Quiz 01

Name: ____________________

Question:	1	2	3	4	5	6	Total
Points:	20	20	20	20	10	10	100
Score:							

Above all: Be explicit and concise. If you run out of room for an answer, continue on the back of the page. Partial credit will be based on how well I think you understand the physics of interest, so please be very clear.

[20] 1. Write down a differential equation for the time-dependent, continuous-energy, neutron diffusion equation in a multiplying media, with two source terms: an external neutron and a delayed neutron source. Describe what each term represents.

[20] 2. Starting from your solution to problem 1. Using the following separation of variables, $\phi(\mathbf{x}, E, t) = P(t)\, f(\mathbf{x})\, g(E)$, formally integrate the equation over energy and space. $f(\mathbf{x})$ and $g(E)$ are normalized space and energy distribution functions. Be **SURE** to clearly highlight any assumptions that you make along the way. Make sure to define any variables you use.

[20] 3. Starting from the six group point reactor kinetics equations without external sources, collapse the equations into the one delayed group point reactor kinetics equations. Use a method that accurately captures the delayed neutron source, not the total delayed neutron precursor population.

[20] 4. Solve for $y(t)$ from the following system of differential equations using Laplace Transforms. Note: You don't need a closed form solution for $x(t)$, just $y(t)$.

$$\begin{aligned} \frac{dy}{dt} &= 4\,y(t) + 2\,x(t) \\ \frac{dx}{dt} &= 2\,y(t) + 4\,x(t) \end{aligned} \quad , \qquad \begin{aligned} y(0) &= 1 \\ x(0) &= 5 \end{aligned}$$

[10] 5. What is the difference between λ_{ave} and λ_{inv} in both formulation and meaning?

[10] 6. What is the Inhour Equation for the 6DG PRKE?

Laplace Transforms

Function	**Transform**
1	$\frac{1}{s}$
a, a is a constant	$\frac{a}{s}$
$\delta(t-\tau)$, δ is the Dirac Delta function	$e^{-\tau s}$
$H(t-\tau)$, H is the Heaviside function	$\frac{e^{-\tau s}}{s}$
$t\ H(t)$	$\frac{1}{s^2}$
e^{at}	$\frac{1}{s-a}$
$sin(at)$	$\frac{a}{s^2+a^2}$
$cos(at)$	$\frac{s}{s^2+a^2}$
$f(t)$	$\tilde{f}(s)$
$\frac{df(t)}{dt}$	$s\tilde{f}(s)-f(0)$