

MAAE 3004: DYNAMICS OF MACHINERY

Course Outline – Fall 2017

Instructors

Section A	Prof. Rob Langlois, Ph.D., P.Eng.	Section B	Prof. Rishad Irani, Ph.D., P.Eng.
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Class Times	Section A	Tuesdays and Thursdays	10:05 - 11:25	Room UC 180
	Section B	Tuesdays and Thursdays	11:35 - 12:55	Room TB 342

Problem Analysis Sessions	L1: Tuesdays	2:35 - 4:25	Room SA 304
	L2: Thursday	3:35 - 5:25	Room TB 342

Outline

Week	Chapter	Topics
1	Introduction	<i>Definitions; geometrical categorization of mechanisms; mobility; kinematic inversion; Grashof's law.</i>
2	Displacement Analysis	<i>Introduction; graphical solution of vector equations.</i>
3, 4	Velocity Analysis	<i>Definitions; velocity polygons; apparent linear velocity of a point; apparent angular velocity; instant centres of velocity.</i>
5, 6	Acceleration Analysis	<i>Linear acceleration; angular acceleration; acceleration difference vector; acceleration polygons; apparent acceleration; instant centres.</i>
7	Force Analysis of Mechanisms	<i>Preliminaries; forces acting on links; graphical analysis and superposition; analytical force balance and matrix solution.</i>
8	Force Balancing	<i>Introduction; balancing of machinery; balancing of rotating shafts; analysis of rotor balancing.</i>
9, 10	Free Vibration of SDOF Systems	<i>Basic concepts; undamped translational system; Rayleigh's energy method; free vibration with viscous damping.</i>

11, 12 Harmonically-excited
Vibration

Equation of motion; undamped response; magnification factor; damped response; energy dissipation.

Required Textbook

J.J. Uicker, Jr., G.R. Pennock, and J.E. Shigley. Theory of Machines and Mechanisms, 5th edition, Oxford University Press, 2017. (Alternatively, Revisions 3 and 4 of the text are also fine)

Additional References

1. J. L. Meriam and L. G. Kraige, Dynamics, Fourth Ed., John Wiley & Sons, 1998.
2. R. C. Hibbeler, Engineering Mechanics: Dynamics, Ninth Ed., Prentice Hall, 2001.
3. B. I. Sandor, Engineering Mechanics: Dynamics, Prentice Hall, 1983.
4. F. P. Beer, E. R. Johnston Jr., and W. E. Clausen. Vector Mechanics for Engineers - Dynamics, 7th edition, McGraw-Hill Inc.
5. H. H. Mabie and C. F. Reinholtz. Mechanisms and Dynamics of Machinery, 4th edition, Wiley.
6. G. H. Martin. Kinematics and Dynamics of Machines, 2nd edition, McGraw-Hill.
7. W. T. Thomson and M. D. Dahleh. Theory of Vibration with Application, 5th edition, Prentice-Hall.

Drawing Instruments

Students will require the elements of a geometry set to perform graphical kinematic analysis. This includes: ruler, protractor, compass, 45-45-90-degree triangle, 30-60-90-degree triangle, eraser shield, masking tape.

Notes and Assignments Posted on cuLearn

Evaluation

Course evaluation will be based on a midterm exam (30%) and a final exam (70%). Exams will be closed book and closed notes. A formula sheet will be provided with the final exam containing formulae related to the vibration portion of the course. Only non-communicating calculators can be used during the midterm and final exams. The final exam is for evaluation purposes only and will not be returned to students.

The midterm has been scheduled for Thursday October 19, 7:00-8:30 PM.

Additional Information

- ZERO TOLERANCE for cell phone use in class. No instant messaging, no web browsing, emailing, or games. If you are found using your cellphone, you may be told to leave the lecture. If there are extenuating circumstances, notify the instructor prior the start of the class and an exception can be discussed.
- Web browsing, instant messaging, emailing, etc., is not permitted during class. If you are found

violating this rule, you may be told to leave the lecture.

- Unless accompanied by an official academic accommodation or approved by the instructor, audio recordings, video recording, and photographs of lectures are prohibited.
- Students must pass the final examination to pass the course.
- Assignment problems will be posted on cuLearn but they will not be marked. Students are expected to fully participate in the Problem Analysis (PA) sessions where the assignment problems will be reviewed and questions answered.
- During each problem analysis session, one practice test problem will be given to help prepare for the midterm and final examinations. These mock tests will be evaluated by the students themselves, but they will not count toward the final grade in the course.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide (<http://www2.carleton.ca/equity/accommodation/academic/students/>).

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide (<http://www2.carleton.ca/equity/accommodation/academic/students/>).

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).