

Tour Report on Visit of IIT Tirupati Team to Canadian and US Universities between 06th -19th September 2018

भारतीय प्रौद्योगिकी संस्थान तिरुपति



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Indian Institute of Technology Tirupati

Visit to Canadian Universities between 12 – 18 Sep 2018

Delegates from IIT Tirupati

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati

Dr. Venkataraman Pandurangan, Assistant Professor, IIT Tirupati

Delegates from IIT Ropar

Prof. Sarit K. Das, Director, IIT Ropar

Dr. Rohit Y. Sharma, Associate Dean, IIT Ropar

1. Background Information

IIT Tirupati and IIT Ropar had a discussion with the Ministry of Human Resource Development (MHRD) of the Government of India, the Hon'ble Canadian High Commissioner to India and his Senior Trade Commissioners, MITACS and Shastri Indo-Canadian Institute (SICI) regarding a proposal for an academic exchange program with the top tier Universities in Canada.

Subsequently, both IIT Tirupati and IIT Ropar met with the senior leadership from top Canadian Institutes at New Delhi at the SICI in February this year. During the meeting, the Directors of both IIT Tirupati and IIT Ropar made presentations about their respective Institutes and proposals for collaboration. IIT Tirupati and IIT Ropar also expressed keen interest to collaborate with Canadian Universities. Subsequently, both the Institutes have been working with SICI and the MHRD to take the initiative forward.

In this regard a delegation from IIT Tirupati and IIT Ropar visited the following Canadian Universities between Sep 12-18, 2018.

1. University of Toronto
2. University of Waterloo
3. University of Calgary
4. University of British Columbia

The main objective of the visit was to explore the possibility of developing a long-term academic partnership encompassing student exchange programs, joint degree programs, and research collaborations. It was also proposed to set up a research Center of Excellence one each at Tirupati and Ropar in the areas of Smart Infrastructure, Food Technologies, Water and Medical Technologies respectively.

The highlights of the discussion and the actions that were identified during the meetings are summarized in the following pages.

2. University of British Columbia

Date of Visit: Sep 11-12, 2018

1 Prof. Alejandro Adem (CEO Mitacs) and Prof. Sujatha Ramdorai (UBC Mathematics)



Prof. Sujatha Ramdorai, Prof. Satyanarayana, Prof. Alejandro Adem, Ms. Fiona Langdon

Prof. Adem Alejandro explained the different programs supported by Mitacs for exchange of students and research scholars:

- Research Internship for international students from May to October, where students participate in a 12-week internship under the supervision of Canadian university faculty.
 - Exchange between research groups (3-6) in any area of research.
 - Industrial Internship for up to 4 months in a Canadian Company.
 - Industrial Postdocs
- a) MITACS is also looking for partners in Indian to connect Canadian students with Indian companies for internships.
- b) MITACS is planning a road show in India to showcase various funding opportunities for students and researchers. In this regard, Ms. Fiona Langdon, Sr. International Relations Officer will coordinate with Dr. P. Venkataraman to provide information on upcoming events and new funding opportunities.

- c) MITACS has in principle agreed to reserve 10 undergraduate exchange scholarship for the student of IIT Tirupati.
- d) Professor Sujatha Ramdorai suggested that IIT Tirupati take up research initiatives in Mathematical Biology, such as Computational Genomics, Disease and Population modeling.

2 Prof. Guy Dumont, Professor Electrical and Computer Science Engineering



Prof. Satyanarayana, Prof. Dumont, Mr. Jonathan Hayes, Prof. Das.

Prof. Guy Dumont group works in the area of biomedical engineering particularly on biomedical signal processing and automatic drug delivery. He talked about some of the technologies that they have develop in collaboration with the local hospitals like the automatic control system for anaesthesia, using wireless sensors that can be connected to the smart phone and used to analyze patient health.

Prof. Das mentioned that the IIT Ropar has a strong group working on Medical technologies in coordination with the hospitals in the region. IIT Ropar will put together a list of faculty members working on various topic together with IIT Tirupati to initiate further discussion among faculty.

The possibility of organizing a joint workshop next year will also be explored.

3 Faculty of Land and Food Systems: Prof. Rickey Yada (Dean), Prof. Christine Scaman (Associate Dean, Academic), Zhaoming Xu, Associate Dean, Graduate and Postdoctoral Studies, Dr. Anubhav Pratap Singh



Prof. Satyanarayana, Prof. Rickey Yada.

The Faculty at Land and Food Systems work broadly in the topics such as food technology, thermal and non-thermal processing of food, cold plasma technology, food encapsulation and fortification, access to potable water etc. They have also set up a 60-acre experimental farm to study greenhouse gas mitigation, composting systems, air quality monitoring and precision agriculture. To drive the collaboration forward, the following action items were identified

- a) Both IIT Tirupati and IIT Ropar will compile an Expression of Interest from faculty interested in collaborating with UBC faculty by the end of the November.
- b) Once initial contact between the faculty is established, the institutes will try to facilitate exchange of faculty and research scholars. Possible funding options such as travel/research grants from MITACS and SICI can be explored to facilitate exchange.
- c) Some of the faculty members from the Faculty of Land and Food Systems are attending the World Food Congress in Oct 2018 in Mumbai, India. IIT Tirupati and

IIT Ropar faculty can use the opportunity to connect with UBC faculty and discuss research opportunities.

- d) IIT Tirupati and Ropar together with UBC will also work towards the ‘visiting international research student’ an internship program for undergraduate student where they will be matched with a professor at UBC to work on a research project for 10-12 weeks in summer.
- e) Dr. Anubhav Pratap Singh from UBC will coordinate these initiatives with IITs.

