Knowledge Incubation for TEQIP

Indian Institute of Technology Kanpur
TYPES OF ACTIVITIES

- Innovative content development
- Design of experiments and set-ups
- Seminars
- Teaching workshops and schools in specific cluster of courses
- Short-courses and workshops in niche areas
- Reports and repository
- Short-term visit of graduate students from TEQIP institutions
- Summer and winter internship program
- Visiting researcher program
1. Pravartanā 2013
2. Five day workshop on Systems Engineering
3. International Workshop on Novel Combustion Concepts for Sustainable Energy Development
4. Workshop on Leadership Exposure
5. TEQIP workshop on Teaching Methodologies in Chemical and Material Sciences
6. TEQIP workshop on Mechanics in Physics
7. Workshop on Dynamics and Vibrations
8. Summer internship and visiting researcher program 2014
9. MOOC on Cloud Computing & MOOC on MOOC
10. Workshop for Computer Science Teachers
11. Pravartanā 2014
12. Winter Internship and Visiting Researcher Program 2014
13. TEQIP Workshop on Digital Networks and Communications
14. Short Course on Structure and Characterization of Materials
15. International Workshop on Sustainable Energy, Power and Propulsion
16. CALDAM, School on Discrete Mathematics
17. Mechanics School at IITK
18. TEQIP Workshop on Electromagnetic Theory
19. Workshop on Effective use of EdRP Components
20. Short Course on Basic Physics for B.Sc. students, 2015
21. TEQIP Summer Internship and visiting researcher Program, 2015
22. TEQIP School on System & Control
23. Short term Course on Micro manufacturing
24. TEQIP Workshop on Materials & Metallurgy Curriculum Discussion
26. TEQIP Winter Internship and Visiting Researcher Program (December 1-23, 2015)
27. TEQIP Workshop on High Resolution X-Ray & Electron Diffraction
29. Short term course on Research Skills & Methods
30. TEQIP Workshop on Advanced Robotics
31. TEQIP School on Computational Methods in Engineering Application
32. TEQIP Workshop on Advanced Micro-nano Technologies
33. TEQIP Summer Internship and visiting researcher Program, 2016
34. Short Course on Basic Physics for B.Sc. students
35. TEQIP Workshop on Machining Dynamics
36. TEQIP Workshop on Advanced sensors and Actuators
37. TEQIP Workshop on Control Techniques and Applications
38. A Short Course on Combustion: Fundamental and Applications
39. Winter Internship
40. TEQIP School on Mechanics of Reinforced Polymer Composites
41. TEQIP Workshop on Modeling, Simulation & Implementation using MATLAB & Simulink
42. Rarefied and Microscale Gases and Viscoelastic Fluids: a Unified Framework
43. International Workshop on Energy, Propulsion and Environment
44. UP Start-up Conclave on Entrepreneurship & Innovation in Academic Institutions: Challenges and Opportunities.
Objective: The main goal of the workshop was to promote interdisciplinary conversation and informal faculty mentoring, while providing all faculty with opportunities to hone and expand their teaching.

Number of Registered Participants: 77
Number of Institutes Participated: 17
Number of Speakers: 18
Objective: This workshop discussed the links of system engineering to fundamentals of decision theory and statistics.

Number of Registered Participants: 08
Number of Institutes Participated: 7
Number of Speakers: 04
Objective: This workshop focused on required course content and pedagogy of combustion education both in undergraduate levels as well as the research ideas and methods in related issues.

Number of Registered Participants: 17
Number of Speakers: 30
Number of Institutes Participated: 05
Objective: It aimed at discussing and suggesting curricula and directions for Chemical and Materials Engineering Programs. The workshop emphasized that the teaching methods must evolve with ever changing field requirements. The participants discussed how to fill the current gap between the theory and hands-on skills of the students and how to design motivational curricula for them.

Number of Registered Participants: 30
Number of Speakers: 25
Number of Institutes Participated: 11
Objective: The objective of the workshop was to introduce the participants to the organizational structure of IIT Kanpur and how it functions as an autonomous institute.

Number of Registered Participants: 33
Number of Speakers: 20
Number of Institutes Participated: 08
Objectives: The chief aim of the workshop was to motivate and empower the participants to articulate their eagerness for a contemporary Engineering Physics Curriculum.

Number of Registered Participants: 52
Number of Speakers: 10
Number of Institutes Participated: 24
Objective: The 4 day workshop aimed at an exposure to the subject at various levels for the teaching faculty. Talks and discussions on the subject and special topics were delivered by experts from teaching institutes and industrial organization.

Number of Registered Participants: 16
Number of Speakers: 10
Number of Institutes Participated: 06
Summer internship and visiting researcher program

May - July, 2014

Objective: This program aimed at encouraging research collaborations and motivate students from QC institutes to work with experts at IITK to learn new skills and techniques.

Number of selected candidates:
6 Faculty members and 12 Students

List of Selected Faculty Members

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Faculty Name</th>
<th>Institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. K.K Dubey</td>
<td>University Institute of Engineering and Technology (UIET), MDU, Rohtak</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Avinash Shukla</td>
<td>IFTM University, Moradabad</td>
</tr>
<tr>
<td>3.</td>
<td>Dr. Deepak Singh Bisht</td>
<td>IFTM University, Moradabad</td>
</tr>
<tr>
<td>4.</td>
<td>Dr. Prabhakar Bhandari</td>
<td>IFTM University, Moradabad</td>
</tr>
<tr>
<td>5.</td>
<td>Dr. Nagendra Reddy</td>
<td>NIT Kurukshetra</td>
</tr>
<tr>
<td>6.</td>
<td>Dr. N.K Singh</td>
<td>NIT Kurukshetra</td>
</tr>
</tbody>
</table>

