Graduate Program for International Students in Mechanics or Aerospace Engineering

http://sae.xjtu.edu.cn/

Overview

This graduate program is designed for international students studying for a master's degree or doctoral degree in Mechanics or Aeronautical/Astronautical Engineering offered by the School of Aerospace Engineering of Xi'an Jiaotong University.

1. Objectives

This program aims to cultivate professional talents with comprehensive abilities and help them to grow morally, intellectually, and physically.

For master candidates, they are required to master basic theories and systematic professional knowledge. They should learn about the trends in sci-tech development in their research area and be able to undertake scientific research or technical projects independently.

For doctoral candidates, they are required to master in depth the extensive basic theories and systematic professional knowledge to have the ability to undertake scientific research independently, strive to innovate in their research field, and develop rigorous and earnest scientific attitude.

2. Research Areas

1) Structure failure mechanism and strength theory
2) Multi-field coupling theory and structural lightweight design
3) Modern theories in dynamics and control
4) Theory and technology in structural integrity and security
5) Fluid mechanics and fluid-solid coupling theory
6) Aircraft design
7) Theories in advanced aircraft navigation, guidance, and control
8) Aerospace propulsion theory and engineering
9) Aerospace manufacturing engineering

3. Length of Study

The full-time scheme lasts for two years for Master's candidates and three to six years for Doctoral candidates.

4. Training Modes

For Master candidates, the mode of training with direction from the supervisor is the top priority in the program; while an alternative mode of joint training with a professor or researcher from another university or an institute, or a professional from a factory or an enterprise may also be applicable. Based on the requirements of the program and student's personality, the supervisor will help to make plans in courses studies and direct the student in all the stages of research: literature search, surveying, designing of research, dissertation writing, and oral defense, etc.

For Doctoral candidates, the mode of group training directed by the supervisor is the top priority in the program; while an alternative mode of joint training with a professor or researcher from another university or an institute, or a professional from a factory or an enterprise may also be applicable, in which a professor, a researcher or a professional from the joint partner institution participates in research guidance. Based on the requirements of the program and student's personality, the supervisor will help to make plans in courses studies and direct the student in all the stages of research: literature search, surveying, designing of research, dissertation writing, and oral defense, etc.

5. Courses Studies

For Master candidates, at least 49 credits in total are required. The detailed courses and credits for each course modules and thesis work are shown in the following table.

Table 1: Curriculum Structure for Master Candidates

Course Module	Course Code	Course Title	Credits	Minimum Requirement
Communication	LITE6102	Comprehensive Chinese	2	4
	LITE6101	The Outline of China	2	
Courses	ENGL6008	Scientific and Technological English Writing	2	6
	MATH6001	Computational Method	3	

	AASP7110	Aerospace Structural Analysis	2	
	AASP7111	Dynamics of Rotating Machines	2	
	AASP7112	Flight Dynamics	2	
	INSM6101	Electromagnetic Nondestructive Testing and Evaluation	2	
	AASP6111	Hypersonic Aerodynamics	2	
	MECH7125	Mechanics of Soft Active Materials	2	
	AASP6110	Intermediate Heat Transfer	2	
	MECH6127	Principles of Continua	2	
	MECH61	Advanced Incompressible Fluid Mechanics	2	
Optional		Students can select any course from the list of courses of the Graduate School		10
Compulsory	BXHJ6003	Lectures (Master)	1	4
	BXHJ6007	Mid-term Assessment(Master)	3	
	BXHJ6008	Thesis	25	25
Total				49

For Doctoral candidates, at least 88 credits in total are required. The detailed courses and credits for each course modules and thesis work are shown in the following table.

