Mechanical and Aerospace Engineering Graduate Students Orientation

Prof. Stephen Tse & Ms. Lena Tang-Sinad

August 13, 2024

Welcome

Chair
Prof. Mina Pelegri

Departmental Administrator
Ms. Carmen Elsabee

Ms. Lily Lu, Ms. Marleiz Ghattas,
Ms. Cassandra Schroeder

UG Director (ME)
Prof. Qingze Zou

B-232A, B-226

Graduate Director
Prof. Stephen Tse

Ms. Lena Tang-Sinad

MEGA (Mechanical Engineering Graduate Student Association

UG Director (AE)
Prof. Aaron Mazzeo

Associate Chair
Prof. Jerry Shan

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!

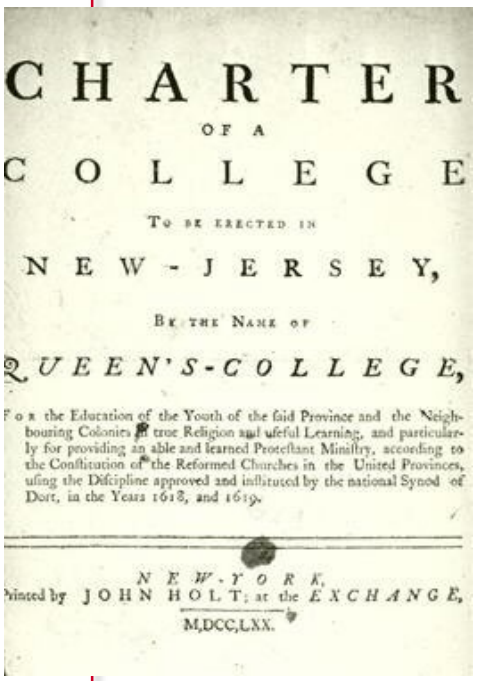
Mechanical and Aerospace Engineering

Today, we will discuss:

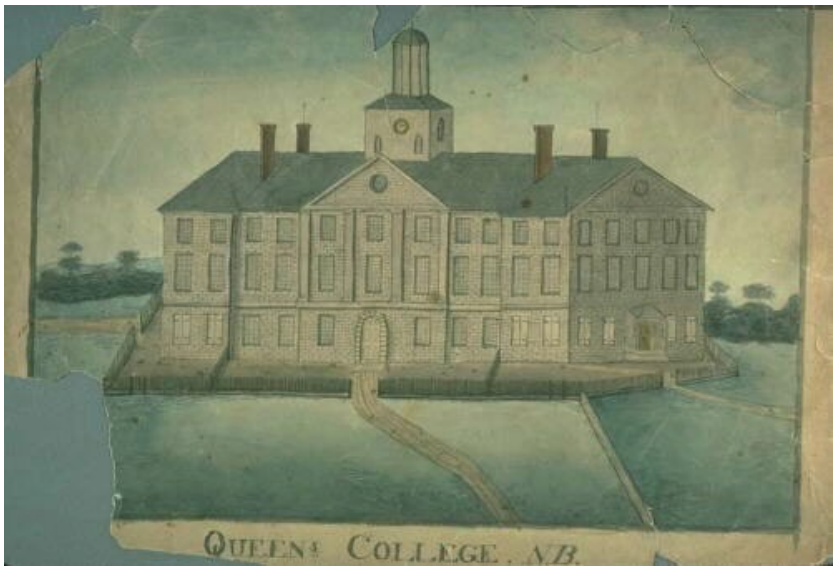
1. **Rutgers History & Highlights**
2. Degrees Offered and Requirements
3. Courses Offered
4. Choosing a Project/Thesis & Advisor
5. Mechanical Engineering Graduate Students Association (MEGA)
6. Expectations, Funding, To-dos (Today)

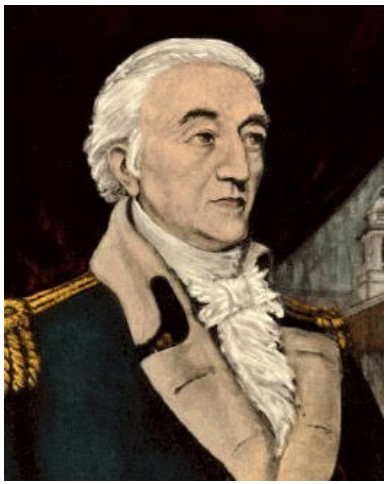
Rutgers History

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



CHARTER
OF A
COLLEGE
TO BE ERECTED IN
NEW-JERSEY,
BY THE NAME OF
QUEEN'S-COLLEGE,
For the Education of the Youth of the said Province and the Neighbouring Colonies in true Religion and useful Learning, and particularly for providing an able and learned Protestant Ministry, according to the Constitution of the Reformed Churches in the United Provinces, using the Discipline approved and instituted by the national Synod of Dort, in the Years 1618, and 1619.
NEW-YORK,
Printed by JOHN HOLT; at the EXCHANGE,
M,DCC,LXX.



