Name of Institute: **Indus Institute of Technology & Engineering**
Name of Faculty: **Prof. Dharmendra Sapariya**

Course code: **ME0437**
Course name: **Energy Management (OE-V)**
Pre-requisites: Metrology and Instrumentation, Basic electrical engineering,
Credit points: 03
Offered Semester: 4th

Course Coordinator (weeks 16 – 03 lecture per week)
Full Name: Prof. Dharmendra Sapariya
Department with seating location: Mechanical engineering Department, Drawing Hall 02, 3rd floor, Bhanwar Building
Telephone: 8866245022
Email: dharmendrasapariya.me@indusuni.ac.in
Consultation times: 4:20 pm

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives
This course enables the students to:
1) Aware of present energy scenario.
2) Understand the energy management approach.
3) Prepare energy audit report for different energy conservation instances.
4) Inculcate sustainable technology development competence into students.

Course Outcomes (CO)
After completing this course, the student:
1) Students will be aware of energy scenario in various energy sectors.
2) Students will learn to prepare energy audit report for different energy conservation instances.
3) Students will understand the energy management approach.
4) Sustainable technology development competence will be inculcated in the students.

Course Outline
The course gives knowledge about present energy scenario, energy management tools. It describes energy audit process and importance of energy audit. It describes recent environment effects and climate change and its effects.

Method of delivery
Lecture through chalk talk method, presentation and videos, Demonstration, case study, Group Discussion.

Study time
3 Hours/week

CO-PO Mapping (PO: Program Outcomes)

Program Outcomes (PO's)

Engineering Graduates will be able to:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs) of Department

At the end of the program, the student:

PSO1. Should be able to clearly understand the concepts and applications in the field of design of mechanical systems, thermal engineering and production technology and also possess the skills to communicate effectively as well as demonstrating the practice of professional ethics and the concerns for societal and environmental wellbeing.

PSO2. Should be able to associate the learning from the courses related to Thermodynamics, Fluid Science, Mechanical system design, Machining and Manufacturing processes, Production Technology and Automation of systems, to arrive at solutions to real world problems.

PSO3. Should have the capability to comprehend the technological advancements in the usage of modern design tools to analyze and design subsystems/processes for a variety of applications.

Mapping CO's with PO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	-	-	-	-	-	-	-	-	-	-
CO2	√	-	-	-	-	√	√	-	√	-	√	√
CO3	√	-	-	-	-	√	-	-	-	-	√	√
CO4	√	-	-	-	-	-	√	-	-	-	-	√

.2 Mapping of CO's with PSO's

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

Blooms Taxonomy and Knowledge retention

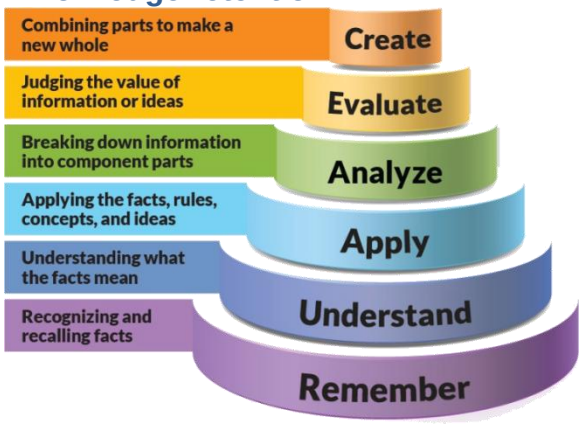

Figure 1: Blooms Taxonomy

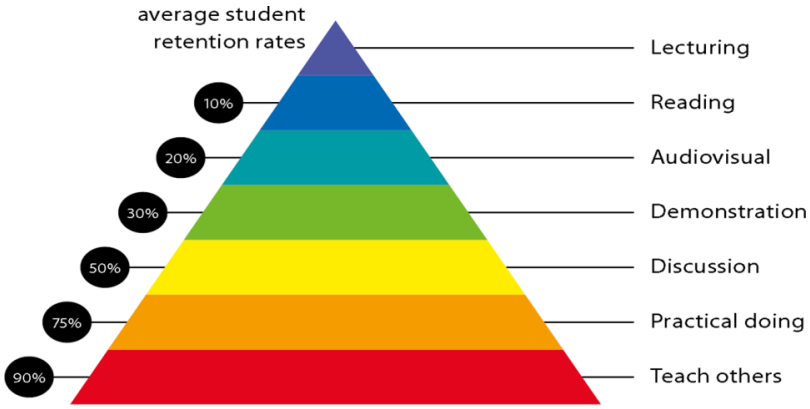

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

General Graduate Qualities	Specific Department of Mechanical Graduate Capabilities
Informed Have a sound knowledge of energy management, need to study or profession and understand its current issues, locally and internationally. Understand how to apply this knowledge to ground level. Understand how an energy management has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners By case study on energy management lead to develop ideas and ways of thinking and critically analyze issues. By providing expert lecture references help in to get extend subject knowledge. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities in industries and organization related to Energy issues by case study. By Demonstration of energy losses help in to understand problem faces in industries and try to give solution to resolve problems. Apply creative and logical to respond effectively. Make and implement decisions.	**3 Problem solving skills**
Effective communicators Report or Assignment writing help in improve written communication. Presentation need to give based on case study or research paper related to course. Work collaboratively and engage with people for innovative ideas of energy saving and presentation. Recognize how culture can shape communication.	**4 Written communication** **5 Oral communication** **6 Teamwork**

Responsible Understand and Implements of Energy management techniques lead to sustainability of nation and world. Help in fulfill energy requirement of the nation and world without harmful environment impact.	**7 Sustainability, societal & environmental impact**

Demonstration of following equipment should be given to the students:

(a) Energy auditing instruments/equipments (b) Boiler Models (c) Vapor compression refrigeration system (d) Air conditioning system

Lecture times

Lecture-1 **Lecture-2** **Lecture-3**

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Text book, Reference book, online sources like NPTEL lectures

Text books and Reference Books

Text Books

1) Energy Technology Non-conventional, Renewable & Conventional, S. Rao, Dr. B.B. Parulekar, Khanna Publishers, Third Edition, Delhi - 2007.