List of Selected Students

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Student Name</th>
<th>Institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Abhinav Singh</td>
<td>Madan Mohan Malaviya University of Technology</td>
</tr>
<tr>
<td>2.</td>
<td>Abir Roy</td>
<td>MNNIT, Allahabad</td>
</tr>
<tr>
<td>3.</td>
<td>Mr. Deepak Kumar</td>
<td>IFTM, Moradabad</td>
</tr>
<tr>
<td>4.</td>
<td>Harmeet Grehwal</td>
<td>GB Panth Engineering College, Pauri Garhwal</td>
</tr>
<tr>
<td>5.</td>
<td>Jaikishan Damani</td>
<td>MANIT, Bhopal</td>
</tr>
<tr>
<td>6.</td>
<td>Nandini Shama</td>
<td>PEC University of Technology, Chandigarh</td>
</tr>
<tr>
<td>7.</td>
<td>Parnika Mishra</td>
<td>UIET, Panjab University, Chandigarh</td>
</tr>
<tr>
<td>8.</td>
<td>Paritosh Agrawal</td>
<td>UIET, Panjab University, Chandigarh</td>
</tr>
<tr>
<td>9.</td>
<td>Sannidhya Kumar Ghosh</td>
<td>Jadavpur University, Kolkata, India</td>
</tr>
<tr>
<td>10.</td>
<td>Soumya Varma</td>
<td>Maulana Azad National Institute of Technology, Bhopal</td>
</tr>
<tr>
<td>11.</td>
<td>Vinay Jain</td>
<td>UICET, Panjab University</td>
</tr>
<tr>
<td>12.</td>
<td>Avijeet Mukherjee</td>
<td>IIEST, Shibpur</td>
</tr>
</tbody>
</table>
MOOC on Cloud Computing

Objective: This course was planned to address the challenges posed by contemporary application scenarios. A set of short lecture videos in the form of learning objects were given to students. This course had assessment components in the form of quizzes. It also offered opportunities to discuss online with fellow students and instructors. Students were given a certificate of accomplishment after successfully completing the course.

Number of Registered Participants: 1648
Number of Institutes Participated: 63

August 25 – November 15, 2014

http://www.iitrpr.ac.in/class/a4c//
TEQIP Workshop for Computer Science Teachers

Objective: This was planned to impress upon the participants the need of developing a theoretically sound curriculum with strong Mathematical and Logical base.

Number of Registered Participants: 31
Number of Speakers: 05
Number of Institutes Participated: 15
Pravartana 2014

Objective: This workshop was in two parts, a school followed by a symposium in the broad fields of mechanics and applied mathematics. This was another step towards expanding the scope IIT Kanpur's engagement with TEQIP institutes in both research and pedagogy. This workshop aimed at bringing together educators to discuss teaching methodologies in mechanics and applied mathematics to expand their pedagogical goals.

Number of Registered Participants: 75
Number of Speakers: 21
Number of Institutes Participated: 18
Objective: The course highlighted the most important concepts of digital communications and networks, especially from the perspective of UG teaching. The focus was on basics, and ideas that constitute the bedrock of modern communication systems.

Number of Registered Participants: 44
Number of Speakers: 06
Number of Institutes Participated: 10
Winter Internship and Visiting Researcher Program 2014

**Objective:** It aimed to give a boost to the culture of collaborative work between IITK and Institutes in it’s quality circle. This was also planned to create opportunity for them to learn new ideas and gain new interests in their research field.

**Number of selected candidates:**
- **Students:** 20
- **Faculty Members:** 8
Short Course on Structure and Characterization of Materials

Objective: The course was designed to demonstrate the relevance and importance of key materials characterization method to the teachers and industrial participants and to familiarize them with the technical advances that have taken over the years.

Number of Registered Participants: 43
Number of speakers: 8
Number of Institutes participated: 18
International Workshop on Sustainable Energy, Power and Propulsion

January 05-07, 2015

Objective: This was a 3 day workshop held at Jadavpur University, Kolkata. It aimed to discuss major technological advances in power, energy, transport and propulsion developments for diverse applications. Special focus was on high speed propulsion, micro-scale power generation and novel combustion concepts using fossil fuels, bio-fuels and their mixtures.

Number of Registered Participants: 23
Number of speakers: 32
Number of Institutes participated: 6
Objective: This conference was focused on topics related to:
- Efficient algorithms and data structures, their analysis (both theoretical and experimental) and the mathematical problems arising there.
- New applications of discrete mathematics, advances in existing applications and development of new tools for discrete mathematics.

Number of Registered Participants: 12
Number of speakers: 12
Number of Institutes participated: 06
Mechanics School at IIT Kanpur

**Objective:** TEQIP workshop ‘Mechanics School at IIT Kanpur’ intended at introducing its participants to the basic fundamentals of mechanics and applied mathematics which should be emphasized while teaching a course on these subjects to undergraduate students. This event was designed adhering to the feedbacks of participants from previous similar workshops. For the first time a workshop with parallel sessions was organized by KIT, IIT Kanpur. The idea was to make the event flexible for participants, so that they can chose to attend the lectures they are truly interested in.

**Number of Registered Participants:** 66  
**Number of speakers:** 10  
**Number of Institutes participated:** 22
Objective: This workshop aimed to cover a coherent group of topics: EMT, Optics and Lasers. This workshop discussed the contemporary aspects of teaching EMT/Optics/Lasers in a physics course at the technical colleges. There were model lectures, experiments, tutorial-sessions and discussions and homework/exam problems. In addition to understanding and appreciating the contemporary aspects of traditional EMT, lectures given by experts in this workshop aimed to present the seamless transition from EMT to optics and lasers. One of the objectives of this workshop was commend the contents covered in the workshop to form part of the engineering physics curriculum.

