


HEAT EXCHANGERS: FUNDAMENTALS AND DESIGN ANALYSIS

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INTENDED AUDIENCE : Mechanical Engineering, Chemical Engineering, Energy Engineering, Cryogenics Engineering, Aerospace Engineering etc.

PREREQUISITES : Thermodynamics, Fluid Mechanics and Heat Transfer (at a very basic level).

INDUSTRY SUPPORT : All the companies generating coal based and nuclear based power (NTPC, different state electricity boards, CPRI, BARC, andNPCL etc.). Companies dealing with the design and fabrication of heat exchangers, auto mobile industries, process industries, oil refineries. Companies dealing with waste heat recovery and renewable. Some specific companies could be BHEL, ALSTOM, HP, HPCL, IOCL, THERMAX, BPCL, GAIL, Reliance, TATA Chemicals etc.

COURSE OUTLINE :

Heat exchangers are extensively used in diverse industries covering power generation, refrigeration and air conditioning, cryogenics, oil refineries and chemical processes, automobiles and other transport devices. The performance of a heat exchanger is very important for the conservation of energy, assurance of product quality, process viability and environmental protection. The present course aims at developing a familiarity with various types of heat exchangers, their construction and applications. Conventional methods of heat exchanger analysis; brief design methodology of typical heat exchangers and synthesis of heat exchanger network. It is planned to develop an appreciation and basic expertise in heat exchanger through description, mathematical analysis and numerical examples.

ABOUT INSTRUCTOR :

Prof. Prasanta Kumar Das is a Professor of Mechanical Engineering and presently the Dean Post Graduate Studies and Research at IIT Kharagpur. He possesses a vast experience in teaching and research. His research interests lie in the broad area of thermal engineering with a special emphasis on two phase flow. Apart from teaching many fundamental subjects he offered applied courses like Power Plant Engineering, Thermal System Design, Waste Heat Recovery etc. He has also conducted tailor-made courses for industries. He contributed actively in sponsored research and offered consultancy to different Government and private industries. He contributed more than 190 publications in international journals, a vast number of publications in national and international conferences and 10 patents. He has supervised more than 20 scholars for their doctoral degree. He is fellows of Indian National Academy of Engineering and National Academy of Sciences India.

Prof. Indranil Ghosh received his B. Sc. and M. Sc. in Physics from Jadavpur University in 1990 and 1992 respectively, M.Tech and Ph.D. from the Cryogenic Engineering Centre, Indian Institute of Technology, Kharagpur in 1995 and 2005 respectively. With the experience of being an engineer, R&D of Bharat Heavy Plates and Vessel Ltd., Visakhapatnam and Post-Doctoral researcher in Hydrogen Research Institute, University of Quebec at Trois Rivieres, he joined Indian Institute of Technology, Kharagpur as an Assistant Professor in 2006. His research interests include heat transfer in cryogenic systems, heat transfer in metal foam, compact heat exchangers, sorption cooling techniques etc. He has carried out some sponsored projects (on-going) with MHRD and CSIR. He has published 22 research papers in peer reviewed international journals, 15 papers in national and international conferences.

COURSE PLAN :

Week 1 : Background, Application, Classification, Common terminologies.

Week 2 : Introduction to Thermal and hydraulic aspects, pressure drop and heat transfer, sizing and rating. F-LMTD and -NTU method.

Week 3 : Tubular Heat Exchangers: different designs, brief description of Shell and Tube Heat Exchangers, Special types.

Week 4 : Compact heat exchangers, enhancement of heat transfer, extended surface or Fin, fundamental of extended surface heat transfer,Fin tube heat exchanger

Week 5 : Plate Fin Heat Exchangers (PFHE), types, construction, fabrication, design, application. Multistream PFHE.

Week 6 : Multistream PFHE continued. Direct contact heat exchangers, types, application, simple analysis.

Week 7 : Regenerators, types of regenerators, construction, application. Theory of Regenerator, -NTU and - method..

Week 8 : Heat pipes, construction, working principle, application, analysis. Special heat pipes.

Week 9 : Microscale Heat Exchangers and heat sinks; heat transfer and fluid flow through narrow conduits, special design considerations

Week 10 : Phase change HEX; phase change heat transfer, introduction to evaporators and condensers.

Week 11 : Phase change HEX; phase change heat transfer, introduction to evaporators and condensers.

Week 12 : Heat Exchanger testing, steady state and dynamic methods.