2) Energy management Audit and conservation, Barun Kumar De, 2nd Edition, Vrinda Publications P Ltd.,2014.

3) Energy Engineering and management, Amlan Chakrabarti, PHI Publication, 2011.

Reference Books

1) Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, CRC Press, 2nd Edition.

2) Handbook of Energy Audits, Albert Thumann, The Fairmont Press, 6th Edition.

3) Bureau Energy Efficiency Reference book: No.1, 2, 3 4

4) Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science

5) Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing.

Additional Materials

Web links:

1) http://shodhganga.inflibnet.ac.in/bitstream/10603/46067/11/11_chapter%201.pdf

2) http://lab.fs.uni-lj.si/kes/erasmus/Energy%20Management%20Handbook.pdf

3) https://nptel.ac.in/courses/108106022/#

4) https://www.youtube.com/watch?v=iWWyI8CZhUw
5) https://www.youtube.com/watch?v=IdPTuwKEfmA
6) https://www.youtube.com/watch?v=- LJkqydYbls&list=PLYuR1TUYRLpFrrm4CAElBP1-2XPB7QxD4
7) https://geda.gujarat.gov.in
8) www.powermin.nic.in

MOOCS:

List of Open Source learning website:

1) Energy management systems: https://nptel.ac.in/courses/108106022/
2) Energy systems Engineering: https://swayam.gov.in/courses/5286-energy-systems- engineering
3) Energy and Development https://www.edx.org/course/energy-and-development-1
4) Environment and Ecology: https://nptel.ac.in/courses/122102006/

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Class Test I (Objective 1)	
Class Test II (Objective 2,3)	**20 Marks (Consider Best 2 class test Marks)**
Class Test III (Objective 4)	
Group Presentation (Max. 2 students)	**20 Marks**
Or Innovative Live Project	
Assignments	**10 Marks**
Class Participation/Attendance	**10 Marks**
Final exam	**40 Marks**

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in Continues Internal Evaluation (CIE) and end semester will be considered for supplementary assessment in the respective components (i.e CIE or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (CIE or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of - % of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

Course schedule (subject to change)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	**Energy Scenario:** Classification of Energy, Indian energy scenario, sectoral energy consumption (domestic, industrial sectors),	CO 1	Chalk Talk, Presentation
	Weeks 2	**Energy Scenario:** Energy needs of growing economy, energy intensity, long term energy scenario,	CO 1	Presentation, Topic Video
	Week 3	**Energy Scenario:** Energy pricing, energy security, energy conservation and its importance, energy strategy for the future. Energy conservation Act 2001.	CO 1	Chalk talk, Presentation, Topic Video
	Week 4	**Energy Management & Audit:** Definition, energy audit, need, types of energy audit,	CO 2	Chalk talk, Presentation
	Week 5	**Energy Management & Audit:** Energy management (audit) approach-understanding energy costs,	CO 2	Chalk talk, Presentation of students, Submission of Assignment 1
	Week 6	**Energy Management & Audit:** Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies,	CO 2	Demonstration, Presentation, Videos
	Week 7	**Energy Management & Audit:** Optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.	CO 2	Presentation, Videos lecture Case study, Presentation of students
	Week 8	**Energy Management and Energy Planning:** Definitions and significance, Energy strategy, energy policy and energy planning, objectives of energy management, Trade - off between energy and environment	CO 3	Chalk Talk, Presentation, Presentation of students, Class Test 1

	Week 9	**Energy Management and Energy Planning:** Energy and economy, Transportation of energy, Seven principles of energy management.	CO 3	Presentation, Videos lecture, Presentation of students, Submission of Assignment 2,
	Week 10	**Energy Monitoring and Targeting:** Defining monitoring & targeting, elements of monitoring & targeting, , Data and information- analysis	CO 3	Presentation, Videos lecture. Presentation of students
	Week 11	**Energy Monitoring and Targeting:** Techniques – energy consumption, production, Cumulative sum of differences (CUSUM).	CO 3	Chalk Talk, Presentation, Presentation of students
	Week 12	**Energy Monitoring and Targeting:** Energy Management Information Systems (EMIS).	CO 3	Presentation, Videos lecture, Case study, Class Test 2
	Week 13	**Energy, Environment and Climate Change:** United Nations Framework Convention on Climate Change (UNFCC),	CO 4	Chalk Talk, Presentation, Videos, Submission of Assignment 3
	Week 14	**Energy, Environment and Climate Change:** Sustainable development, Kyoto Protocol, Conference of Parties (COP),	CO 4	Presentation, Videos, Demonstration, Presentation of students
	Week 15	**Energy, Environment and Climate Change:** Clean Development Mechanism (CDM), CDM Procedures case of CDM - Bachat Lamp Yojna and industry;	CO 4	Presentation, Videos lecture, Presentation of students
	Week 16	**Energy, Environment and Climate Change:** Prototype Carbon Fund (PCF).	CO 4	Presentation, Videos lecture, Presentation of students Submission of Assignment 4, Class Test 3
End of Semester				

B.TECH MECHANICAL ENGINEERING (2019)