

# Department of Mechanical & Aerospace Engineering

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## Degrees Offered

- Bachelor of Science in Aerospace Engineering (B.S.A.E.)
- Bachelor of Science in Mechanical Engineering (B.S.M.E.)
- Dual Degree in Aerospace and Mechanical Engineering

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## FACULTY

### CHAIR

- Jacky C. Prucz - Ph.D. (Georgia Institute of Technology)  
Structural Design, Composite Materials, Solid Mechanics

### PROFESSORS

- Richard A. Bajura - Ph.D. (University of Notre Dame)  
Director NRCCE, Fluids Engineering
- Ever J. Barbero - Ph.D. (Virginia Polytechnic Institute & State University)  
Materials, Experimental and Computational Mechanics
- Ismail Celik - Ph.D. (University of Iowa)  
Fluids Engineering, Fuel Cell Technology
- Nigel N. Clark - Ph.D. (University of Natal, South Africa)  
Provost WVU-IT, Multiphase flows, I.C. engines and emissions
- Bruce S. Kang - Ph.D. (University of Washington)  
Experimental Mechanics, Advanced Materials
- John M. Kuhlman - Ph.D. (Case Western Reserve University)  
Fluid Mechanics
- Xingbo Liu - Ph.D. (University of Science and Technology of China, Beijing)  
Materials Science
- Kenneth H. Means - Ph.D., P.E. (West Virginia University)  
Kinematics, Dynamics and Stability, Friction and Wear
- Gary J. Morris - Ph.D. (West Virginia University)  
Fluid Mechanics, Combustion, Aerodynamics
- Victor H. Mucino - Dr.Eng., P.E. (University of Wisconsin-Milwaukee)  
Mechanical Engineering Design, CAD, Finite Element Analysis
- Marcello R. Napolitano - Ph.D. (Oklahoma State University)  
Aircraft Stability and Control, Feedback Control, Unmanned Airborne Vehicles (UAVs)
- Mario Perhinschi - Ph. D. (University of Bucharest, Romania)  
Flight Modeling and Simulation
- Songgang Qui - Ph. D.(University of Minnesota)  
Thermodynamics, Heat Transfer
- Samir N. Shoukry - Ph.D. (Aston University, Birmingham, U.K.)  
Pavement Modeling, Non-destructive Evaluation, Structural Dynamics, Neural nets, Instrumentation
- Nithi T. Sivaneri - Ph.D. (Stanford University)  
Structural Mechanics, Composite Materials, FEM, Numerical Methods
- James E. Smith - Ph.D. (West Virginia University)  
Mechanical and Aeronautical Design
- Nianqiang Wu - Ph.D. (Zhejiang Universtiy, China)  
Materials Science and Engineering

### ASSOCIATE PROFESSORS

- Wade W. Huebsch - Ph.D. (Iowa State University)  
Fluid Mechanics, CFD, Numerical Methods

- Hailin Li - Ph.D. (University of Calgary, Canada)  
Combustion, Emissions, Fuel Efficiency of Vehicles and IC Engines
- Osama Mukdadi - Ph.D. (University of Colorado)  
Bioengineering, Acoustics, Solid Mechanics and Materials
- Edward M. Sabolsky - Ph.D. (The Pennsylvania State University)  
Materials, Ceramic Science
- Xueyan Song - Ph.D. (Zhejiang University, China)  
Materials Science, Electron Microscopy
- Gregory J. Thompson - Ph.D. (West Virginia University)  
Thermodynamics, Machine Design
- W. Scott Wayne - Ph.D. (West Virginia University)  
Machine Design, Alternative Fuels

