

# **SMART COMPUTING**

**(Third International Conference)**

**Parul University International Conference on  
Engineering & Technology (PiCET-2020) related to  
Smart Engineering**

**06 & 07 November, 2020**

**Jointly organized by Parul University in associations with  
Department of Electronics & Microelectronics  
UMONS Faculty of Engineering, Belgium**



**ManTech Publications Pvt. Ltd.**

**Ghaziabad, Delhi/NCR**

***Published by:***

Mantech Publications Pvt. Ltd.

***Registered Office:*** 203, Plot No-45, Gyan Khand-2, Indirapuram, Ghaziabad,  
U.P.-201014, Delhi/NCR

***Contact No:*** 7838047803, 8506003804

***Corporate Office:*** 402, Plot No.-127, Gyan Khand-1, Indirapuram, Ghaziabad,  
U.P.-201014, Delhi/NCR

***Contact No:*** 7838047803, 8506003804

***Email:*** info@mantechpublications.com, mantechpublications@gmail.com

***Website:*** www.mantechpublications.com

**First Edition:** 2021

**ISBN:** 978-81-953658-1-4

**Copyright © MANTECH Publications Pvt. Ltd. 2021**

All Rights Reserved

**Price: Rs. 750/-**

*In this book, Mantech Publications is disseminating information gathered from sources that are supposed to be trustworthy. However, neither the authors nor Mantech Publications vouch for working precision or practical applicability of the published information. Therefore, neither the publisher nor the authors take responsibility for any errors, oversight, or losses resulting from application of the published information. This book is published for spreading information but neither the authors nor Mantech Publications are offering any kind of engineering services or operating in any other professional capacity. Those seeking such services are advised to hire bona fide professionals.*

***Printed at:***

Laxman Printo Graphics,  
Sector-10, Noida, U.P

*This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated without the publisher's prior consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.*

# **EDITORS**

**Dr. Arvind R Yadav**

*PIET, FET*

*Parul University, India*

**Dr. Vishal Sandhwar**

*PIET, FET*

*Parul University, India*

**Dr. Ramji Gupta**

*PIET, FET*

*Parul University, India*

**Dr. Shivendu Saxena**

*PIET, FET*

*Parul University, India*

# ORGANIZING COMMITTEE

## CHIEF PATRON

- Dr. Devanshu Patel, President, Parul University

## CONFERENCE CHAIRPERSON

- Dr. M. N. Patel, Provost, Parul University

## CONVENERS

- Dr. Unnati Joshi, Dean, FET
- Dr. Vilin Parekh, Principal, PIET
- Dr. Bhavesh Mewada, Principal, PIT

## CONFERENCE CHAIR

- Dr. Arvind R. Yadav, Professor & Associate Dean, E&C Engg., PIET

## CONFERENCE CO-CHAIR

- Dr. Vishal Sandhwar, Assistant Professor, Chemical Engg., PIT

## COMMITTEE MEMBERS

- Dr. Arvind Yadav (Funding Committee)
- Dr. Vishal Sandhwar (Funding Committee)
- Dr. Chiranjib Bhowmik (Track Coordinator Mechanical Engg.)
- Dr. Ramji Gupta (Track Coordinator E&C Engg.,)
- Dr. Shivednu Saxena (Track Coordinator, Chemical Engg.,)
- Prof. Snehanu Nath (Track Coordinator, Civil Engg.,)
- Prof. Rajiv Gurjwar (Co-Track Coordinator CSE)
- Prof. Ashish Patel (Co-Track Coordinator CSE)
- Dr. Pradeep Karsh (Co-Track Coordinator Mechanical Engg.,)
- Dr. Sumit Das Lala (Co-Track Coordinator Mechanical Engg.,)
- Prof. Sharmin Tinwala (Anchoring Committee, Inauguration & Valedictory Session)
- Prof. Diksha Saxena (Anchoring Committee, Chemical Engg.,)
- Prof. Utkantha Dixit (Anchoring Committee, Mechanical Engg.,)
- Prof. Swati Prajapati (Anchoring Committee, Mechanical Engg.,)
- Prof. Vishwa Dabhi (Anchoring Committee, Computer Engg.,)
- Prof. Nisha Panchal (Anchoring Committee, Computer Engg.,)
- Prof. Isha Vashi (Anchoring Committee, Computer Engg.,)

## PROGRAM COMMITTEE

### INTERNATIONAL

- Dr. Anil Kumar, Senior Researcher in Decision Sciences, Centre of Supply Chain Improvement University of Derby, United Kingdom (UK).

