GEORGIA INSTITUTE OF TECHNOLOGY

The George W. Woodruff School of Mechanical Engineering

NRE/HP Qualifier Exam

Fall Semester 2000

_____Your ID Code

Day 3 – Fusion

Instructions

1. **Use a separate page for each answer sheet (no front to back answers).**

2. **The question number should be shown on each answer sheet.**

3. **Answer all 4 questions.**

4. **Staple your question sheet to your answer sheets and turn in.**

Fusion Prelim Exam

1. Discuss the D + T fusion fuel cycle and alternative fuel cycles:

    a. How much energy is released per fusion event and in what forms?
    b. How can T be produced to fuel the D + T fusion fuel cycle?
    c. What are some alternative fuel cycles and what are their advantages and disadvantages relative to D + T?

Fusion Prelim Exam

2. Discuss magnetic confinement in a tokamak:
   a. Discuss particle drifts.
   b. Explain why a plasma can not be confined by a purely toroidal magnetic field.
   c. Explain the purpose of the toroidal, poloidal and equilibrium fields.

Fusion Prelim Exam

3. Derive the fluid particle, momentum and energy balance equations from the Boltzman transport equation for the ions in an ion-electron plasma.

Fusion Prelim Exam

4. Discuss the interaction of the plasma with the surrounding material walls.
   a. What are the physical mechanisms for ions of the wall material getting into the plasma?
   b. What are the physical mechanisms for the ions striking the wall returning to the plasma as neutral atoms and molecules?
   c. What are the physical mechanisms for the returning neutral atoms and molecules becoming plasma ions again?