ME 689 Smart Materials: Modelling and Applications (3-0-0-6)

Introduction to Smart Materials, what makes them smart, types; Piezoelectric material: derivation of constitutive laws from energy principle and its application as actuator, sensor, and energy harvester; Thermally and Magnetically activated Shape memory alloy: constitutive modelling using phenomenological and thermodynamic approaches, its applications as actuator, sensor, energy dissipater, and stent like biomedical items; Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles; Properties of Magnetostrictive materials and Optical Fibre.

Textbooks:

[1] Mel M. Schwartz, Smart Materials, CRC Press, 2009.

[2] Donald J. Leo, Engineering analysis of smart material systems, John Wiley & Sons, 2007.

References:

[1] Jiashi Yang, Analysis of piezoelectric devices, World Scientific, 2006.

[2] Ralph C. Smith, Smart material systems: model development, siam, 2005.

[3] Vijay K. Varadan, Smart material systems and MEMS: design and development methodologies, John Wiley & Sons, 2006.

[4] Seung- Bok Choi & Young-Min Han, Piezoelectric actuators: control applications of smart materials, CRC Press - 2010.

[5] Antonio Arnau, Piezoelectric transducers and applications, Springer, 2004.

[6] Dimitris C. Lagoudas, Shape Memory Alloys: Modelling and Engineering Applications, Springer, 2008.

[7] T. Yoneyama & S. Mayazaki, Shape memory alloys for biomedical applications, CRC Press, 2009.

[8] Kwang J. Kim & S. Tadokoro, Electroactive polymers for robotics applications: artificial muscles and sensors, Springer, 2007.