- Prof (Dr.) Ir Carlos Valderrama, Head of Department, Department of Electronics and Microelectronics, UMONS Faculty of Engineering, Belgium.
- Dr. Franciszek Restel, Ph.D. Engg., Faculty of Mechanical Engg., Wroclaw University of Science & Technology, Wroclaw, Poland.
- Dr. Tomasz Kisiel, Ph.D. Engg., Faculty of Mechanical Engg., Wroclaw University of Science & Technology, Wroclaw, Poland.
- Dr. Raj Vedam, Senior Principal Engineer Aveva, Houston, TX, USA.
- Dr. Liu Cheng, College of Environment, Hohai University, China.
- Dr. Roshan Kumar, Assistant Professor, Henan University, Henan, China.

## **NATIONAL**

- Dr. Uday Shankar Dixit, Professor, Department of Mechanical Engineering, Indian Institute of Technology Guwahati, Guwahati.
- Dr. Dibakar Rakshit, Associate Professor, Department of Mechanical Engineering, Indian Institute of Technology Delhi, Delhi
- Dr. Rajat Gupta, Director, National Institute of Technology Mizoram, Mizoram.
- Dr. Amitava Ray, Principal, Jalpaiguri Government Engineering College, Jalpaiguri, West-Bengal.
- Dr. Sumit Bhowmik, Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Silchar, Silchar.
- Dr. Pradeep V Malaji, Associate Professor, Department of Mechanical Engineering, BLDEA's VP Dr. PGH CET Vijayapur.
- Dr. Sudip Dey, Assistant Professor, Dept of Mechanical Engineering, National Institute of Technology Silchar, Silchar.
- Dr. Tanmoy Mukhopadhyay, Assistant Professor, Department of Aerospace Engineering, Indian Institute of Technology Kanpur, Kanpur.
- Dr. Susmita Naskar, Assistant Professor, Department of Aerospace Engineering, Indian Institute of Technology Bombay, Mumbai.
- Dr. Vijay Kumar Dalla, Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Jamshedpur, Jamshedpur.
- Dr. Hari Singh, Professor, Mechanical Engineering Department, National Institute of Technology Kurukshetra, Kurukshetra.
- Dr. Bhavesh Bhalja, Associate Professor, Department of Electrical Engineering, Indian Institute of Technology Roorkee, Roorkee.
- Dr. H. Nagendra, Associate Professor, Department of E&C, PDACE, Kalaburagi, Karnataka
- Dr. Mehul Raval, Professor, Electronic & Communication Engineering, Ahmedabad University, Ahmedabad.
- Dr. N. M. Biradar, Principal, Bheemanna Khandre Institute of Technology (BKIT), Bhalki, Karnataka.
- Dr. Divyang Pandya, Professor & Head, Department of Mechanical Engineering, L.D.R.P., Institute of Technology & Research, Gandhinagar.
- Dr. Vedvyas Jayprakash Dwivedi, Pro-Vice Chancellor, C.U. Shah University Wadhwan City, Gujarat.
- Dr. R. S. Anand, Professor, Department of Electrical Engg., Indian Institute of Technology Roorkee, Roorkee.

