Course Information

Course Name Mechanical Vibrations

Course Number ENG ME 441

Semester Fall 2015

Course Description One- and multi-degree-of-freedom systems. Natural frequencies and modes of vibrations, resonance, beat phenomenon, effect of damping, applications to practical problems, and methods to avoid excessive vibrations. Lagrange's equations.

Learning Outcomes i. Become proficient in the modeling and analysis of one-dof-systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping. (A, E, L) ii. Become proficient in the modeling and analysis of multi-dof systems - Lagrange's equations, reduction to one-dof systems for proportionally damped systems, modal analysis, vibration absorbers, vibration transmission, Fourier transforms. Use of Matlab for matrix computations and Fourier analysis. (A, E, K, L)

Prerequisite ENG ME 302: Engineering Mechanics II

Required Course Materials *Mechanical Vibrations*, Fifth Edition, Singiresu S. Rao

Lectures Lectures are held in PHO 205 on Mondays and Wednesdays from 10:00 a.m.–12:00 p.m. You are strongly encouraged to ask questions during lecture and to offer answers to questions asked by the professor, even if you are not sure they are correct. Attendance will be taken at these lectures and used as one indicator of your level of effort. Ringers on cell phones should be turned off during lecture.

Discussion Section The discussion section will not be held.

Instructor Professor J. Gregory McDaniel

Instructor Email `jgm@bu.edu`

Instructor Office Location Room 406, fourth floor of 110 Cummington Mall

Instructor Phone 617.353.4847

Office Hours Wednesday 2 p.m.–4 p.m. or by appointment. To arrange an appointment, email at least two suggested times and a summary of your questions.

Course Average The numerical course average will be computed using the following distribution:

- Project: 10%
- Quiz Average: 30%
- Midterm Examination: 30%
- Final Examination: 30%

Course Grade The letter grade for the course will be determined from the following chart:

Course Average	Letter Grade
92.5–100	A
90–92.5	A-
87.5–90	B+
82.5–87.5	B
80–82.5	B-
77.5–80	C+
72.5–77.5	C
70–72.5	C-
60–70	D
50–60	F

Midterm Examination The midterm examination is scheduled for Wednesday, October 21, from 10:00 a.m. – 12:00 p.m.

Final Examination The final examination is not yet scheduled

Missed Examinations Here is the policy regarding a missed examination:

- If you know ahead of time that you will miss the examination, you must notify the instructor by email and describe your reason for missing the examination.
- If the instructor determines that the reason is appropriate, you will be given a makeup examination. If the instructor determines that the reason is not appropriate, you will receive a zero for that examination. The following reasons are not appropriate: oversleeping, working on an assignment for another course, travel for pleasure.
- If you do not know ahead of time that you will miss the examination, you must notify the instructor in writing as soon as possible after the examination and describe your reason for missing the examination.

Syllabus

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Course Number ENG ME 441

Semester Fall 2015

References in parentheses refer to *Mechanical Vibrations*, Singiresu Rao, Fifth Edition.

- Vibrational elements, problem classification (1.4–1.9)
- Harmonic motion (1.10–1.11)
- Free vibration of undamped single DOF systems (2.1-2.3)
- Stability, Rayleigh's Energy Method, stability (2.4–2.5)
- Free vibration of viscously damped SDOF systems (2.6)
- Free vibration of damped SDOF systems with Coulomb and hysteretic damping (2.7–2.8)
- Harmonically forced SDOF systems (3.1–3.5)
- Harmonic motion of the base, rotating unbalance (Sections 3.6–3.7)
- Forced vibrations of Coulomb-damped and hysteresis-damped SDOF systems, self-excited vibrations (sections 3.8–3.11)
- Periodically forced vibrations (4.2–4.3)
- Non-periodically forced vibrations (4.4–4.5)
- Response spectrum, Laplace transforms (4.6–4.7)
- Free vibration of 2 DOF systems (5.1–5.5)
- Forced vibration of 2 DOF systems (5.6–5.12)
- Vibration Control (9.1–9.12)
- Nonlinear vibration (13.1–13.12)