Exergy Analysis of Industrial Processes

(11 – 15, February, 2019)

Department of Chemical Engineering, NIT WARANGAL

1. Overview

The past two decades have witnessed revolutionary changes in the way thermodynamics is taught, researched and practiced. The emphasis is now on system analysis and thermodynamic optimization, not only in the mainstream of engineering but also in physics, biology, economics and management. The methods of exergy analysis, entropy generation minimization and thermo-economics are the most visible and established forms of this change. The concept of exergy belonged to the field of fundamental thermo physical science or to the applied engineering sciences, such as thermo mechanical and chemical engineering. Exergy analysis is a method that uses the conservation of mass and conservation of energy principles together with the second law of thermodynamics for the analysis, design and improvement of energy and other systems. Today there is a much stronger emphasis on exergy aspects of systems and processes. As a result of these recent changes and advances, exergy has gone beyond thermodynamics and become a new distinct discipline because of its' interdisciplinary character as the confluence of energy, environment and sustainable development. The course will therefore provide a systematic approach of exergy techniques for various systems and processes as well as highlight how energy resources can be utilized in societies.

The course provides detailed information and contrast approach on energy and exergy analysis. Starting with fundamental principles and basic aspects of thermodynamics, energy, entropy and exergy to final applications to drying, power plants, cryogenic systems, crude oil distillation and fuel cells will be covered in the course. It will also illustrate how exergy complements and can be used with industrial ecology. The course would help the participants to develop skills in model formulation, analysis and solution of the model equations which will be helpful for further successful performance enhancement of any system.

2. Objectives

The primary objectives of the course are as follows:

i) To train the participants on general procedures for energy and exergy analysis
ii) To apply exergy and thermo-economic analysis to different industrial process
iii) To provide rich hands on experience on exergy analysis through various exercises.

3. Course Coordinators

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Suggested Lecture Schedule

Date	Time	L/T	Faculty	Topic
11/02/2019 Overview, Introduction and Basics	09.00 to 11.00	L1	ID	Overview of the course: Introduction to thermodynamic fundamentals, energy and exergy concepts
	11.10 to 1:10	L2	ASB	Energy and exergy Analyses
	2.30 to 5.30	T1	ID/ASB	Exercises on Mass, Energy, Entropy and Exergy Balances
12/02/2019 Efficiency, Exergy, Environment and Sustaina-bility	09.00 to 11.00	L3	ID	Performance assessment through energy and exergy efficiencies
	11.10 to 1:10	L4	SR	Exergy, Environment and Sustainable Development
	2.30 to 5.30	T2	SR/VRS	Exercises on Exergy efficiency and impacts of energy systems
13/02/2019 Exergy Analysis	09.00 to 11.00	L5	ID	Exergy Analysis of Selected Industrial Processes, Systems and Applications
	11.10 to 1:10	L6	SR	Exergy Analysis of Heating, Refrigerating, and Air Conditioning systems
	2.30 to 5.30	T3	VRS/SR	Exergy analyses with EES
14/02/2019 Economic Analysis	09.00 to 11.00	L7	ID	Energy and exergy analyses of thermal energy storage systems
	11.10 to 1:10	L8	ID	Exergy analysis of Renewable energy systems
	2.30 to 5.30	T4	ID/ASB/VRS	Cost accounting and evaluation and optimization
15/02/2019 Case Studies	09.00 to 11.00	L9	ID	Exergoeconomic analysis of various energy systems and applications
	11.10 to 1:10	L10	VRS	Examples and case studies on various systems and applications
	2.30 to 5.30	T5	ASB/VRS	Examples, cases studies and short projects

Modules	▪ Overview, Introduction and Basics ▪ Efficiency, Exergy, Environment and Sustainability ▪ Exergy Analysis ▪ Economic Analysis ▪ Case Studies
You Should Attend If…	▪ You are a faculty member/research scientist working in the areas of Chemical, Mechanical, Production & Energy Engineering interested in energy and exergy analyses. ▪ You are a professional chemical / mechanical / production or energy engineer interested in energy and exergy analyses to improve the performance. ▪ You are a PG student / Research Scholar of chemical / mechanical / production working in the areas of energy.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $300** **Industry/ Research Organizations: Rs. 10,000/-** **Faculty: Rs. 4,000/-** **Students & Research Scholars:** **Without award of Grade: Rs. 1,500/-** **With award of Grade: Rs. 2,000/-** The above fee includes all instructional materials, computer use for tutorials and assignments. The participants from academic/research institutes and Industry will be provided with boarding and lodging on additional payment of Rs. 4,000/- in Visitors Block on twin sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels (DASA) on additional payment of Rs. 2,500/-. Please note that, accommodation inside NITW campus is very limited and same will be provided to participants on first-cum-first-serve basis. The accommodation facility is basic in nature. You can contact coordinators if you are interested in opting for better accommodation in nearby hotels on payment basis. Also, note that, if you are working in academia/industry and pursuing PhD, you are required to register under Faculty/Industry category and not as a student.

