Department of Chemical Engineering	
Heat Transfer Operations (64334)	
Total Credits	**3**
major compulsory	
Prerequisites	P1 : Fluid Mechanics (64231) OR Fluid Mechanics (64333)

Course Contents

A study of concepts involved in heat transfer. Applications of the continuity and energy equations. Boundary layer theory. Conduction, convection and radiation heat transfer. Boiling and condensation. Evaporation. Heat exchanger calculations. At the end of this course, the student will be able to apply heat transfer concepts and calculation methods, dealing with the three modes of heat transfer, to engineering analysis and design. This course deals with an important rate process, heat transfer, which has extensive applications in chemical, mechanical and oil &gas engineering. The course will provide an introduction to the scientific, mathematical and semi-empirical techniques for dealing with the heat transfer phenomena in an applied context. The learning will be facilitated through the concept of driving force or potential and the resistance to the flow of thermal energy. The application of various theoretical concepts will be demonstrated through numerical problems to reinforce their learning. Upon completion of this course, the student should have an understanding of, and be able to solve engineering problems in: steady-state conduction, transient conduction, forced and free (natural) convection, heat transfer during phase change, transfer of radiation energy between surfaces, heat Exchangers design, multi-mode heat transfer situations, and evaporation.

Intended Learning Outcomes (ILO's)		Student Outcomes (SO's)	Contribution
1	Demonstrate knowledge on heat transfer concepts, multi-mode heat transfer situations and calculation methods	A	30 %
2	Identify, formulate, and solve one-dimensional steady-state and transient heat transfer problems.	E	45 %
3	Analyze, apply and design different types of heat exchangers using the log mean temperature difference method (LMTD) and the effectiveness-NTU method. .	C	25 %

Textbook and/ or Refrences

Y. A. Gengel, Heat Transfer A Practical1- Approach, McGraw-Hill, 2003. References: F. P. Incropera and D. P. DeWitt, Fundamentals of Heat and Mass Transfer, 5th ed., John Wiley and Sons, 2001 J. P. Holman, Heat Transfer, 8th ed., McGraw-Hill, 1997.

Assessment Criteria	Percent (%)
First Exam	20 %
Second Exam	20 %
Quizzes	10 %
Homeworks	10 %
Final Exam	40 %

Course Plan

Week	Topic
1	Introduction to Conduction
2-3	One-Dimensional Steady State: Conduction equation Resistance analogy Transient Conduction
4	First Exam (September 28, 2013)

5-6	Introduction to Convection
7-8	Forced Convection (External Flow)
7-8	Forced Convection (External Flow)
9-10	Forced Convection (Internal Flow)
11	Second Exam (October 31, 2013)
11-12	Free Convection
13-14	Boiling and Condensation
15	Heat Exchangers