Number of Registered Participants: 34
Number of speakers: 07
Number of Institutes participated: 16
Effective Use of EdRP Components

Objective: The objective of EdRP components was to provide software components, for use in academic institutes in India to facilitate easy management of learning resources in an academic system. The main goal of the project was to put together an integrated e-learning environment for a University/Institute for improving quality of learning. This workshop aimed at providing exposure to effective use of the Brihaspati EdRP products (Brihaspati-3 LMS, BGAS, Payroll System, PICO).

Number of Registered Participants: 40
Number of Speakers: 04
Number of Institutes Participated: 19
Objective: The Summer Internship programme aimed at exposing selected students and faculties from QC institutes to the academic culture of IIT Kanpur and help them adopt new methods of learning their subject of interest.

Number of selected candidates:
Faculty: 17
Students: 35
Short term courses on
Basic Physics for B.Sc Students

Objective: The 2-week course intended to give students a flavour of Basic Physics at UG level both in experiments and in theory.

Number of Registered Participants: 41
Number of Institutes Participated: 19
Number of Speakers: 13
Objective: It aimed at giving tutorial lesson on control system and it gave exposure to the participants to contemporary technological applications.

Number of Registered Participants: 61
Number of Institutes Participated: 23
Number of Speakers: 14
Objective: The basic objective of the course was to acquaint the participants with the principles, basic machine tools, developments in the \(\mu\)-manufacturing processes, micro and nano metrology and research trends in the area of \(\mu\)-manufacturing processes. Thus, this short term course dealt with various areas of micro manufacturing including measurement techniques.

Number of Registered Participants: 28
Number of Institutes Participated: 21
Number of Speakers: 30
Objective: The primary aim of the workshop was to discuss the undergraduate curriculum of Materials and Metallurgical Engineering and similar disciplines. The emphasis was to understand the structure of curriculum in various institutes and come up with a model curriculum with common core courses which can be adopted across all institutes.

Number of Registered Participants: 25
Number of Institutes Participated: 15
Microstructure Engineering via Heat Treatments

Objective:

• To introduce the fundamental concepts applied in designing various heat treatments of steels and Aluminum alloys.
• To introduce the basic characterization techniques used to analyze heat treated components.
• To impart hands on experience in metallographic sample preparation as well as live demonstration of some heat treatment processes and characterization of heat treated components.

Number of Registered Participants: 29
Number of Institutes Participated: 11
Number Of Speakers: 06
Objective: It aimed to give a boost to the culture of student and faculty exchange between IITK and Institutes in its quality circle. This was also planned to create opportunity for the participants to learn new ideas and gain new interests in their research field.

Number of selected candidates:
Students: 4
Faculty Members: 9
Objective: The aim of this workshop was to provide in-depth theoretical knowledge about the principles of the advanced diffraction techniques and provided information about the state of the art equipment available at the Department of Materials Science and Engineering and Advanced Centre for Materials Science of IIT Kanpur.

Number of Registered Participants: 45
Number of Institutes Participated: 19
Number of Speakers: 09
Objective: The aim of this symposium was to bring together experts from various academic institutions and research labs within the country and participants from the various TEQIP institutes and expose the participants to the recent trends in applied areas of mechanics with special focus on vibrations, plasticity and non-destructive testing.

Number of Registered Participants: 19
Number of Institutes Participated: 12
Number of Speakers: 21
Short term course on Research Skills & Methods

**Objective**: The broad objective of this course was to make individuals who are launching their research careers understand the philosophy of research and introduce them to various tools that can help improve their research and problem solving skills.

**Number of Registered Participants**: 46  
**Number of Institutes Participated**: 22  
**Number of Speakers**: 5  

*February 19 - 21, 2016*
Objective: The aim of this workshop was to provide the basic and advanced topics of robotics to the engineering faculty and students working in this field. The workshop comprised of the essential theory with hands on experiments by the experts from academic institutions to improve the understanding of this highly technical field.

Number of Registered Participants: 40
Number of Institutes Participated: 20
Number of Speakers: 12
Objective: The aim of the school was to impart basic level courses for the various computational methods used in the area of solid and fluid mechanics. In this school, emphasis was given on the basic understanding of these methods through the lectures or talks from the experts in the respective fields.

Number of registered participants: 33
Number of Institutes Participated: 12
Number of Speakers: 14
Objective: This workshop aimed at providing hardware training in realizing miniaturized products like sensors, actuating devices, optical devices, fluidic devices etc. The course was more focused on Miniaturization, which has resulted from the increased needs of the industry to produce devices that occupy very less space and are time and energy efficient.

Number of Registered Participants: 32
Number of Institutes Participated: 15
Number of Speakers: 23
Summer Internship and Visiting Researcher Program

Objective: This program was offered in all the departments at IIT Kanpur. Visiting Researcher Program was planned to facilitate knowledge exchange between faculty members of IIT Kanpur and guest faculties from Institutes under KIT’s quality circle. The Summer Internship part aimed at exposing selected students from QC institutes to the academic culture of IIT Kanpur and help them adopt new methods of learning their subject of interest. The selected candidates conduct their internships on approved topics given to them by their host faculty at IITK.

Number of selected candidates:
Internship Students: 24
Faculty Members: 4
Short course on basic physics for B.Sc. students

This course was organized by Prof. H.C Verma at IIT Kanpur. The course was designed to give students a flavour of Basic Physics at UG level both in experiments and in theory. This course was designed for students going to 2nd year of BSc program, it focused on deeper understanding and analysis of the phenomena and developing competence in applying the Principles in a given situation.

Number of selected candidates: 39
Objective: The workshop introduced essential theory to model machining processes, machine tool dynamics and models to characterize process-machine interactions to predict and avoid unstable chatter vibrations. Hands-on experimental testing of machine dynamics, cutting force characterization and chatter detection and avoidance enabled the participants to improve their understanding of this highly technical and non-intuitive field. Engineering faculty, students, researchers in R&D labs along with personnel working in machine tool/cutting tool developer and user industries were the target audience. Learning from this workshop helped faculty to motivate students to address challenges faced by the manufacturing enterprise.

