

Sankalchand Patel University
Faculty of Engineering and Technology
First Year Master of Technology in Civil Engineering
(Computer Aided Structural Analysis and Design)
In Effect from Academic Year 2023-24

Branch Name:	Civil Engineering (Computer Aided Structural Analysis & Design)
Semester/Year:	Semester II / First Year
Subject Title:	Structural Health Monitoring through IOT (Elective-II)
Subject Code:	2ET2100204T
Pre-requisite:	Repair and Rehabilitation of Structures, Structure Design, Failure of Concrete structures

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	0	4	24	60	16	40	00	00	00	00	100

Course Objective:

1. To understand the structural health monitoring for structures.
2. To understand the conditional assessment & techniques for strengthening and retrofitting of structures.
3. To understand the suitable methods

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Introduction of Structural Health Monitoring Need of Structural Health Monitoring, Definition & Concept of SHM, SHM & Biomimetic Comparison of SHM with NDT, Types & Components of SHM, Procedure of SHM, Objectives & Operational Evaluations of SHM, Advantages of SHM.	07	25	
2	Instrumentations & Sensors for SHM Basics of Instrumentations & Measurements, Classifications, Input-Output Configurations of Instruments, Static & Dynamic Characteristics, Functions. Various Types of Electromechanical, Electronics & Digital Instruments for SHM. Data Acquisition Systems-Types, Hardware & its Components. Basics of Sensors, Transducers & Actuators, Classification of Sensors, Characteristics & Working Principles of Various Types of Sensors like Strain Gauges, LVDT, Accelerometers etc. Concept of Smart Materials & Smart Structures with SHM, Basics of Smart Materials like Piezoelectric, Shape Memory Alloys, ER & MR Fluids etc.	09	25	
3	Methods of SHM Methodologies and Monitoring Principles, Local & Global Techniques for SHM, Static & Dynamic Field Testing, Short & Long-Term Monitoring, Active & Passive Monitoring. Vibration Based SHM Techniques - Use & Demonstration of Dynamic Properties of Structures for Damage Detection & SHM, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Wave Propagation Based Techniques, Fibre Optics Based Techniques, Remote & Wireless SHM Techniques, IoT Application in SHM, Artificial Intelligence & Machine Learning in SHM.	12	30	
4	Structural Audit Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.	8	20	

Term-Work:

1. Minimum 15 problems from above topics.



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Course Outcome:

After learning the course, the students should be able to:

1. Understand characteristics of earthquake and its effect on structures, Skill Development
2. Estimate lateral forces acting on symmetric as well as asymmetric buildings, Skill Development
3. Find mode shapes and natural frequency, Skill Development
4. Carry out seismic response analysis of a structure, Skill Development
5. Design and detail to enhance ductility, Employability
6. Understand various seismic response control strategies, Employability
7. Design earthquake resistant masonry structures. Employability

Reference Books

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components_Methods with Applications,
3. Douglas E Adams, John Wiley and Sons, 2007.
4. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
5. Structural Health Monitoring with Wafer Active Sensors, Victor Giurgutiu, Academic Press Inc, 2007

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand characteristics of earthquake and its effect on structures,	L-1 and L-2
CLO2	Estimate lateral forces acting on symmetric as well as asymmetric buildings,	L-3 L-4 and L-5
CLO3	Find mode shapes and natural frequency,	L-5
CL04	Carry out seismic response analysis of a structure.	L-4 and L-5
CL05	Design and detail to enhance ductility,	L-4 L-5 and L6
CL06	Understand various seismic response control strategies,	L-1 and L-2
CL07	Design earthquake resistant masonry structures.	L-4 and L-5

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CLO1	M	M		M		M	M		M			M	M		M
CLO2	M	M	M	M		M			M			M	M		M
CLO3	M	M	M	M	H	M		M	M			H	M	H	M
CL04	M	M	M	M	H	M		M				M	M	M	M
CL05	M	M	M	M	H	M		M				M	M	M	M
CL06	M	M		M		M		M	M			H	M	H	M
CL07	M	M	M	M	H	M		M				M	M	M	M

H: High, M: Medium, L: Low