

# Department of Aeronautics and Astronautics

## Graduate Field Evaluation Subjects – AY2024-2025

**\*Please note, these requirements apply to students who matriculated *Fall 2024 or later.***

### **Air Sector**

#### **1. Aerospace, Energy and the Environment**

Structure: Students are required to take the Core Subject. Students must then choose at most one subject from the other categories for a total of 3 subjects.

##### A. Core Subject

16.715: Aerospace, Energy, and the Environment

##### B. Air Transportation

16.72: Air Traffic Control OR

16.886: Air Transportation Systems Architecting OR

16.781: Planning and Design of Airport Systems

##### C. Energy and Fuels

2.28: Fundamentals and Applications of Combustion OR

2.62: Fundamentals of Advanced Energy Conversion OR

2.65: Sustainable Energy

##### D. Aircraft Design

16.110: Flight Vehicle Aerodynamics OR

16.885: Aircraft Systems Engineering

##### E. Environmental Science

12.806: Atmospheric Physics and Chemistry OR

1.84/10.817/12.807 Atmospheric Chemistry

##### F. Propulsion

16.511: Aircraft Engines and Gas Turbines

16.530: Advanced Propulsion Concepts (previously offered SP21 as 16.S598)

##### G. Energy and Environmental Policy

IDS.410: Modeling and Assessment for Policy

## **2. Air-breathing Propulsion**

Students must choose Core Subject, and two Additional Subjects.

Core Subject:

16.511: Aircraft Engines and Gas Turbines

Additional Subjects:

2.25: Advanced Fluid Mechanics

2.28: Fundamentals and Applications of Combustion

16.120: Compressible Flow

16.540: Internal Flows in Turbomachines

## **3. Aircraft Systems Engineering**

Structure: Students cannot choose both 16.422 and 16.453. Students cannot choose both 16.885 and 16.886.

16.110: Flight Vehicle Aerodynamics

16.511: Aircraft Engines and Gas Turbines

16.343: Spacecraft and Aircraft Sensors and Instrumentation

16.888: Multidisciplinary Design Optimization

16.422: Human Supervisory Control of Automated Systems OR

16.453: Human Systems Engineering

16.885: Aircraft Systems Engineering OR

16.886: Air Transportation Systems Architecting

## **4. Air Transportation Systems**

Structure: Students must choose the Core Subject and two additional subjects.

Core Subject:

16.71: The Airline Industry

Additional Subjects:

16.715: Aerospace, Energy, and the Environment

16.763: Air Transportation Operations Research

16.781: Planning and Design of Airport Systems

# Computing Sector

## 5. Aerospace Computational Engineering

Structure: Students must choose the two Core Subjects, and one subject from the remaining sections.

### A. Core Subjects

16.920: Numerical Methods for Partial Differential Equations

18.335: Introduction to Numerical Methods

### B. Probability and stochastic modeling

6.7700: Fundamentals of Probability OR

16.940: Numerical Methods for Stochastic Modeling and Inference

### C. Optimization methods

6.7200: Optimization Methods OR

6.7220: Nonlinear Optimization

### D. Fluid mechanics

2.25: Fluid Mechanics OR

16.110: Flight Vehicle Aerodynamics OR

16.13: Aerodynamics of viscous fluids OR

16.540: Internal Flows in Turbomachines

### E. Mechanics of solid materials

2.071: Mechanics of Solid Materials OR

16.225: Computational Mechanics of Materials

## **6. Autonomous Systems**

Structure: Students must choose the Core Subject.

Core Subject:

16.413: Principles of Autonomy

Additional Subjects:

6.4212: Intelligent Robotic Manipulation

6.7900: Machine Learning

6.8210: Underactuated Robotics

9.660J: Computational Cognitive Science

16.32: Principles of Optimal Control and Estimation

16.332 Formal Methods for Safe Autonomous Systems

16.412: Cognitive Robotics

16.420: Planning under Uncertainty

16.485: Visual Navigation for Autonomous Vehicles

## **7. Communications and Networking**

Structure: Students must take two Core Subjects.