Number of registered participants: 29
Number of Institutes Participated: 16
Number of Speakers: 09
Objective: KIT, IIT Kanpur in association with Centre for Mechatronics, IITK organized a 4 day workshop on “Advanced Sensors and Actuators” to make teachers/researchers aware of theoretical and practical aspects of sensors and actuators together with the associated technologies in practice. The workshop comprised of the essential theory with hands on experiments by the experts from academic institutions and industries. Eminent researchers in the areas of Aeronautical, Computer Science, Mechanical Engineering, Electrical and Electronics, Physics, and Medical Sciences, etc. from across the country delivered the lectures.

Number of registered participants: 42
Number of Institutes Participated: 18
Number of Speakers: 15
Objective: With the recent focus being on developing autonomous vehicles for carrying out sophisticated tasks, understanding system identification, state estimation and control techniques has gained importance. This aimed at introducing the participants to advance control techniques, system identification methods, and their applications to aerospace systems like quadrotors, fixed-wing vehicles, and helicopters.

Number of registered participants: 32
Number of Institutes Participated: 18
Number of Speakers: 16
A Short Course on Combustion: Fundamental and Applications

This course is expected to cover fundamental understanding of this multi-scale, multi-physics problem, i.e. combustion and their potential applications and challenges in the development of modern combustion systems for the transportation, power-generation and other industrial applications.

Number of Registered Participants: 15
Number of Institutes Participated: 10
Number of Speakers: 03
The winter Internship program is planned towards boosting the culture of collaborative work between IITK and TEQIP Institutes in its quality circle.

**Number of selected candidates:**

**Students:** 11

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name</th>
<th>University</th>
<th>Internship Subject</th>
<th>Worked Under</th>
<th>Duration of stay</th>
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<tbody>
<tr>
<td>1</td>
<td>Ajay Kumar Gangwar</td>
<td>AMU</td>
<td>Two complementary split ring resonators loaded on folded dipole for triple-band applications</td>
<td>Dr. Kumar Vaibhav Srivastava</td>
<td>Nov 19 - Jan 05, 2017</td>
</tr>
<tr>
<td>2</td>
<td>Prashant Upadhyaya</td>
<td>AMU</td>
<td>Performance comparison of open source speech recognition toolkit</td>
<td>Prof. Rajesh M. Hegde</td>
<td>Nov 27 - Jan 05, 2017</td>
</tr>
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<td>3</td>
<td>Afzal Amanullah</td>
<td>AMU</td>
<td>Disturbance Observer based speed control of BLDC motor</td>
<td>Prof. Ramprasad Potluri</td>
<td>Dec 02 - Jan 14, 2017</td>
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<tr>
<td>4</td>
<td>Prachi Tripathi</td>
<td>HBTU, Kanpur</td>
<td>Under Water Communication using IDMA Scheme</td>
<td>Prof. Ajit Chaturvedi.</td>
<td>Nov 21 - Jan 01, 2017</td>
</tr>
<tr>
<td>5</td>
<td>Tarushi Singh</td>
<td>HBTU, Kanpur</td>
<td>Status of PUCC and its impact on Air Quality in Kanpur</td>
<td>Prof. Anubha Goel</td>
<td>Dec 13 - Jan 01, 2017</td>
</tr>
<tr>
<td>6</td>
<td>Reena Sharma</td>
<td>HBTU, Kanpur</td>
<td>Coating of polydopamine on TiO$_2$ nanofibers</td>
<td>Dr. Raju Kumar Gupta</td>
<td>21 Nov - 14 Jan, 2017</td>
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<td>7</td>
<td>Jigyasa Kumar</td>
<td>HBTU, Kanpur</td>
<td>Oxidant-Induced polydopamine coating on melamine foam</td>
<td>Dr. Raju Kumar Gupta</td>
<td>21 Nov - 14 Jan, 2017</td>
</tr>
<tr>
<td>8</td>
<td>Toshi Srivastava</td>
<td>HBTU, Kanpur</td>
<td>Solid Waste Landfills Management using Geosynthetic Clay Liners</td>
<td>Prof. Rajesh Sathiyamoorthy</td>
<td>Dec 19 - Jan 20, 2017</td>
</tr>
<tr>
<td>9</td>
<td>Tahzeeb Zahra</td>
<td>HBTU, Kanpur</td>
<td>Preconcentration of Heavy Metal Ions And its Modelling</td>
<td>Prof. Nishith Verma</td>
<td>Dec 13 - Jan 01, 2017</td>
</tr>
<tr>
<td>10</td>
<td>Akriti Rastogi</td>
<td>HBTU, Kanpur</td>
<td>Behaviour of Piles under Earthquake Loading’</td>
<td>Dr. Nihar Ranjan Patra,</td>
<td>Jan 01-28, 2017</td>
</tr>
<tr>
<td>11</td>
<td>Dinesh Kumar Malviya</td>
<td>MMMUT, Gorakhpur</td>
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</table>
The school on Mechanics of Reinforced Polymer Composites emphasized on the fundamentals of theoretical and experimental mechanics of reinforced polymer composites.

Participants got the chance to interact with experts of different fields at common place.

Participant got an exposure to the mechanics of reinforced polymer composites at macro as well micro levels and the insight to the experimental mechanics.

The lectures delivered by speakers were very useful for participants to explore their research and career.

The theoretical part of the school represented the different aspects of mechanics of fiber and particular composites.

Advanced techniques presented by invited speakers.

This school introduced the fundamental of characterization of composites under various conditions.

Number of Registered Participants: 63
Number of Institutes Participated: 22
Number of Speakers: 08
This workshop aimed at providing practical methods for incorporating Simulink in the classroom to enhance teaching of technical concepts.

