IIT Mandi
Proposal for a New course

Course Number	:	CE611
Course Name	:	Structural Health Monitoring
Credits	:	3-0-0-3
Prerequisites	:	Strength of Materials and Structures - CE301 and Structural Dynamics with Application to Earthquake Engineering - CE511 or equivalent.
Intended for	:	UG and PG
Distribution	:	Discipline Elective (UG and PG)
Semester	:	Odd/Even

Preamble: The increasing complexity of the modern day civil infrastructure systems substantiates the need to maintain them within required safety and serviceability envelope. Assessment of the current health of the structure has thus emerged as an attractive field of research in the last few decades. Commonly structural health assessment is taken up as a category of inverse problems in which the information in the measured structural response is mapped back to the domain of physically understandable structural parameters through which the current health of the structural system can be estimated indirectly.

To achieve uninterrupted health monitoring, important structures are often equipped with a network of sensors to continuously collect the response data. Over the era, several developments in this field enriched the archive of available techniques for condition assessment of infrastructure systems. Of them, the phenomenological model based schemes, model independent approaches, Gradient/ Hessian based optimization algorithms and nature mimicking evolutionary algorithms are few to name. This course will take a tour of the chronological developments in this research area before introducing them to the cutting-edge techniques. The course is more application based and therefore will include a good amount of weightage on a group project.

Course Modules with Quantitative Lecture Hours:

Module 1 (4 Hours):
Introduction to SHM, brief history structural rehabilitation, Condition monitoring, Infrastructure management, Components of SHM, Sensors and Instrumentation, Measurement noise and precision

Module 2: (4 Hours)
Nondestructive evaluation based methods: Acoustic emission based, Ultrasonic testing, Eddy current based method, Radiographic imaging based

Module 3 (15 Hours):
Vibration based methods, basic procedures (Operational evaluation, data acquisition fusion and cleansing), feature extraction, feature discrimination, Modal information based approaches: Model independent methods, Frequency based (forward and inverse), Mode shape and modal curvature based methods, Modal information based approaches: Model dependent methods, Direct matrix update, Parameter optimization, soft computing based methods

Module 4 (4 Hours):