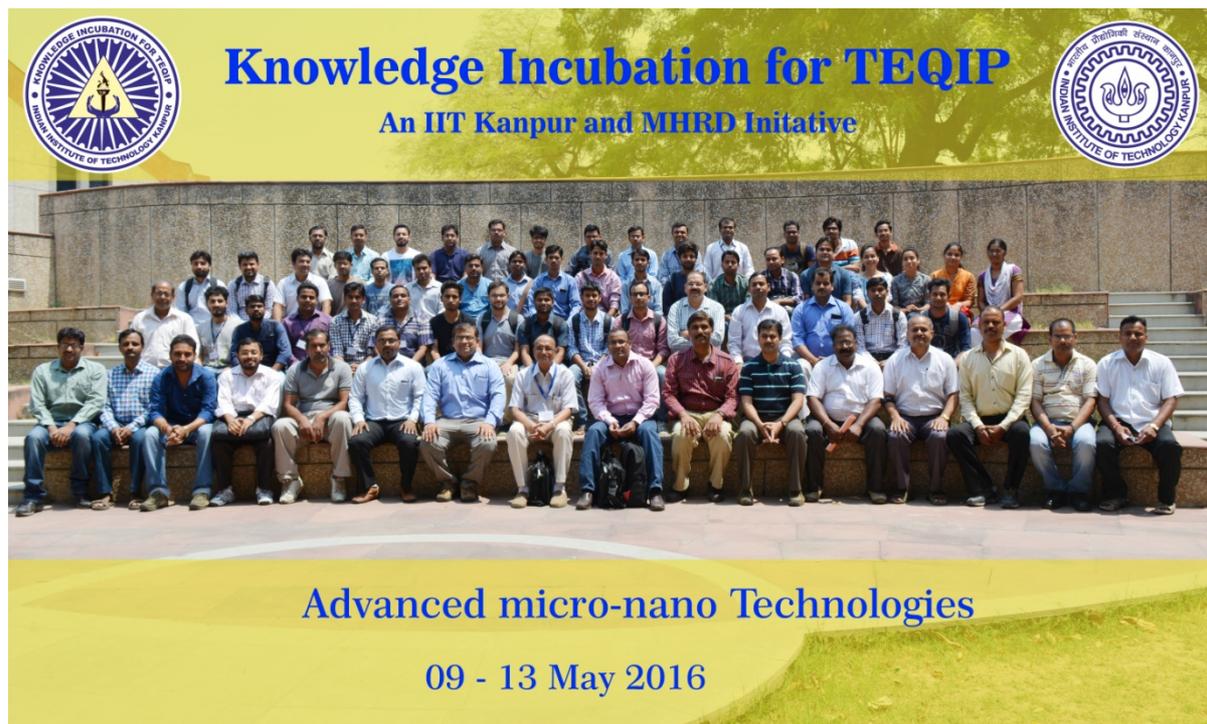




KNOWLEDGE INCUBATION FOR TEQIP, IIT KANPUR

TEQIP Workshop on Advanced Micro-nano Technologies

May 09 - 13, 2016



TEQIP workshop on **Advanced Micro-nano Technologies** was held from **09 -13 May, 2016 at IIT Kanpur**. This workshop offered a platform for providing hardware training in realizing miniaturised 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. Through the proposed course, the plan was to enable information flow necessary for sustenance of the existing research ecosystem in this area.

The following sessions were planned for the organization of this course.

1. Sensor Systems and Technologies
2. Healthcare technologies and Environmental systems.
3. Advanced micro/ nano machining processes.
4. Microfluidic systems.
5. Nano finishing processes.