After attending this workshop, participates got an idea on how to use Matlab tools to enhance their teaching/research and make learning more effective. The participants learnt about different features of Matlab and how to combine them with their theoretical knowledge to analyze and visualize data for their teaching and research.

Participants learned how to use Matlab for:
- Technical Computing (programming, plotting etc.)
- Modeling physical systems
- How to do different simulations using Matlab
- How to do signal processing and image processing and its applications

Number of Registered Participants: 82
Number of Institutes Participated: 22
Number of Speakers: 01
Objective

The proposed course focused on developing an understanding/appreciation for the use of higher order continuum equations (extended hydrodynamics)/DSMC for studying flows of rarefied microscale gases and viscoelastic fluids. It aimed at explaining the procedures of the advanced subject of non-equilibrium fluid dynamics in a simplistic. The course also touched upon the state-of-the-art research going on in the world, and the opportunities/challenges that exist in this area. The course was conducted through lectures, case studies and assignments.

Number of Registered Participants: 07
Number of Speakers: 06
About

The International Workshop on Energy, Propulsion and Environment is a jointly organized workshop by University of Maryland, TEQIP, College Park, University of Illinois at Chicago, ACRI CFD and Indian Institute of Technology Kanpur, and conducted at Indian Institute of Technology Kanpur. It is the 7th workshop in a Series on Status of Combustion in India.

Highlights

• Invited lectures by renowned experts in the field of energy and combustion from across the globe.
• Pre-workshop tutorials on experimental combustion diagnostics.
• Poster presentation competition for students.

Topics to be discussed:

• Lean Direct Injection Research
• Study of Molten Flow Breakup Behavior in Solid Rocket Motor
• Design and Investigation on Modified Mechanism on Stirling Engine Powered by Renewable Energy
• Development of Rate-Controlled Constrained-Equilibrium for Modeling Non-equilibrium Combustion Process
• Sustainable Biofuels for Transportation
• Catalytic conversion of triglycerides and to green liquid biofuels
• A cloud-based, real-time emergency response system
• Innovative Bio-Char Briquetting from Corn Residue by Torrefaction Process
• Effect of Fuel Unsaturation on Emissions in Diesel Engine Combustion
• Low Damköhler number combustion in bespoke fractal grid turbulence
• Alternate Energy and Fuel Development for South India
• Dynamics of Ducted Inverse Diffusion Flames: A Dynamical Systems Approach
• How a spray interacts with swirling flow
• GE Aviation Low Emissions Combustion Technologies
• Fuel Cell Systems in India: Opportunities and Challenges
• Boron Nanoparticles for Energy and Propulsion Applications

Number of Registered Participants from TEQIP Institutes: 11
Number of Speakers: 27
Objective

This workshop aimed at making teachers and students acquainted with the process of converting a viable innovative idea/research into a valuable product and the final outcome being generating entrepreneurs. The participants were familiarized to the challenges faced by potential entrepreneurs to actuate their ideas into a product. Entrepreneurs from different domains were invited to share their success stories and challenges faced by them.

Topics discussed:
- Importance of Entrepreneurship
- Elements of TBI Infrastructure and Challenges
- Importance of IP Management
- IP commercialization
- Challenges faced by Entrepreneurs
- government funding avenues to the Incubator and Startup Companies

Number of Registered Participants: 98
Number of Speakers: 18
Total number of participants in events organized by KIT IIT Kanpur: **1516**
MOOC participants: **1648**
Total number of events organized: **44**

**Workshops organized in different Department during 2014-2016**
A paper entitled "Tensile test on pine needles and crack analysis of pine needles short fiber reinforced composites" has been published in the IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) based on the work carried out by the students from BTKIT Dwarahat, Mr. Litton Bhandari and Vipin Singh Panwar as part of their summer internship program with Profs. P M Mohite and C. S. Upadhyay. The full paper is at: http://www.iosrjournals.org/iosr-jmce/papers/vol12-issue5/Version-4/A012540108.pdf

Mr. Mudit Kumar Singh, a Ph D student at Motilal Nehru National Institute of Technology (MN NIT), Allahabad has returned for his second summer internship with Prof. A K Sharma at IIT Kanpur. This has helped him in shaping the research problem and conceptual modelling of his work. He has also written two chapters of his PhD thesis based on his work here.

They have together worked on some publications as well. The details of these are:


Long term training program at NcFlexE, IIT Kanpur

Two faculty from R.V college of Engineering are visiting IIT Kanpur for training under Dr. Deepak Gupta and Dr. Panda. Details of their work is given below:

<table>
<thead>
<tr>
<th>Program:</th>
<th>Long Term Training (Supported by TEQIP &amp; RVCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venue:</td>
<td>Samtel Center for Display Technologies - NcFlexe, IIT-Kanpur</td>
</tr>
<tr>
<td>Faculty Name:</td>
<td>Dr. Divakara S G, Dept. of Chemistry, RVCE - Bengaluru</td>
</tr>
<tr>
<td>Mentor Name:</td>
<td>Dr. Deepak Gupta, Dept. of MSE, IIT-Kanpur</td>
</tr>
</tbody>
</table>

