



Mechanical and Aerospace Engineering Graduate Students Orientation

Prof. Stephen Tse & Ms. Lena Tang-Sinad

August 16, 2023 (updated)

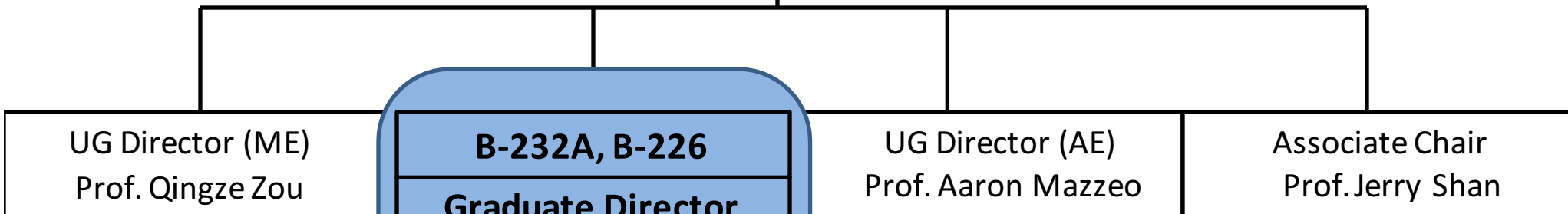


Welcome



Chair
Prof. Mina Pelegri

Departmental Administrator
Ms. Carmen Elsabee
Ms. Shefali Patel, Ms. Cassandra Schroeder



B-232A, B-226
Graduate Director
Prof. Stephen Tse
Ms. Lena Tang-Sinad
MEGA (Mechanical Engineering Graduate Student Association)

Office Hours (in-person only, call-in for Online M.Eng. only):
Tue Thu 1 – 2 PM
(No advisement via email)

sdytse@rutgers.edu



Communication

Email is NOT for advisement nor “Alexa/Siri” questions

- Questions are answered at office hours of Prof. Tse and Ms. Tang-Sinad
- Email is for forms, specific logistical requests, and confirmations
- Email must include your name in the subject line with appropriate topic detail – otherwise may not be answered
- Email must address one specific person in salutation. Including multiple people (in cc or to) usually results in no response
- See Grad program website first, then your research advisor, then Ms. Tang-Sinad, and finally Prof. Tse
- Your fellow students (especially labmates) should be one of your first resources!



Mechanical and Aerospace Engineering

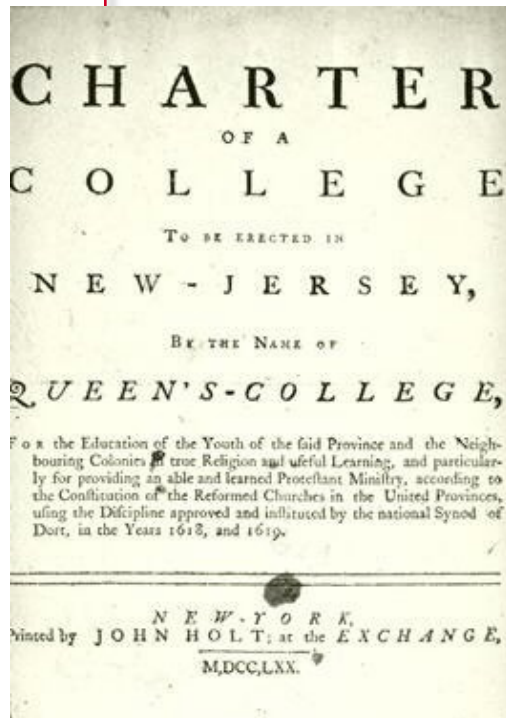
Today, we will discuss:

- 1. Rutgers History & Highlights**
2. Degrees Offered and Requirements
3. Courses Offered
4. Choosing a Project/Thesis & Advisor
5. Mechanical Engineering Graduate Students Association (MEGA)
6. Expectations, Funding, To-dos (Today)



