COURSE MAP SAMPLE

UC San Diego

Module # and Title	Program Learning Outcomes	Learning Objectives	Instructional Materials	Activities: Learner Interaction & Engagement	Assessments and Rubrics
Module 1: Modeling and Analysis for Vibration Test (Weeks 1, 2, 3)	**5,10**	**After completing this module, students will be able to:** 1.1 Develop linear dynamic system models in spatial, modal, and frequency response domains. **(Program Learning Outcome 5)** 1.2 Perform eigenanalysis on linear dynamic system models to find modal properties. **(Program Learning Outcome 5,10)** 1.3 Apply modal effective mass fraction, modal assurance criteria, and model reduction techniques to select vibration test target modes and degrees of freedom. **(Program Learning Outcome 5,10)**	**Lecture Week 1:** multi DOF linear vibrations review; mass, stiffness, and damping matrices; time domain solution for multi DOF discrete linear systems **(Learning Objective 1.1)** **Lecture Week 2:** modal solution for multi-DOF discrete linear systems, Fourier analysis, frequency response function, comparison of spatial, modal, and response models **(Learning Objectives 1.1, 1.2)** **Lecture Week 3:** finite element method review, MATLAB modeling of test system including boundary conditions, DOF selection, model reduction techniques (dealing with unmeasured DOFs) **(Learning Objectives 1.1, 1.3)**	**Lab Week 1** MATLAB software review **(Review; just assessing basic MATLAB coding knowledge)** **Lab Week 2** Test structure modeling **(Learning Objectives 1.1, 1.2)** **Lab Week 3** Test structure modeling, DOF selection, model reduction **(Learning Objectives 1.2, 1.3)**	**Lab 0** • Ungraded pre-assessment **Lab 1** • Learning Objectives 1.1, 1.2 • Lab Rubric **Lab 2** • Learning Objectives 1.2, 1.3 • Lab Rubric **Exam 1:** vibrations and modal analysis • Learning Objectives 1.1, 1.2, 1.3 • Exam 1 Rubric
Module 2: Vibration Test Data Acquisition, Signal	**1,10**	**After completing this module, students will be able to:**	**Lecture Week 4:** basic DSP (discrete data, averaging, windowing, FFT), introduction to test hardware, piezoelectric accelerometers **(Learning Objectives 1.3, 2.1)**	**Lab Week 4** Introduction to experiments, introduce equipment, select instrumentation DOFs	**Lab 3**

Processing, and Data Quality (Weeks 4-8)		2.1 Execute a basic modal vibration test. **(Program Learning Outcomes 1,10)** 2.2 Apply basic signal processing techniques for assessing vibration test data quality. **(Program Learning Outcome 10)** 2.3 Estimate the frequency response function from measured vibration test data. **(Program Learning Outcomes 1,10)** 2.4 Apply basic frequency domain modal parameter estimation using rational fractional polynomial expansion technique. **(Program Learning Outcomes 10)**	**Lecture Week 5:** data acquisition basics, data quality, advanced DSP (FRF, spectra) **Lecture Week 6:** advanced DSP (FRF, spectra)**,** data quality **(Learning Objectives 2.1, 2.2, 2.3)** **Lecture Week 7 & 8:** experimental modal testing: excitation methods; data quality checks; modal parameter extraction **(Learning Objectives 2.3, 2.4)**	**(Learning Objectives 1.3, 2.1)** **Lab Week 5** Initial experimental test to verify boundary conditions **(Learning Objectives 2.1, 2.2)** **Lab Week 6** DSP exercises **(Learning Objectives 2.2, 2.3)** **Lab Week 7-8** Experimental modal testing: excitation methods; data quality checks; modal parameter extraction **(Learning Objective 2.4)**	• Learning Objectives 1.3, 2.1 • Lab Rubric **Lab 4** • Learning Objectives 2.1, 2.2 • Lab Rubric **Lab 5** • Learning Objectives 2.2, 2.3 • Lab Rubric **Lab 6 (2-week lab)** • Learning Objective 2.4 • Lab Rubric **EXAM 2:** DSP / Testing • (Learning Objectives 2.2, 2.3, 2.4) • Exam 2 Rubric

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Module 3: Model Updating and Optimization (Week 9-10)	**1,10,11**	**After completing this module, students will be able to:** 3.1 Define and MATLAB-code a constrained optimization problem for model updating based on modal parameters. **(Program Learning Outcomes 10,11)** 3.2 Perform basic sensitivity analysis on tunable model updating parameters. **(Program Learning Outcomes 1,10)** 3.3. Report comprehensive strategy for vibration plan, execution, and updating. **(Program Learning Outcomes 1,10,11)**	**Lecture Week 9 & 10:** model / test correlation and updating principles **(Learning Objectives 3.1, 3.2)**	**Lab Week 9-10** Model correlation; objective function formulation; updating/optimization **(Learning Objectives 3.1, 3.2)**	**Lab 7** Learning Objectives 3.1, 3.2 • Lab Rubric **Final Project ("Lab 8")** • Learning Objectives 3.3 • Final Project Rubric

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