THE DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

AA 312 STRUCTURAL VIBRATIONS

WINTER QUARTER

CREDITS AND CONTACT HOURS: 4 credits , Four 50-minute lectures per week.

COORDINATOR: K. Morgansen Assistant Professor of Aeronautics and Astronautics

TEXTBOOK: Engineering Vibration, Inman, Daniel J. 4rd Edition" Prentice Hall, Englewood Cliffs, New Jersey, 2013.

SUPPLEMENTAL MATERIAL: Last two chapters of ENGR 230 text - either Dynamics by Merriam, Kraige or Beers, Johnson

CATALOG DATA: STRUCTURAL VIBRATIONS Required - Vibration theory. Characteristics of single and multi-degree-of-freedom linear systems with forced inputs. Approximate methods for determining principal frequencies and mode shapes. Application to simple aeroelastic problems.
Prerequisites: ME 230 Offered: W.

PREREQUISITES BY TOPIC:
1) Sophomore level dynamics - ENGR 230 OR ME 230.
2) Vector analysis

OUTCOMES:
1) Students will know how to develop and solve single degree-of-freedom systems in free vibration.
2) Students will be able to solve single degree-of-freedom general forced vibration problems.
3) Students will be able to model analytically and numerically systems with multiple degrees-of-freedom.
4) Students will be able to model and compute vibration of continuous syste

RELATIONSHIP TO STUDENT OUTCOMES:
a) An ability to apply knowledge of mathematics, science, and engineering.
e) An ability to identify, formulate, and solve engineering problems.
k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

TOPICS:
1. Single-degree-of-freedom systems: modeling, free vibration of undamped and damped systems.
2. Forced vibration of single-degree-of-freedom systems subject to harmonic excitation: Laplace transform.
3. Forced vibration of single-degree-of-freedom systems subject to general dynamic excitation: convolution integral, integration method.
4. Multiple degree-of-freedom systems: lumped-parameter models, Lagrange's equations to lumped-parameter models.
5. Free vibration of multiple degree-of-freedom systems: normal frequencies and modes, Rayleigh method.

6. Eigenvalues and eigenvectors: matrix orthogonality, numerical computation.
7. Forced vibration of multiple degrees-of-freedom systems.
8. Distributed-parameter systems: modeling, longitudinal and torsional vibrations, transverse beam vibration, vibration of plates and membranes.