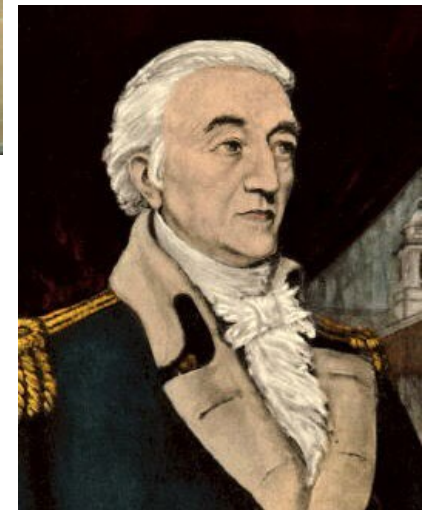
Rutgers History

1766 Chartered as **Queen's College** in New Brunswick, New Jersey.



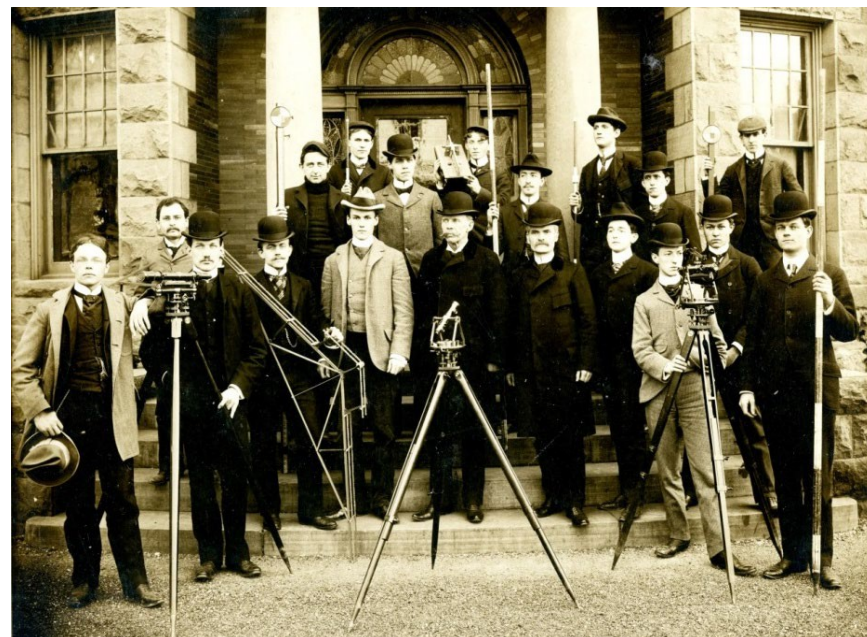
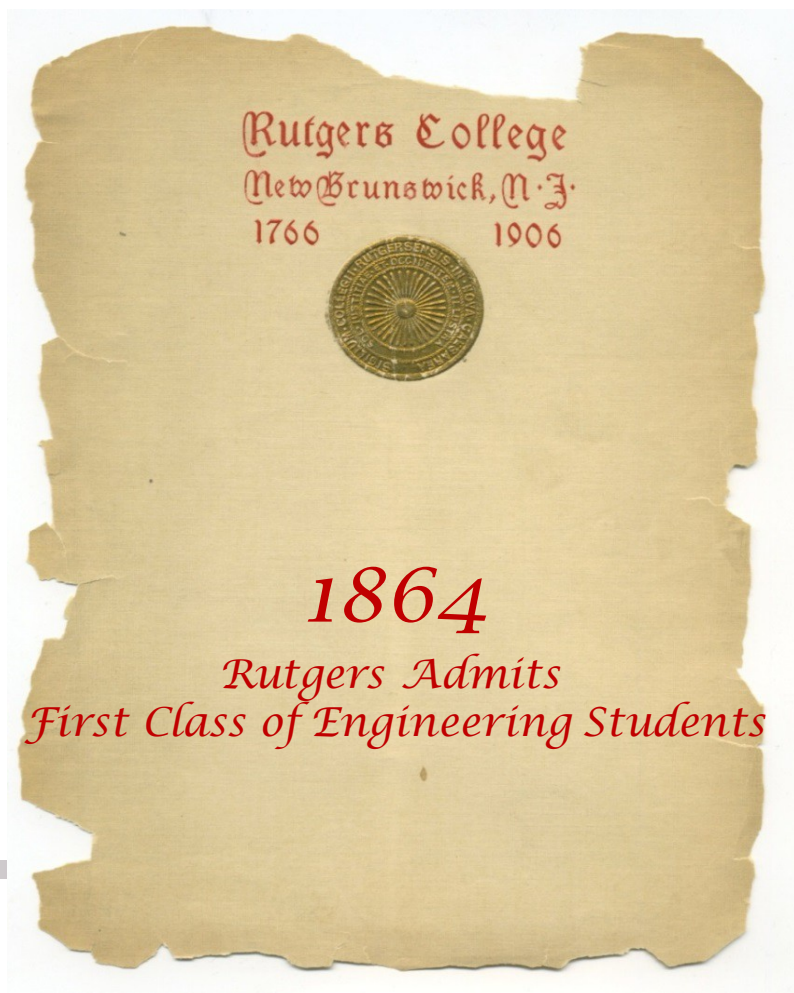
1776 American Revolutionary War