## **ASSISTANT PROFESSORS**

- V'yacheslav Akkerman - Ph.D. (Umea University, Sweden)  
Turbulent Combustion, Flame Turbulization, Propulsion Instabilities in Rocket Engines
- Patrick H. Browning - Ph.D. (West Virginia University)  
Aerodynamics, Aircraft Design
- John A. Christian - Ph.D. (University of Texas)  
Spacecraft Design, Navigation, Estimation Theory
- Cosmin E. Dumitrescu - Ph.D. (University of Alabama)  
Combustion, Alternate Fuels, IC Engines
- Jason N. Gross - Ph.D. (West Virginia University)  
Unmanned Aerial Vehicles, Avionic Systems, Flight Testing
- Yu Gu - Ph.D. (West Virginia University)  
Robotic Systems, Sensor Fusion
- David S. Mebane - Ph.D. (Georgia Institute of Technology)  
Fuel Cells, Multi-Scale Simulation of Chemical and Electrochemical Systems
- Terence D. Musho - Ph.D. (Vanderbilt University)  
Nanoscale Thermal and Electrical Transport, Direct Energy Conversion
- Andrew C. Nix - Ph.D. (Virginia Polytechnic Institute & State University)  
Turbines, Engines and Emissions
- Konstantinos Sierros - Ph.D. (University of Birmingham, U. K.)  
Flexible Optoelectronic Devices, Tribology, Materials for Renewable Energy
- Arvind Thiruvengadam - Ph.D. (West Virginia University)  
Emissions of Heavy-Duty Internal Combustion Engines

## **TEACHING ASSISTANT PROFESSORS**

- Peter D. Gall - Ph. D. (West Virginia University)  
Aerodynamics, Aircraft Design

## **RESEARCH ASSOCIATE PROFESSOR**

- Thomas Evans - Ph. D. (West Virginia University)  
Solid Mechanics, Structures
- David C. Lewellen - Ph.D. (Cornell University)  
Fluid Dynamics, Turbulence
- Eduardo Sosa - Ph. D. (University of Puerto Rico)  
Thin Wall Structures

## **RESEARCH ASSISTANT PROFESSORS**

- Marc Besch - Ph. D. (West Virginia University)  
Alternative Fuels, Engines and Emissions
- Yun Chen - Ph.D. (Universidade Tecnica de Lisboa)  
Material Science, Metal Hydrides, Cathode Material Development
- Derek Johnson - Ph.D. (West Virginia University)  
Alternative Fuels, Engines and Emissions
- Ross Ryskamp - Ph. D. (West Virginia University)

Alternative Fuels, Engines and Emissions

## VISITING PROFESSORS AND ADJUNCT PROFESSORS

- Alberto Ayala - Ph.D. (University of California, Davis)  
Engine Emissions
- Dureid Azzouz - Ph.D. (University of Southampton, U.K.)  
Fluid Mechanics
- David Booker - Ph. D. (Univeristy of Exeter)  
Exhaust Flow
- Albert Boretti - Ph.D. (University of Florence, Italy)  
Innovative Combustion Engines
- Darran R. Cairns - Ph.D. (University of Birmingham, U.K.)  
Materials Science
- Weigiang Ding - Ph.D. (Northwestern University)  
Nanostructures
- Mridul Gautam - Ph.D. (West Virginia University)  
Alternate Fuels, Engine and Emissions, VP for Research UNR
- Luis A. Godoy - Ph.D. (University of London, U.K.)  
Structural Stability
- Frank E. Goodwin - Sc.D. (Massachusetts Institute of Technology )  
Materials Engineering, ILZRO
- Valeriya Gritsenko - Ph.D. (University of Alberta, Canada)  
Neuroscience
- Huang Guo - Ph.D. (West Virginia University)  
Electro-Chemistry, Materials Science, Mechanical Engineering
- Srinkath Gururajan - Ph.D. (West Virginia University)  
Small Unmanned Aerial Vehicle Systems
- Yiqun Huang - Ph.D. (University of Texas, Austin)  
Engine and Emissions Control
- George Kiriakidis - Ph.D. (Salford University, U.K.)  
Physics, Mechanics
- Stephen Kukureka - Ph.D. (University of Birmingham, U.K.)  
Materials Science
- Andrew D. Lowery - Ph.D. (West Virginia University)  
Control Systems
- Alejandro Lozano-Guzman - Ph.D. (University of New Castle Upon Tyne, U.K.)  
Structural Analysis, Power and Control Systems (CICATA-IPN)
- Eugene A. McKenzie - Ph.D. (West Virginia University)  
Mechanical Engineering Design, NIOSH
- Chris Menchini - Ph.D. (West Virginia University)  
Computational Fluid Dynamics, Fire Modeling
- Vincenzo Mulone - Ph.D. (Universtiy of Rome Tor Vergata)  
Internal Combustion Engines, Emissions
- John Nuzkowski - Ph.D. (West Virginia University)  
Alternative Fuels and Engine Emissions, UNF
- Ming Pei - M.D., Ph.D. (Beijing Medical University, China)  
Tissue Engineering HSC-WVU
- Matthew Robinson - Ph. D. (West Virginia University)  
Analysis and Optimization of Engines
- Alber Alphonse Sadek - Ph.D. (Osaka University)  
Alloys
- Brad Seanor - Ph.D. (West Virginia University)  
Controls Systems
- Benjamin Shade - Ph.D. (West Virginia University)  
Engine Emissions, IAV Automotive
- Alberto Traverso - Ph.D. (University of Genoa, Italy)  
Energy Systems and Control, DIMSET - Italy

