Fusion Reactor Technology 1

(459.760, 3 credits)

1st Semester of 2014

Department of Nuclear Engineering

Classroom: Rm 32-201

Time: Monday 14:00 - 15:15

Instructor: Prof. Yong-Su Na (Rm 32-206, x 7204, ysna@snu.ac.kr)

T.A.: Dong-Hyun Na (Rm 30-117, x 8336, hope123@snu.ac.kr)

Overview:

This course deals with key issues of fusion reactor technologies based on magnetic confinement, focusing on the tokamak concept. Overview of the fusion power plant system will be introduced and energetics of which will be addressed. Then, the way how to build and operate a tokamak is going to be covered. Plasma instabilities and plasma transport which limit fusion performance in a reactor based upon the tokamak concept will be touched upon in view of reactor core operation. The fusion technologies focusing on the heating and current drive and the plasma edge will also be introduced and their current status and main issues will be addressed.

Prerequisite courses:

- Introduction to plasma physics
- Introduction to Nuclear Fusion

Textbook:

- B. B. Kadomtsev, "Tokamak Plasma: A Complex Physical System", Institute of Physics Publishing, Bristol and Philadelphia (1992)
- L. C. Woods, "Theory of Tokamak Transport - New Aspects for Nuclear Fusion Reactor Design", WILEY-VCH (2006)
- A. A. Harms, K. F. Schoepf, G. H. Miley, D. R. Kingdon, "Principles of Fusion Energy", World Scientific Publishing Co. Pte. Ltd. (2000)
- R. O. Dendy, "Plasma Physics: An Introductory Course", Cambridge University Press (February 24, 1995)

References:

- J. Wesson, "Tokamaks", Oxford University Press, 3rd Edition (2004)

Evaluation Elements:

- Attendance & Course Participation (10%), Homework (10%),
- Midterm Exam (40%), Final Exam (40%)

Class Schedule

Week	Contents
1	Magnetic Confinement
2	Fusion Reactor Energetics (Harms 2.4, 7.1-7.5)
3	Tokamak Operation (I): Basic Tokamak Plasma Parameters (Wood 1.2, 1.3)
4	Tokamak Operation (II): Startup
5	Tokamak Operation (III): Tokamak Operation Mode
6	Midterm Exam
7	Tokamak Operation Limits (I): Plasma Instabilities I (Kadomtsev 6, 7, Wood 6)
8	Tokamak Operation Limits (I): Plasma Instabilities II (Kadomtsev 6, 7, Wood 6)
9	Tokamak Operation Limits (II): Plasma Transport I (Kadomtsev 8, 9, Wood 3, 4)
10	Tokamak Operation Limits (II): Plasma Transport II (Kadomtsev 8, 9, Wood 3, 4)
11	Heating and Current Drive (Kadomtsev 10)
12	Divertor and Plasma-Wall Interaction
13	How to Build a Tokamak (I) (T. N. Todd)
14	How to Build a Tokamak (II) (T. N. Todd)
15	Final Exam