1825 Renamed as **Rutgers College** in honor of trustee and Revolutionary War veteran Colonel **Henry Rutgers**.



Engineering Begins

1864 The state legislature picks the **Rutgers Scientific School** over Princeton University to be the state land-grant college, which marks the beginning of the **Engineering** programs at Rutgers.



Joining the Big Ten

2012 Rutgers joins the **Big Ten**.



2014 Rutgers University-New Brunswick ranks **33rd** among world's top universities and **24th** among the US universities according to **Center for World University** rankings.



250th Anniversary

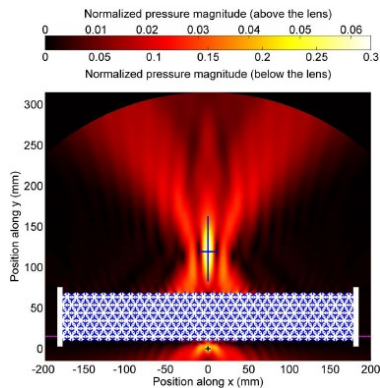
2016 Rutgers celebrates its **250th Anniversary**.

President Barack Obama speaks at Rutgers Commencement

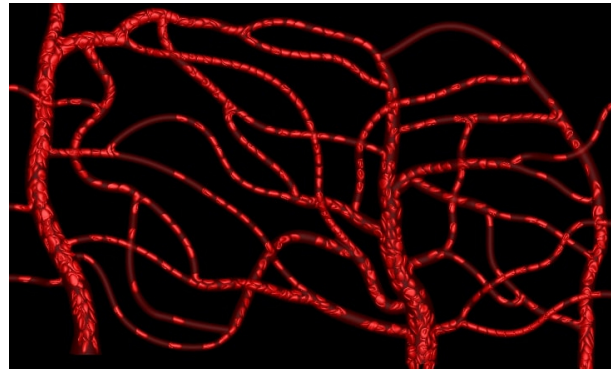


Research Leadership

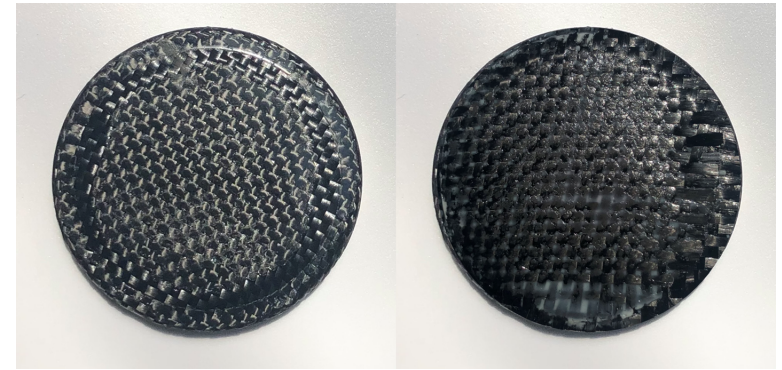
- MAE Department is among the top 20% in the nation based on faculty reputation and productivity (Academic Analytics)



