Fusion Reactor Technology 2

(459.761, 3 credits)

2nd Semester of 2020

Department of Nuclear Engineering

Classroom: Rm 32-109

Time: 14:00 – 15:15 on Tuesday and Thursday

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

T.A.: SangJun Lee (Rm 30-103, x 8336, sangjun11316@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 to set the operation goal of a tokamak. Then, the way how to operate a tokamak is going to be covered. Plasma instabilities and plasma transport which limit fusion performance will be touched upon in a reactor based upon the tokamak concept. The fusion technologies focusing on the heating and current drive and the plasma edge will also be addressed. Finally, how to build a tokamak will be discussed.

Prerequisite courses:

- Introduction to Plasma Physics
- Introduction to Nuclear Fusion

Reference:

- 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)
- J. Wesson, "Tokamaks", Oxford University Press, 3rd Edition (2004)
- J. Feidberg, "Plasma Physics and Fusion Energy", Cambridge (2007)
- R. O. Dendy, "Plasma Physics: An Introductory Course", Cambridge

University Press (February 24, 1995)

Evaluation Elements:

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

Class Schedule

Week	Contents
1	Magnetic Confinement
2	Fusion Reactor Energetics
3	Tokamak Operation (I): Basic Tokamak Plasma Parameters
4	Tokamak Operation (II): Tokamak Operation Mode 1
5	Tokamak Operation (III): Tokamak Operation Mode 2
6	Tokamak Operation Limits (I): Plasma Instabilities - Sawtooth
7	Tokamak Operation Limits (I): Plasma Instabilities - ELMs
8	Midterm Exam
9	Tokamak Operation Limits (I): Plasma Instabilities –Fishbone, RWM NTM
10	Tokamak Operation Limits (II): Plasma Transport I
11	Tokamak Operation Limits (II): Plasma Transport II
12	Heating and Current Drive – OH, NBI, RF
13	Divertor and Plasma-Wall Interaction
14	How to Build a Tokamak
15	Final Exam