4 Prof. Nemkumar Banthia, Civil Engineering and CEO of IC-IMPACTS



Dr. Salman, Prof. Satyanarayana, Prof. Banthia, Prof Das. Dr. Rohit Sharma, Dr. Venkataraman.

Prof. Banthia provided an overview of the IC-IMPACTS (the India-Canada Centre for Innovative Multidisciplinary Partnerships to Accelerate Community Transformation and Sustainability) program that is dedicated to the development of research collaborations between Canada and India. They fund research under three broad areas

- Integrated Water management
 - Safe and Sustainable Infrastructure
 - Public Health
- a) During the discussion it emerged that the thrust areas identified at IIT Tirupati and Ropar such as Water, Medical Technologies and Smart Infrastructure align with the

research focus at IC-IMPACTS. Hence, Prof. Banthia suggested that the funding opportunities in these areas can be explored.

- b) Prof. Bhanthia also took the delegation for a tour of his lab facilities and explained some of the major research activities in his group.

5 Dinner meeting with Prof. Santa Ono (President & Vice Chancellor) & Prof. Murali Chandrashekar (Vice Provost, International)



Dr. Rohit Sharma, Dr. Venkataraman, Prof. Das, Prof. Ono, Prof. Satyanarayana, Prof. Murali Chandrashekar, Prof. Banthia, Ms. Wendy Yip

Prof. Ono, President UBC hosted a dinner reception at his official residence in UBC. During the interaction, both Directors talked about the progress that have been made by both the Institutes, the main objectives of the visit and their plans for collaboration with UBC. The President was very happy to learn about the initiatives and has offered to extend all possible support.

3. University of Calgary

Date of Visit: Sep 13 & 14, 2018



Prof. Satyanarayana, Prof. Ruwanpura, Prof. Das, Prof. Mehrotra

1 Prof. Janaka Ruwanpura, Vice-Provost (International) and Prof. Anil Mehrotra, Interim Department Head and Professor, Chemical and Petroleum Engineering, Schulich School of Engineering, Mr. Scott Vu, Partnership officer, International Relations.

Professor Janaka Ruwanpura gave an overview of the University of Calgary and their international strategy including staff and student mobility, partnerships and development. Some of their major programs include:

- a) Collaborative academic programs for Science and engineering graduates under the 2+2 and 3+2 schemes, wherein the student complete two to three years of study at the home institution and the remaining at the University of Calgary to earn a degree from both the universities.
- b) PhD Cotutelle program which allows students from partner universities to be jointly supervised by a faculty member at the University of Calgary.
- c) The University of Calgary is open to both the Joint degree, PhD Cotutelle programs, undergraduate student exchange and faculty exchange programs.

- d) Two possible funding avenues for supporting these initiatives are the: Mitacs Globalink Research Internship initiative for international undergraduates from India where the students participate in a 12-week research internship under the supervision of a Canadian university faculty member, and the Queen Elizabeth Scholarship program wherein Canadian universities can recruit research scholars based on their area of focus from partner countries, for stays ranging between three months and three years.
- e) Prof. Satyanarayana talked about the setting up a Center of Excellence at the each of the two IIT's to give a head start to these research initiatives. He also to briefed about the Scheme for Promotion of Academic and Research Collaboration (SPARC) program launched by MHRD to facilitate short term/long term visit of foreign faculty and mobility of research scholars in both directions.

2 Schulich School of Engineering: Prof. Bill Rosehart, Dean, Prof. Gopal Achari, Associate Dean (graduate studies).



Prof. Achari, Dr. Venkataraman, Dr. Rohit, Prof. Satyanarayana, Prof. Das, Prof. Rosehart.

Earlier in the day, Prof. Gopal Achari hosted a breakfast meeting with the delegates from IIT Tirupati and Ropar to learn about the developments at both the IITs. He was supportive of the initiative and offered to provide the required support. This was followed by a meeting with Dean Prof. Rosehart later in the day. Prof. Rosehart was very welcoming to the idea of research collaboration with both IIT Tirupati and IIT Ropar. The Directors from both IITs also talked about the main purpose of the visit, which is to foster research collaboration

between both the institutes. To kick start these initiatives, the following actions were identified

- a) Both IIT Tirupati and IIT Ropar will identify suitable faculty member who will be interested in collaborating with the School of Engineering at the University of Calgary. Possible areas of collaboration include Smart Infrastructure, Water, Energy, Biomedical Engineering and Autonomous technologies. As a first step, 3-6 academics from two focus areas will be identified by the end of October.
- b) Some of the faculty from the University of Calgary are visiting India between Jan-Mar 2019 and will plan a visit Tirupati and Ropar for further discussion. Based on these interactions, IIT Tirupati and Ropar would support some of their faculty to spend 4-6 weeks' time at University of Calgary in summer of 2019. Local hospitality at the respective ends will be taken care of by the host institutes.

3 Dr. Leslie Rigg, Dean, Faculty of Science and Dr. Cindy Graham, Vice-Dean, Faculty of Science



Dr. Cindy Graham, Prof. Leslie Rigg, Prof. Satyanarayana, Prof. Das, Dr. Rohit

Prof. Leslie Rigg provided an overview of the research activities in the group some of which include.

- Cryptography
- Environment Science
- Data Science

- Information Security
- Sensor technology
- Wearable technology

They are also working with the city of Calgary on Advancing Canadian Wastewater Assets (ACWA) project to develop wastewater treatment technologies to address environmental and human health issues.

Dr. Leslie Rigg and Dr. Cindy Graham, were open to collaboration, particularly in the field of Computer Science and Water.