Prof. Norris

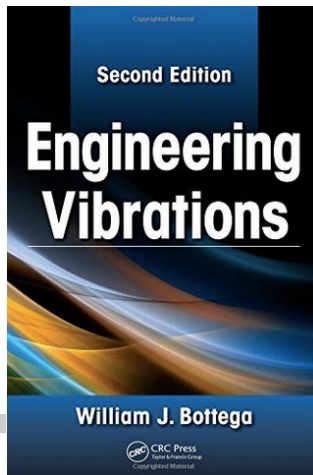


Prof. Bagchi

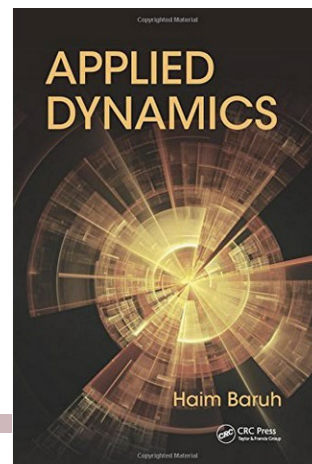


Prof. Singer

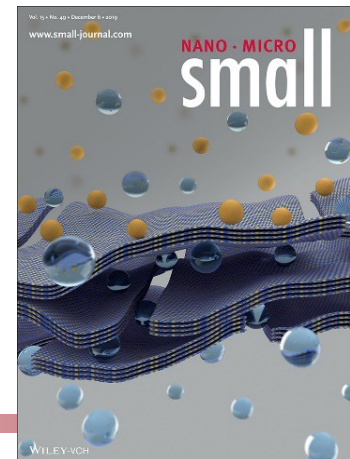
- Recent books/covers



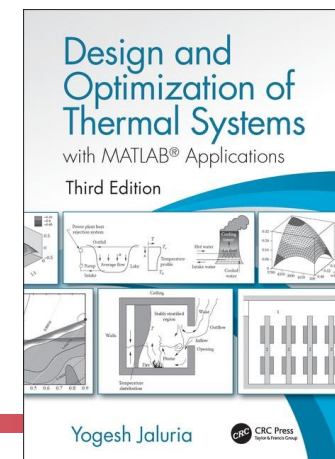
Prof. Bottega



Prof. Baruh



Cover *Small*,
Semih Cetindag & Prof. Shan



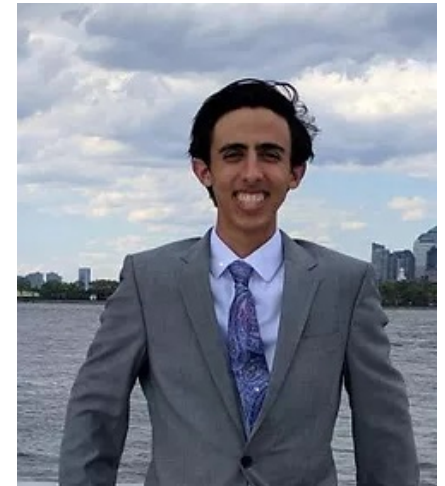
Prof. Jaluria



World-Class Faculty & Students

Selected recent student awards

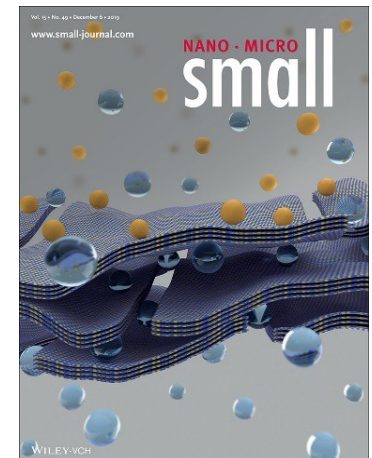
- Peter Balogh, Ph.D. graduate (2018)
 - Joined NJIT's Mechanical Engineering Department as a tenure-track assistant professor, 2021
 - computational fluid dynamics, biofluid mechanics, and high-performance computing
 - 2019 recipient of the Acrivos dissertation award from the American Physical Society
- Jeremy Cleeman, Ph.D. candidate
 - National Science Foundation Graduate Research Fellowship, Fall 2022
 - *machine learning based in-situ control of both geometry and properties in Large Area Additive Manufacturing*



