

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5021W - Dynamics of Bridges

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: To provide students with understanding of: Sources of vibrations and how to estimate the levels of shaking during design, and Permissible levels of vibrations under different load actions.

Course Content: Vibrations Classification accelerations, displacements; Factors causing vibrations acceleration of vehicles; Special Features wind-induced, vehicle-induced, and pedestrian-induced vibrations; Earthquake-induced oscillations; Spectra wind; earthquake; wave Method of Analysis Linear static; nonlinear static; linear dynamic; nonlinear dynamic time history Permissible Levels Choice of limits acceleration or displacement & natural frequency limits; IRS, IRC and other International Standards; Research studies Aerodynamic Stability of Bridges Aerodynamic instability - vortex shedding, galloping, flutter, long span bridges during wind, Tuned mass dampers; cable dynamics Wind Tunnel Testing types; wind tunnel composition; scale models; requirements; procedures; use of results in structural design; analytical methods Applications Simply Supported Bridges single span and multi-span; Continuously Supported Bridges; Cable-Stayed Bridges, Suspension bridges Special Topics Vehicle-bridge interaction; Soil-Structure interaction; Pedestrian bridge vibrations; Linear and nonlinear seismic analysis; Multi support excitations; Base isolation; Bridge health monitoring; Vibration control applications.

Text Books: None

Reference Books

- Svensson, H., (2012), Cable-Stayed Bridges 40 Years of Experience Worldwide, Ernst & Sohn, ISBN-13: 978-3433029923
- Guerreiro, L.M.C., (2014), Bridge Aerodynamic Stability, <https://fenix.tecnico.ulisboa.pt/downloadFile/844820067124155/dissertacao.pdf>
- Cheng, S., (1999), Structural and Aerodynamic stability analysis of long-span cable-stayed bridges, https://www.collectionscanada.gc.ca/obj/s4/f2/dsk1/tape4/PQDD_0022/NQ52316.pdf
- Murakoshi.J., Fumoto, K., Ashizuka, K, Kiyota, R., and Miyazaki, M., Experimental Study on Aerodynamic Stability and Vibration Characteristics of Steel Two-Girder Bridges, <https://www.pwri.go.jp/eng/ujnr/joint/36/paper/31murako.pdf>
- Katsuchi, H., Yamada, H., Nishio, M., and Okazaki, Y, (2014), Improvement of Aerodynamic Stability of Simplified Suspension-Bridge Girder Structure, http://www.i-asem.org/publication_conf/acem14/1.WAS/M3A.3.MS523_733F.pdf

Prerequisite: NIL