4 Prof. Venkataraman Thangadurai, Associate Head, Faculty of Science and Dr. Diwakar Krishnamurthy, Electrical and Computer Engineering, Ms. Savera Hayat, Director, Programs and International Development, Mahesh Jayaraman, Manager, International Capacity Development and Training Programs

- a) Prof. Thangadurai's group works on fuel cells, SOFCs and gas sensors. He was very eager to know about the developments at IIT Tirupati and Ropar and expressed his willingness to collaborate. He will be attending the International Conference on "Green Energy Technologies for Smart Cities, 2018 at Amaravati and will use the opportunity to visit IIT Tirupati.
- b) Dr. Diwakar Krishnamurthy works in the general area of performance evaluation of software systems, big data, and Internet of Things (IOT) systems. Dr. Sai Krishna from IIT Tirupati has already initiated collaborative work with Dr. Krishnamurthy where he spent some time in Calgary on a research visit. Dr. Krishnamurthy would like to take forward the partnership and is also open to new collaborations.
- c) Ms. Savera provided an overview of the various avenues available for international student and research scholars to spend time at University of Calgary such as student internships, joint degree program and PhD Cotutelle programs. Ms. Savera will coordinate with Dr. P. Venkataraman to provide information on the various opportunities available at University of Calgary.

4. University of Waterloo

Date of Visit: Sep 17, 2018



Prof. Sushanta Mitra, Prof. Satyanarayana, Prof. Das

1 Prof. Sushanta Mitra, Executive Director, Waterloo Institute for Nanotechnology (WIN), Dr. Lisa Pokrajac, Assistant Director, WIN, Dr. Rick Culham, Vice-Dean, Engineering, Drew Knight, Director, Global Research & Strategic Alliances

The WIN headed by Prof. Sushanta Mitra is a university research Centre, founded in 2008. Nanotechnology research at WIN is highly interdisciplinary with faculty drawn from nine different disciplines working collaboratively on problems aimed at improving the quality of life for all. The thematic areas of research in WIN include

- Smart and Functional Materials
- Connected Devices
- Next Generation Energy Systems
- Therapeutics and Theranostics

The Directors of IIT Tirupati and Ropar discussed strategies for taking the collaboration forward. The following points emerged during the discussions

- a) It was recognized that to initiate research collaboration things have to be initiated at the grassroots level. This includes mobility of faculty to get them talking, facilitating visiting scholar programs, identifying 2-3 areas for shared research, having faculty from WIN as host advisors for PhD students and organizing invited lectures.
- b) Prof. Satyanarayana talked about the need for setting up a center of excellence at the each of the two IITs. He mentioned that establishing a center would provide more focus and leave a strong Canadian presence at the IITs in the long run. It would also make it easier for securing research funding from the Government.
- c) Prof. Das talked about the SPARC program launched by MHRD to facilitate short term/long term visit of foreign faculty and mobility of research scholars. The GIAN and VAJRA program are now part of the SPARC program. He also mentioned that SPARC, MITACS and SICI and other Canadian funding options can be explored to facilitate both student and faculty exchange.
- d) Prof. Das also mooted the idea of hosting a joint workshop with about 10 faculty members from either side, possibly at the end of April, which would provide a platform for people to discuss research ideas. At the end of workshop, a research consortium can be formed based on the interest.

Dr. Lisa Pokrajac also took the delegation for a tour of various laboratories and provided an overview of the various research activities.

2 Dr. Jeff Casello, Associate Provost, Graduate Studies, Dr. Kankar Bhattacharya, Professor, Electrical and Computer Engineering, Dr. Dipanjan Basu, Associate Professor, Civil and Environmental Engineering.

Prof. Jeff Casello, Associate Provost, Graduate Studies hosted the lunch. During the meeting, the IIT Directors talked about the progress that have been made, the main objectives of the visit and their plans for collaboration. Prof. Casello also talked about the various opportunities available for both undergraduate and graduate students to spend time at University of Waterloo. He was supportive of the collaboration initiative and has offered to provide all necessary support from his end.

3 Dr. Parisa Hamilton, Program Coordinator, Centre for Bioengineering and Biotechnology, Colin Russell, Manager, Program Development and Partnerships, Dr. Carl Haas, Interim Chair, Civil & Environmental Engineering, Dr. Mei Nagappan, Cheriton School of Computer Science, Mr. Kevin Boehmer, Managing Director, the Water Institute



Dr. Mei Nagappan, Dr. Carl Haas, Kevin Boehmer, Prof. Basu, Prof. Satyanarayana, Prof. Das, Dr. Rohit Sharma

Dr. Colin Russel provided an overview of the research activities at the center for Bioengineering and Biotechnology some of which include.

- Drug Delivery
 - Sensing
 - Diagnostic and Imaging
 - Nano Particles
 - Fluid Mechanics
- a) They expressed interest to collaborate in the area of medical imaging and devices and have requested a list of faculty members in the area of Biomedical engineering who will be willing to work with faculty from Waterloo.
- b) Dr. Mei Nagappan is already working with Dr. Sridhar Chimalakonda at IIT Tirupati in the area of software engineering and they are already planning to offer a joint course next semester. Dr. Nagappan has agreed to host both undergraduate and graduate students for internships.