Here at IIT Kanpur, we are working on the IGZO based bottom gate structure TFT devices. The devices typically have band mobility ($\mu_0$) in the range of 20–50 cm$^2$/V-sec, depending on process conditions and film quality, a low off-current of $\sim$100fA, and a steep sub-threshold slope (S) of 0.1–0.2 V/dec. They are normally operated in enhancement mode; thus, the threshold voltage $V_T$ is positive (1–5 V), depending on the doping density. To control $V_T$, Ga or Zn compositions can be varied. In order to achieve the same in our designs, the fabrication steps used are depicted in Fig. 1. A metal layer was used for gate and source/drain (S/D) electrodes. These metal electrodes were patterned using a lift-off technique. The gate insulator (Al2O3/SiO2/SiNx) and the active layer (a-IGZO) were deposited by RF magnetron sputtering or PECVD/ ALD process. After the active-layer formation and (S/D) electrode definition, an additional Al2O3 capping layer was added, which served as passivation for the TFT back channel. Finally, the TFT was subjected to a thermal annealing.
Source separation is one of the most relevant estimation problems found in sensing chemicals in an environment with more than one chemical present which are mixed together. A mixing process can also take place even when the components are not chemically mixed. For instance, in ionic analysis of liquid samples, the ions are not chemically connected, but, due to the lack of selectivity of the chemical sensors, the acquired responses may be influenced by ions that are not the desired ones. Also, there are some situations where the pure components cannot be isolated chemically since they appear only in the presence of other components. A possible solution to this problem is to set up an array composed of different ISEs. This allows the desired information to be recovered by signal processing methods that exploit the diversity provided by the array (diversity here means that each sensor responds differently). In this context, unsupervised signal processing methods can be particularly useful, since it works without calibration, or, at least, with a limited number of training samples. Such a feature can be interesting since it avoids the need for performing calibration from time to time. A system architecture with the chemical sensor array and the required algorithm for improving sensitivity and selectivity would be called as smart sensor architecture.

The approach followed is show in the below figure.

<table>
<thead>
<tr>
<th>Program:</th>
<th>Long Term Training (Supported by TEQIP &amp; RVCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venue:</td>
<td>Samtel Center for Display Technologies - NcFlexe, IIT-Kanpur</td>
</tr>
<tr>
<td>Faculty Name:</td>
<td>Mr. Ravishankar Holla, Dept. of ECE, RVCE - Bengaluru</td>
</tr>
<tr>
<td>Mentor Name:</td>
<td>Dr. Siddhartha Panda, Dept. of MSE, IIT-Kanpur</td>
</tr>
</tbody>
</table>

The implementation is done in phases with each block in the above diagram representing a phase. Testing of the implemented phase is done against experimental data.

Other than the above approach, there are some other techniques also which are applicable for chemical sensing applications. Once they are implemented and tested a comparison can be done with respect to usage of the techniques for various mixing models and sensor arrays.
**Synthesis and Characterization of GaFe1-xTixO3 (x=0.025, 0.05, 0.075, 0.10) ceramics**

In recent years, much attention has been paid to multiferroic materials because of their applications in the non-volatile memories, spintronics and sensors. Gallium ferrite (GaFeO3) is one of the few single phase multiferroic material. GaFeO3 (GFO) crystallizes non-centrosymmetric orthorhombic structure with space group Pc21n. There are four different types of cations (Ga1, Ga2, Fe1 and Fe2) and six types of oxygen atoms. Ga1 is tetrahedrally coordinated whereas Ga2, Fe1 and Fe2 are octahedrally coordinated with oxygen atoms. The electric polarization in this compound is mainly due to the non-centrosymmetric structure of the Fe ions. Fe1 and Fe2 sites are surrounded by distorted network of oxygen octahedra which in turn disturbs the positions of Fe ions and the off-centering shift of the Fe ions gives the electric polarization along the b axis. The ferromagnetic to paramagnetic transition temperature for GFO is below room temperature and it is also possible to tune the magnetic transition temperature near to room temperature by changing the Fe–O–Fe bond parameters due to the exchange interaction between Fe+3 ions. The properties of GFO can be altered by making changes to the materials processing method, microstructure tuning as well as by altering the chemistry. For example, the ferrimagnetic to paramagnetic transition temperature (Tc) can also alter by using different synthesis technique by tailoring the ratio of Ga to Fe ions and also by doping at A/B site in the GFO.

In this project, we doped the Ti at B-site in GaFeO3, synthesized by solid state reaction method.
High Efficiency Vertical Axis Wind Turbine
Abhishek, Abhijit Kushari, Yonas Gebre, Palash Jain
Department of Aerospace Engineering

Theme / Broad area of the invention/technology
- Disruptive vertical axis wind turbine design with variable amplitude dynamic blade pitching
- Small wind energy for solar-wind hybrid system
- Low startup speed (2 m/s) ideal for low wind areas and areas with non-laminar wind profile

Industrial usage/ Target industry/ Technology transfer status
- J. S. Auto Pvt. Ltd. Has expressed interest in commercializing this technology
- Target market: Rural non-electrified India, Business establishments, Hilly areas with abundant wind energy potential, but lack of round-the-clock power supply

Patent details

Description/ State-of-the-art
- Lab scale prototype developed and tested
- Proof of concept demonstrated
- Physics based design tool developed and validated
- No potential alternatives with comparable capabilities offering more than 50% efficiency

Novelty of the technology
- Solved age old self-starting problem of Darrieus type turbines
- Dynamic blade pitching with variable amplitude ensures high efficiency over wide range of wind speeds
- Built-in aerodynamic braking for storm protection
- Easily adapts to rapid changes in wind direction
- Exploits unsteady aerodynamics for high efficiency

Summary/ Outlook/ Ongoing work
- 1 kW prototype being fabricated
- Field testing of 1 kW prototype planned for later this year
**Proposed Work**

A joint project between Department of Aerospace Engineering, IIT Kanpur and BTKIT Dwarahat with help of TEQIP has been undertaken for studying the possibility of using a novel wind turbine concept as source of power generation in Himalayan mountain ranges to improve the electricity access in remote location. Under this project a prototype of Vertical Axis Wind Turbine (VAWT) of approximately 1 kW capacity has been designed jointly by IIT Kanpur and students of BTKIT Dwarahat. Five students from BTKIT has come to IIT Kanpur during their summer break and have participated in the design and analysis process and have been trained in wind energy technology. Currently, a small lab scale proof of concept prototype has been made and the full scale 1kW capacity wind turbine is being fabricated at IIT Kanpur. The instrumented prototypes would then be installed at BTKIT Dwarahat and field tested to gage its energy generation potential.

