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

Course code: **ME0709**
Course name: **Energy Conservation and Management (DE-II)**
Pre-requisites: Metrology and Instrumentation, Thermal engineering, Heat transfer, cooling load calculation, Refrigeration and Air conditioning Basic electrical engineering,
Credit points: 03
Offered Semester: 7th

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) Understand how to conserve energy.
2) Do effective energy management.
3) Learn financial management of energy.
4) Carry out energy audit for commercial and industry purpose.
5) Apply techniques for increase energy efficiency of various devices in industries or organization.
6) Analyze environment impact due to energy conservation.

Course Outcomes (CO)
After completing this course, the student:
1) Will come to know the present energy scenario
2) Energy management, conservation and financial aspect will be understood by students
3) Able to carry out energy audit effectively.
4) Will learn improvement of energy efficiency of various mechanical machines
5) Solve problem environment effects and climate change effects will be understood by all, by using a tools and technology for skill development and employability.

Course Outline
The course gives knowledge about present energy scenario, energy management tools. It describes energy audit process and importance of energy audit. This course helps to understand energy efficiency of various mechanical machines. 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.

PO 9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 **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.

PO 11 **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.

PO 12 **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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	√	-	-	-	-	√	-	-	-	√	√	√
CO2	√	√	√	-	-	√	√	-	-	-	-	√
CO3	√	√	√	√	-	-	√	√	√	-	√	√
CO4	√	-	√	-	√	-	-	√	-	√	√	√
CO5	√	√	-	-	-	-	√	-	-	√	√	√
CO6	√	-	√	-	-	√	√	-	-	√	√	√

.2 Mapping of CO's with PSO's

	PSO 1	PSO 2	PSO 3
CO1	√	-	-
CO2	√	-	-
CO3	√	-	-
CO4	√	√	√
CO5	√	√	√
CO6	√	√	√

Blooms Taxonomy and Knowledge retention

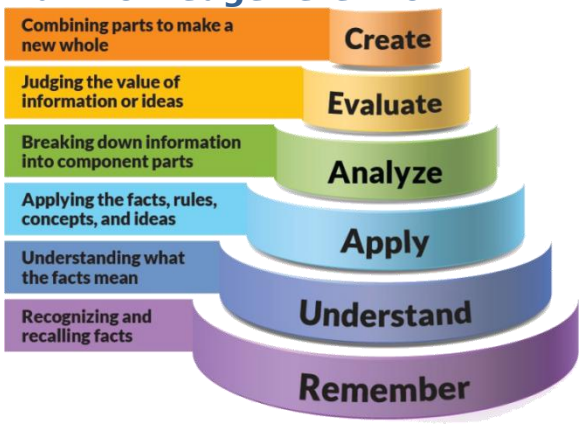

Figure 1: Blooms Taxonomy

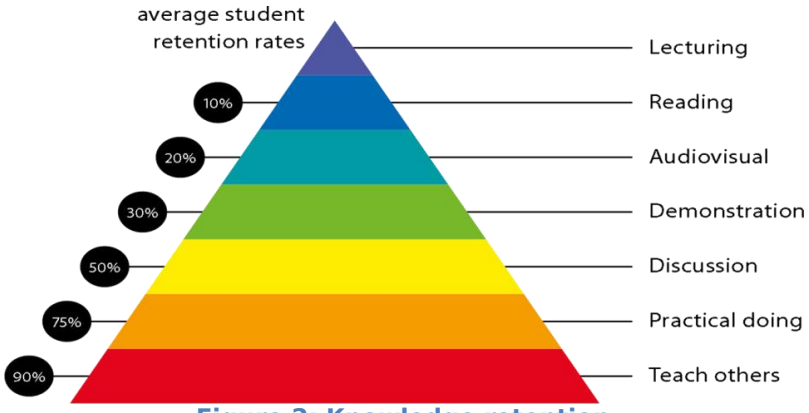

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

General Graduate Qualities	Specific Department of Mechanical Graduate Capabilities
Informed Have a sound knowledge of energy conservation and 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	**1 Professional knowledge, grounding & awareness**

management has developed and how it relates to other areas.	
Independent learners By case study on energy conservation and 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 conservation and 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	**Tuesday**	**10.00 – 11.00**
Lecture	**Wednesday**	**11.10 - 12.10**
Lecture	**Thursday**	**12.20 - 13.20**

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) Bureau of Energy Efficiency Reference book: No.1, 2
2) Bureau of Energy Efficiency Reference book: No. 3, 4
3) Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication

Reference Books

1) Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2) Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3) Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
4) Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994

Additional Materials

Web links:

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

MOOCS:

List of Open Source learning website:

1) https://nptel.ac.in/courses/112105221/
2) https://nptel.ac.in/courses/108106022/
3) https://nptel.ac.in/courses/105102175/
4) https://nptel.ac.in/courses/122102006/
5) https://nptel.ac.in/courses/105102089/12

