MECH4100 Experiential Projects in Aerospace Engineering

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<th>Course Code: MECH-4100</th>
<th>Course Title: Experiential Projects in Aerospace Engineering</th>
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<tr>
<td>Required Course Or Elective Course:</td>
<td>Terms Offered (Credits): Spring (3 credits)</td>
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<td>BEng (AE) Elective Course</td>
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<td>Faculty In Charge: Larry Li</td>
<td>Pre-Requisites: MECH 1907 OR (MECH 2020 AND MECH 2310)</td>
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<td>Course Structure: seminar (2 hours/week), lab sessions (3 hours/week), field trips (10 hours/term)</td>
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Bulletin Course Description:

This course takes an experiential approach to aerospace engineering through (i) a series of seminars and workshops delivered by faculty and industry professionals, (ii) student-initiated tutorials on aerospace-related topics, and (iii) participation in an international aerospace competition. As well as giving students the opportunity to apply theoretical classroom knowledge to real-world engineering problems, this course develops students’ skills in technical communication, teamwork, conflict resolution, and project management. This course will initially be led by faculty and then self-directed by students with faculty retreating as coaches. Students should seek approval from the course instructor prior to enrolling.

Course Topics:

1. Course overview; team selection; project timeline; introduction to the DBF competition; experience sharing from previous years
2. Sub-team formation; lessons learned from previous competitions
3. Rule interpretation; loophole identification; score sensitivity analysis; finances and budgeting; solicitation of sponsorship
4. Flight mission analysis; score modeling; materials procurement
5. Brain-storming for conceptual design; preliminary layout and sizing; aerodynamics; airfoil selection; wing geometry; fuselage design; empennage selection and sizing; tail configuration; wing loading
6. Structural design; stress analysis; materials selection; manufacturing processes; destructive and non-destructive testing
7. Landing gear configuration and sizing; flight stability; control surface selection and sizing; balance and handling performance
8. Avionics and propulsion systems; battery technology, motor performance, data logging; safety considerations; human factors
9. Design review and refinement; prototype build; mission simulation
10. Detailed design; prototype build; flight testing; design refinement
11. Prototype build; flight testing; design refinement
12. Prototype build; flight testing; design refinement
13. Design justification via performance calculations and self-collected flight data (submission of report and oral presentation)
| **Course Objectives:** (correlated program objectives) | 1. To equip students with the fundamental working principles and technologies used in aerospace engineering today (P-O1, P-O2, P-O3)  
2. To introduce basic and entry-level theory and terminology of aerospace engineering (P-O3).  
3. To provide students with an overview of the social and environmental impacts of the aviation industry (P-O4). |
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| **Course Outcomes:** (correlated course objectives and program outcomes) | A. Develop a clear understanding and knowledge of the fundamental engineering and mathematical theories underlying aerospace engineering [1, 2] (POC3).  
B. Be able to use CAD and CFD software to simulate the behavior of aerospace components such as flow over the wings, propellers, and structural members. [1, 2] (POC1, POC2, POC4, POC6, POC7)  
C. Be able to understand and identify the social and environmental impacts of the aviation industry [3] (POC9, POC10, POC12). |
| **Assessment Tools:** (correlated course outcomes) | Lab sessions – 70% [A,B]  
Group discussion – 30% [A,B,C] |