

COURSE PLAN

Fr. CRCE (Mechanical)

Academic year: 2022-23

Fr. Conceicao Rodrigues College of Engineering

Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50

Department of Mechanical Engineering

B.E. (Mechanical) (Semester VIII) (2022-2023)

Course Plan

Subject: Smart Materials (SM) (MEDLO8052)

Credits – 03

Syllabus Mechanical Engineering

Module	Contents	Hrs
01	Introduction to Smart Materials: Overview of the different types of Smart Materials, Smart materials used in structures, smart material for sensors, actuators controls, memory and energy storage and their interrelationships, concept of High bandwidth- low strain generating materials (HBLS), and Low Bandwidth High Strain Generating Materials (LBHS), Nano Composite Materials	07
02	Important Concepts of Smart Materials: artificial skins, artificial muscles, biomimetic materials, materials with tuneable responses, nonlinear properties, self-healing materials, adaptive structures, self-replicating materials/structures, self-assembly, inch worm devices, hysteresis, integrated sensing and actuation	08
03	Overview of the following materials with focus on synthesis, constitutive/governing relationships, strengths and weaknesses, and applications (both sensing and actuation etc) 1. Piezoelectric Materials 2. Magneto strictive Materials 3. Shape Memory Alloys 4. Electroactive Polymers	06
04	Overview of the following materials with focus on synthesis, strengths and weaknesses, and applications 1. Ferrofluids and Magneto rheological Fluids and applications in dampers 2. Soft Matter and its applications as smart skins, smart textiles etc 3. Carbon Nanotubes and Carbon nanostructures and its applications 4. Thermoelectric Materials and Peltier devices	06
05	Smart Materials for Energy Applications: Materials used for energy storage, Hydrogen Storage Materials, Energy harvesting, Energy scavenging from vibrations	06
06	Manufacturing techniques for smart materials: micromanufacturing, high resolution lithography, LIGA process, Generative manufacturing processes such as STL, SLS, SPB, BPM, LOM, SGC, FDM, BIS, BPM, Self-assembly process, Ion beam processes	06

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Co No.	Course Outcomes
CO1	Classify and select different types of smart materials
CO2	Comprehend Important Concepts and principles of Smart Materials
CO3	Synthesis, sensing and actuation of Piezoelectric Materials, Magneto strictive Materials, Shape Memory Alloys, Electroactive Polymers
CO4	Synthesis, sensing and actuation of Ferrofluids and Magneto rheological Fluids, Soft Matter, Carbon Nanotubes and Carbon nanostructures, Thermoelectric Materials
CO5	Classify and select Smart Materials for Energy Applications: Materials used for energy storage
CO6	Classify and select Composite Materials, Nano Composite Materials

CO-PO Mapping

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2	3											
CO3	3											
CO4	3											
CO5		2										
CO6		2										

CO-PSO Mapping

CO-PSO Mapping	PSO1	PSO2
CO1		3
CO2		2
CO3	3	
CO4	3	
CO5		3
CO6		3

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Target = 2 for all COs

FINAL CO	=	(0.8* Direct) + (0.2* Indirect)
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Direct	CO1	(0.7*Test) +(0.3*Univ Exam)
	CO2	(0.7*Test) +(0.3*Univ Exam)
	CO3	(0.7*Test) +(0.3*Univ Exam)
	CO4	(0.7*Test) +(0.3*Univ Exam)
	CO5	(0.7*Test) +(0.3*Univ Exam)
	CO6	(0.7*Test) +(0.3*Univ Exam)

Indirect	CO1	(1*Exit Survey)
	CO2	(1*Exit Survey)
	CO3	(1*Exit Survey)
	CO4	(1*Exit Survey)
	CO5	(1*Exit Survey)
	CO6	(1*Exit Survey)

LESSON PLAN

*Note: - Content beyond syllabus (CBS) is in **bold***

Tentative Weekly Plan	Topic	Module
Week 1 (09/01/23 – 15/01/23)	Introduction to Smart Materials: Overview of the different types of Smart Materials, Smart materials used in structures	1
Week 2 (16/01/23 – 22/01/23)	Smart material for sensors, actuators controls, memory and energy storage and their interrelationships, concept of High bandwidth- low strain generating materials (HBLS), and Low Bandwidth High Strain Generating Materials (LBHS)	1
Week 3 (23/01/23 – 27/01/23)	Nano Composite Materials, Important Concepts of Smart Materials: artificial skins, artificial muscles	1, 3
Week 4 (30/01/23 – 03/02/23)	Overview of the following materials with focus on synthesis, constitutive/governing relationships, strengths and weaknesses, and applications (both sensing and actuation etc), Piezoelectric Materials,	3

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	Magneto strictive Materials	
Week 5 (06/02/23 – 10/02/23)	Overview of the following materials with focus on synthesis, constitutive/governing relationships, strengths and weaknesses, and applications (both sensing and actuation etc), Shape Memory Alloys, Electroactive Polymers	3
Week 6 (13/02/23 – 17/02/23)	Smart Materials for Energy Applications: Materials used for energy storage, Hydrogen Storage Materials	5
Week 7 (20/02/23 – 24/02/23)	Energy harvesting, Energy scavenging from vibrations	5
Week 8 (27/02/23 – 03/03/23)	UNIT TEST – 1	
Week 9 (06/03/23 – 10/03/23)	Important Concepts of Smart Materials: artificial skins, artificial muscles	2
Week 10 (13/03/23 – 17/03/23)	Biomimetic materials, materials with tuneable responses, nonlinear properties, self-healing materials, adaptive structures, self-replicating materials/structures	2
Week 11 (20/03/23 – 24/03/23)	Self-assembly, inch worm devices, hysteresis, integrated sensing and actuation	2
Week 12 (27/03/23 – 31/03/23)	Overview of the following materials with focus on synthesis, strengths and weaknesses, and applications, Ferrofluids and Magneto rheological Fluids and applications in dampers, Soft Matter and its applications as smart skins, smart textiles etc	4
Week 13 (03/04/23 – 07/04/23)	Overview of the following materials with focus on synthesis, strengths and weaknesses, and applications, Carbon Nanotubes and Carbon nanostructures and its applications, Thermoelectric Materials and Peltier devices	4
Week 14 (10/04/23 – 14/04/23)	Manufacturing techniques for smart materials: micromanufacturing, high resolution lithography, LIGA process, Generative manufacturing processes such as STL, SLS, SPB, BPM, LOM, SGC, FDM, BIS, BPM, Self-assembly process, Ion beam processes	6
Week 15 (17/04/23 – 21/04/23)	UNIT TEST – 2 TERM END	