

## PREFACE

Research is a continuous process through which many developments take place for a better life in the world. It is this motivation which has resulted in organizing an “International Symposium on Engineering and Technology (ISET-2014), on 9-10th January 2014 at Trinity College of Engineering and Research, Pune, one of the premier technical Institutes, affiliated to University of Pune. The ISET 2014 comprised three conferences,

1. International Conference on Design, Manufacturing and Mechatronics
2. International Conference on Automotive Technology
3. International Conference on Renewable Energy and Sustainable Development

This has been the theme in bringing the Industrialists, academicians, scientists and technologists globally to a single platform through this international symposium to discuss the state of the art of technology and to make a guideline for future study and research work.

We are delighted by the enthusiastic response of both Indian and overseas authors in submitting excellent research papers to this conference. It is strongly believed that the special volume, based on papers presented in ISET 2014, entitled “Advanced Research in Design, Manufacturing and Materials” will serve to demonstrate the depth of current innovations and research and also acts as a reliable source of information for making significant advances in the this area.

Foreign delegates from Japan, South Korea, Australia, Iran, Egypt, Malaysia, Nigeria and Bangladesh added the international flavor to the symposium. The symposium featured eight invited keynote speeches.

Special gratitude is extended to all the reviewers who went through the works of the contributors meticulously to enhance the quality of the papers. The valuable advice from reputed persons in the International and National advisory committee is also gratefully acknowledged. We express sincere thanks to our KJEI’s Hon, President Shri. Kalyan Jadhav, and Campus Director Dr. Ashok Ghatol for all the support for organizing this symposium.

Team ISET 2014  
Pune, India

## INTERNATIONAL ADVISORY COMMITTEE

Dr. C.D. Rakopoulos	National Technical University of Athens	Greece
Dr. Izhak Etsion, Technion	Israel Institute of Technology	Israel
Dr. T.S. Zhao	The Hong Kong University of Science & Tech.	Hong Kong
Dr. Ilhami COLAK	Gazi University	Ankara/Turkey
Dr. Durai Prabhakaran R.T	Wind Energy Department, DTU	Denmark
Dr. Rosli Abu Bakar	Universiti Malaysia Pahang, Kuantan	Malaysia
Dr. M. Affan Badar	Indiana State University	USA
Dr. Hadiyanto	Diponegoro University	Indonesia
Dr. Saiful Bari	University of South Australia	Australia
Dr. Rajendra S. Adhikari	Politecnico di Milano	Italy
Dr. Meyer JP (Josua)	University of Pretoria	South Africa
Dr. Catalin Teodoriu	Clausthal University of Technology	Germany
Dr. Khaidzir bin Hamzah	Universiti Teknologi Malaysia	Malaysia
Dr. Ameya Sathe	Technical University of Denmark	Denmark
Dr. Bhuvanesh Rajamony	University Malaysia Perlis	Malaysia
Dr. Hakan F. OZTOP	Firat University	Elazig/Turkey
Dr. Prasad Yarlagadda	Queensland University of Technology	Australia
Dr. P. Abdul Salam	Asian Institute of Technology	Thailand.
Dr. Waleed Khalil Ahmed	United Arab Emirates University	UAE
Dr. Seeram Ramakrishna	National University of Singapore	Singapore
Dr. Saman K. Halgamuge	Melbourne School of Engineering	Australia
Dr. P. V Aravind	Technische Universiteit Delft	Netherlands
Dr. Ante Munjiza	Queen Mary University of London	UK
Dr. P. M. Sirimanne	Uva Wellassa University, Badulla	Sri Lanka
Dr. A.K.M. Sadrul Islam	Islamic University of Technology	Bangladesh
Dr. P. A. Patil	Well Engineering Partners	Netherlands
Dr. Mohammad Akram	Tohoku University, Sendai	Japan
Dr. Shripad Joshi	JCI, Leverkusen	Germany