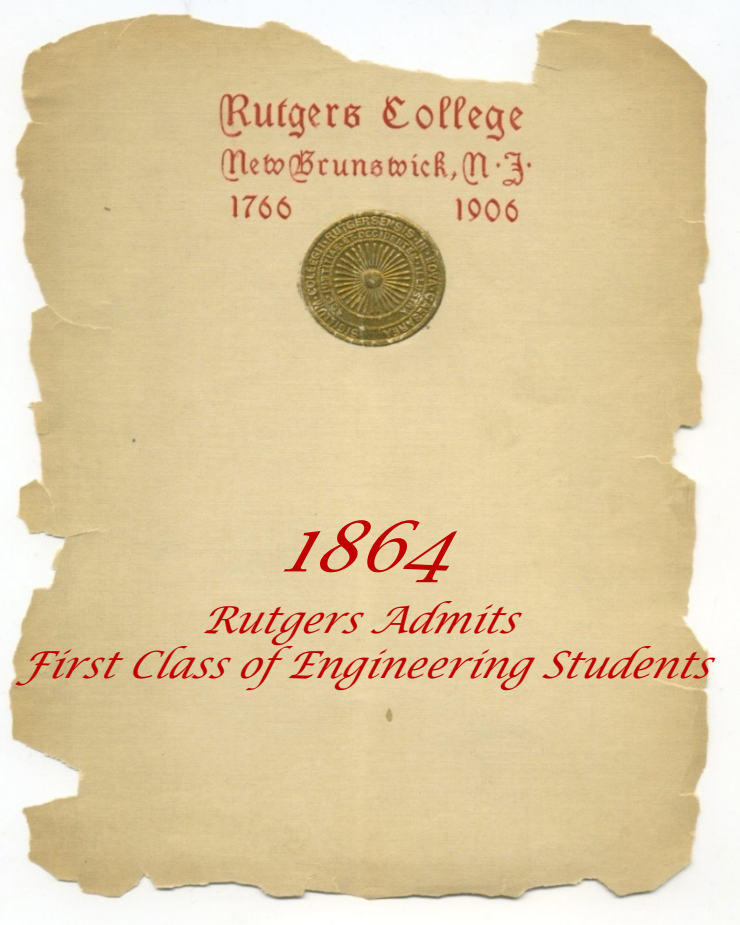


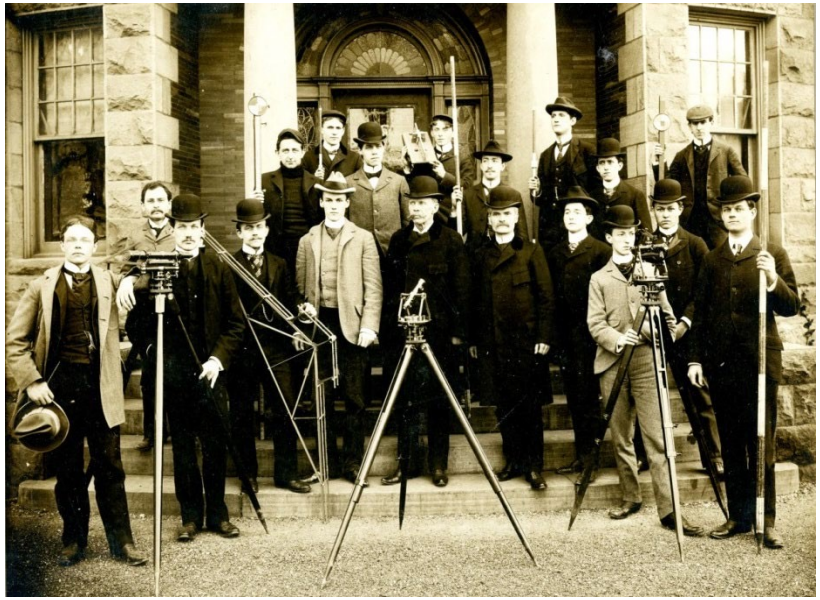
1776 American Revolutionary War

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.**

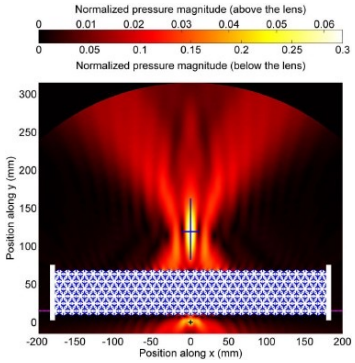
250th Anniversary

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

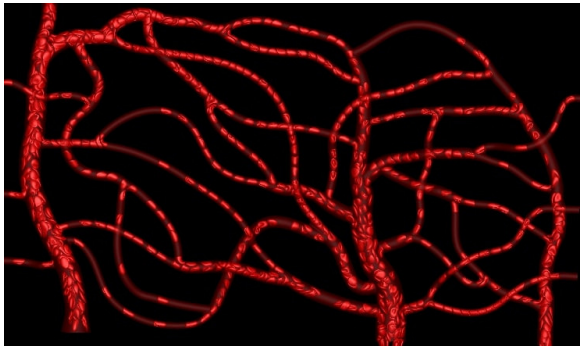
President Barack Obama speaks at Rutgers Commencement

Research Leadership

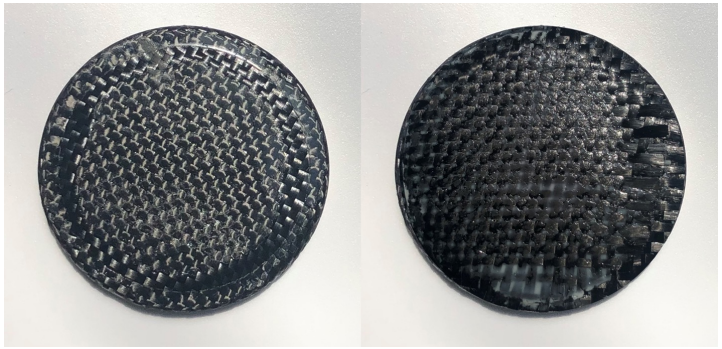
- MAE Department is among the top 20% in the nation based on faculty reputation and productivity (Academic Analytics)



Prof. Norris

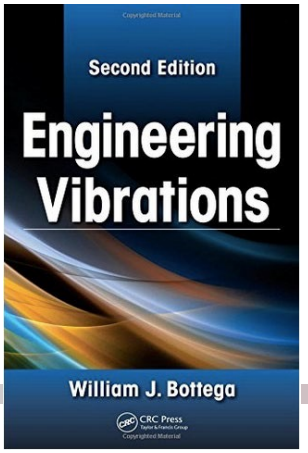


