

# Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

**AY 2023-24**

## Course Information

<b>Programme</b>	M. Tech. Applied Mechanics
<b>Class, Semester</b>	First Year M. Tech, Sem II
<b>Course Code</b>	7OE502
<b>Course Name</b>	Structural Health Monitoring
<b>Desired Requisites:</b>	

Teaching Scheme		Examination Scheme (Marks)			
<b>Lecture</b>	3 Hrs/week	<b>MSE</b>	<b>ISE</b>	<b>ESE</b>	<b>Total</b>
<b>Tutorial</b>	--	30	20	50	100
<b>Credits: 3</b>					

## Course Objectives

<b>1</b>	To examine the use of low-cost, long term monitoring systems to keep civil infrastructure under constant surveillance, ensuring structural integrity.
<b>2</b>	To develop sustainable maintenance and rehabilitation schemes for structures.
<b>3</b>	To assess the civil infrastructure using structural health monitoring systems after disaster.

## Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

<b>CO1</b>	<b>Demonstrate</b> the knowledge of SHM for various components of structures.	Applying
<b>CO2</b>	<b>Evaluate</b> various techniques for SHM of structures	Evaluating
<b>CO3</b>	<b>Design</b> various SHM techniques for various structures.	Creating

Module	Module Contents	Hours
I	<b>Introduction to Structural Health Monitoring (SHM)</b> Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.	7
II	<b>Application of SHM systems</b> Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.	7
III	<b>Non Destructive Testing of Concrete Structures</b> Introduction to NDT - Situations and contexts, where NDT is needed, classification of NDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra Red thermography, ground penetrating radar, radio isotope gauges, other methods.	7
IV	<b>Condition Survey &amp; NDE of Concrete Structure</b> Definition and objective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, quality control of concrete structures - Definition and need, Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies of a few NDT procedures on concrete structures.	6
V	<b>Rehabilitation and Retrofitting of Concrete Structure</b> Repair rehabilitation & retrofitting of structures, damage assessment of concrete structures, Materials and methods for repairs and rehabilitation, modeling of repaired composite structure, structural analysis and design -	6

	Importance of re-analysis, execution of rehabilitation strategy, Case studies.	
VI	<b>Damage Detection of Composite Structures</b> Introduction to composites and their applications in structural Industry. Learning from failures. Various kinds of damage detection techniques. Repair & rehabilitation & retrofitting of composite structures, damage assessment of composite structures, Case studies.	6
<b>Textbooks</b>		
1	Daniel Balageas, Claus - Peter Fritzenmayer, Alfredo Guemes, Structural Health monitoring, Published by ISTE Ltd., U.K. 2006	
2	Guide Book on Non-destructive Testing of Concrete Structures, Training course series No.17, International Atomic Energy Agency, Vienna, 2002.	
<b>References</b>		
1	Hand book on "Repair and Rehabilitation of RCC Buildings", Published by Director General, CPWD, Govt. of India, 2002.	
2	Hand Book on Seismic Retrofitting of Buildings, Published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.	
<b>Useful Links</b>		
1	<a href="https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm07/">https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm07/</a>	
2	<a href="https://onlinecourses.nptel.ac.in/noc20_mm07/preview">https://onlinecourses.nptel.ac.in/noc20_mm07/preview</a>	
3	<a href="https://nptel.ac.in/courses/105/108/105108141/">https://nptel.ac.in/courses/105/108/105108141/</a>	
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<b>CO-PO Mapping</b>						
	<b>Programme Outcomes (PO)</b>					
	1	2	3	4	5	6
<b>CO1</b>	1		3	2		
<b>CO2</b>		2				
<b>CO3</b>			2	2	2	3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High  
Each CO of the course must map to at least one PO.

<b>Assessment</b>
<p>The assessment is based on MSE, ISE, and ESE.</p> <p>MSE shall be typically on modules 1 to 3.</p> <p>ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.</p> <p>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.</p> <p>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).</p>