Topics Discussed

- Micromanufacturing : A Vision.
- Interfacial flow through Micro Channels
- Micro EDM Issues
- Challenges in Silicon machining for Sensor fabrication
- Zino Oxide nano particles and its applications
- Micro and Nano fabrication methods
- Bio Medical Applications of Nano Technology
- Nanoindentation of Materials
- Pepti based hydrogel for bio medical applications.
- Additive manufacturing at microlevel: some challenges
- Optical Sensors and Biomedical Applications
- Flexible electronics
- Surface finishing and its importance on application in Micro and Nanodomain
- Micro Manufacturing system development and challenges
- Science and technology of miniaturization
- Laser Micro Machining of advanced materials
- Micro casting modelling and validation a challenge
- Ultrasonic Micromachining for MEMS applications
- Micro Electric Discharge capabilities and application
- Microscale fluid control for diagnostics
- Nano fabrication and characterization of energetic materials
- Fabrication, characterization and application of nanostructures in sensing and remedication
- Learning of hydrophobicity and hydrophilicity from bio applications

Lab session

- Bio MEMS Lab
- Micromanufacturing Lab
- 4I lab
- ACMS lab visit
- Nano science lab

List of Speakers

- Prof. V.K.Jain, IITKanpur
- Prof. Ashish Kumar Sen, IIT Madras
- Prof. J.Ramkumar, IIT Kanpur
- Prof. S.Panda, IIT Kanpur
- Prof. Santanu Bhattacharya, IIT Kanpur
- Prof. S.Anantha Ramakrishna, IIT Kanpur
- Prof. Niraj Sinha, IIT Kanpur
- Dr. Kantesh Balani, IITKanpur

- Prof. Arindan Banerjee, IACS Kolkatta
- Prof. P.V.M.Rao, IIT Delhi
- Prof. N.J.Vasa, IIT Madras
- Prof. MonicaKatiyar, IIT Kanpur
- Prof. Ajay Sidpara, IIT Kharagpur
- Dr. Nagahanumaiah, CMERI Durgapur
- Prof. Ramesh K Singh, IIT Bombay
- Prof. Vinod Yadav, MNNIT Allahabad
- Prof. Arvind Kumar, IIT Kanpur
- Dr. JameelAkthar, CEERI Pilani
- Prof. S.K. Subbu, NIT Warangal
- Dr. Rishikant, IIT Kanpur
- Dr. Vinay Patel, G.B.Pant University
- Dr. Ankur Gupta, IIT Kanpur
- Dr. Nripen Chandra, CMERI Durgapur

Participating Institutes

Institute	Number of Participants
G. B. Pant University of Agriculture & Technology, Pantnagar	3
DeenbandhuChhotu Ram University of Science and Technology	1
Birla Institute of Technology, Mesra Ranchi	1
College of Engineering, Kidangoor, Kerala	3
Government Engineering College, Ajmer	1
IFTM University Moradabad	1
MNNIT Allahabad, U.P	1
IET Lucknow	5
NIT Kurukshetra	2
BIET Jhansi	2
MMMUT Gorakhpur	4
Aligarh Muslim University	4
ISM Dhanbad	2
BTKIT Dwarahat	1
KNIT, Sultanpur	1
Total	32

Workshop Schedule

9 May, 2016

Time	Event
9:00 – 10:30 AM	Micromanufacturing : A Vision <i>Prof. V. K Jain, IIT Kanpur</i>
10:30 – 10:45 AM	Tea Break
10:45 – 12:00 PM	Interfacial flow through Micro Channels <i>Prof. Ashish Kr. Sen, IIT Chennai</i>
12:00 – 1:15 PM	Micro EDM Issues <i>Prof. J. Ramkumar, IIT Kanpur</i>
1:15 – 2:15 PM	Lunch Break
2:15 – 3:15 PM	Challenges in Silicon machining for Sensor fabrication <i>Prof. Siddharth Panda, IIT Kanpur</i>
3:15 – 3:30 PM	Tea Break
3:30 – 5:00 PM	Zino Oxide nano particles and its applications <i>Prof. Santanu Bhattacharya, IIT Kanpur</i>

