



**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	U23OE310PH
CIE	Assignments (02)	Quizzes (02)		Internal Exams(02)		Total CIE Marks
Ave. Marks	05	05		30		40

Course Objectives	Course Outcomes	BTL
<b>The student will be able to</b>	<b>the student should at least be able:</b>	
1. grasp the concepts of piezo and ferro electric materials	1. summarize various properties and applications of piezo and ferro electric materials	2
2. Learn fundamentals of pyro and thermo electric materials	2. apply fundamental principles of pyro and thermo electricity in relevant fields of engineering	3
3. gain knowledge on shape memory alloys	3. Explain types of shape memory alloys and their properties and applications	3
4. acquire fundamental knowledge on chromic materials	4. Outline the importance of chromic materials in engineering fields.	2

**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, 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 detector.

**Thermoelectricity.** thermoelectric effect, Seebeck effect, Peltier effect, thermocouple, Principle and working of thermoelectric generator and Thermoelectric cooler, applications of thermoelectric materials

**UNIT III: SHAPE MEMORY MATERIALS (8 hours)**

Introduction to shape memory alloys (SMA)- Shape Memory Effect (SME), Austenite, Martensite phases, Properties and characteristics SMAs, one-way and two way shape memory effects, Properties of Ni-Ti shape memory alloy, Cu-based shape memory alloys, and their applications, Applications of SMAs.

**UNIT-IV: (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

<b>Prof. D Karuna Sagar</b>	<b>Prof. M. Srinivas</b>	<b>Prof. S. Srinath</b>	<b>Dr. S.V. Manorama</b>	<b>Prof. A.S. Sai Prasad</b>
O.U Nominee & Chairman, BoS (Physics)	Head, Dept. of Physics, OU	Subject Expert, Univ. of Hyderabad	Principle scientist, IICT, Hyderabad	Head & BOS chairman, Dept of Physics, VCE

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