

About the Foreign Speaker

Partha P. Banerjee is Professor and Director of Electro-Optics Program and Professor of Electrical and Computer Engineering at the University of Dayton, USA. He was Chair of the ECE department at the University of Dayton from 2000-2005. Prior to that, he was at the University of Alabama in Huntsville from 1991-2000, and at Syracuse University from 1984-1991. He received his B.Tech. in Electronics and Electrical Communication Engineering from the Indian Institute of Technology, Kharagpur in 1979 and his M.S. and Ph.D. from the University of Iowa in 1980 and 1983, respectively. His areas of research interest are digital holography, metamaterials, nonlinear optics, photorefractives, and acousto-optics. He has authored/co-authored 5 textbooks, 10 book chapters, over 120 refereed journal articles, and over 150 conference papers/presentations. He was general co-chair of OSA's Digital Holography topical meeting in 2010, and is topical editor of Applied Optics. He is a Fellow of OSA, SPIE and IoP, and is a senior member of IEEE. He received the NSF Presidential Young Investigator Award in 1987.

About the Indian Speaker

Naveen K. Nishchal is a professor in the Department of Physics at the Indian Institute of Technology (IIT) Patna. He joined IIT Patna in Dec. 2008. Prof. Nishchal received his PhD degree in physics from IIT Delhi in 2005. He joined Instruments Research and Development Establishment, Dehradun under DRDO as a Scientist 'C' in July 2004 and worked until June 2007. Subsequently, he moved to IIT Guwahati and worked as an assistant professor in the department of physics from June 2007 to Nov. 2008. He has been a visiting researcher to the Oulu Southern Institute, University of Oulu, Finland. His research interests include optical information processing, image encryption, watermarking, digital holography, interferometry, correlation-based optical pattern recognition, and fractional Fourier transform-based signal processing. Prof. Nishchal is a senior member of OPTICA and SPIE. He is a life member of the Optical Society of India, Indian Science Congress Association, and Lasers and Spectroscopy Society of India. He has authored a book titled *Optical Cryptosystems* published by IoP Pubs., UK in 2019. He has authored or co-authored 78 peer-reviewed international journal papers, two book chapters, and 200 papers in various conferences/seminars/symposia. He is an associate editor of the journal Optical Engineering, SPIE.

Course Coordinator

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Department of Physics

The Department of Physics at IIT Patna was established and started its activity in August 2008 to train undergraduate engineering students. In July 2009, the department started Ph.D. program in various frontier fields of Physics. M.Tech. in Nanoscience and Nanotechnology had been running in the department from July 2012 till July 2019. The department is offering 2 year M.Sc. program in physics from July 2016 and 4 year B.Tech. in Engineering Physics from July 2021. The department is committed to engage in high-quality research and pursuit of excellence in teaching. The faculty members of the department are actively involved in research and development activities in challenging areas of both theory and experiment. Currently, the main research emphasis of the department comprises optics, condensed matter physics, quantum physics, biophysics, atomic & molecular physics, and high-energy physics.

Global Initiative of Academic Network (GIAN) Workshop

on Digital and Dynamic Holography with Applications

December 12 (Monday) to
December 17 (Saturday) 2022
(5 days)

Organized by
Naveen K. Nishchal



Department of Physics
Indian Institute of Technology
Patna, Bihta, Patna Bihar, INDIA

Indian Institute of Technology Patna is one of the new IITs established by an Act of the Indian Parliament on August 06, 2008.

Patna which was known as Patliputra has been a center of knowledge since long has been attracting visitors and scholars from many parts of the world such as China, Indonesia, Japan, Korea, Sri Lanka, among others. This has been a land of visionaries. Some of the legends from this region include Lord Gautam Buddha, Lord Mahavir, Guru Gobind Singh, the famous astronomer Aryabhata and the first President of India, Dr. Rajendra Prasad.

IIT Patna has ten departments: These are Computer Science & Engineering, Electrical Engineering, Mechanical Engineering, Chemical and Biochemical Engineering, Civil & Environmental Engineering, Materials Science & Engineering, Chemistry, Physics, Mathematics and Humanities & Social Science departments. IIT Patna campus is located at Bihta which is approximately 40 kms from Patna.