10 May, 2016

Time	Event
9:00 – 10:30 AM	Micro and Nano fabrication methods <i>Prof. S. Anantha Ramakrishna, IIT Kanpur</i>
10:30 – 10:45 AM	Tea Break
10:45 – 12:00 PM	Bio Medical applications of Nano technology <i>Prof. Niraj Sinha, IIT Kanpur</i>
12:00 – 1:15 PM	Nanoindentation of Materials <i>Dr. Kantesh Balani, IIT Kanpur</i>
1:15 – 2:15 PM	Lunch Break
2:15 – 3:15 PM	4i Lab
3:15 – 3:30 PM	Tea Break
3:30 – 5:00 PM	Boi-Mems lab

11 May, 2016

Time	Event
9:00 – 10:30 AM	Pepti based hydrogel for Bio medical applications. <i>Prof. Arindan Banarjee, IACS Kolkatta</i>
10:30 – 10:45 AM	Tea Break
10:45 – 12:00 PM	Additive manufacturing at microlevel: some challenges <i>Prof. P.V.M.Rao, IIT Delhi</i>
12:00 – 1:15 PM	Optical Sensors and Biomedical Application <i>Prof. N.J.Vasa, IIT Madras</i>
1:15 – 2:15 PM	Lunch Break
2:15 – 3:15 PM	Flexible electronics <i>Prof. Monica Katiyar, IIT Kanpur</i>
3:15 – 3:30 PM	Tea Break
3:30 – 5:00 PM	ACMS lab visit

12 May, 2016

Time	Event
9:00 – 10:30 AM	Surface finishing and its importance on application in Micro and Nanodoman <i>Prof. Ajay Sidpara, IIT Kgp</i>
10:30 – 10:45 AM	Tea Break
10:45 – 12:00 PM	Laser Micro Machining of advanced materials <i>Prof. Vinod Yadava, MNNIT Allahabad</i>
12:00 – 1:15 PM	Micro Manufacturing system development and Challenges <i>Dr. Nagahanumaiah, CMERI Durgapur</i>
1:15 – 2:15 PM	Lunch Break
2:15 – 3:15 PM	Science and technology of miniaturization <i>Prof. R. K Singh, IIT Bombay</i>
3:15 – 3:30 PM	Tea Break
3:30 – 5:00 PM	Micro casting Modelling and validation a Challenge <i>Prof. Arvind Kumar, IIT Kanpur</i>

13 May, 2016

Time	Event
9:00 – 10:30 AM	Ultrasonic Micromachining for MEMS applications <i>Dr. Jamil Akhtar, CEERI Pilani</i>
10:30 – 10:45 AM	Tea Break
10:45 – 12:00 PM	Learning of Hydrophobicity and hydrophilicity from Bio applications <i>Dr. Nripen Chandra, CMERI Durgapur</i>
12:00 – 1:15 PM	Micro Electric Discharge capabilities and application <i>Dr. S.K.Subbu, NIT Warangal</i>
1:15 – 2:15 PM	Lunch Break
2:15 – 2:45 PM	Nano fabrication and characterization of energetic materials <i>Dr. Vinay Kumar Patel</i>
2:45 – 3:15 PM	Fabrication, characterization and application of nanostructures in sensing and remediation <i>Dr. Ankur Gupta, IIT Kanpur</i>
3:15 – 3:45 PM	Microscale fluid control for diagnostics <i>Dr. Rishikant, IIT Kanpur</i>
3:45 – 4:00 PM	Tea Break
4:00- 5:00 PM	Nano Science lab

Faculty Feedback

Workshop

<i>Questions</i>	<i>Excellent</i>	<i>Good</i>	<i>Ordinary</i>
Clarity of communication about workshop	01	03	00
Organization of the sessions	01	02	01
Quality of lectures	01	04	00
Effectiveness of discussions	00	03	01
Effectiveness of learning experience	02	02	00
	<i>Appropriate</i>	<i>Short</i>	<i>long</i>
Duration of workshop	04	00	00
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have more such sessions?	04	00	00
Would you like e-lectures by experts on special topics?	02	02	00
Suggest specific topic that you would like additional expert lectures on	<ul style="list-style-type: none"> ➤ Tribology, nano composites, biomedical applications. ➤ Nano Electronics area ➤ Design and Development of nano structured materials for energy application like super capacitor li-ion batteries. ➤ Some lectures to be arranged by industrial expert. ➤ Lecture should be more on nano application. 		
Additional Suggestions	<ul style="list-style-type: none"> ➤ This time the information about experts lectures are not in proper manner. Otherwise programme was good and fruitful. ➤ Course content not related to electronics engg. ➤ If possible hands on training and more laboratory activity. 		

