

Fusion Reactor Technology 1

(459.760, 3 credits)

1st Semester of 2021

Department of Nuclear Engineering

Classroom: Rm 32-109

Time: Tuesday, Thursday 14:00 - 15:15

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

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Overview:

The lecture covers the overall system and its design of a fusion power plant, composed of the fusion reactor system, heat transfer & fuel cycle system, and power conversion system, based on the tokamak concept. Issues and current status of the fusion power plant development are addressed. The course deals with physics of burning plasmas and steady state operations of the fusion reactor system. For the heat transfer & fuel cycle system, the tritium breeding blanket is covered with the material issues. Finally, current status and future prospect of the fusion energy development is addressed with the roadmap of each country participating in the world largest fusion programme, ITER (International Thermonuclear Experimental Reactor).

Textbook:

- Japan, Fusion Reactors - Tokamak Reactor Designs and Their Basis on Plasma Physics and Reactor Technology - Journal of Plasma and Fusion Research (Feb. 2011)
- A.A. Harms, K.F. Schoepf, G.H. Miley, D.R. Kingdon, "Principles of Fusion Energy", World Scientific Publishing Co. Pte. Ltd. (2000)
- Japan, Report on Technical Feasibility of Fusion Energy and Extension of the Fusion Program and Basic Supporting Research (2000)
- 세키 마사히로, 핵융합로 공학 개론, 일간공업신문사 (2001)

References:

- EU, A Conceptual Study of Commercial Fusion Power Plants, EFDA-Report (2005)
- U.S.A., Advanced Tokamak Fusion Power Plant ARIES-AT, Report (2000)
- Japan, 2050년에 토카막형 실용 핵융합 플랜트를 가동시키기 위해서, Journal of Plasma and Fusion Research (2005)

Evaluation Elements:

- Attendance (10%), Homework (10%),
- Midterm Exam (20%), Final Exam (30%)
- Project (30%)

Class Schedule

Week	Contents
1	Introduction
2	Basic Concept of Tokamak Fusion Reactor I
3	Basic Concept of Tokamak Fusion Reactor II
4	Basic Concept of Tokamak Fusion Reactor III
5	Basic Concept of Tokamak Fusion Reactor IV
6	Basic Concept of Tokamak Fusion Reactor V
7	Midterm exam
8	Blanket Concept I
9	Blanket Concept II
10	Material I
11	Material II
12	Fusion Reactor Design I
13	Fusion Reactor Design II
14	Safety
15	Operation and Maintenance
15	Final exam and Project presentation