Prof. Bagchi

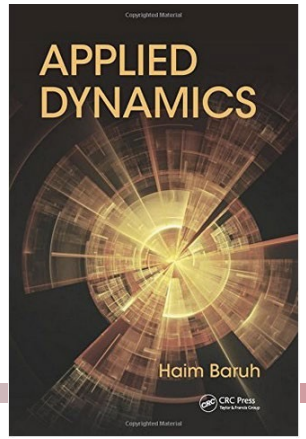


Prof. Singer

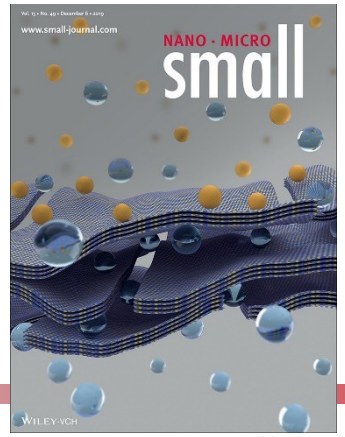
- Recent books/covers



Prof. Bottega



Prof. Baruh



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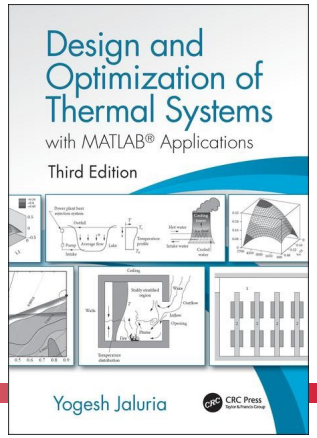
Semih Cetindag & Prof. Shan



Prof. Jaluria

World-Class Faculty & Students

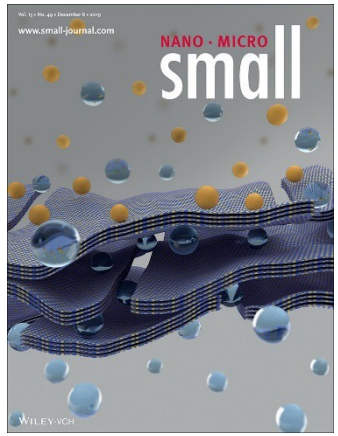
Selected recent student awards

- 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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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-academics)