Table 2: Curriculum structure for Doctor Candidates

Course Module	Course	Course Title	Credits	Minimum

	Code			Requirement
Communication	LITE6102	Comprehensive Chinese	2	4
	LITE6101	The Outline of China	2	
Courses	ENGL6001	Scientific and Technological English Writing	2	4
	MATH6008	Computational Method	3	
	AASP7110	Aerospace Structural Analysis	2	
	AASP7111	Dynamics of Rotating Machines	2	
	AASP7112	Flight Dynamics	2	
	INSM6101	Mechanical Measurements and Nondestructive Testing	2	
	AASP6111	Hypersonic Aerodynamics	2	
	MECH7125	Mechanics of Soft Active Materials	2	
	AASP6110	Intermediate Heat Transfer	2	
	MECH6127	Principles of Continua	2	
	MECH61	Advanced Incompressible Fluid Mechanics	2	
Optional		Students can select any course from the list of courses of the Graduate School		4
Compulsory	BXHJ8003	Lectures (Doctoral)	2	16
	BXHJ8004	Opening Report (Doctoral)	2	
	BXHJ8001	Mid-term Assessment (Doctoral)	6	

	BXHJ8005	Final Academic Report	6	
	BXHJ8006	Dissertation	60	60
Total				88

6. Dissertations

Master Thesis: Before applying for granting the Master's degree, a Master candidate should finish writing a thesis independently under the guidance of his or her supervisor. The thesis must be systematic and complete with new opinions. The topic of the thesis should be determined with the help of the supervisor after reading extensive literature and surveying. To ensure the quality of the thesis, the candidate must spend at least one year on the studies and writing it. On condition that the thesis meets the requirements of Xi'an Jiaotong University, the candidate can apply for final oral defense to apply for a Master's degree.

A Master candidate is required to make a thesis proposal in the third semester; the research can be continued on condition that it is affirmed by the professional in the joint partner institution and usually three professors in the same research field. In the fourth semester, the Master candidate should pass a mid-term evaluation on research progress and the following research plans to be implemented. If the Master candidate cannot pass the mid-term evaluation, he/she will be suggested to give up the Master's degree.

Doctoral Dissertations: Before applying for granting a Doctoral degree, a Doctoral candidate should complete writing a Doctoral dissertation independently under the guidance of the supervisor. The topic for the dissertation should be determined with the help of the supervisor after reading extensive literature and surveying. The research must produce results that bring at least three new ideas. During the doctoral studies, the doctoral candidate should invest most effort on the research work. To ensure the quality of the dissertation, the candidate must spend at least two years on the research and writing it. On condition that the dissertation meets the requirements of Xi'an Jiaotong University, the candidate can apply for final oral defense to obtain a Doctoral degree.

A Doctoral candidate is required to make a dissertation proposal in the third semester; the research can be continued on condition that it is affirmed by the joint partner professional and usually three professors in the same research field. In the fourth semester, doctoral candidate should pass a mid-term evaluation on research progress and the following research plans to be conducted. If the doctoral candidate cannot pass the mid-term evaluation, he/she will be suggested to give up the doctoral degree or to change to apply for a Master's degree.

7. Research Centers

(1) State Key Laboratories for Strength and Vibration of Mechanical Structures

The State Key Laboratories for Strength and Vibration of Mechanical Structures were established in 1985, and are open to the entire world in 1988. After 30 years of efforts; the laboratories have become an important base with adequate funding support and well-functioning research facilities in mechanics for applied basic research and advanced professional training in mechanics.

(2) International Center of Applied Mechanics (ICAM)

The main academic leaders of ICAM are the distinguished alumni of Xi'an Jiaotong University including Zhigang SUO, Huajian GAO, Zishun LIU, and Xi CHEN, etc. Under the guidance of world-class mechanics scholars such as John W. Hutchinson, John R. Willis and Alan Needleman, ICAM is committed to fostering first-class young talents, producing first-rate academic achievements, and establishing a world-leading center in mechanics (http://icam.xjtu.edu.cn/).

(3) Department of Aerospace Engineering

Aerospace Engineering was founded in aerospace engineering in 2005, and was re-established as an independent department in 2012 based on Aerospace Science and Technology, discipline, and solid Mechanics. The new department takes as the main focus the major national needs in the field of aerospace, with an aim to develop spacecraft designing and advanced engineering expertise (http://sae.xjtu.edu.cn/).

8. Description of Courses

Course Name: Mechanics of Soft Active Materials
Course Code: MECH7125
Credits: 2
Prerequisites: **Theory of Elasticity; Continuum Mechanics**
Description:
This course focuses on fundamentals of thermodynamics of soft solid materials undergoing finite deformation. The related topics to cover in this course include heat conduction, free energy, pressure, chemical potential, and finite deformation of soft solid materials in equilibrium under mechanical, electrical and chemical loadings. The behaviors of representative soft materials are introduced.