Teaching

Which subjects do you teach?	<ul style="list-style-type: none"> ➤ Advanced materials tech, advanced machining process, Engg mechanics, energy management & audit, material science & engineering. ➤ Basic Electronics, Digital Electronics. ➤ Nano structured materials for various application. ➤ Polymeric Nanohybrid materials. ➤ Manufacturing science, kinematics. 			
What is average student to teacher ratio in your institute?	<ul style="list-style-type: none"> ➤ 20:01 ➤ 85:01 ➤ 40:01 ➤ 60:01 			
Questions	YES		NO	
Do you have additional support for teaching (tutors, graders, teaching Assistants, etc)?	02		02	
Do you give class projects for UG classes?	04		00	
Do you give class projects for PG classes?	03		00	
Do you have sufficient resources for laboratory courses?	02		02	
	Sufficient		Inadequate	
Is the library/journal/e-connection support adequate?	00		03	
	Definitely	May be	No	
Would you like to have common (TEQIP) repository of course material?	01	01	01	
Would you like to visit IITK to participate in and develop course material (existing or new)	03	00	00	
Would you like to participate in creation of the repository material (course files/lab. Manuals/question bank/etc)	03	00	00	
	e-courses	Workshops	Content	none
How can IITK effectively help you prepare for teaching?	01	01	00	00

How can TEQIP help improve your teaching?	<ul style="list-style-type: none"> ➤ Firstly I want to appreciate the working of TEQIP it provides each & almost person great knowledge & facilities. If possible kindly increase the practical workshops or training for students as well as for faculties. ➤ Giving opportunity to attend such courses in future.
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Research

<i>Questions</i>	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to visit an IIT for a visiting-faculty/ post-doctoral fellow, if offered (via-TEQIP)?	02	00	01
Would you like to share/use research infra-	03	00	00
Would you like to conduct collaborative	03	00	00
Would you like lectures by experts (Indian and international) on niche research areas/topics?	03	00	00
Do you want special-topic conferences?	01	01	01
How can TEQIP help improve your research?	<ul style="list-style-type: none"> ➤ Kindly collaborate in between TEQIP funded institutes that they can do research or use any equipments if they belongs to TEQIP without facing any problem & funds. ➤ To make initiative for collaboration work in terms of sharing idea as well as equipment facility. ➤ Exposure in attending the workshop STC etc. 		

Student Feedback

Workshop

Questions	<i>Excellent</i>	<i>Good</i>	<i>Ordinary</i>
Clarity of communication about	19	10	00
Organization of the sessions	18	09	02
Quality of lectures	20	09	00
Quality of posters	15	10	00
Effectiveness of discussions	13	16	00
Effectiveness of learning experience	1		
	<i>Appropriate</i>	<i>Short</i>	<i>long</i>
Duration of workshop	17	01	06
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have more such	19	5	1
Would you like e-lectures by experts on special topics?	20	2	1
Suggest specific topic that you would like additional expert lectures on	<ul style="list-style-type: none"> ➤ Fracture mechanics at nano level. ➤ Texturing on machining tool. ➤ Patterning possibility with laser. ➤ Additive Manufacturing ➤ Bio-MEMS and Micro-Fluids ➤ Simulation, flexible manufacturing system ➤ Finite element modelling. ➤ Control and monitoring (artificial intelligence) ➤ Effect of parameters such as temperature and pressure, chemical composition on the nano structures (like nano tube etc) synthesis. ➤ Bio-chemical study. ➤ Sensors ➤ Laser matter interaction ➤ Nano electronics ➤ Micromachining. ➤ Hybrid Processing. 		
Additional Suggestions	<ul style="list-style-type: none"> ➤ Please keep only on lab demonstration in a day. ➤ Kindly arrange the lectures on characterization techniques & their mechanism for nanomaterials. ➤ Lectures must be more industry oriented, all theory was cut and pass from books, speakers must tell what the new is going on the industries. ➤ Please decrease the work load in a day & increase total number of days. 		