- 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 Semester[3] (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

1st Semester (3-4 cr)				2nd Semester (3-4cr)		
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

3rd Semester (2-3cr)				4th Semester (3cr)		
Elective	22:620:624 Opportunity Identification and Evaluation	3cr		Required	22:620:654 Managing Growing Ventures	3cr
	or 22:620:674 Social Entrepreneurship and Innovation	3cr				
	or 22:620:588 Strategic Management	2cr				
	or 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
- See: https://mae.rutgers.edu/resources-forms-and-useful-links

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 can 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 2024

- 650:504 MMEng: Advanced Control I
- 650:512 Robotics and Mechatronics
- 650:530 Fluid Mechanics I (o)
- 650:531 Additive Manufacturing (o)
- 650:550 Mechanics of Materials (o)
- 650:554 Mechanics of Continua (SM I)
- 650:562/563 CTEC 1 Discovery to Business Model
- 650:570 Conduction Heat Transfer
- 650:605 AT: Habitats on the Moon & Mars (o)
- 650:634 Compressible Flows
- 650:652 Composites
- 650:670 Combustion

Take 2 or 3 of these plus Math & Seminar

Add/drop deadline is Sep 16, 2024 (W)

⋮

- 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	Sum23	F23	S24	Sum24	F24	S25	Sum25	F25
650:504	Math Methods in Eng: Adv. Control I	X		X			X			X			X
650:505	Math Methods in Eng: Adv. Control II		X		X			X			X		
650:512	Robotics & Mechatronics	X					X			X			X
650:514	Design Mechanism/Mechanisms of Robotics				X			X			X		
650:522	Analytical Dynamics		X		X			X			X		
650:524	Optimal Design		X		X (O)			X (O)			X(O)		
650:531	Additive Manufacturing	X			X					X?X(O)			X(O)
650:550	Mechanics of Materials	X		X			X			X (O)			X
650:554	Mechanics of Continua (SM I)	X		X			X			X			X
650:556	Elasticity (SM II)		X		X --			X --			X		
650:560	Drones Fundamentals and Applications					X (O)	X (O)						X(O)
650:567	Spacecraft Dynamics & Control	X		X (O)			X			X?			X
650:569	Mechanics of Advanced Manufacturing		X		X (O)			X (O)			X(O)		
650:605	Adv ME Topics: Habitats on the Moon & Mars			X						X?X(O)			X(O)
650:606	Special Topics: Drones I: Fundamentals and Applications	X		X (O)				X --					
650:606	Special Topics: Drones II: Control & Coordination		X		X (O)				X (O)	X?		X(O)	X
650:651	Viscoelasticity & Plasticity (SM III)	X					X --						
650:652	Composites (SM IV)			X						X?X			X
650:653	Structural Mech (SM V)		X					X --					
650:660	Comp. Solid (SM VIII)		X		X			X --			X		
650:664	Fracture (SM VII)		X								X		

Course info at https://mae.rutgers.edu/graduate-academics. Typically will offer ~2-4 summer classes as well

Graduate Course Schedule 2/2

		F21	S22	F22	S23	Sum23	F23	S24	Sum24	F24	S25	Sum25	F24
650:530	Fluid Mechanics I	X		X			X			X (O)			X
650:532	Exptl. Fluid Mechanics			X						X?			X
650:534	Comput. Fluid Mechanics		X					X? --					
650:562/563	CTEC 1: Discovery to Business Model / Practicum	X		X			X			X			X
650:564/565	CTEC 2: Business Model to Launch / Practicum		X		X			X			X		
650:570	Conduction Heat Transfer	X		X			X (O)			X			X(O)
650:574	Thermodynamic Theory		X		X			X			X		
650:578	Convection & Radiation Heat Transfer		X		X			X			X		
650:582	Comput. Heat Transfer			X						X - Cancel			X
650:605	Special Topics: Smart Manufacturing & Cybersecurity				X --								
650:605	Adv ME Topics: Renewable Energy		X		X			X	X (O)		X(O)		
650:605	Special Topics: Building Thermal Comfort and Ventilation		X				X --					X(O)	
650:605	Adv ME Topics: Value Chain & Analytics Management MAE							X			X	X(O)	
650:607	Special Topics: Aerospace Accident Investigation										X(O)		
650:607	Advanced ME Topics: Smart Manufacturing & Cyber Security						X (O)				X(O)		
650:608	Seminar M.E. (1 credit)	X	X	X (O)	X		X (O)	X (O)		X (O)	X(O)		X (O)
650:630	Fluid Mechanics II		X		X			X			X		
650:631	Fluid Mechanics III						X			X - Cancel			X
650:634	Compressible Flow	X			X --					X?X			X
650:670	Combustion	X					X			X			

