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Editors

# Advances in Optical Science and Engineering

Proceedings of the Third International  
Conference, OPTRONIX 2016

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*This volume is dedicated to the students and  
researchers who dream and work for a better  
tomorrow*

# Preface

Optics and Photonics are related to the science of light and it can be harnessed for utilization in an enormous variety of applications, as evidenced by its increasing pervasiveness in our everyday lives. We use photonic technologies to light up our homes, offices and cities, to harvest renewable energy from the sun, to make telephone calls or surf the Internet, to enable early medical diagnosis and treatments, to establish clean and efficient manufacture of a multitude of everyday products, or to provide reliable security systems to protect us as we travel. Already, over 90% of all the data transferred for telecommunications is transmitted by optical fibre. Green photonics is the study and development of applied optical systems for generating clean, renewable energy. This includes solar cells and photovoltaic devices, creating energy-efficient optical sources for lighting and display applications and developing environmental friendly materials for optoelectronic devices and components.

The 3rd International Conference on Opto-Electronics and Applied Optics, OPTRONIX 2016 ([www.optronix.iem.edu.in](http://www.optronix.iem.edu.in)) has been organized by Research and Development Council, University of Engineering and Management, UEM, New Town, Kolkata, India, in association with Institute of Engineering and Management, IEM, Salt Lake, Kolkata, India, on 18–20 August, 2016 at UEMK Campus. The Conference has got technical collaboration with Optical Society of India, OSI and American Journal of Advanced Computation Technology (AJACT), Canada and was supported by SPIE (Society of Photonics and Instrumentation Engineers, USA) and OSA (Optical Society of America, USA) approved IEM–UEMK Group Student Chapters.

The theme of the Conference is selected as the emerging research area, “Green Photonics: The Scope of Research and Development in harnessing Clean Energy”. In addition to the theme, diversified areas, namely Silicon Photonics, Advanced Photovoltaics, Application of Solar Energy, Fibre and Integrated Optics, Organic Photovoltaics, Nano-Photonics, Bio-Photonics and Bio-Medical Optics, Opto-Electronic Materials, Optical and Digital Data and Image Processing, Photonics for Space Applications, Adaptive Optics, Optical Design, Fabrication and Testing, E.M. Radiation Theory and Antenna, Interferometry, Micro-Electronics

and VLSI, Quantum Optics and Information Processing, Digital Holography, Terahertz Technology, etc., have been selected on which researchers have disseminated their contributions. The conference is organized to promote the International Solar Alliance of over 120 countries initiated by Hon'ble Prime Minister of India, Mr. Narendra Modi with the French President, François Hollande, at the Paris COP21 climate summit. "Solar technology is evolving, costs are coming down and grid connectivity is improving", as said by Hon'ble Prime Minister "The dream of universal access to clean energy is becoming more real. This will be the foundation of the new economy of the new century". Twenty seven eminent Scientists and Professors from India and abroad had been invited to deliver keynote, plenary as well as invited addresses in the related field. More than seventy research papers have been registered and presented in the Conference. Among distinguished International Invited Speakers were Prof. Toyohiko Yatagai, Director, Centre for Optical Research and Education (CORE), Utsunomiya University, JAPAN and Former President SPIE (2015), San Diego, USA; Prof. Vasudevan Lakshminarayanan, Professor of Optometry (Vision Science), Physics, Electrical and Computer Engineering and Systems Design Engineering, University of Waterloo, Canada; Prof. Motoharu Fujigaki, Professor, Human and Artificial Intelligent Systems, Graduate School of Engineering, University of Fukui, Japan; Prof. Takeo Sasaki, Professor, Department of Chemistry, Tokyo University of Science, Japan; and Prof. Tigran Galstian (over Skype), Professor, Department of Physics, Centre d'optique, photonique et laser (COPL), University of Laval, Quebec, Canada.

The distinguished National Invited Speakers include Prof. Ajoy Ghatak, Prof. Kehar Singh, both are eminent Physicists and former professors of IIT Delhi; Prof. Rajpal Sirohi, Professor of Eminence, Tezpur University, Assam and Former Director, IIT Delhi; Prof. Samit Kr. Ray, Dean of Postgraduate Studies and Research, IIT Kharagpur; Prof. Lakshminarayan Hazra, Emeritus Professor, Department of Applied Optics and Photonics, Calcutta University, India; Dr. Amitava Roy, Scientist 'F', Department of Science and Technology, Govt. of India; Prof. Rajesh Gupta, IIT Bombay; Prof. Navin Nishchal, IIT Patna; Prof. Rajan Jha, IIT Bhubaneswar; Prof. Partha Roy Chaudhuri, IIT Kharagpur; Prof. Samudra Roy, IIT Kharagpur; Prof. Asim Kar, Former Professor, Jadavpur University; Prof. Shyamal Bhadra, Emeritus Scientist, Raman Centre for Atomic, Molecular and Optical Sciences, Indian Association for the Cultivation of Science (IACS), Jadavpur, Kolkata; Prof. Kallol Bhattacharya, Department of Applied Optics and Photonics, Calcutta University; Prof. P.T. Ajithkumar, CEO and Leading Scientists, Light Logics Holography and Optics, Trivandrum, Kerala; Prof. Tarun K Gangopadhyay, Senior Principal Scientist, CSIR-Central Glass and Ceramics Research Institute, Jadavpur, Kolkata; Prof. Somnath Ghosh, INSPIRE Professor, Calcutta University; and Prof. A.K. Chakraborty, Prof. K.K. Ghosh, Prof. K.P. Ghatak and Prof. Rajiv Ganguly, all professors of UEMK and IEM Group.

I am extremely thankful to SERB, Symposia Section, Department of Science and Technology, Govt. of India, for providing partial grants-in-aid to support the

TA and DA of Senior Scientists and young researchers to participate in the conference. My sincere gratitude to the International Advisory Committee and Technical Program Committee for providing valuable guidance and extended support in reviewing the submitted contributions continuously. I would like to thank Prof. Dr. Mrimnoy Chakraborty, Assistant Professor, Dr. B.C. Roy Engineering College, Durgapur, for his support and cooperation in the review process.

My special thanks to Prof. Dr. Mina Ray, Assistant Professor, Department of Applied Optics and Photonics, University of Calcutta, Kolkata and Prof. Dr. Debotosh Guha, Professor, Institute of Radio Physics and Electronics, Calcutta University, eventually both are my seniors at Rajabazar Science College Campus of University of Calcutta, for their presence and chairing technical sessions in their area of expertise. I would like to express my sincere thanks and gratitude to the respected faculty members and staffs as well as the Student Organizing Committee of UEMK–IEM Group who has provided relentless support and cooperation to make the Conference successful.

Kolkata, India

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