INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

OPEN ENDED EXPERIMENTS

Course Title	**AEROSPACE STRUCTURAL DYNAMICS**				
Course Code	AAEC35				
Program	B.Tech				
Semester	VII	AE			
Course Type	Core				
Regulation	UG-20	.			
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mr. K Arun Kumar, Assistant Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	Formulate mathematical models of problems in vibrations using Newton's second law or energy principles.
II	Determine a complete solution to the modelled mechanical vibration problems.
III	design a mechanical system that has desirable vibrational behavior.
IV	Assess the underlying assumptions in the aeroelastic analysis of fixed wing and rotary wing aerospace vehicles/systems.

COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the fundamental concepts of mechanical vibrations and justify their application in a variety of engineering design contexts	Apply
CO 1	**Analyze** Analytically and numerically predict the dynamic response of a single degree-of-freedom mass-spring-damper system with no force excitation, with harmonic force excitation, and with general force excitation.	Analyze
CO 2	**Compute** the natural frequency (or frequencies) of vibratory systems for determining the system's modal response.	Apply

CO 3	**Apply** theoretical and numerical procedures for predicting the dynamic response of continuous structural systems under the most diverse loading conditions.	Apply
CO 3	**Formulate** the static aeroelasticity problems such as typical section and wing divergence problems; for their selection in real world applications.	Apply

OPEN ENDED EXPERIMENTS / PROBLEMS / PROJECT IDEAS

S.No	TOPICS	CO's
1	Introduction to theory of vibration	CO 1
2	Equation of motion, free vibration	CO 1
3	Response to harmonic excitation,	CO 1
4	Response to an impulsive excitation	CO 1
5	Response to a step excitation,	CO 1
6	Response to periodic excitation (Fourier series)	CO 1
7	Response to a periodic excitation (Fourier transform),	
8	Laplace transform (Transfer Function).	CO 1
9	Equations of motion, free vibration,	CO 2
10	The Eigenvalue problem,	CO 2
11	response to an external applied load	CO 2
12	Damping effect;	CO 2
13	Multi degree of freedom systems,	CO 2
14	Modeling of continuous systems as using Newton's second law to derive equations of motion	CO 2
15	Influence coefficients - stiffness influence coefficients,	CO 2
16	Flexibility influence coefficients,	CO 2
17	Inertia influence coefficients;	CO 2
18	Potential and kinetic energy expressions in matrix form,	CO 3
19	generalized coordinates and generalized forces	CO 3
20	Lagrange's equations to derive equations of motion,	CO 3
21	equations of motion of undamped systems in matrix form	CO 3
22	Solution of the Eigenvalue problem, expansion theorem,	CO 3
23	unrestrained systems, free vibration of undamped systems	CO 3
24	Forced vibration of undamped systems using modal analysis,	CO 3
25	forced vibration of viscously damped systems	CO 3
26	Introduction to nonlinear vibrations, simple examples of nonlinear systems,	CO 4
27	Physical properties of nonlinear systems	CO 4
28	Solutions of the equation of motion of a single-degree-of-freedom nonlinear system nonlinear systems	CO 4

29	Solutions of the equation of motion of a multi-degree-of-freedom nonlinear systems	CO 4
30	Introduction to random vibrations;	CO 4
31	Classification of random processes,	CO 4
32	Probability distribution and density functions,	CO 4
33	description of the mean values in terms of the probability density function	CO 4
34	Properties of the autocorrelation function,	CO 5
35	Power spectral density function,	CO 5
36	Properties of the power spectral density function,	CO 5
37	White noise and narrow and large bandwidth,	CO 5
38	Single-degree-of-freedom response, response to a white noise	CO 5
39	Introduction, transverse vibration of a string or cable	CO 5
40	longitudinal vibration of a bar or rod	CO 5
41	torsional vibration of a bar or rod	CO 5
42	Lateral vibration of beams, the Rayleigh-Ritz method.	CO 5
43	Collar's aero elastic triangle, static aeroelasticity phenomena	CO 5
44	Dynamic aero elasticity phenomena, aero elastic problems at transonic speeds	CO 65
45	Aero elastic tailoring, active flutter suppression	CO 5
46	Effect of aero elasticity in flight vehicle design	CO 5

Course Coordinator: **HOD, AE**
Mr. K Arun Kumar, Assistant Professor