5. University of Toronto

Date of Visit: Sep 18, 2018



Prof. Tamer El Diraby, Dr. Judy Farvolden, Dr. Adriano Vissa

1. **Tamer El Diraby, Associate Professor, Civil and Mineral Engineering; Judy Farvolden Executive Director, UTTRI, Oh Sung Kwon Associate Professor, Civil and Mineral Engineering, Adriano Vissa Associate Director, Corporate Partnerships**
 - a. Prof. Judy Farvolden provided an overview of the University of Toronto Transportation Research Institute (UTTRI) that works with faculty and experts from engineering, economics, policy, urban geography and planning and computer science to address problems in complex transportation systems from the perspectives of engineering, science and humanities.
 - b. Dr. Adriano Vissa talked about the MaRS program which is an entrepreneurial program that brings together educators, researchers, social scientists, entrepreneurs and business experts together. It acts like an incubation center for researchers to commercialize their research ideas and assist startups by providing expert advice and market intelligence.
 - c. Prof. Tamer El Diraby, presented the main research activities in his group. He mainly works on construction management focusing on integrated civil infrastructure systems. His research broadly covers
 - construction engineering/constructability analysis,
 - information systems

- sustainable construction.
- d. Dr. Oh-Sung Kwon presented some of the research work in this group which include
- Hybrid simulation techniques that combine numerical models and experiments.
 - Development of constitutive models for steel fiber reinforced concrete
 - Impact response of structures.
 - Development of tubular steel structures

Dr. Kwon had visited IIT Tirupati this year to talk about the hybrid simulation techniques. He had also provided a number of suggestions for the development of the structures lab at IIT Tirupati based on his experience. He also took the delegation for a tour of various laboratories and provided an overview of the various research activates in his group.

2. Ramin Farnood, Vice-Dean, Research



Prof. Satyanaryana, Prof. Farnood, Prof. Das.

Prof. Farnood, Vice-Dean Research hosted the lunch. During the lunch discussions, the Directors from both the IITs talked about the progress that have been made, the main objectives of the visit and their plans for collaboration. Prof. Farnood welcomed the initiative and offered to provide the necessary support from his end.

5. **Mark Fox, Professor, Director, Centre for Social Services Engineering, Amy Bilton, Associate Professor, Mechanical and Industrial Engineering, Director of the Centre for Global Engineering, Ahmed Mamoud, Program Manager, Centre for Global Engineering**



Prof. Das, Prof. Satyanaryana, Dr. Rohit Sharma, Dr. Adriano Vissa, Prof. Mark Fox, Professor, Dr. Amy Bilton

- a. Prof. Fox from the Transportation Research institute talked about his research which involves the application of artificial intelligence to smart cities. His group works on:
- Semantic Interoperability in SMART cities
 - Ontologies for Semantic Interoperability
 - Next Generation Urban Operating Systems
 - Toilet Block Design
 - The PolisGnosis Project for Computational Analysis of City Performance

- b. Professor Fox has an extensive knowledge of India and has been working on the Smart Cities projects in India along with IIT-Bombay, Tata Trusts and Government of Ontario to provide sustainable solution for growth. He also works at the University of Toronto School of Cities, which is a center interdisciplinary urban research, education and engagement with the aim of making cities and urban regions more sustainable.
- c. Prof. Satyanarayana mentioned that Amara Raja Batteries is also working on Smart village project with a similar objective and may be willing to fund such an initiative.
- d. Dr. Fox will be visiting India in Dec. and has agreed to visit the IITs to discuss research possibilities.
- e. Dr. Bilton works on the development new electromechanical systems that have applications in water purification systems, desalination systems, and renewable energy. She is currently working on the deployment of a solar-powered water purification system in the developing world.
- f. The Center for Global Engineering also works on food fortification to combat anemia in developing countries. The team works on projects to deliver micronutrients like iron by fortification of commonly used food products such as tea and salt. They have developed Double Fortified Salt fortified with iron and iodine that has been introduced in Tamilnadu, India. They are also working on tea fortification technologies for including iron in tea without changing its taste and color.
- g. Both the Directors mentioned that there is strong group working on water at both the Institutes and there exists a lot of potential for collaboration.

Visit to Texas A&M University

Delegates from IIT Tirupati

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati

Dr. Venkataraman Pandurangan, Assistant Professor, IIT Tirupati

1. Background Information

IIT Tirupati has already initiated a fruitful ongoing relationship with Texas A&M. Last summer (2017), five of our Mechanical Engineering students were selected for a 6 weeks undergraduate summer research grant program supported by the Head of Industrial and Systems Engineering Department at Texas A&M. This summer one student was offered the prestigious S. N. Bose Scholarship to work with Prof. Satish Bukkapatnam. We also had the privilege of hosting Prof. J. N. Reddy at our campus in July 2017 for interaction with our students and faculty. Also this year, Prof. Satish Bukkapatnam together with the Manufacturing faculty at IIT Tirupati and the Confederation of Indian Industries (CII), are working on a joint workshop with Industry 4.0 as its central theme. We had a detailed discussion with Prof. Eyad Masad, Executive Director for Global Initiatives on the prospective collaboration avenues. Professor Arun Srinivasa from the Mechanical Engineering department visited IIT Tirupati this year.

Building on these interactions, IIT Tirupati was keen on developing the positive relationship with Texas A&M into a long-term academic partnership including student exchange programs, joint degree programs, and research collaborations, and also explore the possibility of signing a formal MoU.

IIT Tirupati has always been keen on pursuing opportunities to engage with top-tier universities across the world. During the Canadian visit, the IIT Tirupati delegation also visited Texas A&M University (TAMU) to explore the possibility for establishing a formal collaboration.

The highlights of the discussion and the actions that were identified during the meetings are summarized in the following pages.

Date of Visit: Sep 10, 2018

1 Prof. J N REDDY, Distinguished Professor, Regents' Professor and inaugural holder of the Oscar S. Wyatt Endowed Chair in Mechanical Engineering at Texas A&M University



Prof. Reddy, Prof. Satyanaryana, Prof Satish Bukkapatnam.

