Diffractive Micro-optics of IR and THz ranges

Overview:

Diffractive optical elements (DOEs) have found wide applications in laser technological equipment and optical devices for different spectral ranges. Application of DOEs allows optical devices to be designed with reduced weight and size characteristics and broad functionality.

Wide use of infrared (IR) lasers in technological applications (metal cutting and hardening, laser evaporation, laser bending etc.) have stimulated a research in the field of synthesis of IR-range diffractive micro-optical focusing elements, which could retain their functionality under continuous irradiation with high power. Successive fulfillment of this requirement is stipulated both by selection of an appropriate substrate material and by development of technologies for creation a diffractive microrelief on a substrate as well as numerical methods and software for microrelief optimization taking into account possible technological constraints.

Development of terahertz lasers opens new possibilities in such fields as fundamental research, material science, biomedicine, telecommunications, security and monitoring. A prospective application of terahertz lasers in radar systems has been considered also. The emergence of coherent, high-power sources of THz radiation has created a need for optical elements to control this radiation.

The presented course is devoted to computer design and simulation, technology of fabrication and practical applications of diffractive micro-optics of IR and THz ranges.

Objectives:

The primary objectives of the course are as follows:

i) Exposing participants to the fundamentals of diffractive micro-optics.

ii) The importance and practical applications of IR and THz micro-optics.

iii) Numerical methods for DOE design and technologies for structuring IR/THz materials.

iv) Prospective of IR and THz optics.

To achieve these objectives, the course will focus on practical examples described in high-impact research reports from our group in the field.

Modules/ Brief Syllabus	**A: Duration:** October 09-13, 2017 **B: Venue :** Centre for Nanoscience and Nanotechnology, Jamia Millia Islamia, New Delhi **No. of Participants for the course will be limited to fifty.**
Module A: The importance and practical applications of IR and THz micro-optics	**October 09, Monday** **Inaugural Ceremony: 10:00AM to 11:00 AM** **Lecture 1: 11:15 AM to 12:30 PM** **Importance and practical applications of IR and THz diffractive micro-optics** **Tutorial 1: 2:30 PM to 4 PM** **Problem solving session with examples: Identifying different type of DOEs.** **October 10, Tuesday** **Lecture 2: 10:00 AM to 11:30 AM** **Direct and inverse tasks of diffraction. Approaches for solution of inverse task of diffraction.** **Lecture 3: 11:45 AM to 01:15 PM** **Basics of computer DOE Design and Simulation. Discretization and quantization of DOE phase function.** **Tutorial 2: 2:30 to 4:00 PM** **Problem solving session with examples: Determination of parameters of a diffractive optical element like width of narrowest zone, number of zones, diffractive microrelief height (for transmission and reflective modes) etc.**
Module B: Numerical methods for DOE design and technologies for structuring IR/THz materials	**October 11, Wednesday** **Lecture 4: 10:00 AM to 11:30 AM** **Iterative calculation of diffractive optical elements. DOE calculation based on generalized projection method and direct search method.**

	Lecture 5: **11:45 AM to 01:15 PM** **CAD Software and Data Format for DOE design.** **Tutorial 3:** **2:30 to 4:00 PM** **Practical design of DOEs by use of CAD software.** **October 12, Thursday** **Lecture 6:** **10:00 AM to 11:30 AM** **Lithographic and direct writing approaches for diffractive microrelief forming.** **Lecture 7:** **11:45 AM to 01:15 AM** **Materials and technologies for IR and THz diffractive micro-optics.** **Tutorial 4:** **2:30 to 4:00 PM** **Characterization of IR diffractive microrelief by microscopy and interferometry.** **October 13, Friday** **Lecture 8:** **10:00 AM to 11:30 AM** **Challenges in IR and THz optics** **Lecture 9:** **11:45 AM to 01:15 PM** **Scope of future research** **Tutorial 5:** **2:30 to 4:00 PM** **Interactive session** **Valedictory Ceremony 4:00 PM to 5:00 PM**
You should attend If	• Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories. • Student students at all levels (B.Tech/M.Sc./M.Tech/Ph.D) or Faculty from reputed academic institutions and technical institutions.
Fees	The participation fees for taking the course is as follows: **Participants from abroad:** US $500 **Industry/Research Organisations:** 10,000/-

