Mechanical Engineering Dept. Department

Syllabus

ME 429: Energy Efficiency and Auditing (3-0-3)

Course Catalog Description:

Overview on energies and energy auditing process, understanding and analysis of energy bills, economic and life cycle costing analysis, fundamentals of electric systems, lighting, electric motors and drives, Building Envelop (revisions of modes of heat transfer, Insulation and building codes), HVAC, boilers and steam distribution systems, compressed air systems, renewable energy systems and waste water management, human behavior and facility energy management.

Course Objectives:

1. Introduce students to basic fundamentals of energy efficient utilization
2. Introduce students to energy auditing process.
3. Make students familiar with energy utilization assessments in buildings and industrial facilities.
4. Enable the students to conduct energy auditing, assess and analyze energy utilization.
5. Make the students able to propose energy efficient solutions and conduct its cost life analysis
6. Enable the students to write detailed energy auditing reports.

Course Learning Outcomes:

CLO1. Be fully aware and familiar with energy auditing standard processes.

CLO2. Recall the fundamental of energy efficiency in industrial systems and air compressors

CLO3. Perform a technical analysis of energy auditing in cost-effective projects.

CLO4. Analyse the energy consumption in electric, HVAC, Boilers and steam generation systems and air compressors

CLO5. Employ energy auditing techniques for residential, commercial, and industrial facilities.

CLO6. Prepare and present detailed energy auditing reports with recommendations.

CLO7. Appreciate the need for Energy Efficiency awareness campaigns and consider the social, environmental and economic impact of energy efficiency and auditing

Learning Resources:

- Capehart, B. L, Turner, W. C., and Kennedy, W. J., Guide to Energy Management, 8th edition, TFP The Fairmont Press Inc., CRC Press, Taylor & Franci Group LLC, ISBN 978-1-4987-7988-3, (2016).
- Doty S. and Turner, W. C., Energy Management Handbook, 8th edition, TFP The Fairmont Press Inc., CRC Press, Taylor & Franci Group LLC, ISBN 978-1-4665-7828-9, (2013)

- https://www.seec.gov.sa/en https://www.seec.gov.sa/en/capacity-development/training-courses-registraion/?Type=1469 https://www.aeecenter.org/ https://onlinelibrary.wiley.com/journal/1099114x https://www.journals.elsevier.com/applied-energy https://www.journals.elsevier.com/energy https://energyeducation.ca/encyclopedia/Renewable_and_sustainable_energy https://www.ieee.org/
- • Notes provided by instructor through Bb • KFUPM senior level related online courses such as ME 435 (thermal power plants), ME 430 (Air Conditioning) • https://www.seec.gov.sa/en • https://www.energy.gov/eere/amo/industrial-assessment-centers-iacs • https://iac.university/
- any related publications and reports of local and international case studies (e.g., instructor related publications)

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
second major exam	13	15.0%
Term project	15	15.0%
Final Exam	16	30.0%
First Major	6	15.0%
HWs	biweekly	10.0%
Field visits discipline	TBA	5.0%
Class activities, tests and Quizzes	TBA	10.0%

Lecture Weekly Schedule:

Week#	Topics
1	Overview on energies, and energy auditing process: Energy efficiency and sustainability; ASHRAE energy auditing Level 1, 2 and 3
	Revision of Thermodynamics and First Law Efficiency and its application to thermal Power generation and HVAC systems
2	Revision of Thermodynamics and First Law Efficiency and its application to thermal Power generation and HVAC systems (Continue)
3	Revision of Thermodynamics and First Law Efficiency and its application to thermal Power generation and HVAC systems (Continue)
4	Revision of Thermodynamics and First Law Efficiency and its application to thermal Power generation and HVAC systems (Continue)
	Understanding and analysis of energy bills, economic and life cycle costing analysis
5	Fundamentals of electric systems
6	Electric energy auditing equipment
7	Building envelop, Insulation and building codes
8	HVAC systems
9	Building and HVAC energy auditing equipment
10	Boilers and steam distribution systems and related energy auditing equipment

Week#	Topics
11	Compressed air systems and related energy auditing equipment
12	Renewable energy systems and wastewater management
13	Energy policy and Global Programs
14	Human behavior and facility energy management
15	Energy auditing (ASHRAE Level 1) for an actual facility