Professor Reddy was very supportive about the emerging partnership between IIT Tirupati and TAMU. He suggested the following ideas for taking the collaboration forward.

1. Mentoring of Young Faculty and Postdocs by distinguished faculty members of TAMU. He suggested that IIT Tirupati and TAMU faculty to co-advise PhD students.
2. Establishment of a sister centre at IIT Tirupati in partnership with local Industries to provide skill development programs for industry personnel.
3. Exploring the possibility for establishing a TEES centre at IIT Tirupati.
4. Establishment of an Industry Consortium with a threefold mission.
 - Carrying out Applied research
 - Training of Industry Personnel
 - Formation of a consultancy cell to provide expert advice to local industries to solve some of their day-to-day problems. One possible model is where the industries pay a small annual membership to IIT Tirupati for the service and for larger problems provide a research grant.

5. Provide institute level funding/Explore funding options for postdocs to spend time in TAMU to facilitate research collaboration.

2 Prof. VIKRAM KINRA, Professor, Aerospace Engineering

Prof. Vikram Kinra was very much interested in kick starting the collaborative initiatives with IIT Tirupati.

1. To begin with, he suggested that both TAMU and IIT Tirupati work on the “study abroad” program wherein a group of 15-20 students led by a faculty from TAMU visit IIT Tirupati every summer and offer a course for both TAMU and IIT Tirupati student. TAMU students will get an international exposure and get to experience the local culture of the region, and IIT Tirupati students will benefit by getting to learn from experienced TAMU faculty and will get an opportunity to network. IIT Tirupati faculty will also get an opportunity to collaborate with TAMU faculty.
2. Both TAMU and IIT Tirupati will work towards this initiative and target the summer of 2020 for hosting the first batch of students from TAMU. Prof. Satish Bukkapatnam and Dr. P. Venkataraman will follow up on this initiative from the respective ends.
3. IIT Tirupati has in principal agreed to take care of the accommodation and local hospitality for TAMU students.

3 Prof. ZACHARY GRASLEY, Director, Center for Infrastructure Renewal

Prof. Zak Grasley provided an overview of some of the research activities at the Center for Infrastructural Renewal which is the largest center of its kinds in the US. Some of the research areas in his group are

- NDT evaluation
- Using Drones for repair and evaluation of structures
- Use of Additive manufacturing/ 3D printing in construction
- Connected Infrastructure
- Smart Grids
- Rail research and Transportation Infrastructure

The group also works on developing materials for Infrastructure development. Prof. Grasley is open to engage with IIT Tirupati on the research front. He suggested that IIT Tirupati identify certain research themes where the students and faculty can work together.

4 Thomas E. Lacy, Jr., Professor of Aerospace Engineering and Computational Engineering

Prof. Lacy mainly works in computational and experimental solid mechanics. He was earlier the CTO of the composite centre at Boeing. He presented the major research activities in his team which include

- Multiscale modeling of composite structures.

- Multifunctional materials
- Stochastic multiscale modeling
- Lightning strike test on composites
- Fatigue and fracture studies on Composites

He works with Prof. J. N. Reddy and was welcoming to the idea of a possible research collaboration between the two institutes.

5 Prof. P R KUMAR - Professor and College of Engineering Chair in Computer Engineering and Prof. NARASIMHA REDDY J.W. Runyon Professor in Electrical and Computer Engineering, Associate Dean for Research

Prof. Kumar suggested that IIT Tirupati consider research initiatives in the following areas to establish itself in the forefront of research

1. Research areas
 - Medical Devices
 - Drones that typically fly between 200-500 feet within a 20km radius for precision agriculture and surveillance
 - Renewable energy
 - Shale gas
 - Cyber Security
 - Galium Nitride FABs
2. Forming an advisory team with TAMU faculty and industry experts on board and organizing brainstorming sessions with IIT Tirupati faculty on some of these leap frogging technologies. This would enable IIT Tirupati to remain at the forefront of research.
3. Develop the innovation and entrepreneurship ecosystem within the campus. He gave example of the AGGIES invent program at TAMU (<https://aggiesinvent.tamu.edu/>) wherein a group of students are given a problem and a 48 hour window to come up with a possible solution. Some interesting outcomes from these competitions include heat sensors for babies locked up in cars, Pacifier that detects hydration in babies etc.
4. Making it mandatory for students to attend many seminars to broaden their domain knowledge and working on research problems that are of relevance to the local community at large.
5. Encouraging faculty to actively engage with Industry in consulting roles by minimizing the paper work and without the need for establishing a formal relationship.

6 Prof. BALAKRISHNA HARIDAS, Biomedical Engineering, Executive Director, TEES Division of Commercialization and Entrepreneurship

Prof. Balakrishna provided an overview of the role played by his team to help researchers commercialize their research. The commercialization and entrepreneurship office comprises of senior Entrepreneurs-In-Residence who are from the industry and

Entrepreneurs-In-Training who are a group of PhD students who have entrepreneurial interest. The team collaborates with researchers on matters relating to IP, conducting training programs on IP, and providing incubation support for research interested in launching new start-ups. Some of the activities include:

1. Conducting “New Ventures” competition where students come with a business plan and pitch in front of an expert panel.
2. Conducting a six week I-Corps Fellow program to help students develop a business model based on their research innovations.
1. His suggestion for IIT Tirupati were
 - Providing IP Training for faculty and researchers.
 - Promoting a start-up culture within the campus with a greater engineering focus and targeting low revenue companies.
 - Establishment of an “New investment fund” with the support of high net worth Alumni to support some of these initiatives.