Jeremy Cleeman

Selected recent faculty awards

- Xiaoli Bai
 - 2019 NASA Young Investigator Award
 - 2016 Air Force Young Investigator Award
- Jonathan Singer
 - 2021 Office of Naval Research Young Investigator Award
- Aaron Mazzeo
 - 2016 NSF CAREER award



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Semih Cetindag



Mechanical and Aerospace Engineering

Today, we will discuss:

1. Rutgers Highlights
- 2. Degrees Offered and Requirements**
3. Courses Offered
4. Choosing a Project/Thesis & Advisor
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6. Expectations, Funding, To-dos (Today)



Graduate Degrees Offered

Master of **Science**

Master of **Engineering**

Doctor of Philosophy



Graduate Degrees Offered

Master of Science (MS)

- 24 **course credits** + 6 research credits
- Thesis and Defense

Master of Engineering (MEng)

- 30 **course credits**
- Report & Presentation

Doctor of Philosophy (PhD)

- 42 **course credits** + 24 research credits + 6 credits of research and/or courses
- Qualifying exam and PhD proposal
- Dissertation and Defense



Course Credits (MS, MEng)

Master of Science (MS)

- 24 **course credits** + 6 research credits

Master of Engineering (MEng)

- 30 **course credits**

For both:

- B and above average, **max** 1 C/C+ grade, no P/F
- **Max** 1 independent study
- **Can take 2 courses from other departments w/ GDP approval**
- **Min** 5 MAE courses (MS), 7 MAE courses (MEng), No UG MAE courses (UG course from other dept only w/ GDP approval)
- 1 Math **642: 527**
- **Seminar (1 course credit, minimum 2 semesters, max 3 semesters to count for degree requirements)**



Online Courses (available for all but limited)

Online Courses

- 3-4 offered each semester
- Anyone in MAE can take, except Seminar Online
- Seminar Online graded by 1-page report for each seminar (meant for All-Campus Online MEng)
- Seminar in-person graded by attendance only

4+1 BS/Master

- Only for Rutgers UG (no GRE), transfer of credits

All-Campus Online Master of Engineering (MEng)

- Targeted for non-Rutgers UG (GRE preferred) and no transfer of credits



Specialized Certificates (MS, MEng)

Three Specialized Certificates with guided sequence of courses (<https://mae.rutgers.edu/graduate-program-information>)

- Advanced Manufacturing (example below)
- Robotics
- Space Systems

1st Semester (10cr)

Required	642:527 Math	3cr
Required	650:530 Fluid Mechanics 1	3cr
Required	650:570 Conduction Heat Transfer	3cr
Required	Seminar	1cr

2nd Semester (10cr)

Required	Mech. of Advanced Manufacturing	3cr
Required	Seminar	1cr
Manufacturing Elective	(Choose one from the list below)	3cr
Technical Elective	See below	3cr

3rd Semester³ (10cr)

Required	650:550/4 Mechanics of Materials/Continua	3cr
Required	Seminar	1cr
Manufacturing Elective	(Choose one from the list below)	3cr
Manufacturing Elective	(Choose one from the list below)	3cr



Specialized Certificates (M.S., M.Eng., Ph.D.)

Self-standing Certificate with Rutgers Business School (additional 12 credits)

- Business Innovation: Technology Entrepreneurship & Commercialization

<u>1st Semester (3-4 cr)</u>			<u>2nd Semester (3-4cr)</u>		
Required	16:650:562 "CTEC-1 - Discovery to Business Model," lecture + practicum (563) [cross-listed with RBS as 22:620:685 "CTEC"]	3-4cr	Required	16:650 564 "CTEC-2- Business Model to Launch," lecture + practicum (565) [cross-listed with RBS as 22:620:687 "Business Model to Launch"]	3-4cr