Course Name: Principles of Continua
Course Code: MECH6127
Credits: 2
Prerequisites: **Statics and Dynamics; Strength of Materials**
Description:

The primary objective of this course is to develop a fundamental understanding of how to formulate the governing equations of continua with the aid of basic conservation laws of physics that govern the behavior of a continuum. A secondary objective is to apply the governing equations to simple problems of heat transfer, fluid mechanics, and solid mechanics and to determine their response.

Course Name: Aerospace Structural Analysis
Course Code: AASP7110
Credits: 2
Prerequisites: **Mathematic; Mechanics; C Programming**
Description:
This course introduces the basic theory in mechanical analysis of various aerospace structures, such as beams, bars, thin-walled structures, and composites. The analytical methods and numerical procedures of structural analysis for static stress, buckling and vibration are also presented.

Course Name: Flight Dynamics
Course Code: AASP7112
Credits: 2
Prerequisites: **Theory Mechanics; Aerodynamics**
Description:
Flight dynamics is primarily concerned with the flight qualities of the aircraft in the atmosphere. The contents of this course are divided into two parts: Part one focuses on the flight qualities under the known external forces; part two deals with the flight stability and maneuverability of aircraft under external disturbance and maneuver. By studying this course, the students can grasp the essential principles of flight dynamics and are trained in the analysis technology about the flight performance.

Course Name: Intermediate Heat Transfer
Course Code: AASP6110
Credits: 2
Prerequisites:
Description:
The course deals with the basic modes of heat transfer (conduction, convection, and radiation) and their mathematical descriptions. It introduces classical heat transfer problems and their analytical solutions through step-by-step mathematical derivation and demonstration examples. In addition, gas turbine heat transfer and cooling is introduced as an application of intermediate heat transfer.

Course Name: Dynamics of Rotating Machines
Course Code: AASP 7111
Credits: 2
Prerequisites: **Vibration Dynamics; Mechanical Design**

Description:

This course will enable the students to understand the most important aspects of the dynamics of rotating machines, starting from the most basic explanations, and proceeding to more accurate numerical models and analysis, and they will learn about what affects the machine's stability, how the vibration can be reduced and which sorts of rotor vibration are the worst in the rotating machines. They will develop this understanding initially using extremely simple models for each phenomenon, in which (at most) four equations capture the behavior. More detailed models are then developed based on finite element analysis, to enable the accurate simulation of the relevant phenomena for real machines. The students are taught to use analytical software (in MATLAB) to make good predictions of critical speeds and rotating mode shapes of rotating machines.

Course Name: Mechanical Measurements and Nondestructive Testing

Course Code: INSM6101

Credits: 2

Prerequisites: Mechanics of Materials; Elasticity Mechanics; Fundamentals of Electrotechnics; Engineering Mathematics; Electronic Circuitry; Electromagnetics

Description:

The course elaborates on the aims and significance of Nondestructive Testing (NDT), and its vital role in structure health inspection and evaluation. The conventional NDT methods, particularly Ultrasonics and Eddy Current are presented systematically. The principle, characteristics and application scope regarding each method are introduced in conjunction with examples on practical applications. The advanced NDT techniques are also introduced in the course.

Course Name: Hypersonic Aerodynamics

Course Code: AASP6111

Credits: 2

Prerequisites: Aerodynamics

Description:

Hypersonic aerodynamics is a course focusing on the flow phenomena, aerodynamic characteristics and relevant know ledge for air with velocity more than Mach 5. It is a special branch of the study of aeronautics. This course includes in viscid hypersonic flow, viscous hypersonic flow, and high-temperature gas dynamics.

Course Name: Advanced Incompressible Fluid Mechanics

Course Code: MECH61

Credits: 2

Prerequisites:

Description:

This course covers the main concepts and methods of Fluid Mechanics, focusing on

incompressible flows. Topics include: governing equations of motion, exact solutions of the Navier-Stokes equations, potential flow, viscous flow, boundary layer, interfacial flows, vorticity dynamics, hydrodynamics stability. These concepts will be illustrated with experimental results, high-speed imaging videos and recent research publications in fluid mechanics.