

ENGINEERING PHYSICS 4D3/6D3

DAY CLASS

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DURATION: 15 minutes

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Special Instructions:

Open Book. All calculators and reference material permitted.

THIS EXAMINATION PAPER INCLUDES 1 PAGE AND 1 QUESTIONS.

1. Summarize the course. Use diagrams, text, equations as you feel necessary. What are the main ideas and how do they relate to each other?

Basic Nuclear Processes
- Radioactive decay
 $\frac{dN}{dt} = -\lambda N$

- attenuation
 $\frac{dI}{dx} = -\Sigma I$

numerical methods

stiffness concerns.

practical limitation on flux.

Exponential nature
limitations of Fick's Law.

linear, homogeneous, unlimited

Feedback.

set to 0 for S.S.

fast response times < msec

$$\frac{1}{v_g} \frac{\partial \phi_g}{\partial t} = \nabla \cdot D_g \nabla \phi_g - \Sigma_{ag} \phi_g + S_g - \Sigma_{sg} \phi_g + \sum_{g'=1}^G \Sigma_{sg'g} \phi_{g'}$$

$$S_g = \chi_g \sum_{g'=1}^G \nu_{g'} \Sigma_{fg'} \phi_{g'} + S_{g, ext}$$

seconds → minutes

$$\frac{dc_i}{dt} = -\lambda_i c_i + \beta_i \nu \Sigma_f \phi$$

Point kinetics, no space dependence

Boundary Conditions

days - Σ 's deplete over time as fuel burned up
 $\frac{dN_F}{dt} = -N_F \sigma_a^F \phi$

hours - Σ 's change due to fission products
 $\frac{dX}{dt} = \gamma_X \Sigma_f \phi + \lambda_I I - \lambda_X X - \sigma_a^X \phi \Rightarrow$ poison out

Criticality concepts

4(6) factor formula

neutrons see only nuclei, not other neutrons \Rightarrow superposition & linearity