Learning

Questions	Yes	No	
Do you get enough class projects?	18	7	
Is the learning adequate?	25	2	
Do you have sufficient resources for	24	2	
What is your area of specialization	<ul style="list-style-type: none"> ➤ Nano Technology ➤ VLSI design. ➤ Mechanical Design. ➤ Micro-EMD (production) ➤ Bio-MEMS ➤ Mechanical ➤ Micro-Machining ➤ CIM ➤ Manufacturing (nanotech) ➤ Microfabrication ➤ Bio-Mems ➤ Micromachining ➤ CNC milling, Advance Machining. 		
	Sufficient	inadequate	
Is the library/journal support/e-connection adequate?	19	3	
	Definitely	Maybe	No
Would you like to have common (TEQIP) repository of course material?	21	3	1
Would you like to visit IITK to attend specialized courses?	23		
Would you like MOOCS/e-resources based courses?	22	1	

<p>How can TEQIP help improve your learning?</p>	<ul style="list-style-type: none"> ➤ Practical oriented. ➤ We get enough exposure by seminar and discussions. ➤ By giving latest research works undergoing in the world. ➤ By the pictorial presentation. ➤ Its always better to learn something that too (research). ➤ Different technologies and undergoing research. ➤ By giving such an excellent environment of learning with excellent faculty and good machine equipment. ➤ By providing reading facility at library. ➤ Got an idea about research trends and gaps ➤ By having lectures on current technology changes. ➤ Some discussion classes may be arranged dedicated for current research activities. ➤ Giving ideas for research ➤ TEQIP must approach the industrial people rather than professor. ➤ It is my advice to TEQIP head to think over the practical outcomes of this workshop ➤ It would be better if Govt. Give this much money to village areas.
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Research

Questions	Definitely	Maybe	No
Would you like to visit an IIT for a short visit /internship/post- doctoral stint ,if offered (via TEQIP)?	19	1	1
Would you like to share/use research infrastructure at IITK, if made available?	19	1	1
Would you like to conduct collaborative research with IITK faculty?	19		1
Would you like lectures by experts (Indian and international) on niche research areas/topics?	21		
Do you want special-topic conferences?	18	3	
How can TEQIP help improve your research?	<ul style="list-style-type: none"> ➤ Highly practical oriented environment. ➤ By looking the problem which the researcher are facing we get ready for that before actually facing the problem. ➤ Laboratory session. ➤ I want to work on EDM. And i have no idea about its real working but after demonstration of EDM and now we modify parameters and applications with is used. ➤ By giving us ideas, and details of current technological changes, available. ➤ By knowing some of the current research activities. ➤ By expert lecture held during workshop. ➤ Focus on the application of various process. 		

Outcome

Twenty five participants from approximately 15 academic institutions across the country participated in the course. This course has been conducted by the joint efforts of thirty one eminent speakers from different reputed academic institutions, scientists from R & D houses, and practicing engineers from industries. The course was more focused on Miniaturization, which has resulted from the increased needs of the industry to produce devices that occupy very less size and are time and energy efficient. Many lectures covered on today's bundle of products in almost all walks of life like aerospace, defence, microelectronics, healthcare, pharmaceuticals, communication systems, machining technologies etc. As a part of the course, the participants had a lab visit to several micro manufacturing facilities available in the institute such as DST nano centre, Manufacturing Science Lab, 4 I lab, Bio-MEMS and ACMS lab.