7 Prof. Mark H. Weichold, Regents Professor, Executive Director for Halliburton Global Engineering Program, Senior Associate Dean for Academic Affairs

1. Prof. Weichold talked about the various distance education programs at TAMU. He also mentioned that the student can enroll with the online courses on a provisional basis. If they satisfactorily complete the courses with good grades they are considered for a degree program at TAMU, else offered a certificate for the courses that they have completed.
2. When working with partner universities, TAMU favors the Dual degree model over the Joint degree model where the students complete the required credits from both Institutes and get a degree from both the Institutions.
3. One possibility for IIT Tirupati is the Dual Bachelor-Master’s program where students earn their Bachelor degree from IIT Tirupati and Master degree from TAMU. For the Master’s degree, students can earn some of their credit at Tirupati by enrolling in online courses conducted by TAMU or completing certain graduate level courses at IIT Tirupati and transferring those credits to TAMU. This would help them finish their Master’s degree at TAMU faster. The funding option for this model has to be worked out.
4. Co-advising PhD students can be considered in the immediate future for promoting research collaboration between the two institutes and the mentoring of IIT Tirupati faculty.

8 Prof. Cathy Banks, Dean of Engineering, Director, Texas A&M Engineering Experiment Station and Prof. N.K. Anand, Executive Associate Dean of Engineering, Associate Director, Texas A&M Engineering Experiment Station

1. Prof. Satyanarayana provided an overview of IIT Tirupati, its current developmental status and the previous engagements with TAMU. To further take these collaborations forward, the Director suggested the following
 - a. Launching of the “Study Abroad” program
 - b. Setting up of a TEES office at IIT Tirupati as suggested by some faculty at TAMU
 - c. Exchange program for Faculty and Graduate students
 - d. Joint research programs
2. Prof. Anand was supportive of the “study abroad” program. Regarding the setting up of a TEES office, he will discuss it further with the top management.
3. He mentioned that the Co-advising of PhD students and Dual degree programs models are feasible and can be worked out in the near future.
4. He also suggested that CII workshop and academic workshop on Industry 4.0 being planned at IIT Tirupati should not be a one off event, but a regular event which will help in promoting research collaboration between the two Institutes.
5. Prof. Anand is willing to offer a GIAN course on Finite volume method.

9 Dinner reception hosted by Prof. P R Kumar



Prof. Thomas E. Lacy, Prasad N Enjeti, Prof. Amarnath Banerjee, Prof. Satish Bukkapatnam, Prof. Satyanaryana.

Prof. Kumar organized a dinner reception in the evening at college station. It was attended by some of the senior faculty members of the TAMU including:

- Prof. Binayak P Mohanty, Department of Biological and Agricultural Engineering
- Prof. Prasad N Enjeti, Associate Dean of Academic Affairs and TI-Professor
- Prof. Satish Bukkapatnam, Director, TEES Institute for Manufacturing Systems
- Prof. Vikram Kinra, Professor Aerospace Engineering
- Prof. Amarnath Banerjee, Professor Corrie and Jim Furber '64 Faculty Fellow
- Prof. P R Kumar, College of Engineering Chair in Computer Engineering
- Prof. Thomas E. Lacy, Jr, Aerospace Engineering and Computational Engineering
- Prof. Natarajan Gautam, Electrical and Computer Engineering
- Dr. Dinakar Sagapuram, Assistant Professor, Industrial and Systems Engineering

Prof. Satyanarayana talked about IIT Tirupati's journey so far starting from its announcement in 2014, commencement of operations in 2015 to its current state. He also talked about the existing partnership with TAMU and his plans for the taking the collaboration forward. The faculty present at the reception were happy to learn about the progress made by IIT Tirupati and offered to provide all possible support with regards to the collaborative initiatives.

ANNEXURES

UBC Visit Itinerary for the Indian Institutes of Technology – Tirupati & Ropar

Visitors

- Prof. Satyanarayana Kalidindi (Director – IIT Tirupati)
- Prof. P. Venkataraman (Assistant Professor – IIT Tirupati)
- Prof. Sarit Kumar Das (Director – IIT Ropar)
- Prof. Rohit Sharma (Associate Professor – IIT Ropar)

Tuesday, September 11, 2018

Time	Activity	Location
4:30 PM	Meeting with Prof. Alejandro Adem (CEO – Mitacs)	West Coast Suites, 5961 Student Union Blvd
6:00 PM	Dinner meeting with Prof. Nemkumar Banthia (CEO & Scientific Director – IC-IMPACTS)	TBC (Meet at West Coast Suites)

Wednesday, September 12, 2018

Time	Activity	Location
11:00 AM	Meeting with UBC Faculty of Land and Food Systems <ul style="list-style-type: none">• Prof. Rickey Yada (Dean)• Prof. Christine Scaman (Associate Dean, Academic)	Dean's Office (Room # 248), Second Floor, HR MacMillan Building, 2357 Main Mall
12:00 PM	Free time	
2:30 PM	Meeting with Prof. Sujatha Ramdorai (UBC Mathematics and Tata Institute for Fundamental Research)	Pacific Institute for the Mathematical Sciences, Room # 4176, Earth Sciences Building, 2207 Main Mall
4:00 PM	Meeting with Prof. Nemkumar Banthia for tour of UBC Civil Structural and Earthquake Labs	(Meeting Location TBC)
5:00 PM	Free Time	
6:00 PM	Dinner with Prof. Santa Ono (President & Vice Chancellor) & Prof. Murali Chandrashekar (Vice Provost, International)	Norman Mackenzie House, 6565 NW Marine Drive
7:45	Depart for Airport	

IIT Tirupati & IIT Ropar

Thursday, September 13, 2018

1:00 p.m. to 6:00 p.m.

