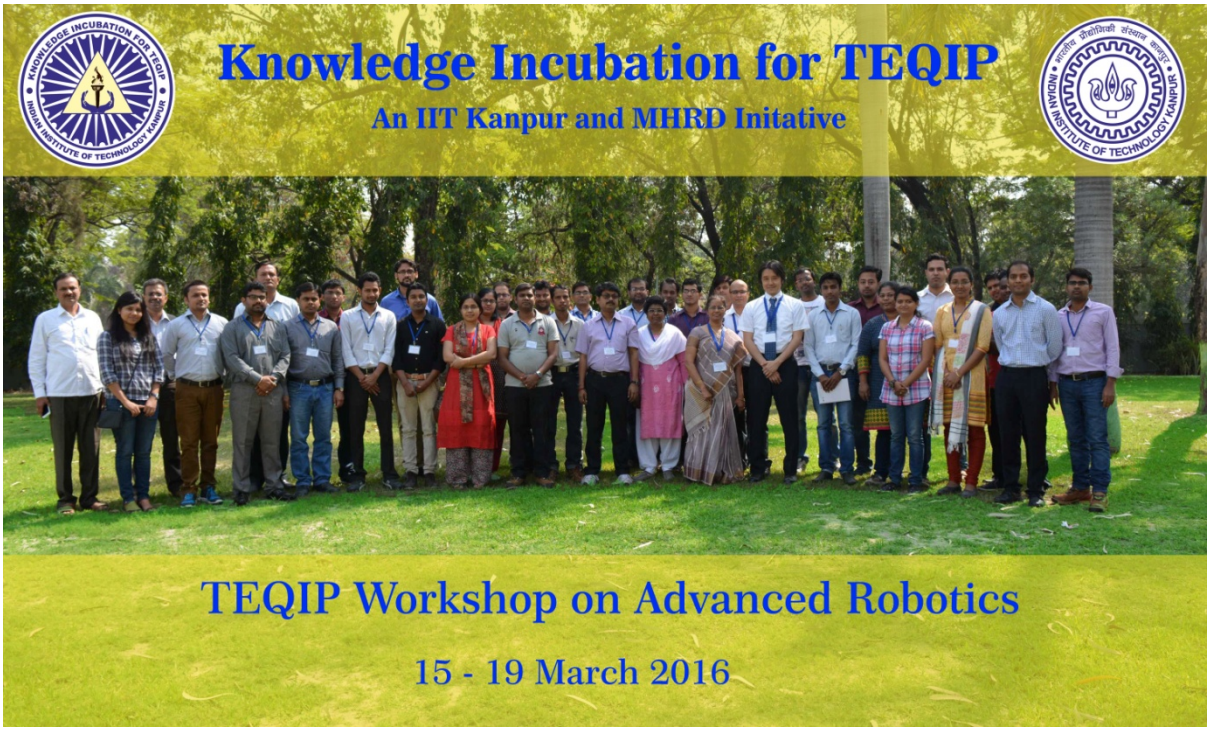
KNOWLEDGE INCUBATION FOR TEQIP, IIT KANPUR

TEQIP Workshop on Advanced Robotics

March 15 - 19, 2016



KIT, IIT Kanpur organized a five day workshop on **Advanced Robotics** during **March 15-19, 2016**. 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.It is hoped that this will improve the quality of the teaching which will motivate the students to take up the challenges in this inter disciplinary field. Plenary talks by the eminent researchers in the area from across the country also was the part of the workshop. The workshop included five keynote lectures, followed by the lectures on various topics related to advanced robotics by the experts from academic institutions, government organizations and industry.