- Nathan Weiland - Ph.D. (Georgia Institute of Technology)  
Energy Systems, Experimental, Computational, Theoretical Methods
- Jay Wilhelm - Ph.D. (West Virginia University)  
Unmanned Aerial Systems, Wind Turbine Modeling and Design
- Gergis William - Ph.D. (West Virginia University)  
Structural Engineering
- Sergiy Yakovenko - Ph.D. (University of Alberta, Canada)  
Neuroscience
- Kirk Yerkes - Ph.D. (University of Dayton)  
Energy Optimized Aircraft

## PROFESSORS EMERITI

- Larry Banta - Ph.D. (Georgia Institute of Technology)
- Eric Johnson - Ph.D. (University of Wisconsin-Madison)
- John Loth - Ph.D. (University of Toronto, Canada)
- Michael G. Palmer - Ph.D. (West Virginia University)
- John E. Sneckenberger - Ph.D. (West Virginia University)
- Wallace S. Venable - Ed.D. (West Virginia University)
- Richard E. Walters - Ph.D. (West Virginia University)

## Dual Degree in Aerospace Engineering and Mechanical Engineering

In the modern technical marketplace, college graduates must attain every competitive edge possible to enhance their career opportunities. One way to do this is with a master's degree following the bachelor's degree; however, this often results in more specialization than may be desired and may take an additional two years. Another option is to broaden the undergraduate experience, thus opening more opportunities for the graduate. The dual B.S.A.E./B.S.M.E. program awards both the aerospace engineering and mechanical engineering degrees at the completion of a planned curriculum.

Students under this option pursue the B.S.A.E. and B.S.M.E. degrees simultaneously. This can be accomplished by declaring intentions as a freshman requesting admission to the programs or by informing an MAE advisor of the dual-degree preference. Maximum scheduling flexibility will result when this decision is made as early as possible in the student's academic career. Dual-degree students must take all courses listed in the 155-hour dual curriculum under the Major tab and satisfy the other requirements of the two individual programs.

The state of West Virginia is a member of a group of Academic Common Market (ACM) states. WVU allows residents of states within the ACM to enroll in the dual B.S.A.E./B.S.M.E. program on an in-state tuition basis. Application must be made through the higher education authority of the state of residence.

## Curriculum for the Dual Degree in Aerospace Engineering and Mechanical Engineering

A requirement for graduation in aerospace and mechanical engineering is a departmental grade point average of 2.0 or better for all required mechanical and aerospace engineering (MAE) courses. If a required MAE course is repeated, only the hours credited and the grade received for the last completion of the course is used in computing the student's departmental grade point average. Also a grade of C or better is required in each of the four required mathematics courses and physics 111.

It is important for students to take courses in the order specified as close as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.A.E./B.S.M.E. degree program that completes degree requirements in four and a half years is listed below.

Students must complete a minimum of 155 credit hours to graduate - the total at the bottom reflects all possible course combinations

<b>Mechanical and Aerospace Engineering Core Requirements</b>		
CHEM 115	Fundamentals of Chemistry	4
ECON 201	Principles of Microeconomics	3
ECON 202	Principles of Macroeconomics	3
ENGR 101	Engineering Problem Solving 1	2
ENGR 102	Engineering Problem-Solving 2	3
ENGR 199	Orientation to Engineering	1
Select one of the following: *		4
MATH 155	Calculus 1	
or MATH 153 & MATH 154	Calculus 1a with Precalculus and Calculus 1b with Precalculus	
MATH 156	Calculus 2 *	
		4