	Academic Institutions: Faculty members: Rs. 3000/- Masters/PhD Students: Rs. 1500/- The above fee is towards participation in the course, the course material, computer use for tutorial and assignment, 24-hour free internet facility. Course Fees Payment: The DD should be prepared in favour of **"Registrar, Jamia Millia Islamia"**, payable at New Delhi and submit to the Centre for Nanoscience and Nanotechnology, Jamia Millia Islamia, New Delhi
Registration	The participants should register on the following link: http://www.gian.iitkgp.ac.in/GREGN/index

Professor Vladimir S. Pavelyev graduated from the Samara State Aerospace University (Samara, Russia) and received the Engineer Diploma in Applied Mathematics in 1993. He has PhD (Candidate of Sciences, Technique of physical experiment) degree from Samara State Aerospace University (1996), and Dr. of Sciences degree (Optics) from Samara State Aerospace University (2004). Currently he is working as a Head of Nanoengineering Department with the Faculty of Electronics and Instrument Engineering, Samara University, Samara, Russia. Besides he has part-time position of Chief Researcher at Image Processing Systems Institute of Russian Academy of Sciences, Samara.

He has over 23 years of teaching and research experiences.

His fields of interest include Sensors and Sensing Technology, Instrumentation, Micro-optics and Nano-

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photonics, Micro and Nano-technologies, technologies of MEMS etc.
He has authored/co-authored six books and over 100 papers in different international journals and conferences. He was a Fellow of DAAD (Germany, 2000, 2012). He was awarded a Russian President Stipend for research stay abroad, 1995-1996 (stay at Friedrich-Schiller University, Jena, Germany). He was awarded a Russian Federation State Prize for young scientists, 2003. He was awarded a Grant of President of Russia (2005, 2007). He is the Member of Editorial Board of Computer Optics journal. He is the Member of Academic Council of Samara University and Member of Academic Council of Image Processing Systems Institute of Russian Academy of Sciences.
He has been co-supervisor of Russian-German project supported by German foundation DLR-BMBF. He has been project leader in number of research projects supported by Russian Foundation for Basic Research (RFBR), Program of the Presidium of the Russian Academy of Sciences (RAS), US Civilian Research & Development Foundation (CDRF). He was an Advisory Committee member of ICANN 2016. He was Program Committee member of SPIE conferences, Optical Modeling and Design, Photonics Europe (Brussels, Belgium, 2010, 2012, 2014 2016), Photon Management (Strasbourg, France, 2004, 2008), Photon Management II (Strasbourg, France, 2006), Wave-Optical Systems Engineering II (San-Diego, USA, 2003). He was Program Committee member of conferences Diffractive Optics and Nanophotonic, ICONO/LAT2013 (Moscow, Russia, 2013) and Information Technology and Nanotechnology, ITNT-2016 (Samara, Russia, 2016).

Dr. Prabhash Mishra is an Assistant Professor in Centre for Nanoscience and Nanotechnology, Jamia Millia Islamia, New Delhi, INDIA. He received his Ph.D. (Electronics, sensors; 2014) from JMI, New

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Delhi. He has a wide range of experience in the field of nanomaterials and nano-device fabrication. During his Ph.D., he worked on designing and fabrication of gas sensors based on carbon nanotubes. In 2014, he moved to Samara State Aerospace University, Samara, Russia as a Senior Scientist where he worked on terahertz optics, microsystems development and MEMS based sensors. Later, in 2015, he moved to IMDEA Nanoscience, Madrid, Spain to work on mechanically interlocked carbon nanotubes (MINT) and 2-D materials for optical and electronics applications. He has published 33 research papers in various reputed peer-reviewed international journals. He has filed 06 Indian and 02 U. S. Patents. He has also Invited EOI for technology transfer, which has been published on JMI website. The video for the laboratory prototype is available at: (YouTube link: http://youtu.be/cUsVIiPqll). Dr. Mishra has also received Young Scientist award, 2014 from SERB-DST, Govt. of India.

Further details about Prabhash Mishra can be seen at his homepage:
http://jmi.ac.in/cnn/facultymembers/Dr_Prabhash_Mishra-3567