The Faculty

Dr. Ibrahim Dincer is Professor in Department of Automotive, Mechanical and Manufacturing Engineering, University of Ontario Institute of Technology, Canada. His research areas include: Drying, Energy and exergy analyses, Energy conversion and management, Heat and mass transfer, Hydrogen and fuel cell systems, Refrigeration, Renewable energies, Thermal energy storage, and Thermodynamics. Prof. Dincer has authored 24 refereed books. Prof. Dincer has served as Editor-in-chief/Editorial Board Member for several journals which include: International Journal of Energy Research, International Journal of Exergy, etc. Prof. Dincer has guided 72 Masters, 76 PhD and 61 PDF students and currently 8 Masters, 11 PhD and 4 PDF students are working under his guidance. Prof. Dincer has completed about 62 research projects totaling more than $6,165,000 and involved in more than 200 project reports. Multiple patents filed by Prof. Dincer are under active consideration. Prof. Dincer is Vice President for Strategy in International Association for Hydrogen Energy (IAHE) and Vice-President for World Society of Sustainable Energy Technologies (WSSET). Prof. Dincer has published 808 papers in refereed journals, 404 Papers in Refereed Proceedings in International Conferences, 22 Refereed Edited Books and Proceedings, 120 Refereed Book Chapters/Contributions and has 20,000 Citations by Other Researchers during the past six years.

Dr. V. Siva Reddy is Professor & Energy Auditor in School of Mechanical Engineering, Rajiv Gandhi Memorial College of Engineering and Technology, Nandyal. His research interests include Energy and exergy analysis of power plants, Indigenous development of a energy efficient solar (PV & Thermal) based technologies for industrial, commercial and domestic utilization. He worked as principal scientist & I/C Head, Solar Energy Division, Sardar Patel Renewable Energy Research Institute (SPRERI), Gujarat for three years. Prof. Siva Reddy has about 22 papers published in peer-reviewed SCI indexed journals and authored one book. He has handled several sponsored R&D and Consultancy projects worth of Rs. 3.40 crores as a principle investigator. He secured Shrimati Vijay Usha Sodha Research Award for best research publication in the field of energy for the year 2012-2013 from IIT Delhi. He is Technical adviser and committee member for various committees such as: Ministry of Health & Family Welfare, Govt. of India, Ministry of New and Renewable Energy, Govt. of India, Empanelled consultant for preparation of DPRs under UNDP-GEF project on CSH, BIS, Govt. of India, and Sectional Committee MED 04 on Renewable Energy Sources.

Dr. Sarath Babu Anne is a Professor of Chemical Engineering at NIT Warangal. His research areas of interest include: Modeling, Simulation and Optimization; Chemical Reaction Engineering; Chemical Engineering Thermodynamics and Renewable Energy. He has published 20 research papers in International/National Journals and conferences. He received “Chinnamaul Memorial Award” for the Best Technical Paper presented at the Annual Session of Indian Chemical Engineering Congress 2002. He has conducted a number of STTPs sponsored by ISTE and TEQIP on Computational Methods in Chemical Engineering and Applications of Process Simulators in Chemical Engineering. He has successfully completed 3 consultancy projects for BHEL, R&D; Coromandel International Pvt. Ltd.; M/s SS GAS Lab Asia Pvt. Ltd. He has successfully completed (1) R&D project on “Waste Water Treatment” sponsored by MHRD and (2) MHRD project on Curriculum Design and Development for 'Fluid & Particle Mechanics" under National Mission project on education through ICT.

Dr. Ramsagar Vooradi is an Assistant Professor of Chemical Engineering at NIT, Warangal. His research areas of interest are: Chemical process modeling and simulation, Process scheduling, Hybrid separations and Chemical looping combustion. He has published eight papers in SCI Journals and presented a number of papers in International and National Conferences. He has been awarded with the Conference Best Paper Award in International Conference on Chemical and Bioprocess Engineering-India (ICCBPE-IN) 2013. He has carried out a research project on “Heuristic Modeling Approach (Genetic Algorithm) for Scheduling of Multistage Plants” with an outlay of Rs. 5.00 lacs. Dr. Ramsagar has completed a consultancy project on “Steady state modeling and simulation of CO_2 absorption from flue gases using MEA solvent” for M/s SS Gas Lab Asia Pvt. Ltd., New Delhi.