Course info at https://mae.rutgers.edu/graduate-academics. Typically will offer ~2 summer classes as well

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/resources-forms-and-useful-links)
  - Annual Individual Development Plan (IDP) must be submitted in January to assess progress (https://sgs-studentidp.rutgers.edu/)

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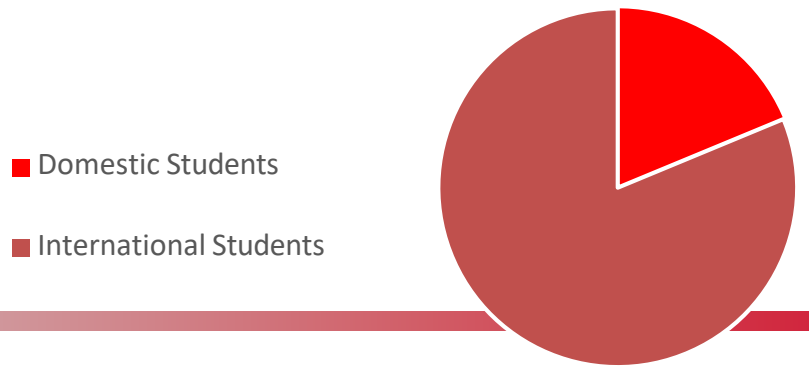
MEGA – Student Organization

- **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:

  - –ADITYA ASHUTOSH MAIRAL <am2957@scarletmail.rutgers.edu>
  - –Ben Greenberg <brg60@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

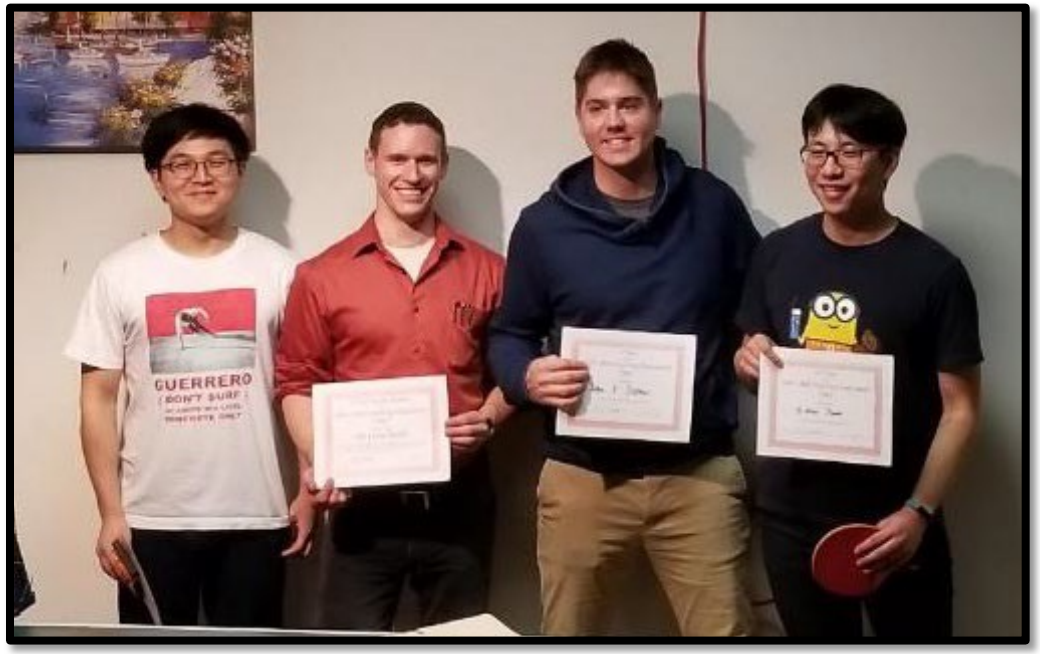
Our bowling event

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:	Organizer:	1st Place:	2nd Place:
Hang	Rick	JP	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, Faceboard info)
- Graduate Advisor-Advisee Agreement (End of 1st semester or ASAP)
- Begin researching projects and advisors (will provide link to spreadsheet)
- 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)