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Mid Semester Exam	**40 Marks**
Group Presentation (Max. 2 students)	**10 Marks**
Or Innovative Live Project/ Research Paper	
Assignments	**05 Marks**
Class Participation	**05 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, Sectorial energy consumption (domestic, industrial sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.	CO 1	Chalk Talk, Presentation
	Weeks 2	**Energy Scenario:** Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy.	CO 1	Presentation, Topic Video
	Week 3	**Financial Management** 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 Energy Service Companies (ESCOs).	CO 1,2	Chalk talk
	Week 4	**Energy Monitoring and Targeting:** Defining monitoring & targeting, elements of monitoring & targeting, data and information- analysis	CO 2	Chalk talk, Presentation

	Week 5	**Energy Monitoring and Targeting:** Techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS).	CO 2	Chalk talk, Presentation of students, Submission of Assignment 1
	Week 6	**Energy Audit:** Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs,	CO 3	Presentation, Videos Class Test 1
	Week 7	**Energy Audit:** Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.	CO 3	Presentation, Videos lecture Case study, Presentation of students
	Week 8	**Energy Efficiency in Thermal Devices-I** **Boilers:** Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities.	CO 4	Chalk Talk, Presentation, Presentation of students Submission of Assignment 2
	Week 9	**Energy Efficiency in Thermal Devices-I** **Boilers:** Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation.	CO 4	Presentation, Videos lecture, Presentation of students
	Week 10	**Energy Efficiency in Thermal Devices-I** **Furnaces:** Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft	CO 4	Presentation, Videos lecture. Demonstration , Presentation of students

		control, waste heat recovery. Forging furnace heat balance, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace.		
	Week 11	**Energy Efficiency in Thermal Devices-II** **Insulation and Refractoriness:** Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractory, heat loss.	CO 4	Chalk Talk, Presentation, Class Test 2
	Week 12	**Energy Efficiency in Thermal Devices-II** **Waste Heat Recovery:** Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.	CO 4	Presentation, Videos lecture, Case study, Presentation of students
	Week 13	**Energy Efficiency in Thermal Devices-III:** **Heating, Ventilation, Air Conditioning (HVAC) and Refrigeration System** Factors affecting Refrigeration and Air conditioning system performance and energy savings opportunities.	CO 4	Chalk Talk, Presentation, Videos, Submission of Assignment 3
	Week 14	**Heating, Ventilation, Air Conditioning (HVAC) and Refrigeration System** Vapor absorption refrigeration system comparison with vapor compression system and saving potential, heat pumps and their applications, performance assessment of window and split room air conditioners.	CO 4	Presentation, Videos, Demonstration, Presentation of students

	Week 15	**Energy, Environment and Climate Change:** United Nations Framework Convention on Climate Change (UNFCC), Sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM.	CO 5	Presentation, Videos lecture, Presentation of students
	Week 16	**Energy, Environment and Climate Change:** Prototype Carbon Fund (PCF). Carbon Credit Concept, National action plan on climate change, ECBC code for Building Construction.	CO 5	Presentation, Videos lecture, Submission of Assignment 4, Presentation of students Class Test 3
End of Semester				

INDUS UNIVERSITY
Where Practice Meets Theory

Indus Institute of Technology and Engineering

Mechanical Engineering Department

DHARMENDRA SAPARIYA

	1 9:00 - 10:00	2 10:00 - 11:00	3 11:10 - 12:10	4 12:20 - 13:20	LUNCH BREAK 13:20 - 15:10	5 14:00 - 15:00	6 15:10 - 16:10
Mon					LUNCH BREAK		
Tue		7TH MECH A/7TH MECH B/7TH MECH C PV/ECM/AMFP R&AI (DE-3)					
Wed			5TH CIVIL/5TH META/ 5TH IT/5TH CE/5TH CSE/ IR(OE-6)&NCES(OE-7)			7TH MECH A/7TH MECH B/7TH MECH C PV/ECM/AMFP R&AI (DE-3)	
Thur				5TH CIVIL/5TH META 5TH IT/5TH CE/5TH CSE IR(OE-6)&NCES(OE-7)			
Fri				7TH MECH A/7TH MECH B/7TH MECH C PV/ECM/AMFP/ R&AI (DE-3)			5TH CIVIL/5TH META/ 5TH IT/5TH CE/5TH CSE/ IR(OE-6)&NCES(OE-7)

PREPARED BY J.A.RANA, D. SAPARIYA

Faculty Name:

AWB	AMOL BAGESAR	DDS	DHARMENDRA SAPARIYA
BAS	BHAVIK SONEJI	PJS	PARITA SHETH
BHK	BHAVIN KHATRI	RD	RAVI DABLA

Subjects Name: *Effective From 4th August 2020*

EME	ELEMENTS OF MECHANICAL ENGINEERING
IR(OE-6)	INTRODUCTION TO ROBOTICS (OE-6)
NCES (OE-7)	NON CONVENTIONAL ENERGY RESOURSES (OE-7)
PV/ECM/AMFP/R&I	PV/ECM/AMFP R&I (DE-3)
SOM-AU	STRENGTH OF MATERIAL-AUTO

Prepared By
Prof J A Rana & Prof D D Sapariya

HOD Mechanical ITE
Dr. U J Patdiwala

B.TECH MECHANICAL ENGINEERING (2019)