Core Subjects:

16.393 Statistical Communication and Localization Theory

*and* one of 16.37: Data Communication Networks\*\* or 16.363 Communication Systems and Networks

*\*\*Not being offered in academic years 2024/2025 and 2025/2026*

Additional Subjects:

6.3702: Introduction to Probability

6.7200: Optimization Methods

6.7210: Introduction to Mathematical Programming

6.7470: Theory of Information

6.7700: Fundamentals of Probability

16.391: Statistics for Engineers and Scientists

## **8. Controls**

Structure: Students must choose the Core Subject.

Core Subject:

16.31: Feedback Control Systems

Additional Subjects:

6.7100: Dynamic Systems and Control

6.7940: Dynamic Programming and Reinforcement Learning

6.8210: Underactuated Robotics

16.32: Principles of Optimal Control and Estimation

16.332: Formal Methods for Safe Autonomous Systems

16.420: Planning under uncertainty

16.485: Visual Navigation for Autonomous Vehicles

# Space Sector

## 9. Engineering Systems

Structure: Students must choose at least two Core Subjects.

Core Subjects:

16.842: Fundamentals of Systems Engineering

16.863: System Safety Concepts

16.888: Multidisciplinary Design Optimization

Additional Subjects:

16.355/IDS.341: Concepts in the Engineering of Software-Intensive Systems

16.851: Satellite Engineering

16.89/IDS.339: Space Systems Engineering

16.887/EM.427: Technology Roadmapping and Development Technology

16.895J: Engineering Apollo: The Moon Project as a Complex System

16.453: Human Systems Engineering

16.851: Satellite Engineering

## 10. Humans in Aerospace

Structure: Students must choose at least two Core Subjects.

Core Subjects:

16.453: Human Systems Engineering

HST.154/2.792/6.4820 Quantitative and Clinical Physiology\*

16.422: Human Supervisory Control of Automated Systems (alternate years)

16.423: Aerospace Biomedical and Life Support Engineering (alternate years)

16.470: Statistical Methods in Experimental Design

\*This course will be co-listed as a special Course 16 number for 2023-2024

Additional Subjects:

16.456/HST.582 Biomedical Signal and Image Processing

2.183J/9.34J Neural Control of Movement

16.413: Principles of Autonomy

16.89: Space Systems Engineering

16.895: Engineering Apollo: The Moon Project as a Complex System

16.893: Engineering the Space Shuttle

## **11. Materials and Structures**

All students must take:

2.071: Mechanics of Solid Materials **OR** ES240: Solid Mechanics (Harvard University)

Plus, two of the following subjects:

16.221: Structural Dynamics

16.223: Mechanics of Heterogeneous Materials

16.225: Computational Mechanics of Materials

16.235: Design with High Temperature Materials

## **12. Space Propulsion and Plasmas**

Structure: Students must choose at least one Core Subject.

Core Subjects:

16.522: Space Propulsion

16.55: Ionized Gases

Additional Subjects:

2.25: Fluid Mechanics

2.28: Fundamentals and Applications of Combustion

2.62: Fundamentals of Advanced Energy Conversion

5.68: Kinetics of Chemical Reactions

6.210: Electromagnetic Fields, Forces and Motion

8.311: Electromagnetic Theory I

16.346: Astrodynamics

16.512: Rocket Propulsion

22.611: Introduction to Plasma Physics I

22.612: Introduction to Plasma Physics II

22.67: Principles of Plasma Diagnostics



### **13. Space Systems**

All students need to take the sequence\*:

16.842 Fundamentals of Systems Engineering

16.851 Introduction to Satellite Engineering

16.89/IDS.339: Space Systems Engineering

Plus at least one of the following subjects:

16.343: Spacecraft and Aircraft Sensors and Instrumentation

16.346: Astrodynamics

16.363: Communication Systems and Networks

16.853: Advanced Satellite Engineering

16.863: System Safety Concepts

16.888: Multidisciplinary Design Optimization

16.89: Space Systems Engineering