

# Biosensing Principles and Technologies

A course under Global Initiative of Academic Networks (GIAN)

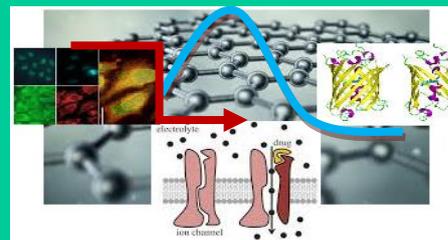
(22 June- 02 July, 2016)

## Overview

Biosensor comprises a hybrid system that integrates a natural bio-recognition element (cell, enzyme, antibody) within an artificial sensor. They offer the simplified biochemical monitoring of complex molecules, e.g. for bioprocessing and as *in vivo* metabolite sensors. However their reliability and effectiveness for biochemical monitoring is strongly influenced by materials and surface functionalities. This course will focus practical issues that have improved monitoring reliability and its linkage to more fundamental drivers of materials biocompatibility. Underpinning techniques and technologies include: polymeric membranes, electrochemistry, fibre-optics, impedance spectroscopy, surface plasmon spectroscopy, patch-clamp technique, contact angle measurements and piezoelectric sensing and actuation. The course will focus on a variety of biosensor technologies aimed at detecting a wide array of bio-molecules and biological agents. Current sensor-related technologies include miniaturized, PCR-based biosensors, as well as a surface plasmon resonance (SPR)-based biosensors. While the PCR-based sensor is primarily aimed at detecting microbial pathogens, the SPR-based sensor is ideally designed for the detection of biological molecules, including protein and DNA.

In addition to biosensor fabrication, the course will also cover the electronic and microfluidic control systems that can automate sensor functions. Such self-contained units provide for on-board power, processing, temperature control, microfluidic control, and optical detection and can be exploited for the testing and integration of microfluidics-based biosensors.

It is expected that participants will get ample scope to learn and update knowledge through their active participation in the lectures, discussions/demonstrations and suitable hands-on experiments. Also assignments and case studies will be conducted to stimulate research motivation of participants.



## Course objectives

- Exposing participants to the fundamentals of biosensing principles and technologies.
- Preparing participants to build a career in bioinspired materials and devices.
- Capacity building amongst the participants in the application of biosensing tools and techniques.
- Making aware of latest principles and techniques of nano-biosensors
- Enriching scientific temper in the field of biosensing, bioimaging for clinical applications.
- Updating participants with the advanced techniques wrt microfluidics and totally integrated optical biosensors.
- Orienting participants towards research and development activities on biocompatibility, biospecificity, bio-functionality and toxicology aspects of nano-biosensors.

## Themes

- Amperometric and potentiometric biosensors and transducers
- Surface acoustic wave and surface plasmon resonance based biosensors
- Fiber optic enzyme sensors and thermistors
- Quantum dot-bioconjugates for imaging and signaling
- Biosensors based on calorimetric and cobrimetry principles
- Advanced bioimaging through nonlinear spectroscopy and optical tweezing techniques
- Molecular motors, transducers and actuators

## The Faculty



Prof. Pankaj Vadgama is currently Director of the Interdisciplinary Research Centre in Biomedical Materials within the School of Engineering and Materials Science, Queen Mary, University of London and was recently Professor of Clinical Biochemistry and Head of Service in the Department of Clinical Biochemistry, Barts Health NHS Trust. Professor Vadgama's research interests include the development of biocompatible biosensors for reliable metabolite monitoring in critically ill patients. Specific systems include sensors for glucose and lactate. He is also investigating the interaction of cells and proteins at materials surfaces, including spider silk as a tissue engineering scaffold. His particular interest is in the materials aspects of biosensors where he has developed permselective, biocompatible and biomimetic polymeric membranes for stable transduction in whole blood and tissue. Both *in vivo* and *in vitro* work has been undertaken, including the use of miniaturized devices for glucose and lactate monitoring, immunosensing and interrogation of tissue-material interactions. Current research work of Prof. Vadgama includes interfacial problems relating to sensor/biomaterial contact with the biomatrix, and the generalisable insights that may emerge from this.



Prof. Ashok Kumar is a Professor in the Department of Physics, Tezpur University. His primary research interest are in electroactive conducting polymers and polymer electrolytes. He has extensively worked on developing conducting polymer based nanostructures and nanocomposites using soft template, rapid mixing and interfacial polymerization techniques for their applications as actuators, chemical and biosensors and antioxidant materials. Prof. Kumar has published more than 120 research papers and has guided 14 doctoral students. He has visited UK under commonwealth fellowship programme and several other countries including USA, Germany, Australia, Italy and Singapore for academic and research purposes.



Dr. Dambarudhar Mohanta is an Associate Professor in the Department of Physics, Tezpur University. His primary research interest includes development of quantum dots and nanorods of semiconductor and rare earth systems for optoelectronic and light harvesting applications. He also works in nanobio interface applications, such as, bioimaging, ion channels, biomembranes etc. Dr. Mohanta has published more than 95 research papers and has supervised 05 doctoral theses. He has handled various projects and visited University of Wisconsin-Madison and Harvard, USA during 2007-08 and 2012-13, through Boyscast and Indo-US fellowship programmes, respectively.

