ME 421, Vibrations and Controls, Winter 2013, CRN 10913, TR 3:30 ~ 5:17, SEB 384

Designation : A required course for all ME students.

Course Description – CATALOG DATA

ME 421 Vibrations and Controls (4)
Linear free and forced response of one and multiple degree of freedom systems. Equations of motion of discrete systems. Vibration isolation, rotating imbalance and vibration absorbers. Transfer function and state-space approaches to modeling dynamic systems. Time and frequency domain analysis and design of control systems.

Instructor : Yin-ping (Daniel) Chang, Associate Professor
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Office hours : TR 5:30 ~ 7:15 pm

TA : Caymen Novak, cmnovak@oakland.edu, office hours : TR 6:00 ~ 7:30 pm at 145 DHE

Textbook : "Engineering Vibrations," 3/E, Daniel J. Inman, Prentice Hall.
"System Dynamics," 4/E, K. Ogata, Prentice Hall.

Prerequisites : ME 322 Dynamics, APM 255 Differential Equation or MTH 256 Linear Algebra.

7:30PM

HW Policy : The HW is due at ~~the beginning of the class~~ on the due date. HW solutions will be presented and provided on due dates. **NO LATE HW WILL BE ACCEPTED!** Any questions about the grading should be addressed to the instructor, **not the TA,** within one week after it's been returned.

Exam and Grading Policy : The final course grade will be a weighted average of:

Attendance	(10*1.5%)	15 %	
HW	(3 ~ 5)	20 %	**(NO late HW accepted.)**
Exams	(3 ~ 5)	65 %	**(NO make-up exams.)**

>90--4, >80--3, >70--2, >60--1, <50--0. Again, any questions about the grading of exams should also be addressed to the instructor, **not the TA,** within one week after it's been returned.

Grade stats : 6 semesters, 31/4.0, 38/3.x, 35/2.x, and 32/1.x & 0.0, average 2.4 ~ 2.8.

Objectives : Upon completion of this course, students should be able to:

1. Derive the E.O.M. (Equations Of Motion) of vibration systems. (a, e)
2. Describe linear free and forced responses of SDOF (Single Degree of Freedom) systems. (a, e)
3. Model dynamic systems by transfer function. (a, e)
4. Analyze and design of control systems in time and frequency domains. (a, e)

Academic Conduct : Computer and Cell phone usage is NOT allowed in the class. Students are expected to read, understand, and comply with the "Academic Conduct Policy" as explained in Oakland University Undergraduate and Graduate catalogs. Violations will be taken before the Academic Conduct Committee. Students found guilty of academic misconduct in this course will receive a grade of 0.0 in addition to any penalties imposed by the Academic Conduct Committee.

CLASS ATTENDANCE IS STRONGLY RECOMMENDED

TENTATIVE LECTURE and EXAM SCHEDULE

The schedule below is to be used as a guideline. There might be some deviation and it is the student's responsibility to be aware of any changes that are announced in class. The early morning or evening lectures/exams are possible.

	Lecture Topics	Reading Materials	Exams
I.	EOM (Equations of Motion) of vibration systems.	Inman's book: 1.1 1st half & 1.4 & 4.7 for reference only	
II.	Linear free response of SDOF systems. ➢ Undamped & Damped systems	Inman's book: 1.1 (2nd half) ~ 1.3	**SDOF Free Response, Exam#1**
III.	Linear forced response of SDOF systems. ➢ Harmonic input forces ➢ General input forces	Inman's book: 2.1, 2.2 & 2.4 Inman's book: 2.3, 2.5, 2.6, 3.1 ~ 3.4 for reference only	**SDOF Forced Response, Exam#2**
IV.	Introduction to system dynamics & mechanical systems.	Ogata's book: Ch.1 & 3 for reference only	
V.	Dynamic systems modeling by transfer function. Time and Frequency domain analysis of dynamic systems.	Ogata's book: Ch.2 & 4 Ogata's book: Ch.8 & 9	**Dynamic Systems Analysis & Modeling, Exam#3 (&4)**
VI.	Time and Frequency domain analysis and design of control systems.	Ogata's book: Ch.10 & 11.	**Control Systems Analysis & Design, Exam#4 (&5)**

HELP ME HELP YOU!!

Prepared by / Date Prepared (& modified)

Prof. Yin-ping (Daniel) Chang / January 23, 2013

Estimated ABET Category Content :

	Engineering Science	Engineering Design
Credits	4	0
%	100	0

Program Outcomes: ABET

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environ., social, political, ethical, health, safety, manufactured ability, sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global economical, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice