

EM423 Introduction to Mechanical Vibrations

**United States Naval Academy
Mechanical Engineering Department**

Catalog Description: EM423 Introduction to Mechanical Vibrations **Credit:** 3 (2-2-3)
Designation: Elective, major

The treatment of vibration fundamentals including free, damped and forced harmonic vibrations of linear single and multi-degree of freedom systems, modal analysis, continuous systems and a practical project.

Prerequisites: EM217 and EM232

Corequisites: None

Textbook:

Course Director: Prof. C.P. Ratcliffe

Course Content:

No.	Topic or Subtopic	hrs.
1	Introduction	1
2	Particle kinematics and coordinate systems	6
3	Particle relative motion	3
4	Equations of motion for particles	11
5	Kinematics of rigid bodies	5
6	Rigid body relative motion	3
7	Equations of motion for rigid bodies	10

Assessment Methods:

		YES	NO
A	Quizzes	X	
B	Homework	X	
C	Exams	X	
D	Laboratory Reports	X	
E	Oral Presentations	X	
F	Design Reports/Notebooks		X
G	Prototypes/Demonstrations		X
H	Projects	X	
I	Other		X

Course Outcomes¹

1. Analyze the free motion of simple continuous systems (A, B, C).
2. Analyze wave motion in strings, rods, shafts and beams (A, B, C, D).
3. Analyze the free and forced response of a single degree of freedom mechanical oscillator, and apply the work to real world engineering examples (A, B, C, D).
4. Analyze and design a tuned vibration absorber (A, B, C).

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5. Analyze discrete mass/spring systems and determine natural frequencies and mode shapes, both analytically and experimentally (A, B, C, D).
6. Work in groups (D, E, H).
7. Communicate effectively in both the written word and by oral presentation (D, E, H)

¹ Letters in parenthesis refer to the assessment methods listed in the previous section.

	Course Outcomes						
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)	X	X	X	X	X	X	X
(b)				X		X	X
(c)			X				X
(d)						X	X
(e)	X	X	X	X	X	X	X
(f)							X
(g)							X
(h)						X	
(i)						X	X
(j)			X				
(k)	X	X	X	X	X	X	X

Date of Latest Revision: 08 JUN 2010, Prof. C.P. Ratcliffe