NPRE 402
**Nuclear Power Engineering**

Fall 2025
 ***Online Temporary Alternative Coverage and access during Avian Influenza Type A Bird Flu H5N1, H5N2 or Covid-19 and possible resurgence through mutations and variants or WHO anticipated Gain Of Function GOF research “Disease-X”***

**“H5N1 bird flu is widespread in wild birds worldwide and is causing outbreaks in poultry and U.S. dairy cows.”**

[***https://www.cdc.gov/flu/avianflu/avian-flu-summary.htm***](https://www.cdc.gov/flu/avianflu/avian-flu-summary.htm)

**1. Please read the assigned-reading lecture-notes chapters.**

**2. Then answer the corresponding written assignment,**

**3. For questions about the assignments, please access the teaching assistants by email or phone:**

<https://www.mragheb.com/NPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering/talist.htm>

**4. Submit the corresponding written assignment through email to** <https://canvas.illinois.edu>
**5. Please use either the Word or pdf formats**

**6. In case of internet “rationing” (e. g. to health and government authorities), instability, or collapse through overload, please read the lecture notes and submit the corresponding assignments. Already-taken tests and submitted assignments would be used in assessing the final grade.**

 **Threat of Nuclear War**:
<https://www.youtube.com/watch?v=HSC7Lp1nvx8>
<https://www.youtube.com/watch?v=M7hOpT0lPGI>

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| **Number** | **Date Assigned** | **Due Date** | **Description** |
| **1** | **8/25** | **9/1** | **Reading assignment**[**Preface**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CTitle-Preface.pdf)**10.** [**Artemis Lunar and Mars Nuclear Power**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CArtemis%20Moon%20Nuclear%20Power.pdf)**Written AssignmentDefine the Terawatt unit of power.On the Kardashev Scale, identify the power needs in Watts for Type I, II and III civilizations.In how many years is our Earth expected to achieve a Type I status?****Write a paragraph on NASA’s Artemis Project.****In Greek mythology, who is Artemis’ brother? Who was born first?**<https://en.wikipedia.org/wiki/Artemis_program> |
| **2** | **8/27** | **9/3** | **Reading assignment**[**Preface**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CTitle-Preface.pdf)**Written Assignment****Access the internet to determine the latest available figure of total global power consumption.****Use the Carl Sagan’s formula to calculate our technological civilization’s level on the Kardashev’s cosmic scale.****Write a paragraph about the “Fermi Paradox”.**What is the percentage share of nuclear energy in: a) The primary energy supply, b) Electrical energy generation?List the components of the envisioned Internet of Things (IoT) for a future energy system. |
| **3** | **8/29** | **9/5** | **Reading assignment**[**1. First Human Made Reactor and Birth of Nuclear Age**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CFirst%20Human%20Made%20Reactor%20and%20Birth%20of%20Nuclear%20Age.pdf)**Written Assignment**Calculate the speed in meters per second of neutrons possessing the following energies:a. Fast neutrons from fission at 2 MeV,b. Intermediate energy neutrons at 10 keV,c. Thermal energy neutrons at 0.025 eV.Compare the power level in Watts of the Chicago Pile Number 1 CP1 to the power level of an existing utility level nuclear power plant. |
| **4** | **9/3** | **9/10** | **Reading assignment**[**1. First Human Made Reactor and Birth of Nuclear Age**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CFirst%20Human%20Made%20Reactor%20and%20Birth%20of%20Nuclear%20Age.pdf)**Written Assignment**List the percentage of each energy source produced, used, stored and exported in France at some time of the day. You may access the www link:<https://www.rte-france.com/en/eco2mix/power-generation-energy-source>List the three sites where the activities of the “Manhattan Project” were conducted during World War II and the main activity assigned to each site. |
| **5** | **9/5** | **9/12** | **Reading assignment**[**1. First Human Made Reactor and Birth of Nuclear Age**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CFirst%20Human%20Made%20Reactor%20and%20Birth%20of%20Nuclear%20Age.pdf)**Written Assignment**Data mine the Chart of the Nuclides for the following information on elements used in nuclear applications:1. *Naturally* occurring isotopes and their natural abundances.2. Atomic masses of isotopes in atomic mass units (amu).for the following elements:1. Uranium (U).
2. Thorium (Th).
3. Carbon (C).
4. Hydrogen (H).
5. Lead (Pb).
6. Beryllium (Be).
7. Lithium (Li).
8. Sodium (Na).
9. Boron (B).
10. Cadmium (Cd).
11. Fluorine (F)