The research work on vertical axis wind turbine has resulted in the following patent and publications:

Achievements

- TEQIP provided a huge platform to all the teachers from QC institutions to interact and work with the best professors from across the country and the world. Till now we have organized 44 workshops/schools/short courses/internship and visiting researcher program etc.
- In Academic year of KIT IITK from July 2015-2016, we hosted around 13 events in which around 400 participants from QC institutions and about 150 experts were brought on the same platform to interact with teachers and researchers of QC institutes.
- Comprehensive reports clearly identifying the major areas of concerns and possible solutions have been prepared in consultation with participants from the QC institutions.
- Model curriculum was discussed and developed for several disciplines – Chemical Science, Material Science, Mechanical Sciences and engineering, Computer Science and Electrical Engineering. These are available on the KIT webpage as an e-resource.
- Summer and winter internship & visiting researcher program were extremely successful. In this academic year we have hosted about 14 faculties and 30 students. Interestingly, some of the visiting faculty and students have written joint research articles with their hosts. Several young faculties could initiate new research activities with this support.
- KIT has provided a unique opportunity to PhD students from the QC institutions to spend time at IIT Kanpur, to carry out their research experiments or literature review (using our library) with a locally identified mentor.
- The student exchange program which has been launched as part of the activities has been appreciated by the students and is also providing nice exposure to students.
- Excellent resources for research and learning have been created, and are now available freely to any interested user.
- Web-based research groups have been started to share announcements and resources.
- Through the short term courses and interactions with subject experts, the faculty of the various participating institutes have improved a lot and it is very beneficial for the overall development of these institutes.
Common Demands from participants

• Create a technical council under UGC to look into the needs of the engineering and technology related departments at various universities.
• There should be more fund under the equipment head from TEQIP funding to upgrade various laboratories.
• Have a central subscription to journals accessible at all institutes.
• Development of common facilities at various TEQIP funded institutes which can be shared among themselves for research and experimentation.
Suggestions

- Creation of **effective transparent and flexible management system** with less paperwork and more productivity. This will clear a lot of hurdles in the path of institute development.
- Change the course syllabus according to field requirement. Students must be equipped with the knowledge of latest technologies in their field of interest.
- Develop good laboratories with fundamental and advanced experimental facilities.
- Provide good technical libraries and e-resources.
- Coming to TEQIP events organized at good universities expose the participants of QC institutes to the work culture of these institutes and interactions with faculty help them gain new perspective in their teaching/research field. Therefore all teachers and students must be encouraged by their institute to participate **actively** in TEQIP events.
  - All teachers and students must be informed about TEQIP events. **Event announcements should be posted on the institute webpage/notice boards.**
  - Faculty members who want to attend the workshops should be given required **support from their institute.**
  - Process of taking leave to attend TEQIP events should be simplified.
Resources generated

• **MOOKIT** an Indigenous MOOCs platform was developed. This is a locally manageable interactive e-learning platform. The first course on ‘Architecting Software for the Cloud’ was offered through this platform which was attended by 1648 candidates.

• All the events with detailed information are announced at KIT webpage [http://www.iitk.ac.in/tkic/teqip.htm](http://www.iitk.ac.in/tkic/teqip.htm) and social networking websites (Facebook, Twitter, Linkedin etc.).

• **Distribution of lecture notes, slides etc.** during / after the workshops.

• All the **workshop lecture videos and slides are uploaded on KIT webpage** so that interested teachers and students can view them anytime

• **620 lectures across various fields, with more 2400 subscribers and 12-15K accesses PER WEEK**
IMPACT OF THE TRAINING PROGRAMS

Since inception, the KIT activities have focussed on supporting quality improvement in technical institutions. Phenomenal effort has been put in by the KIT office, NPIU and the faculty of IIT Kanpur to effectively achieve the stated goals. We have seen a slow but certain change in several institutions. Graduate students from several institutions have benefitted immensely through the courses and the collaborations that have evolved subsequently. A summary of the impact can be given as:

1. **Opportunity to learn from the best teachers and researchers in given fields**: KIT enabled close interaction between the leading academicians and the students and teachers of the TEQIP institutions, which otherwise would have been impossible.

2. **Exposure to current research in given areas**: Through the workshops and conferences, the teachers and graduate students could get updated on the current issues in the research domain, so that they can better plan their own research. Also, close interaction with top researchers from across the world enthused them.
3. **Exposure to modern teaching and learning methodologies:** Through the schools and workshops, the participants got a good idea of the desired modern content of courses in specific areas and the expertise desired in allied topics (e.g. mathematics, physics, numerical analysis, experimental techniques). Since most of the schools also presented model curriculum, the participants have a template to build upon. Detailed outline of desired important new courses have also been given. The video recording of all the proceedings are ready reference material, in case some faculty is interested in following up the lessons learnt by floating a course of his/her own.

4. **Active training on state-of-the-art equipment:** Almost all the courses ensured sufficient experimental training in terms of hands-on sessions with modern equipment available at IIT Kanpur. Participants appreciated the rigorous sessions. The emphasis has been on proper planning of equipment requisition and in-house design of equipment for teaching and research purposes. The faculty from IIT Kanpur have followed up by providing support in setting up facilities, in case they were requested to do so.
5. **Access to IIT Kanpur library:** This is one major deficiency of most institutions. The libraries are poorly equipped and do not have top-quality books and journals. Through KIT any of the QC institution faculty or student is able to access the IIT Kanpur library. Several students have spent time at IIT Kanpur for literature survey. Participants in summer and winter internship programs have also benefitted immensely from the library of IIT Kanpur.

