

Nuclear Science and Engineering
Doctoral Qualifying Oral Exam.
Part 2 Question. Fusion and Plasma Physics

May 2015

The equilibrium and stability of plasma is of central importance in magnetic confinement fusion. The tokamak is the leading configuration for building future fusion reactors. Consider a tokamak with large aspect ratio, circular cross-section. As far as possible give quantitative answers to the questions below.

1. Explain the MHD equilibrium model: give relevant equations, and justify any assumptions made.
2. Describe radial and toroidal force balance in the tokamak, hence show that the tokamak plasma can be in MHD equilibrium.
3. Explain why a tokamak cannot be operated at arbitrary values of current, density and plasma beta; describe the relevant limits.