VIBRATION AND STRUCTURAL DYNAMICS

PROF.MIRA MITRA

Department of Aerospace Engineering

IIT Kharagpur

PRE-REQUISITES : Engineering Mechanics

INTENDED AUDIENCE : Aerospace Engineering students

INDUSTRIES APPLICABLE TO : Automobile, Aerospace, Infrastructure, Wind Turbine Industries

COURSE OUTLINE :

The course aims at imparting fundamentals of vibration and structural dynamics to senior undergraduate and graduate students. The course primarily consists of four modules, namely, single degree of freedom, multi-degree of freedom, continuous system, and analytical methods. The objective of the course is to deliver problem solving capabilities, both for industrial problems and academic research. The course will start from basics of vibrations and gradually deal with more complex problems.

ABOUT INSTRUCTOR :

Prof. Mira Mitra is currently Associate Professor in the Department of Aerospace Engineering, IIT Kharagpur. Prior to joining IIT Kharagpur, she was a faculty member in the Department of Aerospace Engineering, IIT Bombay, between 2007 to 2016. She obtained her PhD and Masters from IISc, Bangalore, both in Aerospace Engineering. She has authored more than 50 papers in International Journals and conferences. She is the recipient of INAE Young Engineering Award, DST-SERB Women Excellence Award, and IIT Bombay Hotch and Lala Excellence in Teaching Award.

COURSE PLAN :

Week 1: Introduction, Equation of motion, Single-Degree of Freedom (SDOF), Undamped and Damped, free vibration of SDOF

Week 2: Examples on free vibration, forced vibration, harmonic loading, Examples on harmonic Loading

Week 3: Response to arbitrary loading: Duhamel's integral, Impulse Loading

Week 4: Multi-degree of freedom (MDOF), Normal modes of vibration, natural frequencies and mode shapes

Week 5: Modal Superposition Theorem, Examples on MDOF

Week 6: Continuous system, Axial vibration in Rod, Natural frequencies & Mode Shapes, forced vibration of rods

Week 7: Flexural vibration in beam, natural frequencies and mode shapes, forced vibration of beams

Week 8: Hamilton's principle, Euler-Lagrange equation