6. **Research experience and guidance:** Through the internship and visiting researcher programs we have provided a platform to the participants to closely work with the faculty of IIT Kanpur using the facilities available at IIT Kanpur. Several PhD students from the QC institutions have benefitted immensely from this initiative. In fact, some students could publish good journal articles based on the work done at IIT Kanpur. Since the program is extremely flexible continued collaboration is also encouraged – through which several faculty and students have initiated joint research activity.
LEARNING

The KIT started with a dream and a desire to achieve the dream. From the courses offered and the visits to the TEQIP institutions several outcomes/learnings can be listed. The major ones are:

1. **Fundamental deficiencies**: Though KIT has been extremely active and accommodating, we often were frustrated at the quality and quantity of participants. This is due to several reasons. The primary reason is the quality and quantity of recruited faculty in the TEQIP institutions. Most institutions have acute shortage of faculty (typical 1:30+ teacher to student ratio) due to opaque hiring policies, favouritism, litigation and flawed government policies. Further, most of these institutions are financially deficient and hence have not invested in research and teaching infra-structure.

2. **Lack of response**: The TEQIP coordinators/departments/institutions have often been extremely sluggish in responding to the announcements. The faculty, especially the senior ones, are not keen to improve quality (several possible reasons) and hence demotivated. The training of the student and aggressive incorporation of modern concepts seems to be the lowest on the priority list. The institutions simply do not respond. In many instances the same person has come as a participant for electrical engineering, mechanical and material science courses. The standard refrain is that the academic calendar is hectic and faculty available is less.

3. **Inefficient systems**: Most institutions have followed the world-bank norms only on paper. The funds from TEQIP have been used as a life-support system to sustain the barest minimum activities – due to severe fund crunch. Academic autonomy and fiscal probity are missing and the decisions are director-driven. This leads to a person-dependent response of institutions. Thus institutions with proactive directors have benefitted the most from the KIT activities (for example IFTM Moradabad). Support to faculty and students from training programs has been sluggish is some cases and absent in some, though TEQIP centres have money. This is also due to constraints imposed by the institution, SPFU and world-bank imposed restrictions.
Silver-lining:

Despite all the obstacles, a good rapport has been established with several institutions and individuals. Many keen faculty and students have benefitted immensely from the programs offered and have also given extremely useful suggestions for further improvement. The fact that research articles have come out of this initiative is extremely satisfying. Further, several faculty have incorporated parts of what they have learnt into their courses. The biggest gain is in the confidence it has instilled in the students – simply through their association with IIT Kanpur. Hope lies in these young potential teachers and researchers. As awareness of the KIT initiative increases, there have been increasing request for use of facilities at IIT Kanpur. Further, the experiences with KIT has motivated the faculty at IIT Kanpur to support this initiative. This has formed a two-way bond that enables effective learning.

Desirables for the future:
In order to significantly improve the effect of the KIT initiatives, it is important that the institutional collaborations improve significantly. This demands signing of MoUs between the TEQIP institutions and IIT Kanpur. The MoU will set the platform on which credits can be earned at IIT Kanpur, and joint research guidance can be done. This required statutory changes in the statutes of these institutions. Further, funds should be released based on effective feedback from KIT and through other evaluation mechanisms. Possible intra-mural research support could be given for collaborative research through KIT approved projects to faculty. This will enable strong faculty-to-faculty linkages which will positively affect the academic ecosystem of these institutions. This will also facilitate visits by IIT faculty to these colleges for lecture-series or for joint research work. Further, a model norm should be put in place for faculty recruitment. Funding should be linked to adherence to this recruitment policy – which should encourage good doctorates to join these institutions as faculty. Incentivising good academic initiatives will also improve quality, as achievers will be given the support that they need.
TEQIP may also review its CoE policy and while promoting the existing CoEs,

it can initiate niche centres (e.g. Hill technology centres in mountain and NE institutions) in these institutions to promote a culture of research and provide the visibility to these institutions – so that good faculty and students can be attracted to these institutions.

Similarly, cluster research facilities can be set-up as regional centres – with an autonomous administrative structure but housed in one of the institutions (like the Fraunhofer model). This will provide access to all the colleges to good research facilities (against a charge).
Feedback/ Suggestions from workshop participants

“Based on my experience after attending lectures of my supervisor Prof. Sharma, I feel such lectures at IITK especially in early stages of PhD, shape up the understanding of research so TEQIP may think in developing a proposal for conducting relevant course works for PhD students. Credit transfer mechanism may also be devised for the same.”

“In this workshop co-ordinator conducted hands on practice for us. This is very good practice for us likewise in future add more experimental things. Hands on learning provides better learning.”

“This workshop has developed my interest in machine tool vibration and its dynamics. It was really very beneficial for the beginner in the field of research like me to choose the direction and developing mechanistic model.”

With all the valuable support and training received under the supervision of Prof. A K Sharma, HSS, IITK during my KIT summer internships (2015, 2016), I am selected by the national committee for Fulbright-Nehru Doctoral fellowship 2017-18. My sincere obligations to Prof. Sharma and TEQIP sponsored KIT-IITK internship for this achievement.

Sincerely,
Mudit Kumar Singh
PhD student, MNNIT Allahabad
Feedback/ Suggestions from workshop participants

“TEQIP can help by organizing various in-house program in my institution help me to complete my research.”

“It was very helpful in learning new things which we can’t learn in our college. We learnt how to model composite, did analysis & find the effective properties. In short very helpful.”

“TEQIP gave us an opportunity to meet several professors of different fields. Communicating with them, helped me to improve my knowledge. Rather the labs of IITK are excellent.”

“TEQIP can help in providing access to all TEQIP institution, e-resources through internet like course materials of professors available at internet, resources like e-journals e-books, magazines etc.”

“The Basic Physics course will actually be of great advantage to my learning. It will bring me beyond the region of examination based studies.”

“TEQIP can conduct some knowledgeable programs where exchange of knowledge can occur between faculty members with industrial experts as well as with the researchers and scientists.”