DEVI AHILYA VISHWAVIDYALAYA, INDORE

School of Energy and Environmental Studies

1.1.1
Program outcome and course outcome

Program Outcomes (POs)

PO1. Acquire fundamental knowledge on the conventional and new and renewable energy sources, systems and technologies and their impact on environment. The students acquire expertize and skills to provide Renewable energy systems and technologies projects for Energy generation, Transportation and utilization with cost benefit analysis.

PO2. Acquire expertise and skills needed for the Energy Management Systems and techniques of monitoring, Energy auditing, energy efficiency and conservation and for the projects development, implementation, and maintenance.
The students acquire expertize and skills to make available as Energy Auditors/ Managers/Consultants.

PO3. Acquire expertise and skills needed for the Environmental Management Systems and techniques of monitoring, Environment audit, Environmental Impact Analysis, environment instrumentation and control systems and for the projects development, implementation, and maintenance. They also able to develop projects in view of Socio-Cultural and behavioral aspects of Energy production and environmental changes
The trained manpower in Environmental and Waste Management provide the environmental Auditors/ Managers/Consultants.

PO4. The students will be able to analyze the energy and environmental systems and technologies with Resource Assessment and its optimum utilization.

PO5. Acquire abilities to undertake R & D and consultancy work in the energy and environment related fields

PO6. Students acquire skills for to communicate, prepare, plan and implement the energy project.

Specific Programme Outcomes (PSOs)

PSO.1 The application of fundamental knowledge to identify, formulate and investigate various problems of Energy and Environment of Residential, Commercial, Industrial and Rural including agricultural sectors

PSO.2 The application of recent systems and technologies along with modern software tools for designing, simulating and analyzing and implement Energy and environmental systems to promote sustainable and natural system to meet the demand of energy without or low environmental impacts.

PSO.3 The utilization of knowledge and expertise with skills regarding Energy management techniques and use of sustainable energy generating technologies for developing projects related to Energy management including Energy efficiency and energy conservation; and new and Renewable Energy Systems and technologies for thermal and Power generation, Protection, etc.

Course Outcomes

M.TECH. (ENERGY MANAGEMENT)

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

Code Number and Course Title
EN-701-Solar Energy: Fundamentals, Devices and Systems
Learning outcomes: ▪ Understanding basics of solar energy demand areas of economy. ▪ Design criterions of solar thermal and power generating systems for appropriate use. ▪ Application mechanisms as technical, legal or financial that influence energy consumption. Recognizing opportunities for increasing rational use of solar energy.
EN-702-New & Renewable Energy, Sources and Technologies
Learning outcomes: ▪ Understanding basics of Renewable energy sources, their need and design criterions of appropriate use. ▪ The application and selection mechanisms of the systems to meet the needful demand with techno-economic analysis.
EN-703-Engineering Thermodynamics, Heat Transfer and Process Integration
Learning outcomes: ▪ Ability to apply fundamental concepts of thermodynamics to engineering applications. Applies thermodynamics to conversion devices. ▪ Develops the systematic problem solving skills for thermodynamics and heat transfer systems and processes. ▪ The students will also be able to understand the fundamentals of process integration with performing pinch analysis to design heat exchanger networks for minimum the heat, and water consumption in processes
EN-704-Air, Noise, Water and Waste Water: Pollutions and Control Technologies
Learning outcomes: After successful completion of this course,

- Students will be able to understand an overview of air, noise, water and waste water with the understanding of design, development and evaluation methods.
- The application of use of appropriate technologies will also be done by students to apply them for prevention, control, measures and management of the pollution.

EN-705-Energy Management (Thermal)

Learning outcomes:

After successful completion of this course, students will be able to

- Obtain knowledge about energy conservation policy, regulations and business practices
- Analyze energy systems for Thermal energy management on the basis of techno-economic criterions
- Develop innovative energy efficiency and energy conservation solutions and demand management plans

EN-706-Energy Management (Electrical Systems)

Learning outcomes:

After successful completion of this course, students will be able to

- Obtain knowledge about energy conservation policy, regulations and business practices
- Analyze energy systems for Thermal energy management on the basis of techno-economic criterions
- Develop innovative energy efficiency and energy conservation solutions and demand management plans for electrical establishments/networks/other applications.

EN-707-Efficient Lighting: Sources, Systems and Design Aspects

Learning outcomes:

- Understanding basics of Artificial and Daylighting sources and design criterions of appropriate lighting systems.
- Their application and selection mechanisms of Artificial and Daylighting lighting systems to meet the recommended illumination levels with techno-economic analysis.