MATH 251	Multivariable Calculus *	4
MATH 261	Elementary Differential Equations *	4
PHYS 111	General Physics *	4
PHYS 112	General Physics	4
A minimum cumulative GPA of 2.0 is required in all MAE courses		
Dual Core		
MAE 215	Intro to Aerospace Engineering	3
MAE 241	Statics	3
MAE 211	Mechatronics	3
MAE 242	Dynamics	3
MAE 243	Mechanics of Materials	3
MAE 331	Fluid Mechanics	3
EE 221	Introduction to Electrical Engineering	3
EE 222	Introduction to Electrical Engineering Laboratory	1
MAE 316	Analysis-Engineering Systems	3
MAE 320	Thermodynamics	3
MAE 335	Incompressible Aerodynamics	3
MAE 343	Intermediate Mechanics of Materials	3
MAE 244	Dynamics and Strength Laboratory	1
MAE 322	Thermal and Fluids Laboratory	1
MAE 336	Compressible Aerodynamics	3
MAE 342	Dynamics of Machines	3
MAE 345	Aerospace Structures	3
MAE 365	Flight Dynamics	3
MAE 426	Flight Vehicle Propulsion	3
MAE 434	Experimental Aerodynamics	2
MAE 456	Computer-Aided Design and Finite Element Analysis	3
MAE 476	Space Flight and Systems	3
IENG 302	Manufacturing Processes	2
IENG 303	Manufacturing Processes Laboratory	1
MAE 411	Advanced Mechatronics	3
MAE 423	Heat Transfer	3
MAE 460	Automatic Controls	3
MAE 475	Flight Vehicle Design-Capstone	3
MAE 454	Machine Design and Manufacturing	3
MAE 471	Principles of Engineering Design	3
Aerospace Engineering Technical Electives		9
Mechanical Engineering Technical Electives		9
Aerospace Engineering or Mechanical Engineering Technical Electives		2
GEF Courses (Students who take ENGL 103 must take another technical Elective Course or department approved course) **		15
Total Hours		155

\* Minimum Grade of C required

## DUAL SUGGESTED PLAN OF STUDY

### First Year

Fall	Hours Spring	Hours
CHEM 115 (GEF 2)	4 MATH 156 (GEF 8)	4
ENGL 101 (GEF1)	3 PHYS 111 (GEF 8)	4
ENGR 101	2 ENGR 102	3
ENGR 199	1 GEF 6	3
MATH 155 (GEF 3)	4 GEF 7	3

GEF 5	3	
	17	17
<b>Second Year</b>		
<b>Fall</b>	<b>Hours Spring</b>	<b>Hours</b>
MAE 215	3 MAE 211	3
MAE 241	3 MAE 242	3
MATH 251	4 MAE 243	3
PHYS 112 (GEF 8)	4 MAE 331	3
ENGL 102 (GEF1)	3 MATH 261	4
	ECON 201 (GEF 4)	3
	17	19
<b>Third Year</b>		
<b>Fall</b>	<b>Hours Spring</b>	<b>Hours</b>
MAE 316	3 MAE 244	1
MAE 320	3 MAE 322	1
MAE 335	3 MAE 336	3
MAE 343	3 MAE 342	3
EE 221	3 MAE 345	3
EE 222	1 MAE 365	3
ECON 202	3 Technical Elective	3
	19	17
<b>Fourth Year</b>		
<b>Fall</b>	<b>Hours Spring</b>	<b>Hours</b>
MAE 426	3 MAE 411	3
MAE 434	2 MAE 423	3
MAE 456	3 MAE 460	3
MAE 476	3 MAE 475	3
Two Technical Electives	6 IENG 302	2
	IENG 303	1
	Technical Elective	3
	17	18
<b>Fifth Year</b>		
<b>Fall</b>	<b>Hours</b>	
MAE 454	3	
MAE 471	3	
Three Technical Electives	8	
	14	

Total credit hours: 155

**Note:** The dual degree requires twenty hours of technical electives. The twenty hours consists of: nine hours of approved aerospace engineering technical electives, nine hours of approved mechanical engineering technical electives, and the final two hours can be either aerospace engineering or mechanical engineering approved technical electives. Students should consult with their academic advisor to select courses that form a clear and consistent pattern according to the career objectives of the student.