

Magneto-electric Composites for Smart Sensors and Signal Processing Devices: April 2- 7, 2018^{*} , IIT Bombay

Overview

This course will focus on materials with coexisting ferromagnetic and ferroelectric properties. Such materials are of immense interest for applications in advanced technologies due to the ability to control the magnetic and/or electrical properties with either a magnetic or an electric field. Single-phase materials exhibiting such properties are rare and often show weak coupling between magnetic and electric subsystems. Engineered multiferroic composites of ferromagnetic/ferromagnetic and ferroelectric phases, however, show very strong magneto-electric (ME) coupling and have attracted considerable interests for basic studies and applications. The ME coupling in the composites is mediated by mechanical forces, i.e., mechanical deformation of ferromagnetic phase in a magnetic field leading to charge generation (or electrical) response in the composite due to piezoelectric effect. With appropriate choice of the two phases it is possible to achieve strong ME coupling over a desired frequency ranging from a few mHz to hundreds of GHz. Pico Tesla sensitivity has been reported for such composite magnetic sensors. These systems could also be voltage tuned, at a low 10 V for thin films and 100 V for thick film composites. Nanocomposites, in particular, are predicted to show very significant enhancement in coupling strength compared to bulk or layered composites.

The major course objectives are to learn fundamentals as well as state-of-the art on Theory of magneto-electric phenomena, applications in sensors and smart devices, advanced techniques in processing, characterization and property evaluation. The course is aimed at providing the audience the necessary knowledge base in this new field with the ultimate goal of training a generation of scientists and engineers capable of furthering the field and improve our basic understanding of the ME phenomena. New thoughts on applications for sensors, biomedical imaging, energy harvesting, microwave and millimeter devices, and information storage are also expected to emerge from this targeted course.

**Course lectures/tutorials/lab sessions run from 2-6 April 2018. A test will be conducted for credits on 7 April, 2018*

Modules	A: ME composites, sensors and microwave devices Number of participants for the course will be limited to fifty. (max 20 for QIP)
You Should Attend If...	<ul style="list-style-type: none"> ▪ you are a physicist or materials scientist interested in the basic theory and properties of magneto-electric composites. ▪ you are an electrical engineer interested in voltage tunable ferrite devices for use in the microwave and millimeter wave frequencies. ▪ You are a mechanical or automotive engineer interested in speed, current and magnetic field sensors.
Fees	<p>The participation fee per individual registering for the course is as follows:</p> <p>Participants from abroad : US \$500 Industry/ Research Organizations: Rs 20000 Academic Institutions/ Faculty/ NGO: Rs.8000 Students: Rs. 3000</p> <p>The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges and free internet facility. The participants will be provided with accommodation on payment basis.</p>

The Faculty



Gopalan Srinivasan is a Distinguished Professor of Physics at Oakland University. His research interests are multiferroics, magnetoelectrics, spin wave, ferromagnetic resonance, sensors, and microwave and millimeter wave devices.



Ajit Kulkarni is an IIT Bombay Institute Chair Professor in the department of Metallurgical Engineering and Materials Science. His research interests are Lead free ceramics and piezoelectrics: Bulk, nanostructured and thin films, Impedance spectroscopy for material characterization, Solid electrolyte for sensor and battery (glass, glass-ceramics, polymers and gels), Synthesis-Structure-Property correlation in materials.



N. Venkataramani is a Professor in the department of Metallurgical Engineering and Materials Science, IIT Bombay. His research interests are Ferrimagnetics- bulk and thin film, Electronic materials, magnetoelectric composites, Structure property correlations in nanocrystalline systems

In addition, few topical lectures from subject experts will also be a part of this course.

Course Co-ordinator

Prof. N. Venkataramani

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Course details on : <http://www.cep.iitb.ac.in/>

<http://www.qip.iitb.ac.in/>

GIAN Short Term Course on
Magneto-electric Composites for
Smart Sensors and Signal Processing
Devices

April 2- 7, 2018*, IIT Bombay

Registration Form

Name(in block letters): _____

Qualification: _____

Designation: _____

Organization: _____

Mailing Address: _____

Mobile: _____

Fax: _____

Email: _____

Payment: Rs: _____

IIT Guest House/ Hostel accommodation required (will be provided as per availability and on a payment basis): YES / NO(Please contact the course co-ordinator for the availability details).

Signature of Applicant: _____

Date:

**Classes :2-6 April; Test (for credit): 7 April*

Venue for Classes

Classes will be held in the Seminar Hall of MEMS Department, IIT Bombay.

Venues for tutorials/labs and test will be announced.

Lecture Notes

To fully realize the objectives of the course, the lecture notes will be made available at the time of registration at IIT Bombay.

Date & Time of Registration:

2 April, 2018, 9.00 AM at MEMS Department, IIT Bombay.

COURSE FEE

Participants from abroad: US \$500/-

Industry/ Research Organizations: INR: 20000/-

Academic Institutions/ Faculty/ NGO: INR: 8000/-

Students & Research Scholars:INR: 3000/-

The above fees include all instructional materials, computer use for tutorials and assignments, laboratory usage charges, free internet facility.

Subject to availability, the participants will be provided with accommodation on payment basis. This payment will be made separately by the participant at the accommodation venue.

The course fees have been paid by (Please tick appropriate option)

(i) Logging in at

<https://portal.iitb.ac.in/ceqipapp>.

You will have to create a login ID, look up this course and fill up a registration form.

After approval of the faculty co-ordinator, you can pay the fees.

OR

(ii) Demand draft drawn in favour of "**The Registrar, IIT Bombay - CEP Account**". **If payment is by DD, please furnish the following details:**

(iii) DD No.: _____ Dt: _____

All completed registration forms with bank transaction details may be mailed to:

Prof.N.Venkataramani,
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IIT Powai, Mumbai 400076