

Course Structure

Course Code : SM7302

Course Title : Advanced Smart Materials

Credit Hours : 3

Course Description

advanced and smart materials, Study of the structure, processing and performance of advanced and smart materials, Piezoelectric materials, Shape memory materials, Shape memory alloys, Smart Membrane Materials and Systems, Smart Ceramic Materials and Systems, Smart sensors and Micro electro-mechanical systems, Smart biomaterials, Smart and nano-materials.

Course Objectives

The course aims to introduce the students to the basic concepts of advanced and smart materials. It discusses the fundamental aspects of structure and properties of smart materials used in different engineering applications. The design of advanced and smart materials and how they are tailored to suit a particular engineering application is discussed in detail. The main types of advanced and smart materials are introduced with particular emphasis on the applications related to control systems and energy management.

Course Topics

- Introduction to advanced and smart materials, their structure and properties.
- Study of the structure, processing and performance of advanced and smart materials.
- Piezoelectric materials; their structure and properties.
- Applications of piezoelectric materials for sensors and actuators.
- Shape memory materials; their classification, their structure and properties.
- Shape memory alloys; their structure properties and selected applications.
- 7th week Exam.
- Shape memory polymers; their structure properties and selected applications.
- Smart Membrane Materials and Systems and their applications.
- Smart Ceramic Materials and Systems and their applications.
- Smart sensors and Micro electro-mechanical systems (MEMS) and applications.
- 12th week Exam

- Smart biomaterials properties and selected applications.
- Smart and nano-materials for energy applications.
- Revision
- Final Exam

References

- Wang, Z.L. and Kang, Z.C., Functional and Smart Materials: Structural Evolution and Structure Analysis, Springer, 1998.
- Schwartz, M., Smart Materials, CRC Press, 2008.

M.Sc. in Smart Control Systems for Energy Management

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- Yanauchi, K. and Ohkata, I., Shape Memory and Superelastic alloys: Applications and Technologies, Woodhead Pub., 2011.
- Lagoudas, D.C., Shape Memory Alloys: Modeling and Engineering Applications, Springer, 2010.
- Vijay, K., Varadan K., Vinoy J. Gopalakrisham S.: Smart Material Systems and MEMS: Design and Development Methodologies, Willey 2006.