OVERVIEW

There is a growing interest to meet the growing energy demand with reduced pollutants and greenhouse gas emissions. Efficiency improvement, energy conservation measures are receiving a great deal of attention. Thermal energy storage systems play a dominant role to store excess energy during off-peak hours and supply it during peak hours from power plants. Also there is scope in many industrial applications to use thermal energy storage to improve energy conservation. In the present course, the importance of energy storage and the details related to various thermal energy storage systems will be discussed. The role of thermal energy storage systems in reducing environmental issues will also be discussed. The heat transfer aspects related to energy storage, losses and the efficiency for various thermal energy storage systems will be presented. The sensible energy storage systems, latent heat energy storage systems and the advances in thermal energy storage systems with case studies will be discussed. Also the type of thermal energy storage systems employed for power plants including compressed air energy storage and the related analysis and details will be discussed. The analysis of multiple storage system and their role in district heating will also be covered.

The second law of thermodynamics is receiving lot of attention for the analysis of power generation and thermal systems. In the course, the second law analysis of sensible energy storage systems, latent heat energy storage systems and the ways to reduce the losses from energy storage will be presented. The Thermodynamic optimization of sensible and latent heat energy storage systems will also be discussed. Exergy economics approach vs. energy economics approach for thermal energy storage systems will be discussed. The role of exergy analysis for thermal energy storage systems and district energy systems will also be discussed. Future research directions in exergy area will be presented.

Course participants will learn various thermal energy storage systems through brainstorming lecture series, discussions and through question-answer interactions. Different case studies will be discussed on this particular subject area to stimulate research motivation for participants. The course participants will be benefited by learning the thermal energy systems, research advances and thereby helping them to plan long term research in this important and growing area.

OBJECTIVES

The mail objective of this course is to educate the participants on importance of energy storage and various thermal energy storage systems and their technical details. The role of thermal energy storage systems in reducing environmental issues will also be discussed. In order to achieve this, the following courses objectives are planned:

- **Expose the participants to environmental issues, global warming and the need for thermal energy storage systems and energy conservation measures.**
- **The analysis and details related to sensible, latent and thermochemical heat energy storage systems with case studies.**
- **Performance analysis and improvement of thermal energy storage systems design.**
- **The role of exergy analysis to reduce emissions, improve design of thermal energy storage systems.**

WHO SHOULD ATTEND?

- Undergraduates, MTech/MSc, and PhD students. Any student with a basic background in thermodynamics will be able to follow these lectures and gain valuable information.
- BTech/BSc and MTech/MSc level teachers who wish to update their knowledge in an important special field of thermal energy storage.
- Executives, engineers and researchers from industry, service and government organizations including R&D laboratories who are engaged in solar power and thermal energy storage

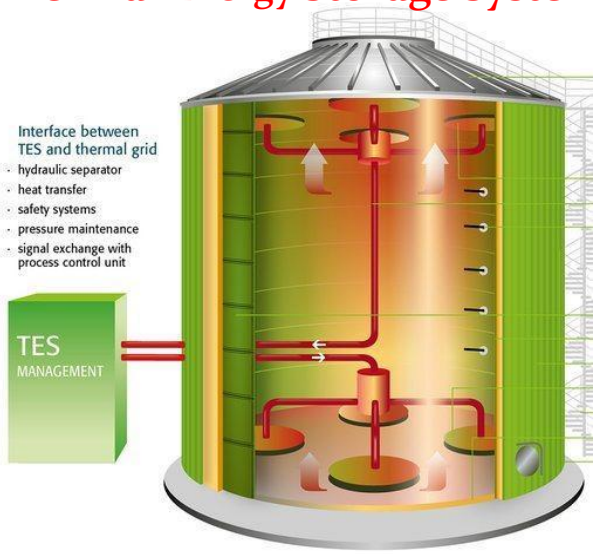
MINISTRY OF HUMAN RESOURCE AND DEVELOPMENT ,GOVERNMENT OF INDIA

सत्यमेव जयते

Global Initiative of Academic Networks

One Week Course on

Second Law Analysis of Thermal Energy Storage Systems



July, 17-22, 2017

Discipline of Mechanical Engineering
Indian Institute of Technology, Indore
Simrol, Indore, M.P. - 453552, India

COURSE CONTENT

The course is planned as a sequence of 14 lectures of 1 hour each, plus 7 tutorials of 2 hours each The course will be covered in two modules (A and B).

