



# SILVER OAK UNIVERSITY

## Engineering and Technology (M.Tech.)

Civil Engineering (Computer Aided Structural Analysis & Design)

Subject Name: Structural Health Monitoring

Subject Code:

Semester: II

**Prerequisite:** Concrete technology, Analysis & Design of reinforced concrete structures, Repairs & rehabilitation of structures

**Objective:** Recent structural failures and the increased deterioration of the civil infrastructure, calls for the technology that can help to preserve structural integrity thereby assuring the public safety. Structural Health Monitoring (SHM) is one such technology that helps to assess the in-service performance of the structures located in earthquake zones or remote areas, using a variety of measurement techniques. SHM plays a predominant role in catering to the need of monitoring of innovative designs and materials & better management of existing structures. The proper diagnosis through SHM helps to suggest the most appropriate retrofitting techniques to localize damages at their first occurrence.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Evaluation Scheme				Total Marks
L	T	P	C	Internal		External		
				Th	Pr	Th	Pr	
3	0	2	4	40	20	60	30	150

### Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	<b>Structural Assessment&amp; Need for retrofitting:</b> Introduction to health assessment of structures, structural damages & failures, Principles of structural assessment, Classification & levels of assessment, Current scenario of infrastructure through case studies	12	20
2	<b>Introduction to SHM:</b> Introduction to global infrastructure crisis, Definition & Motivation for SHM, SHM versus Non-destructive evaluation, Concept of smart materials & smart structures with SHM, SHM & biomimetics, System components & categories of SHM, Classification of SHM systems, Methodologies and monitoring principles, Local & global Techniques for SHM, Advantages of SHM	13	40

3	<b>Monitoring techniques of SHM:</b> Static field testing: Behavior tests, Diagnostic tests, Proof tests, Sensors & sensing technology for Structural monitoring, Structural responses Dynamic Field Testing: Stress history tests, Ambient vibration tests, Dynamic Load Allowance tests, Pull back (anchored cable tests) Periodic Monitoring: Field testing, tests to determine changes in structure Continuous monitoring: Active & Passive Monitoring.	14	40

### Course Outcome:

The learner will be able to analyse different indeterminate structures using Matrix methods.

Sr. No.	CO statement	Unit No
CO-1	Diagnose the distress and the cause of distress in the structure	1
CO-2	Detect the changes in the characteristics of the structure	2
CO-3	Assess the remaining performance capacity	3

### List of Experiments/Tutorials:

1. To determine change in dynamic response of material due to damage : Steel
2. To determine change in dynamic response of material due to damage : Concrete
3. Damage detection using Acoustics/Ultrasonic wave propagation
4. Mapping of reinforcement details of given reinforced concrete element
5. Comparison of core test with destructive testing

### Major Equipment:

1. Vibration analyzer with sensors
2. Concrete Core cutter
3. Cover meter and rebar locator
4. USPV tester
5. Acoustic tester
6. Reinforced member casting facility
7. Load frame for testing elements

### Books Recommended:-

- Structural Health Monitoring, Daniel Balageas, Peter Fritzen, Alfredo Guemes, John Wiley & Sons, 2006. Health Monitoring of Structural Materials and Components\_Methods with Applications, Douglas E
- Adams, John Wiley and Sons, 2007. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan,
- Taylor and Francis Group, London, UK, 2006. Structural Health Monitoring with Wafer Active Sensors, Victor Giurgutiu, Academic Press Inc,

**List of Open Source Software/learning website:**

1. <https://research.csiro.au/data61/structural-health-monitoring>
2. <https://beanair.com/conditioning-monitoring-system.html>
3. <https://www.hindawi.com/journals/ace/2010/724962/>
4. [https://www.ndt.net/events/NDTCanada2014/app/content/Slides/40\\_Tamutus.pdf](https://www.ndt.net/events/NDTCanada2014/app/content/Slides/40_Tamutus.pdf)
5. [https://cpwd.gov.in/Units/FinalDraftHandbook\\_Apr2007.pdf](https://cpwd.gov.in/Units/FinalDraftHandbook_Apr2007.pdf)