<u>3rd Semester (2-3cr)</u>			<u>4th Semester (3cr)</u>		
Elective	22:620:624 Opportunity Identification and Evaluation	3cr	Required	22:620:654 Managing Growing Ventures	3cr
	<i>or</i> 22:620:674 Social Entrepreneurship and Innovation	3cr			
	<i>or</i> 22:620:588 Strategic Management	2cr			
	<i>or</i> 22:553:593 International Business	2cr			



Second Masters degree

Second MEng degree (e.g., ECE)

- Agreement with another SOE department
- Additional five 3-credit courses in other department (cannot double count)
- Need approval from GPDs of both departments
- Form will be put on website later



Course Credits (Ph.D.)

Doctor of Philosophy

- 42 **course credits** + 24 research credits + 6 credits research and/or courses
 - B and above average, **max** 2 C/C+ grades, no P/F
 - **Max 2** independent study
 - **Can take 4 courses from other departments w/GPD approval**
 - **Min 10** MAE courses (No UG MAE courses)
 - **2** Math 642: 527, 642:528
 - **Seminar (1 course credit, 6 semesters required)**
 - One graduate level course from each area within MAE (4 out 5 OK)



Transfer Credits

Only graduate courses will be transferred

- Must take 9 credits before application
- Max 12 **course credits** for Master; max 24 **course credits** for Ph.D. (number depends on GPD approval) from outside institution
 - See instructions in SGS form
(<https://grad.rutgers.edu/academics/forms?&location=23>)
 - MAE J.J. Slade credits can be transferred in addition to max specifications given above (seek GPD approval for anything else)
 - Min number of MAE courses specified in previous slides for M.S., M.Eng., and Ph.D. must be satisfied



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Mechanical and Aerospace Engineering

Five areas for PhD Qualifying Exam:

1. Design and Manufacturing (M)
2. Dynamics and Control (C)
3. Fluid Mechanics (F)
4. Mechanics of Solids, Materials and Structures (S)
5. Thermal Sciences (T)



Classes Offered in Fall 2023

- 650:504 MM: Advanced Control I
- 650:530 Fluid Mechanics I
- 650:532 Experimental Fluids
- 650:550 Mechanics of Materials
- 650:554 Mechanics of Continua (SM I)
- 650:562/563 CTEC 1 Discovery to Business Model
- 650:567 Spacecraft Dynamics & Control
- 650:570 Conduction Heat Transfer
- 650:582 Computational Heat Transfer
- 650:605 AT: Habitats on the Moon & Mars
- 650:606 AT: Drone Fundamentals
- 650:652 Composites

Take 2 or 3
of these plus
Math & Seminar

Add/drop
deadline is
Sep 18,
2023

- ⋮
- 642:527 Math I
- 650:608 Seminar

Attendance will be taken;
Report/seminar for Online

Selected senior-level undergraduate courses can also be taken with permission



Graduate Course Schedule 1/2

		F21	S22	F22	S23	F23
650:504	Adv. Control I	X		X		X
650:505	Adv. Control II		X		X	
650:514	Design Mechanism/Mechanisms of Robotics			--		
650:524	Optimal Design		X		X	
650:522	Analytical Dynamics		X		X	
650:550	Mechanics of Materials	X		X		X
650:554	Continua (SM I)	X		X		X
650:556	Elasticity (SM II)		X		X	
650:512	Robotics & Mechatronics	X			X	X
650:651	Viscoelasticity & Plasticity (SM III)	X			X	
650:652	Composites (SM IV)			X		
650:653	Structural Mech (SM V)		X			X
650:654	Dyn.Solid Struct. (SM VI)					
650:664	Fracture (SM VII)		X			X
650:660	Comp. Solid (SM VIII)		X		X	
650:567	Spacecraft Dynamics & Control	X		X		X
650:569	Mechanics of Advanced Manufacturing		X		X	
650:531	Additive Manufacturing	X			X	
650:606	Advanced Topics: Drones I: Fundamentals	X		X		
650:606	Advanced Topics: Drones II: Control & Coordination		X		X	
650:607	Advanced Topics: Habitats on Moon & Mars			X		

