Course Instructor: Eres Söylemez  Rm C205, e-mail: ers@metu.edu.tr
Assistant: Mehmet Hakan Kandemir Rm C204 e-mail: kandemir@metu.edu.tr
Course Hours: Wednesday 14:40, 15:40, 16:40 Room B101
Textbook: None

Reference Books:

d) “Dynamics of Machinery”, H.Dresig, F.Holzweissig, Springer Verlag, 2010 (also available in German)
e) “Makina Dinamiği”, B.Dizoğlu (Tercüme F.Pasin, M. Gürgöze), İTÜ Mimarlık,Mühendislik Fak. No:110, 1976 (also available in German)
f) “Makina Dinamiği”, Fuat Pasin (İkinci Baskı), Seç Kitap Dağıtım, 1989.
g) “Makina Dinamiği”, Erkan Dokumacı, Nobel Yayınevi, 2011.
h) “Makina Teorisi”, Özsür Turhan, Nobel Yayınevi, 2012

Course Grading (Tentative)

2 Midterms (20% each), Assignments (30%), Final (30%)

ME418 COURSE OUTLINE:

<table>
<thead>
<tr>
<th>Hours</th>
<th>Week</th>
<th>Dates</th>
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<tr>
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<td>13-May</td>
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General Comments

You are expected to work **at least 6 hours** for each week after class. If you think you cannot spend this much time for this course please drop the course.

This course is for senior and MSc students who have a good knowledge in mechanisms and dynamics (ME 208 and ME301) and numerical methods (ME310). It is assumed that you know all the topics covered in those courses i.e. you are expected to perform kinematic position, velocity and acceleration analysis of any planar mechanism, solve a second order differential equation numerically using a computer. You are expected to have a good knowledge in the kinematic analysis of mechanisms.

Make up examination will be given only to those with a valid excuse approved by the department. There is no make-up for the homework. Late homework will not be accepted.
Some homework assignments will be in the form of projects expected to be completed in 2-3 weeks. They will involve some amount of programming. Midterms may be given as take-home exams.

During the semester you will be given approximately 6 hours of lecture on ADAMS© and 3 hours on MatLab Simulink for the dynamic analysis of mechanisms using the above tools. Also 3 hours of lecture on contemporary use of electric motors will be given by Mr. Hüinker Kemal Yurt (BIAS Eng.-ADAMS), Mr. Erman Çağan Özdemir and Mr. Onur Cem Erdoğan (both from ASELSAN, Electric Motors and Simulink). During the lectures you will be shown how to perform dynamic force and motion analysis using Excel as well. At the end of this course you are expected to perform dynamic force and motion analysis for planar mechanical systems using these tools.

Specific course information

a) Force Analysis in Machinery, Static, Dynamic force analysis with and without friction. D’Alambert’s principle, Dynamic force analysis of piston engines
c) Prime movers: electric motors and their characteristics as a prime mover.
d) Dynamic Force and motion analysis using Matlab© and ADAMS©

Specific goals of the course

- Ability to perform static and dynamic force analysis of mechanical systems
- Ability to formulate the equation of motion of any single (DOF) machine by using kinematic influence coefficients.
- Ability to solve the equation of motion of a single DOF machine by using a suitable numerical integration method, and to interpret the simulation results.
- Ability to carry out transient response of a single DOF conservative system by using energy-integral concept.
- Ability to carry out steady-state response of a single DOF conservative system by using energy-inertia diagram.
- Ability to model transient and steady-state AC electric motor characteristics in the form of a torque-speed relation, and to couple it to the machine characteristics.
- Ability to interpret the suitability of the electric motor chosen for particular machine characteristics by way of dynamic simulation.
- Ability to correlate reaction forces with stress distribution at prismatic joints.
- Ability to identify friction lock of mechanisms involving prismatic and revolute joints.
- Ability to calculate shaking forces and moments as harmonic excitations for mechanical vibrations.
- Ability to differentiate between shaking forces and moments in rotating and inertia-variant machines.
- Competence on working principles of field and in-place balancing equipment and balance standards for rotating machinery.
- Ability to readjust mass distribution of machine parts in view of eliminating or reducing shaking forces and moments in inertia variant machines.