ENGINEERING PHYSICS 4D3 Assignment #8 Set:
Due:

1. [Duderstadt & Hamilton 6-5]

Calculate the effective neutron lifetime $\langle \ell \rangle$ for (a) a thermal reactor fueled with U^{233}, (b) a thermal reactor fueled with U^{235} and (c) a fast reactor fueled with Pu^{239}. Typical values needed can be found in Chapter 2.

2. [Duderstadt & Hamilton 6-8]

Derive an expression for the effective delayed neutron yield fractions $\bar{\beta}_i$ characterizing a mixture of several fissile isotopes.

3.

What must the reactivity insertion be for a reactor undergoing a power excursion with a measured period, T, of 1 second ($\omega = 1/T$)? To simplify the calculation, assume the presence of only one delayed precursor group with half life of 20 seconds. Assume a neutron lifetime, ℓ, of 5×10^{-5} seconds and the delayed fraction, β, is 0.007.

4.

Using the Inverse Method, show that if the neutron density slowly decays, ie

$$n(t) = n_0 \, e^{-\alpha t}$$

and if there is only one delayed precursor group with decay constant λ such that $\alpha < \lambda$, then the reactivity insertion must be:

$$\rho = -\frac{\alpha\beta}{\lambda - \alpha} - \alpha\Lambda$$