Department of Mechanical Engineering,
University College of Engineering Kakinada
Faculty Development Program
Advanced vibration analysis and its practical applications
(11^{th}-16^{th} Feb 2019)

Course Faculty: Dr. G. V. Rao, ACS Design Consulting Pvt Ltd, Bangalore

Pre-Requisites: (i) Theory on mechanical vibrations (ii) Probability Theory

Date	Time	Particulars
11^{th} Feb	10.00 am-12.30 pm	➢ Introductory lecture on vibration analysis and presentation of a few industrial requirements. ➢ Role of probability theory and random processes in dynamics and systems analysis.
	2.30 pm-5.00 pm	➢ Review of theory on mechanical vibrations / structural dynamics. i. SDOF systems ii. MDOF systems ➢ Practical vibration analysis using NISA FE software. ➢ Introductory examples on the use of probability theory in reliability studies and systems optimization.
		➢ Vibration analysis: time and frequency domain response computation using modal analysis.

12th Feb	10.00am-12.30 pm	➢ Eigen value extraction methods - illustrations via NISA FE software. ➢ Need for vibration analysis under atmospheric (environmental) loads which are inherently random, introduction to random processes. ➢ Important concepts of probability theory – random variables (RVs), descriptors of RVs and simulation of RVs.
	2.30 pm-5.00 pm	➢ Dynamic analysis using NISA Fe software of some large dimensional systems under deterministic inputs. ➢ MATLAB codes - Simulation of random variables &random processes. ➢ Introducing the random vibration analysis facility in NISA-FE software.
13th Feb	10.00am-12.30 pm	➢ Modeling of the atmospheric loads by random processes and applications in engineering. ➢ Categorization of random loads (processes)- illustration via Mat lab codes. ➢ Characterization of random loads (processes). i. Time domain – autocorrelation function. ii. Frequency domain – power spectral density.

	2.30 pm-5.00 pm	➢ Vibration analysis of SDOF systems. i. Time domain response (in terms of auto-correlation function). ii. Response computation via MATLAB code.
14th Feb	10.00 am-12.30pm	➢ Response analysis in frequency domain under random loads. ➢ Vibration analysis of SDOF systems. i. Frequency domain response (in terms of power spectral density).
14th Feb	2.30 pm-5.00 pm	➢ Vibration analysis of MDOF systems under random inputs Response computation via MATLAB code.
	10.00am-12.30 pm	➢ Important aspects in vibration analysis under random loads. ➢ Probability of failure and first passage (level crossing) problem (to find the probability that a critical level is crossed in (0-T) for the first time).

15th Feb	2.30 pm-5.00 pm	➢ Compute the probability of failure for a few systems via MATLAB code.
16th Feb	10.00 am-12.30 pm	➢ Fundamental concepts of reliability theory and a brief discussion on the methods – FORM and SORM. ➢ Computation of reliability for a few systems using MATLAB code.
	2.30 pm-5.00 pm	➢ A final review of the lecture series and an interactive session with participants.