publication).
9. Principles of Energy Conversion: A.W. Culp (McGraw Hill International edition).

List of e-Learning Resources:

1. https://beeindia.gov.in/sites/default/files/1Ch1.pdf
2. https://archive.nptel.ac.in/courses/121/106/121106014/
3. https://onlinecourses.nptel.ac.in/noc22_ch38/preview

Mandsaur University

M Tech: Energy Technology

Semester-I

L-2 T-1 P-2 C-4

EEE020: Solar Energy Conversion

Course Objectives:

- To provide an understanding of solar energy resources, with scientific examinations of the energy field and emphasis on their technology and applications.
- To know the designing of solar photovoltaic systems their operation and maintenance.
- The course will enables to understand the CSP plants with their design and performance and various applications of solar thermal.

Course Outcomes(COs):

1. Understand the knowledge on principles of operation, construction and working of solar photovoltaic and solar thermal devices.
2. Apply to understand the working of solar photovoltaic's cell. Ability to design solar thermal energy conversion system for appropriate applications.
3. Analyze the designing of solar photovoltaic systems
4. Analyze Mega Solar Power Plants and gaining comprehensive knowledge of how performance of solar energy can be evaluated.
5. Evaluate the performance of solar thermal applications. and thermal storage.

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	1	1	3	2	-	-	1	2	1	-	2
CO2	3	2	1	1	3	-	-	2	1	2	1	2
CO3	3	3	3	1	2	-	-	3	1	1	1	2
CO4	3	3	2	1	1	-	-	3	2	1	-	2
CO5	3	3	2	1	1	-	-	3	1	1	1	1

High-3 Medium-2 Low-1

Unit-I **9 Hours**

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

Unit-II **9 Hours**

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-III **9 Hours**

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-IV **9 Hours**

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-V **9 Hours**

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.

List of Experiment:

1. Study of direct and diffused beam solar radiation.
2. Study of green house effect.
3. Performance evaluation of solar flat plate collector.
4. Study the effect of solar flat plate collector in parallel combination.
5. Performance evaluation of concentrating solar collector.
6. Performance evaluation of solar cooker.
7. Performance evaluation of a solar PV panel.
8. Performance of PV panel in series and parallel combination.
9. Charging characteristics of a battery using PV panel.
10. Effect of tilt angle on solar PV panel.
11. Effect of shadow on solar PV panel.
12. Effect of surrounding temperature on PV panel.
13. Performance evaluation of solar funnel.

Reference(s)

1. Solar Energy fundamentals & applications; by H.P. Garg, J Prakash.
2. Solar Energy Technologies; by ChetanSolanki, IIT, Bombay.
3. Solar Electricity; by Wiley.
4. From Sunlight Electricity by ShirishSinha Teri.
5. Concentrating Solar Power: Renewable Energy Technologies: Cost Analysis Series, Volume 1; Power Sector, Issue 2/5 IRENA 2012.

Total: 45 Hours

List of e-Learning Resources:

1. https://www.youtube.com/watch?v=BWqiPHGM5D0&list=PLwdnzlV3ogoUtaGiq-lVJc4CC6x_czs9D
2. https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk

Mandsaur University

M.Tech. Energy Technology
Semester-I

EEE070: Environmental Lab

L-0 T-0 P-6 C-3

Course Objectives

1. To interpret various fundamentals of the subject & use them in the field of Environmental Engineering.
2. The students will be able to analyze the impact on environment due to some new developmental activities.
3. To acquire skill to test the various physical, chemical & bacteriological parameters of water and wastewater.
4. The students will be able to assess the impact on the environment of various environment management techniques

Course Outcomes (COs)

- Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
- Statistically analyze and interpret laboratorial results.
- Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.
- Understand and use the water and wastewater sampling procedures and sample preservations.
- Obtain the necessary background for subsequent courses in environmental engineering.

Articulation Matrix

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

High-3 Medium-2 Low-1

Practical List:

1. To study Digital Turbidity/Nephelo Meter.
2. To measure turbidity using Digital Turbidity/Nephelo Meter.
3. To study Dissolved Oxygen Meter.
4. To measure Dissolved Oxygen in a given Solution.
5. To study Dissolved TDS meter.
6. To measure Dissolved TDS with the help of Dissolved TDS meter.
7. To study Electro coagulation Process.
8. To study the wastewater purification by Electro coagulation.

List of E-Learning resource:

www.epa.org
www.uneptie.org
www.cpcb.nic.in
www.wri.org
www.safeclimate.net
www.globalwarming.org,
Bureau of Energy Efficiency 186