Topics Discussed

- Fundamentals issues in Robot Kinematics,
- Dynamics
- Mobile Robots
- Motion Planning
- Control Techniques
- Sensors and Actuators
- Visual Robotics
- Multi Robot Co-ordination and formation control

- Optimization of Redundant Manipalators
- Design and Simulation of Robotics System
- Vision in Robotics
- Laboratory Session

List of Speakers

- Dr. Sudipto Mukherjee
- Dr. SandipanBandopadhyay, IIT Madras
- Dr. P. M Pathak, IIT Roorkee
- Dr. Subir K Saha, IIT Delhi
- Dr. T Ashokan, IIT Madras
- Mr. Dhirendra Singh, MATLAB
- Dr. Arshad Jamal, CAIR Bangalore
- Dr. Alok Mukherjee, DRDO Pune
- Dr. Subir K Saha, IIT Delhi
- Dr. M Krishna, IIT Hyderabad
- Dr. P. K. Pal, BARC Mumbai
- Dr. Tomohiro Shibata, Kyushu Institute of Technology Japan

Participating Institutes

Institute	Number of Participants
Dr. BabasahebAmbedkar Technological University	3
P.D.A.College of Engineering Gulbarg, Karnataka	1
SantLongowal Institute of Engineering and Technology	1
Kamla Nehru Insitiute of Technology, Sultanpur UP	3
Madanapalle Institute of Technology and Science	1
Government Engineering College, Ajmer	1
MJP Rohilkhand University	1
MNNIT Allahabad	6
Jadavpur University, Kolkata	3
BTKIT Dwarahat	1
NIT Raipur	3
IFTM University, Moradabad	1
MMMUT, Gorakhpur	1
NIT Rourkela	1
BIET Jhansi	2
HBTI, Kanpur	1
AMU, Aligarh	2
IET Lucknow	2
CSIR-CSIO Chandigarh	1
VNIT Nagpur	5
Total	**40**

Workshop Schedule

15 March, 2016

Time	Event
8:30 – 9:00 AM	**Registration**
9:00 – 10:00 AM	**Inauguration and Keynote I** *Prof. Alok Mukherjee*
10:00 – 10:30 AM	***Tea Break***
10:30 – 12:00 PM	**Introduction, Transformation and Jacobian** *Prof. A. Dutta*
12:00 – 1:30 PM	**Forward and Inverse Robot Kinematics** *Prof. S. Mukherjee*
1:30 – 2:30 PM	***Lunch Break***
2:30 – 4:00 PM	**Geometry and Kinematics of Parallel Manipulators,** *Prof. SandipanBandopadhyay*
4:00 – 4:30 PM	***Tea Break***
4:30 – 6:00 PM	**Bond Graph Modelling of Robots** *Prof. P.M. Pathak*

16 March, 2016

Time	Event
9:00 – 10:00 AM	**Keynote II** *Prof. S.K. Saha*
10:00 – 10:30 AM	***Tea Break***
10:30 – 12:00 PM	**Robot Dynamics** *Prof. S.K. Saha*
12:00 – 1:30 PM	**Motion Planning** *Prof. B. Dasgupta*
1:30 – 2:30 PM	***Lunch Break***
2:30 – 4:00 PM	**Sensors & Actuators** *Prof. A .Dutta*
4:00 – 4:30 PM	***Tea Break***
4:30 – 6:00 PM	**Multi-agent Coordination and Control** *Prof. S.R. Sahoo*

17 March, 2016

Time	Event
9:00 – 10:00 AM	**Keynote III** *Prof. M . Krishna*
10:00 – 10:30 AM	***Tea Break***
10:30 – 12:00 PM	**Intelligent Control Techniques** *Prof. L. Behera*
12:00 – 1:30 PM	**Optimization of Redundant Manipalators** *Prof.B. Dasgupta*
1:30 – 2:30 PM	**Lunch Break**
2:30 – 4:00 PM	**Motion Planning of Underwater Robots** *Prof. T. Asokan*
4:00 – 4:30 PM	**Tea Break**
4:30 – 6:00 PM	**Probabilistically Robust Motion Planning Algorithms**

