



VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF PHYSICS
Open elective Course
SMART MATERIALS AND APPLICATIONS

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
02 : 0 : 0	02	40	90 min	60	3hours	U190E310PH

Course Objectives	Course Outcomes
<p>The student will be able to</p> <ol style="list-style-type: none"> 1. grasp the concepts of piezo and ferro electric materials 2. Learn fundamentals of pyro and thermo electric materials 3. gain knowledge on shape memory alloys 4. acquire fundamental knowledge on chromic materials 	<p>At the end of the course, the student should at least be able:</p> <ol style="list-style-type: none"> 1. summarize various properties and applications of piezo and ferro electric materials 2. apply fundamental principles of pyro and thermo electricity in relevant fields of engineering 3. acquaint with various types of shape memory alloys and their properties and applications 4. appreciate the importance of chromic materials in engineering field.

UNIT I: PIEZO AND FERRO MATERIALS (8 hours)

Piezo electric effect and inverse piezoelectric effect, Piezo electric materials, Structure of Quartz crystal, Piezoelectric oscillator, Magnetostriction, Magnetostriction oscillator, piezo-electric sensors, applications of Piezo-electric materials.
Characteristics and properties of ferro-electric materials, Structure of Barium Titanate, Curie-Weiss law, applications of Ferro electric materials

UNIT II: PYRO AND THERMO-ELECTRIC MATERIALS (6 hours)

Pyroelectricity: pyro electric effect, pyro electric materials, pyro-electric sensors.
Thermoelectricity: thermoelectric effect, Seebeck effect, Peltier effect, thermoelectric sensor, Properties and applications of thermoelectric materials, thermoelectric generator and Thermoelectric cooler.

UNIT III: SHAPE MEMORY MATERIALS (8 hours)

Introduction to shape memory alloys (SMA)- Shape Memory Effect (SME) different phases of Shape memory alloys, Austenite, Martensite, Properties and characteristics of engineering SMAs, Super elasticity, one and two way shape memory effects, Properties of Ni-Ti shape memory alloy, Cu-based shape memory alloys, biomedical Materials, Advantages, disadvantages of SMAs, Applications of SMAs.

UNIT-IV: CHROMIC MATERIALS (6 hours)

Electro-chromaticity, Electro-chromic materials, Electro-chromic sensors and devices.
Photo-chromaticity, Photo-chromic materials, Photo-chromic sensors and devices.
Thermo-chromaticity, thermo-chromic materials, thermo-chromic sensors and devices.
Smart fluids: Magneto-rheological and Electro-rheological fluids.

Learning Resources:

1. K. Otsuka and C M Wayman, Shape memory materials, Cambridge university press, 1998.
2. T W Duerig, K N Melton, D Stockel, C M Wayman, Engineering aspects of shape memory alloys, Butterworth-Heinemann, 1990
3. A.K. Sawhney, A Course in Electronic Measurements and Instrumentation, Dhanpat Rai & Sons, 2015
4. D. Patranabis, Sensors and Transducers, PHI Learning Pvt. Ltd., 2013

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