Tentative course schedule at <https://mae.rutgers.edu/graduate-program-overview>
Typically will offer ~2 summer classes as well



Graduate Course Schedule 2/2

		F21	S22	F22	S23	F23
650:530	Fluids I	X		X		X
650:570	Conduction Heat Transfer	X		X		X
650:574	Thermodynamics		X		X	
650:630	Fluids II		X		X	
650:578	Convection Heat Transfer		Combined		Combined	
650:582	Comput. Heat Transfer			X		
650:670	Combustion	X				X
650:674	Radiation Heat Transfer		Combined		Combined	
650:532	Exptl. Fluid Mechanics			X		
650:534	Comput. Fluid Mechanics		X			
650:634	Compressible Flow	X			X	
650:562/563	CTEC 1: Discovery to Business Model	X		X		X
650:564/565	CTEC 2: Business Model to Launch		X		X	
650:608	Seminar	X	X	X	X	X
650:606	Advanced Topics: Autonomous Navigation					
650:607	Advanced Topics: Aerospace Accident Investigation					
650:605	Advanced Topics: Smart Manufacturing & Cybersecurity			X		X
642:527	Methods of Applied Mathematics I	X		X		X
642:528	Methods of Applied Mathematics II		X		X	
650:605	Special Topics: Renewable Energy		X		X	



Credit Requirements

- Full-time: 9 credits (Maximum 16 credits)
- GA's, TA's, Fellow's must register for E credits (or no signoff on candidacy form)
 - GA: 6E credits(650:866) + max 10 (9+1) credits
 - TA: 6E credits(650:877) + max 10 (9+1) credits
 - Fellowship : 0E credits(650:811) + max 10 (9+1) credits
- Research Credits: 650:701 / 650:701 (S/U)



Topics for PhD Qualifying Exam

- Five areas: Design & Manufacturing, Dynamics & Control, Fluids, Solids, Thermal Science
 - All students will take one 3-hour Mathematics exam, and four 90-minute subject exams (2 chances to pass ALL)
- Offered in early September
 - Taken either at end of 1st or 2nd years
- Tests fundamental knowledge as preparation for research
 - Not necessarily tied directly to particular courses
 - Holistic review of material is good preparation for research
 - Possible conditional-pass exams given in Jan (they are not makeups and are not automatically given)

All subject exams

Adv. Control I
Optimal Design
Analytical Dynamics
Mechanics of Materials
Continua (SM I)
Elasticity (SM II)
Fluids I
Conduction
Thermodynamics
Fluids II
Convection
Mechanics of Advanced Manufacturing



PhD Qualifying Exam by Area (1/2)

- Design & Manufacturing
 - Required: Either Mechanics of Advanced Manufacturing or Optimal Design; Either Mechanics of Materials, Adv. Control I, Analytical Dynamics, Fluids I, or Thermodynamics
 - Elective: Any other two qualifying exam subjects (including those listed above)
- Dynamics & Control
 - Required: Advanced Control I, Analytical Dynamics
 - Elective: Any other two qualifying exam subjects



PhD Qualifying Exam by Area (2/2)

- Fluids
 - Required: Fluid Mechanics, Advanced Fluid Mechanics
 - Electives: Chose two from Thermodynamics, Conduction, Convection, Control, and Continuum Mechanics
- Solids
 - Required: Two chosen from Continuum Mechanics, Mechanics of Materials, Analytical Dynamics, and Elasticity
 - Electives: Any other two qualifying exam subjects
- Thermal Science
 - Required: Two chosen from Thermodynamics, Conduction, Convection
 - Electives: Any other two qualifying exam subjects



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Choosing Project & Advisor

- First point of contact. Consider:
 - Interests? Future goals? Personality/fit in group?
Funding?
- Make appointments to talk to faculty
- For MEng projects, co-advised industry projects are also suitable, also CTEC project
- Talk to senior students!
- **Choose by end of 1st semester!**
 - Return Advisor-Advisee agreement to Ms. Lena Tang-Sinad (B226)
 - See MAE Grad forms (<https://mae.rutgers.edu/forms-0>)
 - Annual Individual Development Plan (IDP) must be submitted in January to assess progress (<https://sgs-studentidp.rutgers.edu/>)