MB 305

Delegates from IIT Tirupati

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati

Dr. Venkataraman Pandurangan, Assistant Professor, IIT Tirupati

Delegates from IIT Ropar

Prof. Sarit K. Das, Director, IIT Ropar

Dr. Rohit Y. Sharma, Associate Dean, IIT Ropar

Delegates from UCalgary

Prof. Janaka Ruwanpura, vice-provost (international)

Prof. Anil Mehrotra, interim department head, professor, Chemical and Petroleum Engineering, Schulich School of Engineering

Ms. Uli Ng, regional manager, Asia Pacific, UC International

Mr. Scott Vu, partnerships officer, Asia Pacific, UC International

Pickup at Hotel Alma

12:45 p.m.

Mr. Scott Vu, partnerships officer, Asia Pacific, UC International

Welcome to the University of Calgary & Introduction to International Strategy

1:00 p.m. – 1:20 p.m.

Prof. Janaka Ruwanpura, vice-provost (international)

Introduction to the Schulich School of Engineering

1:20 p.m. – 1:40 p.m.

Prof. Anil Mehrotra, interim department head, professor, Chemical and Petroleum Engineering

IIT Tirupati Presentation

1:40 p.m. – 2:10 p.m.

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati

IIT Ropar Presentation

2:10 p.m. – 2:40 p.m.

Prof. Sarit K. Das, Director, IIT Ropar

Research Collaboration, Faculty and Student Exchange Discussions

2:40 p.m. – 2:55 p.m.

Break

2:55 p.m. – 3:00 p.m.

Lab Tour

3:00 p.m. – 4:00 p.m.

Group Photo

4:00 p.m.

Dinner at Calcutta Cricket Club
340 17 Ave SW, Calgary, AB T2S 0A8
6:00 p.m. pick-up from Hotel Alma
6:30 p.m. dinner reservation

End

IIT Tirupati & IIT Ropar
Meeting with Schulich School of Engineering
Friday, September 14, 2018
10:00 a.m. to 10:20 a.m.
ENC 101

Delegates from IIT Tirupati

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati
Dr. Venkataraman Pandurangan, Assistant Professor, IIT Tirupati

Delegates from IIT Ropar

Prof. Sarit K. Das, Director, IIT Ropar
Dr. Rohit Y. Sharma, Associate Dean, IIT Ropar

Delegates from UCalgary

Dr. Bill Rosehart, dean, Schulich School of Engineering
Dr. Gopal Achari, associate dean (graduate studies), Schulich School of Engineering
Mr. Tom Liu, country coordinator, UC International

Welcome to the Schulich School of Engineering & Meet and Greet

10:00 a.m. – 10:20 a.m.

Dr. Bill Rosehart, dean, Schulich School of Engineering

Group Photo

10:20 a.m.

Mr. Tom Liu, country coordinator, UC International

End

IIT Tirupati & IIT Ropar
Meeting with Faculty of Science
Friday, September 14, 2018
10:30 a.m. to 11:00 a.m.
Dean's Office, Faculty of Science

Delegates from IIT Tirupati

Prof. Satyanarayana N. Kalidindi, Director, IIT Tirupati
Dr. Venkataraman Pandurangan, Assistant Professor, IIT Tirupati

Delegates from IIT Ropar

Prof. Sarit K. Das, Director, IIT Ropar
Dr. Rohit Y. Sharma, Associate Dean, IIT Ropar

Delegates from UCalgary

Dr. Leslie Rigg, dean, Faculty of Science
Dr. Cindy Graham, vice-dean, Faculty of Science
Mr. Tom Liu, country coordinator, UC International

Welcome to the Faculty of Science & Meet and Greet

10:30 a.m. – 11:00 a.m.

Dr. Leslie Rigg, dean, Faculty of Science

Group Photo & Campus Tour

11:00 a.m. – 12:00 p.m.

Mr. Tom Liu, country coordinator, UC International

End

**IIT TIRUPATI & IIT ROPAR
VISIT TO UNIVERSITY OF WATERLOO**

Date: 17 September, 2018

Time: 10:00 – 15:00

Objective: To discuss opportunities for collaboration in student mobility, joint degree programs, research partnerships, and the possibility for establishing a Canada-India Center of Excellence at each IIT.

Delegates from IIT Tirupati and IIT Ropar:

- Prof. Kalidindi N. Satyanarayana, *IIT Tirupati Director*
- Prof. Sarit Kumar Das, *IIT Ropar Director*
- Dr. Rohit Sharma, *Associate Professor, Electrical Engineering*
- Dr. Venkataraman Pandurangan, *Assistant Professor, Mechanical Engineering*

Research Collaboration Interests:

- IIT Tirupati: Smart Infrastructure and Food Technologies
- IIT Ropar: Water and Medical Technologies

Participants from University of Waterloo:

- Dr. Rick Culham, Vice-Dean, Engineering
- Dr. Jeff Casello, Associate Provost, Graduate Studies
- Drew Knight, Director, Global Research & Strategic Alliances
- Dr. Sushanta Mitra, Executive Director, Waterloo Institute for Nanotechnology
- Dr. Lisa Pokrajac, Assistant Director, Waterloo Institute for Nanotechnology
- Dr. Catherine Burns, Executive Director, Centre for Bioengineering and Biotechnology
- Dr. Parisa Hamilton, Program Coordinator, Centre for Bioengineering and Biotechnology
- Dr. Carl Haas, Interim Chair, Department of Civil & Environmental Engineering; Canada Research Chair
- Dr. Kankar Bhattacharya, Professor, Electrical and Computer Engineering
- Dr. Dipanjan Basu, Associate Professor, Civil and Environmental Engineering
- Dr. Mei Nagappan, Assistant Professor, Cheriton School of Computer Science
- Colin Russell, Manager, Program Development and Partnerships, Centre for Bioengineering and Biotechnology
- Kevin Boehmer, Managing Director, the Water Institute
- Jasmin Ozkur, International Activities Coordinator, Waterloo International

