<table>
<tr><td>COURSE NUMBER: Vm440</td><td>COURSE TITLE: Intermediate Dynamics</td></tr>
<tr><td>TERMS OFFERED: Summer</td><td>PREREQUISITES: Vm 240</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL:
“Fundamentals of Vibrations” by Leonard Meirovitch</td><td>INSTRUCTOR: Tim Gordon
DATE OF PREPARATION: July. 10, 2012
DATE OF UC APPROVAL:</td></tr>
<tr><td>INSTRUCTOR(S): Tim Gordon</td><td>SCIENCE/DESIGN: n/a</td></tr>
<tr><td>CATALOG DESCRIPTION:

Newton/Euler and Lagrangian formulations for three-dimensional motion of particles and rigid bodies. Linear free and forced responses of one and two degree of freedom systems and simple continuous systems. Applications to engineering systems involving vibration isolation, rotating imbalance and vibration absorption.</td><td>COURSE TOPICS:
1. Newton/Euler equations for a system of particles
2. Inertia properties and angular velocity of rigid bodies
3. Newton/Euler equations of motion of rigid bodies
4. Degrees-of-freedom and constraints
5. Kinetic energy, potential energy and virtual work
6. Lagranges equations for holonomic systems
7. Single degree-of-freedom response problem
8. Free response
9. Response to harmonic excitation
10. Base excitation, transmissibility, vibration isolation, rotating imbalance
11. Response to periodic excitation
12. Impulse response and response to arbitrary excitation
13. The two (or n) degree-of-freedom response problem
14. Free undamped response: the associated eigenvalue problem
15. Free and forced responses: solution by modal decomposition
16. Vibration absorbers
17. Second-order models: strings and rods
18. The associated eigenvalue problem: natural frequencies and vibration modes</td></tr>
<tr><td colspan="2">COURSE STRUCTURE/SCHEDULE: Lecture: twice per week, 90 minutes each.</td></tr>
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<tr><td>COURSE OBJECTIVES [Course Outcomes in brackets]</td><td>1. To extend prior learning by treating the three-dimensional motions of rigid bodies and the vibrations of two degree-of-freedom systems and simple continuous systems [1,5]
2. To formulate equations of motion using either Newton-Euler equations or Lagrange's equations [1,5]
3. To teach the mathematics to formulate, solve and interpret problems in dynamics/vibrations [1,5]
4. To demonstrate where dynamics/vibrations phenomena arise in the engineering disciplines [3,5, 10]</td></tr>
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COURSE OUTCOMES [Program Outcomes in brackets]	After completing Vm440, students should be able to: 1. Formulate the Newton/Euler equations of motion for systems of particles and rigid bodies in three-dimensions [a, e, k] 2. Identify constraints and degrees-of-freedom for dynamical systems [a, c, e, k] 3. Formulate the Lagrange equations of motion for particles and rigid bodies [a, e, k] 4. Formulate solutions for free vibration response [a, e] 5. Formulate solutions for forced vibration response due to harmonic, periodic and arbitrary excitation [a, d] 6. Formulate and interpret engineering problems involving vibration transmissibility, vibration isolation, and rotating imbalance 7. Understand eigensolutions and modal analysis [a, e, k] 8. Analyze two degree-of-freedom systems and vibration absorbers [b, e, k] 9. Analyze the vibration modes of strings and rods in extension and torsion [a, e, k] 10. Recognize vibration sources and response phenomena in real-world engineering systems [e, h, l]
ASSESSMENT TOOLS [Course Outcomes in brackets]	Regular homework problems [1-9] Midterm and final exam [1-9]