- Dr. Vinod Kumar, Vice Chancellor, Jaypee University of Information Technology, Wanknaghat, Solan, Himachal Pradesh.
- Dr. R. P. Yadav, Professor, Department of Electronics & Communication Engg., Malaviya National Institute of Technology Jaipur, Jaipur.
- Dr. S. P Harsha, Department of Mechanical Engg., Indian Institute of Technology Roorkee, Roorkee.
- Dr. Arun Balodi, HOD, Electronics and Communication Engineering, Atria Institute of Technology, Bangaluru.
- Dr. Jayendra Kumar, Assistant Professor, Department of Electronics & Communication Engineering, National Institute of Technology Jamshedpur, Jamshedpur.
- Dr. Dilbagh Panchal, Assistant Professor, Industrial & Production Engg., Dr. B.R.Ambedkar National Institute of Technology Jalandhar, Jalandhar.
- Dr. Basheshwer Prasad, Professor, Department of Chemical Engineering, Indian Institute of Technology Roorkee, Roorkee.
- Dr. Vimal Chandra Srivastava, Professor, Department of Chemical Engineering, Indian Institute of Technology Roorkee, Roorkee.
- Dr. Rajesh Kumar Purohit, Chief Scientific officer (Retd.), Gujarat Water Supply and Sewerage Board, Gandhi Nagar, Gujarat.
- Dr. Suja George, Professor, Chemical Engineering, Malaviya National Institute of Technology Jaipur, Jaipur.
- Dr. Krishan Kishore Garg, Deputy Director/Scientist, Ministry of Environment, Forest and Climate Change Government of India.
- Dr. Sushovan Chatterjee, Head, Mechanical Engineering Department, Cooch Behar Government Engineering College, West Bengal.
- Dr. Alpana Pandey, Assistant professor, Department of Electronics & Communication Engineering, MANIT Bhopal, Bhopal.
- Dr. Ajay Somkuwar, Professor, Electronics & Communication Engineering, MANIT Bhopal, Bhopal.
- Dr. Ashish B Deoghare, Assistant Professor, Mechanical Engineering Department, NIT Silchar, Silchar.
- Dr. Bhargav Vyas, Associate Professor, Lukhdhirji Engineering College, Morbi, Gujarat
- Dr. Om Hari Gupta, Assistant Professor, Department of Electrical Engineering, National Institute of Technology Jamshedpur, India
- Dr. S. H. Upadhyay, Professor, Department of Mechanical and Industrial Engineering, IIT Roorkee

## **ACKNOWLEDGEMENT**

The editors extend their sincere gratitude to all the researchers and authorities of their respective colleges for the encouragement and support extended to PiCET-2020. We also express our thanks to the editorial team of the publisher, ManTech Publications, for their professional way of dealing with this proceeding.

The editorial team is grateful to the management of Parul University for providing a platform where deliberation on technological development transpired. Further, we are thankful to Heads of various Departments of Faculty of Engineering and Technology and each and every individuals who has contributed for the success of PiCET-2020.



On behalf of the Conference Committee, I take this opportunity to welcome you all to the 3rd International conference PiCET: "Parul University International Conference on Engineering and Technology: Smart Engineering" Jointly organized by Faculty of Engineering & Technology, Parul University, and Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium on 6th & 7th November 2020 at Parul University.

PiCET-2020 has an objective of creating an international forum for academicians, researchers and scientists across the globe to discuss contemporary research status and advanced techniques to address the challenges related to "Smart Engineering". We invite each and every participant to explore the challenging areas in the field of Smart Computing. Without research it would be very difficult to survive in the upcoming era where technology is changing rapidly.

The members of the various committees and advisory board members have striven hard for many months to make this conference a reality. The conference was morally and financially supported by Management of Parul University. On behalf of PiCET 2020 team, I wish to thank all the people without whose support it would not have been possible to provide this platform to the participants.

Finally, I would like to express my sincere thanks and gratefulness to all the participants, delegates and guests and wish them all a very pleasant, knowledgeable and memorable stay at Parul University.

**Dr. Arvind R. Yadav**

**Chair- PiCET-2020**



It gives me immense pleasure to extend a warm welcome to you all to this 3rd International conference PiCET: "Parul University International Conference on Engineering and Technology: Smart Engineering" Jointly organized by Faculty of Engineering & Technology, Parul University, and Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium on 6<sup>th</sup> & 7<sup>th</sup> November 2020 at Parul University. With the theme of "Smart Engineering", PiCET-2020 is intended to provide an international and multidisciplinary platform to the participants and experts to explore and exchange their valuable knowledge, ideas and thoughts in the challenging field of smart engineering and technology in the present era of rapid industrialization and globalization. I hope that everyone takes the opportunity to engage with others to discuss their ideas for research and practice during their time at the conference.

I would particularly like to extend my sincere thanks and gratitude to all the participants, experts, guests, and members of organizing committee for their valuable efforts to make this conference a huge success.