### **Course Coordinator**

Prof. Ashok Kumar, Department of Physics  
Tezpur University, Napaam-784028, Tezpur, Assam, INDIA  
Phone: (+91)-3712-275553, 09954449469 (M)  
E-mail: [ask@tezu.ernet.in](mailto:ask@tezu.ernet.in)

### **Course Co-coordinator**

Dr. D. Mohanta, Department of Physics  
Tezpur University, Napaam-784028, Tezpur, Assam, INDIA  
Phone: (+91)-3712-275558, 08876507550 (M)  
E-mail: [best@tezu.ernet.in](mailto:best@tezu.ernet.in)

<b>Modules</b>	<b>Duration</b> : June 22 – July 02, 2016 <b>Place/Venue</b> : Tezpur University, Sonitpur, Assam, India <b>Number of participants for the course will be limited to 50.</b>
<b>You should attend if...</b>	<ul style="list-style-type: none"> <li>✓ You are a research scholar and interested in graduate school/postdoctoral training in biosensors.</li> <li>✓ You are a student or faculty from an academic/research institution dealing with biosensors related topics.</li> <li>✓ You are from an industry/research organization and interested in learning about latest biosensing principles and technologies.</li> </ul>
<b>Fees</b>	<p>The participation fees for taking the course is as follows:</p> <p>Participants from abroad : US \$500  Industry/ Research Organizations: INR 10000/-  Academic Institutions:</p> <ul style="list-style-type: none"> <li>➤ Faculty/staffs: INR 4000/-</li> <li>➤ Research scholars: INR 2500/-</li> <li>➤ PG Students: 1000/-</li> </ul> <p>The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 h internet facility. The participants will be provided with accommodation on payment basis in the University Guest House (current official rate is Rs.500/- per day for single occupancy; Rs.400/- per day for double occupancy and Rs.300/- per day in the dormitory of the guest house) and outstation research scholars/PG students will be accommodated in the University hostels (current official rate is Rs. 150/- per day with bed roll).</p>



**Travel Information:** The university campus is about 15 km east of Tezpur town which is located on the northern bank of mighty river Brahmaputra. Tezpur is the district headquarters of Sonitpur District of Assam, and is also known as cultural capital of Assam. It is well connected with Guwahati/Dispur, the capital city of Assam, which is about 200 km from Tezpur. Guwahati, the gate way to the Northeast India is well connected through major airlines and good trains with the rest of the country. Tezpur is connected with Kolkata by Air India flights thrice a week on Tuesday, Thursday and Saturday. Private buses and ASTC buses ply frequently from Guwahati ISBT to Tezpur. Tezpur (Dekargaon) is also connected by rail through the Dekargaon-Rangapara-Kamakhya route. However, preferred mode to reach Tezpur from Guwahati is by road.



**Registration:** Interested participants should register first with the GIAN website (<http://www.gian.iitkgp.ac.in>) for a one-time registration fees of INR 500 which will enable them to enrol for any number of courses being offered. Subsequent registration for this course will have to be done with Tezpur University by the **SHORTLISTED CANDIDATES AFTER GETTING CONFIRMATION E-MAILS FROM THE COURSE COORDINATOR**. They need to pay the requisite fees and fill up the Registration Form attached with this brochure. Duly filled in registration form can be sent to the coordinator both by online and offline modes.

**REGISTRATION CUM ACCOMMODATION REQUEST FORM**

(To be submitted by the **SHORTLISTED CANDIDATES ONLY AFTER GETTING CONFIRMATION E-MAILS FROM THE COURSE COORDINATOR**. This form should reach electronically by April 30, 2016 and hard copy by May 10, 2016)

**INTERNATIONAL WORKSHOP (GIAN) ON  
BIOSENSING PRINCIPLES AND TECHNOLOGIES**

June 22- July 02, 2016

Department of Physics, Tezpur University  
Tezpur, Assam

Name (BLOCK LETTERS): ..... M/F:.....

Designation/ Professional Title: .....

Affiliation/Organization:.....

Address: .....

.....

.....

Tel.: ..... Mobile: .....

E-mail: .....

\*GIAN Registration ID: .....

Accommodation Required (Yes/No): .....

Single Accommodation (Yes/No) : .....

Double Accommodation (Yes/No).....

The Registration fee of Rupees .....has been paid via

Demand Draft No.....in favour of the Registrar, Tezpur

University/through SBI online/offline banking bearing Transaction No. ....

to SBI Tezpur Main Branch (RTGS/IFSC code: SBIN0000195, Bank MICR Code: 784002002) A/C

No. 30448821505 of Tezpur University. Demand Draft/Fee Receipt has been enclosed herewith.

Date:

Signature

---

\*To be generated through registration on the GIAN website <http://www.gian.iitkgp.ac.in>