Random vibrations & Failure Analysis - Web course

COURSE OUTLINE

Introduction, Fundamentals of probability theory: probability space, random variables, functions of random variables, Stochastic processes and random signals: stationarity, ergodicity, power spectrum, covariance functions, calculus of random processes, Linear single and multi degree of freedom structural systems: input-output relations, time domain and frequency domain analysis, linear and nonlinear systems, the fokker-Planck equation, Computational issues, Level crossing and first passage times, extreme value and peak distributions, Applications: random fatigue, probabilistic crack growth, risk analysis.

COURSE DETAIL

Lecture No.	Topic
	MODULE 1: Introduction, Probability Theory, Random variables
L1.	Introduction
L2.	Introduction to uncertainty
L3.	Introduction to Probability-I
L4.	Introduction to Probability -II
L5.	Introduction to Probability-III

NP-TEL

NPTEL

http://nptel.ac.in

Mechanical Engineering

Pre-requisites:

- Structural Dynamics & mechanical vibrations

Coordinators:

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L6.	Introduction to Probability- IV
L7.	Problem Set -1
L8.	Random variables - I
L9.	Random Variables - II
L10.	Functions of random variables-I
L11.	Functions of random variables -II
L12.	Monte Carlo Simulations of random variables
L13.	Problem Set -2
	MODULE 2: Stochastic Processes
L14.	Stochastic Processes-I
L15.	Stochastic Processes -II
L16.	Stochastic Processes - III
L17.	Stochastic Processes- IV
L18.	Problem Set - 3
L19.	Monte Carlo Simulations of Random Processes
	MODULE 3: Crossing statistics and failure probability

L20.	Crossings of stochastic process
L21.	Crossings of non-Gaussian random processes
L22.	Peak distributions of stochastic processes
L23.	Random Fatigue
	MODULE 4: Review of Linear Vibration Analysis
L24.	Review of Linear Vibrations - I
L25.	Review of Linear Vibrations - II
L26.	Review of linear vibrations - III
L27.	Review of linear vibrations- IV
	MODULE 5: Random vibrations
L28.	Random Vibrations of a sdof oscillator
L29.	Random Vibrations of higher order systems
L30.	Non-linear systems
L31.	Problem Set -4
	MODULE 6: Advanced topics
L32.	Karhunen-Loeve Expansions

L33.	Polynomial Chaos Representations
L34.	Markov Processes-I
L35.	Markov Processes-II
L36.	Fokker-Planck-Kolmogorov equation
L37.	Stochastic Calculus

References:

1. A. Papoulis (1997). Probability, random variables and stochastic processes, McGraw-Hill, NY.
2. Y.K. Lin (1967). Probabilistic theory of structural dynamics. McGraw-Hill, New York.
3. N.C. Nigam (1983). Introduction to random vibrations. MIT Press, Massachusetts.
4. L.D. Lutes, S. Sarkani (2004). Random vibrations: analysis of structural and mechanical systems, Elsevier.
5. J. Solnes (1997). Stochastic processes and random vibrations: Theory and practice. John Wiley & Sons, Chichester.