**Dr. Vishal Kumar Sandhwar**

**Co-Chair- PiCET-2020**





I am delighted to learn that Faculty of Engineering & Technology of Parul University is going to organize its 3rd International Conference viz., “PiCET-Parul University International Conference on Engineering & Technology” on the theme of “Smart Engineering” in collaboration with Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium on 6th&7th November, 2020 at Parul University. It is indeed a moment of great pride that this international conference will bring together academicians, scientists, researchers, entrepreneurs from different walks of life on a single platform to present their innovative ideas concerning different spheres of engineering & technology such as Civil, Mechanical, Electrical, Electronics & Communications, Computer Science Engineering, Information Technology, Chemical Engineering etc., and also to showcase their research work done in their respective fields of specializations. 21st Century is indeed the Age of Innovations and innovations presented by the researchers such as Smart Phones, Cloud Computing, Tablets etc., have not only made our lives easier but also have empowered the human beings in reaping economical benefits derived from use of such technologies.

I believe today's youth should be encouraged to develop interest in research from the early age as science, through its innovations, is the only antidote to wipe out the wide-spread maladies of poverty, unemployment, malnutrition, starvation etc...If we equip the youth with acquisition of scientific knowledge and requisite skills, these demographic dividends will definitely make remarkable progress in lifting the underprivileged section of our society from the jaws of poverty, illiteracy and starvation. We, at Parul University, are committed to equip our students with the requisite skills to undertake research during their studies so as to enable them to contribute their skills and knowledge towards Nation Development.

I hope all the participants in this International Conference will benefit immensely from the deliberations conducted in this international conference and interactions with the renowned speakers/ researchers will also open up new avenues of learning in the area of “Smart Engineering” for all the participants.

I wish “PiCET-Parul University International Conference on Engineering & Technology” all success!!!!

**Dr. Devanshu Patel**

**President, Parul University**



On behalf of the Faculty of Engineering and Technology, Parul University, I really feel honored to welcome you all in the Parul University International Conference on Engineering and Technology: SMART ENGINEERING (PiCET 2020). The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied for the technological benefits of humankind. It is envisaged that PiCET 2020 will provide a platform to gather and disseminate the latest knowledge in various arenas of engineering and technology. Academicians, Scientist, Researchers and practitioners of engineering will be able to share and discuss new findings and applications of engineering. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to “Smart Engineering”. I hope that this International and multidisciplinary conference will provide our participants a truly transformative experience through a variety of knowledge and perspectives. I wish all the participants a prolific interaction with experts and a pleasant stay at Parul University.

Finally I would like to congratulate the organizing committee for their tremendous efforts in organizing the conference. I wish a grand success for this conference.

**Dr. Unnati A. Joshi**

**DEAN, Faculty of Engineering & Technology, Parul University**



It gives me immense pleasure to know that Faculty of Engineering & Technology in Parul University has organized an International Conference viz, PiCET-2020 to be held on November 06-07, 2020 in the University Campus. I have always believed that regular conduct of such conferences by academia goes a long way in establishing close linkage between research scholars, academicians, industry professionals and help them exchange ideas pertaining to latest advancements in science and technology. A prestigious platform such as this also motivates teachers and research scholars to present their research work. The theme of the conference is “Smart Engineering”

In this age of information technology, the term “ Smart” has achieved a lot of significance e.g. Smart Computers, Smart Phones, Smart Cities, Smart Villages, Smart Structures etc. All these latest innovations have brought significant change in the functioning of our day to day activities and their contribution towards easing our way of life is commendable. It is the vision of the Government of India to establish 200 smart cities across India with state-of-the-art infrastructure and enhanced educational, healthcare and sanitation facilities. It is envisioned that these smart cities will offer better infrastructural facilities, ease of life and better living conditions to the residents. In order to achieve this, engineers and architects shall come up with innovative structural designs which are not only eye catching and strong but also take up less space. Such innovative ideas shall also be economical. I believe this international conference is a great platform for all engineers, architects, research scholars, academicians and industry professionals to deliberate upon innovative solutions for the problems faced by people pertaining to requisite infrastructure for building Smart Cities. I am confident that deliberations at this international conference will also be adopted by the government and the concerned agencies in implementing concepts of Smart Structures.