Contact:

Jasmin Ozkur, International Activities Coordinator

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Time	Description	Attendees	Location
10:00 – 11:00	Welcome and overview	IIT Delegation Dr. Kalidindi Satyanarayana Dr. Sarit Kumar Das Dr. Venkataraman Pandurangan Dr. Rohit Sharma Waterloo: Dr. Sushanta Mitra, WIN Jasmin Ozkur, Waterloo International	QNC 3402
11:00 – 12:00	Roundtable discussion on opportunities for collaboration (Engineering & general)	IIT Delegation Waterloo: Dr. Rick Culham, Engineering Dr. Sushanta Mitra, WIN Dr. Lisa Pokrajac, WIN Drew Knight, Office of Research Jasmin Ozkur, Waterloo International	
11:45 – 12:00	Tour of WIN facility	IIT Delegation Waterloo: Dr. Lisa Pokrajac, WIN Oleg Stukalov, WIN Jasmin Ozkur, Waterloo International	QNC
12:00 – 13:30	Lunch	IIT Delegation Waterloo: Dr. Jeff Casello, Engineering Dr. Kankar Bhattacharya, Dr. Dipanjan Basu Jasmin Ozkur, Waterloo International	University Club
13:30 -14:00	Bioengineering & Biotechnology	IIT Delegation Waterloo: Dr. Parisa Hamilton, Bioeng. & biotech. Colin Russell, Bioeng. & biotech. Jasmin Ozkur, Waterloo International	Waterloo International
14:00 – 15:00	Smart infrastructure & water	IIT Delegation Waterloo: Dr. Carl Haas, Civil Engineering Dr. Mei Nagappan, Computer Science Dr. Dipanjan Basu, Environmental Engineering Kevin Boehmer, Water Institute Jasmin Ozkur, Waterloo International	Waterloo International

Meeting with IIT Tirupati, IIT Ropar and University of Toronto Faculty of Applied Science & Engineering

September 18th, 2018, 9:00 – 16:30,
Myhal Centre, 55 St. George Street, Toronto, ON, M5S 1A4
Contact person: Adriano Vissa - Mobile: 647-966-5748

Meeting objectives:

- For IIT Tirupati and IIT Ropar to learn about
 - The Faculty of Applied Science and Engineering’s research in areas synergistic to the IIT’s R&D priorities (smart infrastructure, water technologies and global engineering).
 - Models for mentoring, collaboration and partnership at U of T

For U of T Engineering to learn about:

- The IIT’s R&D priorities and challenges
- The IIT’s mandate, current research partnerships and collaborative opportunities between IIT Tirupati, IIT Ropar and U of T Engineering

Agenda

Morning

Time	Topic	Lead	Location
8:45	Coffee served in MY 857	MY 857	MY 857
9:00	Welcome and partnering with UofT Engineering	Allison Brown	
9:20	Overview of IIT Tirupati	Satyanarayana Kalidindi	
9:40	Overview of IIT Ropar	S.K Das	
10:00	Strategies for developing e-cities and smart cities	Tamer El-Diaby	
10:20	Overview of U of T Transportation Research Institute (UTTRI)	Judy Farvolden	

Lunch

Time	Topic	Lead	Location
12:00	Lunch at The Faculty Club with IIT's and Vice-Dean, Research		41 Willcocks St, Toronto, ON M5S 3G3

Afternoon

Time	Topic	Lead	Location
13:45	Coffee served in MY 763	MY 763	MY763
14:00	Overview of IIT Tirupati	Satyanarayana Kalidindi	
14:20	Overview of IIT Ropar	S.K Das	
14:40	The Centre for Social Services Engineering and School of Cities	Mark Fox	
15:10	The Centre for Global Engineering	Amy Bilton & other CGEN members	
16:30	Wrap up		

IIT Tirupati Participants

Name	Role
Satyanarayana Kalidindi	Director, IIT Tirupati
Venkataraman Pandurangan	Assistant Professor, Mechanical Engineering

IIT Ropar Participants

Name	Role
S.K. Das	Director, IIT Ropar
Rohit Sharma	Associate Professor, Electrical Engineering

U of T Participants - Morning

Name	Role
Tamer El-Diraby	Associate Professor, Department of Civil and Mineral Engineering; Director, Centre for Civil Informatics
Judy Farvolden	Executive Director, UTTRI
Oh-Sung Kwon	Associate Professor, Department of Civil and Mineral Engineering
Allison Brown	Director, Corporate and Foundation Partnerships, Faculty of Applied Science and Engineering
Adriano Vissa	Associate Director, Corporate Partnerships, Faculty of Applied Science and Engineering

U of T Participants - Afternoon

Name	Role
Mark Fox	Professor, Department of Mechanical and Industrial Engineering; Department of Computer Science; Director, Centre for Social Services Engineering
Amy Bilton	Associate Professor, Department of Mechanical and Industrial Engineering; Director, Centre for Global Engineering
Ahmed Mamoud	Program Manager, Centre for Global Engineering
Allison Brown	Director, Corporate and Foundation Partnerships, Faculty of Applied Science and Engineering
Adriano Vissa	Associate Director, Corporate Partnerships, Faculty of Applied Science and Engineering
Other CGEN members (to be determined)	