



MHRD – GIAN  
Global Initiative for  
Academic Network



Indian Institute of  
Technology Delhi  
Centre for Biomedical  
Engineering

# NANOMATERIALS FOR BIOLOGICAL APPLICATIONS

## GIAN Certificate Course

**12 – 16 MARCH 2019**

### OVERVIEW

This course will focus on the study of the structure, properties, and processing of extremely small ( $10^{-9}$  m) synthetic and biological materials. At this scale, macroscopic mechanical properties are intimately related to the molecular and atomic structure. The course begins with a series of introductory lectures in nanomechanics that outline the characterization of physical properties at the atomic scale. This includes the forces acting at the atomic scale, friction, adhesion, elasticity, fracture, thermal and electrical conductivity, and molecular interactions.

Experimental methods used to investigate and measure the properties of nanomaterials will also be covered. The course then details the fabrication and processing of nanomaterials for biological applications. Various processing techniques used to manufacture nanomaterials such as nanotubes, nanowires, and nanospheres will be covered. The final section of the course covers the application of nanomaterials to biomedical engineering, medical devices, biosensors, biotechnology and bioenergy applications.

## OBJECTIVES

This course will focus on the study of the structure, properties, and processing of extremely small ( $10^{-9}$  m) synthetic and biological materials. At the end of the course, the student will understand the following:

- understand the general physics and chemistry of nanomaterials
- understand processing techniques for nanomaterials – both chemical and physical approaches
- understand the important biological applications and properties of nanomaterials

# TEACHING FACULTY

(Foreign Faculty should teach minimum 60% of the total course)

1. Prof. Ketul C. Popat (KCP) : 10 hrs lectures and 7 hrs tutorials
2. Prof. Neetu Singh (NS): 4 hrs lectures and 2 hrs tutorials

There will be a site visit for ~ 4 hrs where both faculty will be involved.

<b>MODULES</b>	<p style="text-align: center;"><b>Nanomaterials For Biological Applications:</b></p> <p>March 12th-March 16th, 2019 at Indian Institute of Technology (IIT) Delhi</p> <p><b>Contents:</b></p> <p>Introduction to nanomaterials, surfaces of nanomaterials; Characterization of nanomaterials; Mechanical properties of nanomaterials; Demonstration of simple techniques for fabrication of nanomaterials; Electrical properties of nanomaterials; Carbon based nanomaterials; Nanotubes, nanorods, nanoparticles for biomedical applications; Nanobiology – cues in nature; Nanosensors in medical application; Discussion on the working principle of various characterization techniques for biomedical nanomaterial; Characterization of nanomaterials (contact angle, microscopy); Nanocoatings for medical devices; Nanomedicine and drug delivery; Demonstration of examples for cell-material interaction on nanomaterials; Molecular nanomachines; Societal impact of nanomaterials; Demonstration of examples (Example 2) for cell-material interaction on nanomaterials.</p>
<b>WHO CAN ATTEND</b>	<ol style="list-style-type: none"><li>1. Executives, engineers and researchers from manufacturing, service and government organizations including R&amp;D laboratories.</li><li>2. Student students at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic institutions and technical institutions.</li></ol> <p style="text-align: center;">Number of participants for the course will be limited to fifty.</p>

**REGISTRATION  
PROCEDURE**

**Step 1:** GIAN Web Portal Registration: Register in the GIAN portal <http://www.gian.iitkgp.ac.in/GREGN/index.>, by paying Rs. 500/- online. Registration to this portal is one time affair and will be valid for lifetime of GIAN. Please note that Course fee is separate.

**Step 2:** Course Registration: Login to the GIAN portal with the registered User ID and Password. Choose for the Course registration option. Select the course titled “**Nanomaterials For Biological Applications**” from the list and click the “Save” option. Confirm your registration by clicking the suitable option. Last date for the registration of this course is **February 28th, 2019**.

**Step 3: Course Shortlisting:** Candidates will be intimated through email regarding their selection.

**Step 4: Course Fee Remittance:** Once you receive the intimation from the Course Coordinator, the fee (as applicable) need to be paid. The participation fees for taking the course is as follows:

Students from other Academic Institutes: Rs. 5,000

Faculty from other Academic Institute: Rs. 10,000

Professionals from Industry/ Research Organizations: Rs. 15,000

Participants from abroad: US \$250

The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges. The participants will be provided with accommodation on payment basis.

The details of fee payment by Electronic Clearing Service/ RTGS in the name of “IITD CEP ACCOUNT”:

Bank Name	State Bank of India
Branch Name & Address	IIT Delhi, Hauz Khas, New Delhi – 110016
IFS Code	SBIN0001077
MICR Code	110002156
Type of Account	Saving Account
Bank Account No.	36819334799
SWIFT Code	SBININBB547
IITD PAN No.	AAATI0393L

**Step 5:** Send Registration details, by providing details of the bank transaction. Send the registration form to the Course coordinator at [sneetu@iitd.ac.in](mailto:sneetu@iitd.ac.in) before **February 28th, 2019**.

# FACULTY

## PROF NEETU SINGH

Prof Neetu Singh is an Assistant Professor in the Center for Biomedical Engineering (CBME), IIT-Delhi. She is currently working on systematic probing into nanomaterials biological activity and formulates “design rules” for developing biosystem for specific bio-medical & technological applications. She joined as faculty in the Polymer Sciences and Engineering Division at the National Chemical Laboratory (NCL), Pune in 2012. Her work is published in very high impact journals and also gathered a lot of attention and featured in Faculty of 1000 Prime (identifies top research in biology and medicine) and several other science media outlets. Her important scientific contribution in developing strategies for managing cancer got her the Kiran Shaw-Mazumdar International Oncology Fellowship, for establishing cancer-based-research ties with MIT, USA. She is also a recipient of the “Innovative Young Biotechnologist award 2013” by DBT, India. More details can be found at:



<http://cbme.iitd.ac.in/content/dr-neetu-singh>,  
<http://www.mrnbl.org/dr-neetu-singh>

## PROF KETUL C. POPAT

Dr. Popat is an Associate Professor in the Department of Mechanical Engineering/School of Biomedical Engineering at Colorado State University. His primary research areas of interest are biomaterials, tissue engineering and regenerative medicine. Prior to joining CSU, he was a Research Specialist in the Department of Physiology at University of California, San Francisco. He has authored over 70 peer-reviewed publications in journals such as Langmuir, Biomaterials, Journal of Orthopedic Research, Journal of Biomedical Materials Research, etc. and has an h-index of 30. He has also presented his work at numerous national and international level conferences. More details can be found at:



<https://www.engr.colostate.edu/me/dr-ketul-popat/>

### COURSE CO-ORDINATOR

**Prof Neetu Singh**  
**Phone: +91 11 2659 1422**  
**E-mail: sneetu@iitd.ac.in**