

## MECH3660 Gas Turbines and Jet Propulsion

<b>Course Code:</b> MECH3660	<b>Course Title:</b> Gas Turbines and Jet Propulsion
<b>Required Course Or Elective Course:</b> Elective for BEng(MECH)/Required for Aero Major	<b>Terms Offered (Credits):</b> Spring (3 credits)
<b>Faculty In Charge:</b> Xin ZHANG	<b>Pre/Co-Requisites:</b> Prerequisite(s): (MATH2111 OR MATH2350 OR MATH2351) AND MECH3640
<b>Course Structure:</b> 2 classes (1.5 hours) per week; Tutorial: 1 hour per week	
<b>Textbook/Required Material:</b> <ol style="list-style-type: none"> <li>1. "Jet Propulsion" by Nicholas Cumpsty and Andrew Heyes, 3rd ed., Cambridge University Press, 2015</li> <li>2. Class notes</li> </ol>	
<b>Bulletin Course Description:</b> <p>Jet propulsion, gas turbine, engine types, performance, turbojet, turboprop, E-propulsion engines, designs of compressor, combustor, and turbines, and environmental considerations. For science and engineering students in their third year of study or above.</p>	
<b>Course Topics:</b> <ol style="list-style-type: none"> <li>1. Introduction to jet propulsion and engine classification</li> <li>2. Aerodynamics</li> <li>3. Performance metrics</li> <li>4. A case study</li> <li>5. Numbering and certification</li> <li>6. Intake</li> <li>7. Nozzle</li> <li>8. Ramjet</li> <li>9. Turbojet</li> <li>10. Turbofan</li> <li>11. Bypass ratio</li> <li>12. Dynamic scaling and non-dimensional analysis</li> <li>13. Compressor</li> <li>14. Combustion</li> <li>15. Turbine</li> <li>16. Turboprop</li> <li>17. Rocket</li> <li>18. E-propulsion</li> <li>19. Environmental Consideration: aircraft/ engine noise</li> </ol>	
<b>Course Objectives:</b> (correlated program objectives)	<ol style="list-style-type: none"> <li>1. Students will establish understanding of propulsion systems in aircraft that are essential to graduate engineers who are intended to work in aircraft system/component manufacturing/maintenance environments. [P-01, P-02]</li> <li>2. Students should be able to describe and appreciate the key aeronautical engineering features of the context in which the relevant industry operates. [P-03, P-04]</li> </ol>
<b>Course Outcomes:</b>	A. Students will gain skills in problem solving for aircraft propulsion

(correlated course objectives and program outcomes)	<p>systems, in particular gas turbine engines. [POC1, POC3, POC5, POC7]</p> <p>B. Students will gain the ability to carry out a cyclic analysis of a gas turbine engine, including turbofan engines. [POC1, POC3, POC6]</p> <p>C. Students will be able to determine the applicability of a given propeller system for a given aircraft. [POC1]</p> <p>D. Students will understand the working of various components of gas turbines. [POC1, POC4, POC5]</p> <p>E. Students should gain an appreciation of design constraints and environmental impact of aeroengine. [POC9, POC10, POC11, POC12]</p>
<b>Assessment Tools:</b> (correlated course outcomes)	<p>(1) Mid-term – 30%</p> <p>(2) Attendance – 10 %</p> <p>(3) Final Exam – 60%</p>

### **BEng in Aerospace Engineering (4-year program)**

#### **Program Objectives:**

- P-01. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,
- P-02. Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,
- P-03. Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,
- P-04. Clearly Consider the ethical implications and societal impacts of engineering solutions,
- P-05. Continuously improve through lifelong learning.

#### **Program Outcomes:**

- POC1. Ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints.
- POC2. Ability to design and conduct experiments as well as analyze and interpret data.
- POC3. Ability to apply knowledge of mathematics, science, and engineering for problem solving in aerospace engineering and related sectors or for further education in research career.
- POC4. Ability to develop specification and to design system, component, or process to meet needs.
- POC5. Ability to understand the design, operation, and maintenance of aircraft components and systems.
- POC6. Ability to use modern engineering tools, techniques, and skills in engineering practice.
- POC7. Ability to communicate effectively.
- POC8. Ability to function in multi-disciplinary teams and provide leadership.
- POC9. Broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context
- POC10. Clear understanding of professional and ethical responsibilities
- POC11. Recognition of the need for life-long learning and continuing education
- POC12. International outlook with knowledge of contemporary issues