



# EMERGING BIOPHOTONICS SOLUTIONS FOR DISEASE DIAGNOSIS

Department of Biotechnology,  
Motilal Nehru National Institute of Technology Allahabad  
Prayagraj, Uttar Pradesh – 211004 (India)

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## Course Overview

Biophotonics is a rapidly emerging interdisciplinary field which interfaces and bridges disciplines such as physics, chemistry, biology, medicine and engineering. The exploration of life with light (bio + photonics) enables examination and manipulation of biological systems on the subcellular, cellular, multicellular (tissue) and organ level. Fluorescence microscopy, in particular, has revolutionized the cellular imaging landscape by introducing targeted reporters and genetically encoded fluorescent proteins. Nevertheless, the addition of dye has the following implications: (a) it perturbs the native cell structure and function; (b) dyes are susceptible to photobleaching, and; (c) spectral interference due to cross-talk among multiple dye molecules adversely affect the imaging results. In light of the latest technological advancements, label-free chemical imaging has acquired substantial traction for visualizing the distribution of molecules in live cells driven primarily by its exquisite molecular specificity and ability to perform measurements in a minimally invasive and non-perturbative manner. Recently, these techniques have drawn considerable attention in clinical diagnostics due to the promise of reagent-free, multiplexed and objective determination as well as the ability to gain molecular insights into the specific pathology.

The aim of this course is to introduce optical spectroscopy and imaging-based technologies to a general audience and the impact that our enhanced understanding of disease states using these technologies have made in modern clinical practice. The course will teach advanced methods and applications of label-free modalities namely Raman, IR, and quantitative phase imaging in disease diagnosis including cancers and blood disorders. As representative examples, the participants will be introduced to the potential of spectroscopy-based approaches in monitoring blood analytes including glucose and glycated hemoglobin. Further, the course will also emphasize developing and deploying low-cost spectroscopy and imaging-based label-free device for disease diagnosis in the Indian context. This course will discuss both the potential benefits and possible skepticism surrounding the biophotonics technologies, especially in their clinical translation.

## Objectives

- ❖ Introducing participants to fundamentals of spectroscopy and optical imaging
- ❖ Describe the underlying principles and instrumentation of Raman microspectroscopy, infra-red imaging and quantitative phase imaging
- ❖ Providing exposure of current and emerging biophotonics technologies for biomedical and clinical applications.
- ❖ Evaluate biophotonics approaches for disease diagnosis, margin assessment and treatment of complex multifactorial disease states.
- ❖ Deliberate low cost spectroscopy solutions for disease diagnosis and therapeutic monitoring in the Indian context
- ❖ Highlight the regulatory aspects of laser-based photonic technologies in view of its clinical translation

## Course Modules

Introduction to Biophotonics, Fundamentals of Optical Imaging, Infra-red Microspectroscopy, Quantitative Phase Imaging, Raman Spectroscopy-based Chemical Imaging, Recent Trends in Raman Microspectroscopy, Chemical Imaging in Cancer Diagnostics, Label-free Spectroscopy in Biomarker Identification and Bioanalyte monitoring, Biophotonics from Optical Bench to Clinical Bedside : Challenges and Opportunities.

## Registration Fee

Foreign Participants	\$300
Industry/Research Organizations	Rs. 5,000/-
Academic Institutions (Faculty)	Rs. 3,000/-
Academic Institutions (Student/Research Scholar)	Rs. 1,000/-

- ❖ The above fee includes all instructional materials, computer use for tutorials & assignments (if any).
- ❖ Minimum 90% attendance necessary to be eligible for certificate of participation/attendance.
- ❖ Appearing for evaluations/examinations during the course is necessary for certificate of grades in the course.
- ❖ Accommodation in the campus can be provided subject to availability. The accommodation will be on payment and 'first come first served' basis

**Last date for registration: 31<sup>st</sup> March, 2019.**

## Who can attend

The course is designed for participants from various backgrounds including students, researchers, faculty and scientists working in the field of biotechnology, spectroscopy, biochemistry, imaging, bio-instrumentation, biomedical sciences, biomedical engineering, physicians doing research with an emphasis on new emerging technologies, professionals working in the pharmaceutical industry, and PhD students undertaking courses in any of the above areas. The course offers an excellent introduction for professionals not familiar with the concept of spectroscopy, imaging and will provide a deeper understanding of underlying concepts and instrumentation.

### How to apply:

One-Time GIAN Registration: Please visit <http://www.gian.iitkgp.ac.in/GREGN/> and register by paying Rs. 500/- (those who have already been paid, need not pay again). Then proceed for course registration on GIAN website.

## Teaching Faculty

**Dr. Rishikesh Pandey** is currently an Assistant Professor at Connecticut Children's Innovation Center, University of Connecticut (UConn) School of Medicine, Farmington, Connecticut USA. Prior to joining UConn, he performed his postdoctoral work at Massachusetts Institute of Technology, Cambridge, USA. He earned his Ph.D. from Indian Institute of Science, Bangalore. Dr. Pandey's current research centers on the development and deployment of cutting-edge and transformative label-free biophotonics technologies with the goal of disease detection at early, manageable stages, and guiding interventions. A principal thrust in his current research is focused in the area of pediatric hematology-oncology where he is developing a label-free and rapid multi-modal optical imaging tool to provide biomolecular and morphological insights thereby improving diagnostic and prognostic decisions. Dr. Pandey's research work has been published in top-notch journals including Nature Scientific Reports, ACS Photonics, Analytical Chemistry, and Journal of Biophotonics. Dr. Pandey was selected for IMPACT fellowship by the MIT Innovation Initiative and awards for his research contributions includes Tony B. Academic Travel award and as a Finalist for the Federation of Analytical Chemistry and Spectroscopy Innovation Award. He has delivered several invited lectures including keynote and webinars such as prestigious MIT's Modern and Optics Spectroscopy (MOS) seminar.



## Host Faculty and Principal Coordinator



**Dr. Shivesh Sharma** is presently working as a Professor, Department of Biotechnology at Motilal Nehru National Institute of Technology (MNNIT) Allahabad, Uttar Pradesh, India. His research interests include environmental biotechnology, plant-microbe interactions, PGPR and analyzing the effects of nanomaterials on plant growth and promotion/plant physiology, role of nanomaterials in countering biotic and abiotic stress in plants and development of nano-based bioformulations. His teaching interest includes Microbiology, Environment Biotechnology, Food Technology and IPR. He has published number of research papers, supervised many post graduate and doctoral students and executed projects sponsored by various govt. funding agencies viz., DBT, CSIR, UGC and MHRD.

## Coordinator

**Dr. Durgesh Kumar Tripathi** is presently an Assistant Professor at Amity Institute of Organic Agriculture, Amity University, Noida, Uttar Pradesh, India. His research interests include nanomaterial-plant interactions and their effect on plant physiology along with their effects in combating biotic and abiotic stress in plants. Further his interests include localization and tracking of nanomaterials in plants.



## Contact

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### Local GIAN Coordinator:

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Bank Details

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Account number: 718400301000348

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