EN-708-Green Building Technologies

Learning outcomes:

- Understanding basics of Thermal and Visual comfort and design criterions of appropriate green systems and technologies.
- The integration with building components to create Thermal and Visual comfort conditions by using the sustainable materials and systems to make affinity with natural environment.
- The knowledge and skills will be developed in green building designs with techno-economic analysis.

EN-709-Bio and Solid Waste Management

Learning outcomes:

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

- Understand the use of assessment methods of availability and potential of biomass/waste generation from local bodies/state/national level.

- Understand Thermo-chemical, Biochemical and Agrochemical processes for energy conversion or fertilizer production or both from biomass/waste

- Select the appropriate methodologies, systems and technologies to provide the fuels or fertilizers or both for energy generation for an organization/industry/village/other sectors

- Develop knowledge and skills for Design, Development and Installation of biomass/waste conversion types of energy or fertilizer or both systems for any organization/industry/rural areas/other applications.

EN-710-Sustainable development, Environmental Auditing and Environmental Impact Assessment

Learning outcomes:
At the completion of this course the students will be able to
- Understand the sustainable development
- Understand the basics of Elements of Environmental Impact Assessment, Concepts of the Environmental Audit, Methodologies and legislation
- Select the appropriate EIA methodologies to assess the environmental impact on a organization/industry
- Develop knowledge and skills for preparation of EIA and EA reports for any organization/industry

EN-711-Energy Modeling and Project Management

Learning outcomes:
At the completion of this course the students will be able to
- Understand the use of assessment methods of energy planning and suggesting the good Policies based on mathematical modeling.
- Learn the application of financial methods and techno-economic analysis for feasibility and viability assessment of energy projects.
- Select the appropriate planning models with best option of cost benefit to implement the energy projects in rescannable time frame.
- Develop creativity, knowledge and skills for Development of planning, financial and project management models for the small to large local/regional/national projects.

EN-712-Electrical Power Generation, Instrumentation, Measurements, Transmission and Distribution

Learning outcomes:
At the completion of this course the students will be able to
- Understand the working principles of Electricity generation, transmission and distribution networks and their losses
- Learn the application of energy conservation techniques using energy efficient systems by replacing the existing old systems
- Develop knowledge for better utilization of existing electrical energy generating and network systems by minimizing the losses

EN-801-Heat Transfer and Energy Conservation Laboratory

Learning outcomes

After the doing of Practical's, the students will be able to

- Understand the working principles of real heat transfer systems and practical approach to evaluate heat transfer performance of energy systems.
- Learn the application of energy efficiency and conservation techniques using energy efficient systems or modifying the existing systems.
- Select the energy efficient thermal systems.

EN-802-Biomass and Environmental laboratory

Learning outcomes:

After the doing of Laboratory Practical's, the students will be able to

- Characterize the biomass and organic waste materials with distinguishing different types of biomass suitable for energy or fertilizer of both production and utilization.
- possess knowledge of bioreactors engineering and systems for biofuels generation as producer gas, **biogas**, **bioethanol** and **biodiesel** production,
- Students will be able to analyze problems related to biogas utilization for electricity and heat production on the basis of lab models.

EN-803-Solar Thermal and Photo - Voltaic Laboratory

Learning outcomes

After the doing of Laboratory Practical's, the students will be able to

- Understand the working of real solar thermal and PV systems
- Design the small to large systems on the basis of parametric study of real models of laboratory.
- Students will be able to analyze problems related to solar thermal and electrical systems.

EN-804-Energy & Environment Software Application

Learning outcomes

After the doing of Laboratory Practical's, the students will be able to

- Learn and apply the simulation techniques to design the appropriate energy and environmental system.

EN-805-Field Visits (Lab)

Learning outcomes

After the going to field visits, the students will be able to

- Understand the working of real old and latest different types of industrial processes, renewable energy field systems and technologies and energy and environmental problems.
- Suggest the remedial measures for small to large processes/systems to increase the efficiency/energy conservation opportunities or replacement strategy of conventional to renewable energy systems.

• Students will be able to solve the problems related to inefficient thermal/electrical processes/systems.

EN-806-Seminar
Learning outcomes The students will be able to • Develop the improved communication skills • Enhance the knowledge of latest development of energy and environmental field

EN-807-Mini Project
Learning outcomes The students will learn to apply technical tools to develop • The skills to prepare of technical reports on energy audits and conservation, environmental audit, resource like water audit. • Conversion of existing energy devices/system to more efficient designs. • Solve real-life problems related Energy and environmental issues by research and development.