Mechanical and Aerospace Engineering

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5. **Mechanical Engineering Graduate Students Association (MEGA)**
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MEGA – Student Organization

- **Mission Statement:**

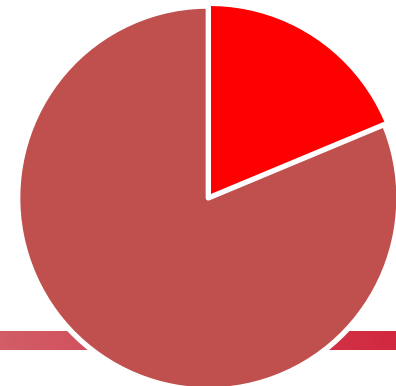
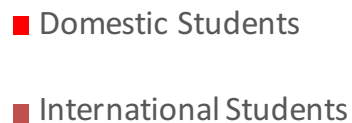
- To improve the lives of the graduate students of the mechanical engineering department by organizing events, career development advice and acting as a point of contact for the students.

- **Recent Actions**

- We completed a survey to get the graduate students' opinions on the qualifying exam and the diversity requirements for PhD students
 - And will help students with their studies on the qualifying exam
- Connected students with recent graduates for job opportunities

- **Department Stats**

- International students(~65%)
- Domestic students(~35%)



Our Organization

- Who We Are

- Need new officers

Contact:

- Hongxiang Cao

hc536@scarletmail.rutgers.edu



- Mohit Agarwal

ma1633@scarletmail.rutgers.edu

- **Your voice matters**

<http://mega.rutgers.edu>



MEGA



RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY



BBQ

- We host summer BBQs for the graduate students
 - The BBQ is a great way to socialize with your fellow students and professors during the summer
 - We cook chicken wings, burgers, hot dogs, and vegetarian burgers for everyone in the department to enjoy!



Social Events

- **Paintball Event**

- We brought together grad students who wanted to have a great time playing paintball



Our bowling event

Over 40 students were in attendance!



Ping Pong Tournament

- Ping Pong Tournament September – November 2018
 - Over \$300 awarded in prizes to the 1st, 2nd, and 3rd place contestants

3rd Place:
Hang

Organizer:
Rick

1st Place:
JP

2nd Place:
Wuhan



Recent MEGA Activities

- Movie watch party
- Online chess tournament
- PhD Qualifying Exam review sessions
- Always looks for other ideas!
- Need new officers



Expectations

- Treat all members of Rutgers community with respect
- Academic integrity
 - Cheating/Copying/plagiarism are grounds for dismissal
 - In research & reports, give references and do not cherry-pick data!
- Contribute to the Department & to the Engineering profession!
 - Research
 - Teaching
 - Personally & Socially



Opportunities for funding

- Hourly employment
 - Graders
 - Proctors
 - Occasionally opportunities for paid research assistance
- Internships
 - Must be approved by advisor & Graduate Program Director
 - Register for course and provide reports to faculty advisor
- PhD students
 - Teaching assistantships
 - Research assistantships
 - Fellowships
 - Other



To Dos & Additional Forms

- Student Information Form (Will send out – return as soon as possible, Facebook info)
- Graduate Advisor-Advisee Agreement (End of 1st semester or ASAP)
- Begin researching projects and advisors
(https://docs.google.com/spreadsheets/d/14qpQR8ICtcQrDV3WQOVQCUluziZyoTT8O_RzRcq5couA/edit#gid=0)
- Participate in MEGA!



Questions?

Have a great (and healthy) Fall semester!

Remember:

1. Office hours (but your advisor is first point of contact)

Ms. Lena Tang-Sinad drop-in office
hours: Mon Wed Fri 2:00-3:00 pm

Professor Tse drop-in office hours
Tue Thu 1-2 pm

2. Deadlines & requirements for graduation (website forms)
3. Check MAE & Graduate School websites for key information (plus your fellow students)
4. Participate in Mechanical Engineering Graduate Students Association (MEGA)

