ME 440 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 440	**COURSE TITLE:** Intermediate Dynamics and Vibrations
REQUIRED COURSE OR ELECTIVE COURSE: Elective	**TERMS OFFERED:** Fall
TEXTBOOK / REQUIRED MATERIAL: D. J. Inman, Engineering Vibration	**PRE / CO-REQUISITES:** MECHENG 240. II (4 credits)
COGNIZANT FACULTY: K.-W. Wang	**COURSE TOPICS:**
BULLETIN 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.	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 16. Vibration absorbers 17. Second-order models: strings and rods 18. The associated eigenvalue problem: natural frequencies and vibration modes
COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 2 hours	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To extend prior learning (ME240) by treating the three-dimensional motions of rigid bodies and the vibrations of two degree-of-freedom systems and simple continuous systems [1] 2. To formulate equations of motion using either Newton-Euler equations or Lagrange's equations [1] 3. To teach the mathematics to formulate, solve and interpret problems in dynamics/vibrations [1, 2] 4. To demonstrate where dynamics/vibrations phenomena arise in the engineering disciplines [1, 2, 4]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Formulate the Newton/Euler equations of motion for systems of particles and rigid bodies in three-dimensions [1,5] 2. identify constraints and degrees-of-freedom for dynamical systems [1,5] 3. Formulate the Lagrange equations of motion for particles and rigid bodies [1,5] 4. Formulate solutions for free vibration response [1,3,5] 5. Formulate solutions for forced vibration response due to harmonic, periodic and arbitrary excitation [1,3,5] 6. Formulate and interpret engineering problems involving vibration transmissibility, vibration isolation, and rotating imbalance [1,3,5] 7. Understand eigensolutions and modal analysis [1,3,5] 8. Analyze two degree-of-freedom systems and vibration absorbers [1,3,5] 9. Analyze the vibration modes of strings and rods in extension and torsion [1,3,5]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework problems 2. Exam(s)

PREPARED BY: N. Perkins
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