**Identify three elements that have a single naturally occurring isotope.Hint: You can access the Chart of the Nuclides at:** <https://atom.kaeri.re.kr/old/ton/>[*Previous version of* Table of Nuclides](https://atom.kaeri.re.kr/old/ton/) |
| **6** | **9/8** | **9/15** | **Reading Assignment**[**1. First Human Made Reactor and Birth of Nuclear Age**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CFirst%20Human%20Made%20Reactor%20and%20Birth%20of%20Nuclear%20Age.pdf)[**4. Nuclear World**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CNuclear%20World.pdf)**Written Assignment**If a single fission reaction produces about 180 MeV of energy, use Avogadro’s law to calculate the number of grams of the fissile elements:1. U2352. Pu2393. U233that would release 1 kT of TNT equivalent of energy. Assume that all the energy release is available, except for the energy carried away by the antineutrinos, as well as the delayed fission products beta particles and gamma rays, which is not fully recoverable. Hint: Use Avogadro’s law to estimate the number of nuclei in a given weight of the fissile material: |
| **7** | **9/10** | **9/17** | **Reading Assignment**[**4. Nuclear World**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CNuclear%20World.pdf)**Written Assignment**The reported time for an ICBM to travel from the continental USA to its assigned target is about t = ½ hour. To cover the distance of 6,000 miles, calculate the speed of travel of the missile in miles / hour.What would the hypersonic Mach Number be?Compare the result with the value reported y the Boeing Company.Hint: Use the speed of sound as 761.2 miles /hour.What do the following nuclear-related acronyms stand for?ICBM, ABM, MIRV,kT, MT, DU, HEU, NPT, MAD, TNT, SALT,UUV, UAV. |
| **8** | **9/12** | **9/19** | **Reading Assignment**[**4. Nuclear World**](file:///C%3A%5Cmragheb%5CNPRE%20402%20ME%20405%20Nuclear%20Power%20Engineering%5CNuclear%20World.pdf)**Written Assignment**Draw a sketch of the Ulam-Teller configuration.Write a paragraph about the Non-Proliferation Treaty NPT.Write a paragraph about The International Campaign to Abolish Nuclear Weapons ICAN.Write a paragraph about the Plowshare Program.Write a paragraph on an instance where a global nuclear conflict was judiciously averted.What is the “Nuclear Football”?What is the current setting of the “Doomsday Clock”? |
| **9** | **9/15** | **9/22** |  |
| **10** | **9/17** | **9/24** |  |
| **11** | **9/19** | **9/26** |  |
| **12** | **9/22** | **9/29** |  |
| **13** | **9/24** | **9/29** |  |
| **14** | **9/26** | **9/29** |  |
|  | First Midterm. |  | Monday September 29 |
| **15** | **10/1** | **10/8** |  |
| **16** |  |  |  |
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**Assignments Policy**

Assignments will be turned in at the beginning of the class period, one week from the day they are assigned.

They need to be submitted earlier when tests are scheduled.

The first five minutes of the class period will be devoted for turning in, and returning graded assignments.

Late assignments will be assigned only a partial grade. Please try to submit them on time since once the assignments are graded and returned to the class, late assignments cannot be accepted any more.

If you are having difficulties with an assignment, you are encouraged to seek help from the teaching assistants (TAs) during their office hours. Questions may be e-mailed to the TA's, but face-to-face interaction is more beneficial.

Although you are encouraged to consult with each other if you are having difficulties, you are kindly expected to submit work that shows your individual effort. Please do not submit a copy of another person's work as your own. Copies of other people's assignments are not conducive to learning, and are unacceptable.

For further information, please read the detailed assignments guidelines.