I wish this international conference a huge success.

**(Dr. M. N. Patel)**

**Provost**



On behalf of the Organizing Committee, I warmly welcome your participation in the 3rd International Conference “PiCET:Parul University International Conference on Engineering & Technology” on the theme of “Smart Engineering” in collaboration with Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium on November 6th&7th, 2020 at Parul University, Limda,Waghodia, Vadodara.

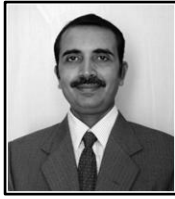
PiCET-2020 is intended to provide a platform to Research Scholars, Academicians, Industrialists and knowledge greedy peoples for exchanging their ideas, thoughts & achievements in the field of Engineering.

The members of the various committees have striven hard for many months to make this conference a reality. The conference was morally and financially supported by the management of Parul University. I wish to thank them all on behalf of PiCET-2020. Without their support, it would not have been possible to provide this platform to the participants.

Finally, I would like to express my sincere thanks and gratefulness to all the participants, delegates and guests and wish them all a very pleasant, knowledgeable and memorable stay at ParulUniversity, Vadodara, Gujarat, India.

**Dr. Vilin Parekh**

**Principal, PIET, Parul University**



I take this opportunity to welcome you all to the 3rd International Conference (PiCET-2020) on Smart Engineering being organized during 06-07th November 2020, jointly organized by Parul University in association with Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium.

Smart engineering practices is supposed to help us engineer reliable, smart, connected products and systems that enable innovation in the face of complexity in all sectors of life. These technologies will be bringing new and exciting possibilities into our lives, everything from changing how we commute to illuminating the way the world around us operates. The intention of this conference was to bring the eminent academicians, scientists, researchers, technocrats, social visionaries and experts from all strata of society, under one roof, to explore the new horizons of innovative technologies to identify opportunities and define the path forward. This new path should eliminate isolation, discourage redundant efforts and promote scientific progress aimed to accelerate India's overall growth to prominence on the International front. The conference will feature regular paper presentation sessions, invited talks and key note addresses by eminent people in specific sectors.

It is believed that the research & review papers included in these Proceedings will form a solid background for constructive discussions during the Conference. For those who, unfortunately, cannot attend this Conference, it is anticipated that these Proceedings will offer valuable reference material and a basis of information on academic accomplishment and current debate in engineering and technology.

In conclusion, on behalf of PiCET-2020 members, associates and supporters, and indeed myself, I wish to express my gratitude to the contributors of this set of Proceedings for their willingness to share their ideas and research work with other international colleagues, and to the referees, who have dedicated their precious time and effort to reviewing these papers.

I would like to appreciate all the members involved, directly or indirectly, in the PiCET 2020 for their hard work to make this event successful.

I wish a great success to this conference.

**Dr. Bhavesh Mewada**

**Principal, PIT, Parul University**

# **PREFACE**

At the outset, the Parul University International Conference on Engineering and Technology (PiCET-2020): Smart Engineering was organized by the Faculty of Engineering & Technology, Parul University, Vadodara, India, during 6th and 7th November 2020. This conference has been jointly organized with Department of Electronics & Microelectronics UMONS, Faculty of Engineering, Belgium. However, due to a global pandemic COVID-19, the conference was organized in an online mode and attracted researchers from Gujarat and across India. The editors are thankful to all the contributors for submitting the papers of high standard and making PiCET-2020 a huge success. Out of total 199 valid Submissions only 80 were selected for publication in two different volumes, i.e., an acceptance rate of nearly 40%. This volume, i.e., Smart Computing, is one of the two volumes published by ManTech Publications Private Limited (OPC). It contains 40 high-quality papers which provide an overview of recent developments in Computer Science Engineering, Information Technology, E&C Engineering, and Chemical Engineering applications in smart computing.

We thank all the organizing committee members, technical program committee members, reviewers, and student coordinators for their valuable support and volunteer work. We also appreciate the role of session chairs/co-chairs. We also thank the ManTech Publications Private Limited (OPC) for their help and quick responses during the preparation of the volume. The editors hope that this volume will provide the readers, relevant information on the latest trends in control system area.