## **NATIONAL ADVISORY COMMITTEE**

- Dr. G K Kharate Dean, University of Pune
- Dr. Kirit Parikh, Chairman, IRADE, New Delhi
- Dr. Chetan Singh Solanki, IIT Mumbai
- Dr. B. B. Ahuja, Deputy Director, COEP Pune
- Dr. Somashekhar Hiremath, IIT Madras, Tamilnadu
- Dr. K. Narasimhan, IIT Mumbai
- Dr. G. V. Parishwad, COEP, Pune
- Dr. P. J. Awasare, MMIT Pune
- Dr. D. W. Pande, Dean, R & D, COEP, Pune
- Dr. G. K. Purohit, PDACOE, Gulbarga, Karnataka
- Dr. S. N. Sapali, COEP, Pune
- Dr. Atul Padalkar, FIT Pune
- Dr. S. S. Thipse, ARAI Pune
- Dr. S. M. Sawant, Dean, Shivaji University, Kolhapur, Maharashtra
- Mr. Hemant Watve, Managing Director, Mather & Platt Pumps Ltd.
- Dr. G. Sankaranarayanan, AECM, Tamilnadu
- Dr. C. Y. Semikeri, GPR, Ratnagiri, Maharashtra
- Dr. V J Kakhandki, PCOEMR Pune
- Dr. G. J. Vikhe, Amrutvahini College of Engineering, Sangamner, Maharashtra
- Dr. D. J. Doke, Chairman, PLC, Institution of Engineers (India)
- Dr. S. J. Wagh, KJCOEMR Pune
- Dr. Ejaz A Qureshi, TIMR Pune
- Dr. B. S. Gawali, Walchand College of Engineering, Sangli, Maharashtra
- Dr. S.J. Deshmukh, P.R.M.I.T., Amravati, Maharashtra
- Dr. A. T. Pise, Government College of Engineering, Karad, Maharashtra
- Mr. N. S Gawhane, Head - Learning & Development, ThyssenKrupp Industries, Pune
- Dr. V. L. Patil, TCOER, Pune
- Prof. M. M. Deshmukh, TCOER, Pune
- Dr. A. M. Kate, KJCOEMR Pune
- Dr. S. B. Thakre, P.R.M.I.T., Amravati, Maharashtra
- Dr. H. A. Mandave, KBP, Satara, Maharashtra
- Er. V. S. Ghogare, Hon Secretary PLC, Institution of Engineers (India)
- Prof. V.S. Hendre, TCOER, Pune
- Prof. Vijay Shingade, TCOER, Pune
- Prof. J. V. Satre, TCOER, Pune
- Prof. M. V. Handore, TCOER, Pune
- Prof. S. S. Mulik, PCOEMR, Pune

## **SCIENTIFIC COMMITTEE**

- Dr. V.V. Khanzode, NITIE, Mumbai
- Dr. M. R. Nandgaonkar, College of Engineering, Pune
- Dr. J. T. Kshirsagar, R & D Head, Mather & Platt Pumps Ltd.
- Dr. B.Y.R. Surnam , University of Mauritius, Mauritius
- Dr. A. A. Latey, College of Engineering, Pune
- Dr. R. Edwin Raj, St. Xavier's Catholic COE, Chunkankadai, Tamilnadu, India
- Dr. Mrs. M. G. Karnik, COEP, Pune
- Dr. Youssef Errami, Mohammed V- Agdal University, Rabat, Morocco
- Dr. S. V. Karmare, Government Engineering College, Avasari
- Dr. Y.J. Bhalerao, MIT, Academy of Engineering, Pune
- Dr. S. A. Khan, BIT, Mangalore, Karnataka, India
- Dr. M.K.Nalawade, Vishwakarma Institute of Technology, Pune
- Dr. H. R. Kulkarni, PCOEMR, Pune
- Dr. Subhash Kamal , Sharada University, Delhi, india
- Dr. N. K. Chougule, College of Engineering, Pune
- Dr. M. L. Kulkarni, MIT, Academy of Engineering, Pune
- Dr. Shashikantha B. Karinka, Bharat Forge, Pune
- Dr. Rajiv B.,College of Engineering, Pune
- Dr. shrihri Notla, DM, R & D,Tranter India Ltd., Pune
- Dr. A. A. Keshte, MES College of Engineering, Pune
- Dr. Suhas Deshmukh, Sihngad Academy of Engineering, Pune
- Dr. S. B. Barve, MIT College Of Engineering, Pune
- Dr. U.S. Chavan, Vishwakarma Institute of Technology, Pune
- Dr. S. S. Kore, Sihngad Academy of Engineering, Pune
- Dr. M. Y. Khire, SBCOE, Miraj Dist - Sangali, Maharashtra

## **STEERING COMMITTEE**

- Chief Patron :Hon. Kalyan Jadhav
- Patron :Dr. Ashok Ghatol
- Symposium Chair : Dr. Prakash S. Dabeer
- Convener :Prof. Kumar D. Sapate
- Co-Convener :Prof. Ganesh P. Bharambe
- Publication Chair : Prof. S. A. Kale
- Organizing Secretary for ICDMM 2014 : Prof. S. H. Mankar
- Organizing Secretary for ICAT2014 : Prof. V. S. Shinde
- Organizing Secretary for ICRESD 2014 : Prof. S. A. Kale