EN-808-Major Project
Learning outcomes In the Fourth Semester of the Programme, every year, our students undertake and learn • The real field projects on Design of a Renewable Energy Based Systems, Detailed Energy Audit of an Industry, Design, Fabrication and Testing of an Energy Related Gadget or Laboratory Experiment, DPR preparation of an Energy Related project, performance, Evaluation of Existing Renewable/ Non Renewable Energy Systems etc. • The project work carried out with industry, consultancy organization of institutions to develop creativity, knowledge, and skills together.

Comprehensive Viva-vice
Learning outcomes • Comprehensive viva voce is held at the end of the semester to Judge the understanding of courses thought in each semester.

Program Outcomes (POs): EN9Z-Ph.D.

PO1 .A PhD in Energy and Environment can lead to a variety of careers. Investing groups may hire someone with this degree to better inform them about the growth potential of different energy and environment sources.

PO2.Environmental protection groups may need someone with this knowledge set to help promote green energy. Energy and environment producers may look for PhD graduates for management, research or development.

PO3.Energy and Environment research focuses on the generation, storage and efficient utilization of energy and natural resources and the assessment of the interaction between the environment and energy technologies in order to establish clean and renewable energy.

 PO4.Research on the interaction between renewable energy technologies and the environment (natural resources) is essential to understanding and establishing sustainability.

PO5.This research embodies the interrelation between atmospheric and environmental conditions and the production and utilization of clean, renewable energy.

PO6. Research on improved solar, wind, and bio-energy, and the interaction of these technologies with water resources, weather, and climate, defines this focus. Two themes are associated with this strategic research area: Efficient & Clean Energy Systems and Sustainable Environmental Systems.

Specific Programme Outcomes (PSOs)

- Use their analytical and theoretical knowledge to elucidate and contextualize complex, Tran's disciplinary issues surrounding energy.
- Contribute to the body of knowledge of complex energy systems through Trans disciplinary research.
- Function within the science-policy nexus with a unique understanding of issues and proposing innovative solutions.
- Produce a portfolio of research accomplishments in complex energy systems that will position them to be competitive for employment opportunities in academia, industry, and government.

Course Outcomes

Eligibility	(M.Sc. / M.Tech.)Master's degree or equivalent in the concerned or allied subject with at least 55% Marks (50% for SC/ST/Physically disabled candidates) of the university, a deemed university or other university
Duration	4 years
Seats	24
Medium of Instructions	English

Code Number and Course Title
Ph. D-701: Research Methodology

Learning outcomes:
- To formulate research goals and a plan to reach this goals within the subject area
- To identify the primary characteristics of quantitative and qualitative research. Research ethics as well as the quality criteria for research.

Ph.D-702: Review of Published Research

Learning outcomes:
- Define what review of literature is; Identify the importance of a good literature review;

- List the ideal procedures for review of literature; Describe common weaknesses in review of literature; and Critique a journal article.

- Literature review will increase your confidence in your research topic if you find other researchers have an interest in this topic and have invested time, effort and resources studying it.

- Literature review can reveal methods of dealing with the research problem that may be similar to the difficulties you are facing.

Ph. D – 703: Computer Applications: Energy Software

Learning outcomes:
- Provide hands-on use of Microsoft Office 2013 applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
- Define the general structure of MATLAB.
- Creates conditional control and loop control
    Application of special functioning of MATLAB for Scientific Programming

• **Describe and discuss the factors which contribute to the consumption of power/ energy in computing systems and how they affect the system performance.**
• **Explain in detail mechanisms found in modern computing systems for conserving energy.**
• Discuss, assess and compare the behavior and performance of energy-saving techniques on computing micro-architectures

Ph. D – 704: Advancement in Energy & Environment Systems & Technologies

Learning outcomes:

- Understand the value of statistics as a discipline and its relevance for Engineering
- Analyze data using appropriate graphical methods and numerical summaries
- Interpret and communicate the outcomes of estimation and hypothesis tests in the context of a problem
- Perform large sample test and small sample testing of Hypothesis as well as calculate confidence interval for a population parameter for real time data.
- Describe and verify mathematical considerations for analyzing time series, including concepts of white noise, stationary, auto covariance, autocorrelation ; apply various techniques of time series models, including the regression with ARMA models
- To provide students with a framework that will help them choose the appropriate descriptive statistics in various data analysis situations.
- To analyze distributions and relationships of real-time data.
- To apply estimation and testing methods to make inference and modelling techniques for decision making using various techniques including multivariate analysis