The Institute has developed modern facilities that are fully equipped with the state-of-the-art facilities (equipment software and machines) that are routinely used to train and educate students in the B.Tech., M.Sc, M.Tech., and PhD. Programs.

Overview of the Course

The discovery of holography in the mid-1900s has opened the door to the recording and reconstruction of three-dimensional (3D) objects. While analog holography required the use of a recording medium such as a photographic film and optical reconstruction of the hologram, the advent of digital recording using charge-coupled device (CCD) arrays facilitated easier recording and numerical reconstruction, thereby ushering in a new area of holography. Digital and analog holography, along with its many variations, viz., holographic interferometry, holographic microscopy, multi-wavelength digital holography, phase-shifting holography, compressive holography, coherence holography, etc., have now become the methods of choice for numerous metrological applications in 3D imaging.

In this course, the basic principles of analog and digital holography and the various topics mentioned above will be discussed with selected applications to real-world problems. Other related topics such as dynamic holography using photorefractive materials and the use of non-Bragg orders for phase-shifting holography, holographic tomography, nonlinear holography etc. will also be explained, as well as a non-holographic technique for 3D visualization, viz., transport of intensity. Finally, interested readers will also be introduced to contemporary topics in the area, viz., nonlinear holography, holographic TV, and digital holography for 3D information security and recognition applications.

Objective of the Course

The objectives of the course are as follows:

- Exposing participants to the fundamentals of analog and digital holography and requisite mathematical background for recording and reconstruction.
- Familiarizing participants to the fundamentals of recording media for conventional and dynamic holography, including photorefractive physics and two-and multi-wave coupling.
- Providing essential background of holographic interferometry, holographic microscopy, multi-wavelength digital holography, phase-shifting holography, compressive holography, coherence holography, and transport of intensity.
- Exposing participants to practical problems utilizing digital and dynamic holography using examples that have been developed in our laboratory over the last ten years and encouraging participants to use the background acquired for other novel applications.

Who can attend?

- Executives, Engineers, and Researchers from Manufacturing, Service and Government Organizations including R&D Laboratories.
- Students at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic and technical institutions.

Course fees

- Participants from Abroad : USD300
- Industry: INR 7,500
- Faculty from Academic Institutions: INR 5,000
- Individual Researchers/Students in India : INR 2,500

Registration

Registration Link:-

<http://www.gian.iitkgp.ac.in/GREGN/index>

Lecture Schedule

| Day | Date | Topic |
|-----|-------------|--|
| 1 | 12 Dec 2022 | <ul style="list-style-type: none"> Introduction, Mathematical preliminaries, and Analog holography. Dynamic holography and photorefractive physics. Problem solving session with examples on in-line and off-axis holography. |
| 2 | 13 Dec 2022 | <ul style="list-style-type: none"> Digital holography, numerical reconstruction, and phase unwrapping. Holographic interferometry and applications. Problem solving session with examples on digital holography and numerical reconstruction algorithms and examples on holographic interferometry. |
| 3 | 14 Dec 2022 | <ul style="list-style-type: none"> Phase-shifting holography and its different geometries. Multi-wavelength digital holography and applications. Problem solving session with examples on phase-shifting interferometry and numerical reconstruction algorithms and examples on multi-wavelength holography. |
| 4 | 15 Dec 2022 | <ul style="list-style-type: none"> Digital holographic microscopy and applications. Compressive sensing and application to digital holography. Problem solving session with examples on digital holographic microscopy. |
| 5 | 16 Dec 2022 | <ul style="list-style-type: none"> Coherence holography and Transport of Intensity Equation. Contemporary topics: computer generated holography, nonlinear holography, holographic TV, Information security, 3D object recognition. Problem solving session with examples on transport of intensity equation and information security using digital holography. |
| 6 | 17 Dec 2022 | <ul style="list-style-type: none"> Examination, Evaluation, and Feedbacks |

Payment Details

Payment link:

<https://www.onlinesbi.com/sbicollect/icollecthome.htm?corpID=1968961>