## NPRE 498  **Special Topics**  credit: 0 TO 4 hours.

Subject offerings of new and developing areas of knowledge in nuclear, plasma, and radiological engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated in the same or separate terms if topics vary.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>63973</td>
<td>Lecture-Discussion</td>
<td>ESG</td>
<td>01:00 PM - 01:50 PM</td>
<td>MWF</td>
<td>100H - Talbot Laboratory</td>
<td>Ragheb, M</td>
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Credit Hours: 4 hours

Energy Storage
Restricted to Graduate - Urbana-Champaign.
Graduate 4 hr section. Comprehensive coverage of energy storage and conveyance methodologies for nuclear and renewable systems in the context of the Internet of Things (IOT) for power systems. The intermittence of renewable systems mandates the development of efficient energy storage and backups as well as conveyance systems for their effective implementation. Exhaustive coverage of energy storage technologies including: battery technologies encompassing primary and secondary electrochemical cells; lead acid, nickel-based, Li-ion batteries; advanced battery systems including redox/flow batteries, sulfur-sodium; hydrogen electrochemical cells and regenerative fuel cells including hydride storages, mechanical energy storage including flywheel, compressed-air and pumped hydraulic storage; thermal and chemical storage based on phase-change and medium enthalpy-change reversible chemical reactions; and inductive storage in super capacitors and magnetic using superconducting magnets are covered. Social and economic aspects of storage technology and specific new development in storage technology are covered.

| 63972 | Lecture-Discussion | ESU     | 01:00 PM - 01:50 PM | MWF  | 100H - Talbot Laboratory | Ragheb, M  |

Credit Hours: 3 hours

Energy Storage
Restricted to Undergrad - Urbana-Champaign.
Comprehensive coverage of energy storage and conveyance methodologies for nuclear and renewable systems in the context of the Internet of Things (IOT) for power systems. The intermittence of renewable systems mandates the development of efficient energy storage and backups as well as conveyance systems for their effective implementation. Exhaustive coverage of energy storage technologies including: battery technologies encompassing primary and secondary electrochemical cells; lead acid, nickel-based, Li-ion batteries; advanced battery systems including redox/flow batteries, sulfur-sodium; hydrogen electrochemical cells and regenerative fuel cells including hydride storages; mechanical energy storage including flywheel, compressed-air and pumped hydraulic storage; thermal and chemical storage based on phase-change and medium enthalphy-change reversible chemical reactions; and inductive storage in super capacitors and magnetic using superconducting magnets are covered. Social and economic aspects of storage technology and specific new development in storage technology are covered.