Module A: Thermal Energy Storage Systems

- ❖ Energy and environmental issues.
- ❖ Introduction to energy storage systems, types.
- ❖ Efficiency role in emissions reduction.
- ❖ Thermal energy storage types, sensible vs latent heat energy storage approach.
- ❖ Energy analysis, problems and calculations of sensible energy and latent heat energy storage system.
- ❖ Compressed air energy storage systems.

Module B: Exergy and Economic Approach

- ❖ Second law of thermodynamics and exergy.
- ❖ Recent advances in thermal energy storage systems .
- ❖ Discussion and problems on II law of thermodynamics .
- ❖ Exergy analysis of sensible and latent heat thermal energy storage systems.
- ❖ Basics of thermochemical energy systems, absorption principles.
- ❖ Problems, case studies and problems related energy balance on thermal energy storage systems .
- ❖ Analysis, problems and case studies of cogeneration and district energy systems.
- ▪ Thermodynamic optimization of thermal energy storage systems (sensible, Latent)
- ▪ Metal hydrides – hydrogen and metallic salts - NH_3 systems for energy storage.
- ▪ Problems and case studies on cogeneration based district energy systems.

TEACHING FACULTY

❑Prof. (Dr.) Bale V. Reddy (BVR):

Prof. (Dr.) Bale V. Reddy is Professor in Department of Automotive, Mechanical and Manufacturing Engineering in Faculty of Engineering and Applied Science, University of Ontario Institute of Technology (UOIT), Oshawa, Ontario, Canada. Prior to this Dr. Reddy also worked as an Associate Professor in Mechanical Engineering Department, University of New Brunswick (UNB), Fredericton, Canada. Dr. Reddy received his MTech and PhD degrees in Mechanical Engineering from IIT, Kharagpur, India under the guidance of Prof. P.K. Nag. Dr. Reddy has 20 years of teaching and research experience in Mechanical engineering with focus on thermal and energy systems, heat transfer, exergy analysis, energy storage, hydrogen and energy management. He has led funded research projects in the area of thermal and energy systems. Dr. Reddy has published 200 papers in refereed journals (various reputed journals) and refereed conference proceedings.

Dr. Reddy has delivered key note and invited presentations in many international conferences in various countries. Dr. Reddy has also received best professor award for excellence in teaching five times both in India (VIT, Vellore) and in Canada (UNB, Fredericton; UOIT, Oshawa).

❑Dr. E. Anil Kumar (EAK):

E. Anil Kumar is Associate Professor in the Discipline of Mechanical Engineering, IIT Indore. He obtained his Ph.D. Degree from the Department of Mechanical Engineering, IIT Madras. His research interests are measurement of Thermodynamic and Thermophysical properties of solid state hydrogen storage materials, Carbon dioxide capture and sequestration. He has published more than fifty papers in peer reviewed International Journals and Proceedings of International and National Conferences.

REGISTRATION FEE

- ❑ Students (UG/PG): Rs. 5000
- ❑ Research Scholars: Rs. 8000
- ❑ Faculty Members: Rs. 12000
- ❑ Foreigners: USD 300
- ❑ Industry and Others: Rs. 15000

IMPORTANT DATES

Last date of registration: July, 14, 2017

Course schedule: July, 17-22, 2017

COURSE COORDINATOR:

For any information regarding eligibility, fee payment, travel information, accommodation, etc., please contact the course coordinator via e-mail or phone.

Dr. E. Anil Kumar
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Email: anil@iiti.ac.in
Mobile: +91-7879779188

TRAVEL INFORMATION

Indore is located in central part of India in Madhya Pradesh state. It is well-connected by rail, road and air. The nearest railway station is Indore Junction and the nearest Airport is Devi Ahilyabai Holkar Airport. For queries regarding travel information, please contact the course coordinator.

ACCOMMODATION

Paid accommodation will be provided to participants on first-come-first-serve basis.