	Prof. Mangal Kothari

18 March, 2016

Time	Event
9:00 – 10:00 AM	**Keynote IV** *Prof. P.K Pal*
10:00 – 10:30 AM	***Tea Break***
10:30 – 12:00 PM	**Design and Simulation of Robotics Systems** *Prof. D. Singh*
12:00 – 1:30 PM	**Vision in Robotics** *Prof. K.S. Venkatesh*
1:30 – 2:30 PM	***Lunch Break***
2:30 – 4:00 PM	**LAB SESSION-I** *Dr. A. V. Kulkarni &Prof.A. Dutta*
4:00 – 4:30 PM	***Tea Break***
4:30 – 6:00 PM	**LAB SESSION-II** *Dr .A. V. Kulkarni &Prof. A. Dutta*

19 March, 2016

Time	Event
9:00 – 10:00 AM	**Keynote V** *Prof. Tomohiro Shibata*
10:00 – 10:30 AM	***Tea Break***
10:30 – 12:00 PM	**Advanced Robotics- I** *Prof. G. Pandey*
12:00 – 1:30 PM	**Advanced Robotics-II** *Prof. A. Jamal*
1:30 – 2:30 PM	***Lunch Break***
2:30 – 4:00 PM	**Advanced Motion Planning** *Prof. I. Saha*
4:00 – 4:30 PM	***VALEDICTORY FUNCTION***

Faculty Feedback

Workshop

Questions	***Excellent***	***Good***	***Ordinary***
Clarity of communication about workshop	11	01	00
Organization of the sessions	09	03	00
Quality of lectures	12	00	00
Quality of posters	03	06	00
Effectiveness of discussions	08	04	00
Effectiveness of learning experience	08	04	00
	Appropriate	***Short***	***long***
Duration of workshop	09	01	01
	Definitely	***Maybe***	***No***

Would you like to have more such sessions?	10	01	00
Would you like e-lectures by experts on special topics?	10	01	00
Suggest specific topic that you would like additional expert lectures on	➢ The topic to be covered the hardware of the robotics. ➢ Swarm Robotics, Algorithms for mobile agents. ➢ Artificial Intelligence ➢ Mobile agents, Swarm Robots ➢ Multi body dynamics, Jacobions, Image processing for robotics applications. ➢ Robot Programming Languages(software), Robot controls in detail(hardware and software) ➢ Humanoid Robots, Simulation tools for Robotics ➢ Parallel Manipulators		
Additional Suggestions	➢ The course should be covered 50:50 basis of hardware and software about the robotics. ➢ While selecting participants, preference should be given to researchers working in the domain. ➢ Could have arranged some hands on Robotics simulation software.		

Teaching

Which subjects do you teach?	➢ CAD, CAM, Kinematics. ➢ Design & Analysis of Algorithms, Graph Theory, Optimization mobile computing. ➢ Sensors & Actuators Artificial Intelligence ➢ Networking & distributed systems. ➢ Computer Science ➢ CALDAM, Robotics, Machine Design ➢ Cyber Security. ➢ Industrial Robotics, Artificial Intelligence, Robotics & m/c vision ➢ Robotic Engg. Machine Desing. ➢ Discrete Mathematics. ➢ Distributed Systems & Parallel computing, Cryptography, robotics, Unix/Linux. ➢ Mech. Measurements & signal Processing Solid Mechanics Design.

What is average student to teacher ratio in your institute?	➢ 10:01 ➢ 08:01 ➢ 10:01 ➢ 30:01 ➢ 20:01 ➢ 20:01 ➢ 15:01 ➢ 20:01 ➢ 12:01			
Questions	***YES***		***NO***	
Do you have additional support for teaching (tutors, graders, teaching Assistants, etc)?	06		05	
Do you give class projects for UG classes?	09		02	
Do you give class projects for PG classes?	09		02	
Do you have sufficient resources for laboratory courses?	07		05	
	Sufficient		***Inadequate***	
Is the library/journal/e-connection support adequate?	09		03	
	Definitely	***May* be**	***No***	
Would you like to have common (TEQIP) repository of course material?	12	00	00	
Would you like to visit IITK to participate in and develop course material (existing or new)	09	03	00	
Would you like to participate in creation of the repository material (course files/lab. Manuals/question bank/etc)	08	04	00	
	e-courses	***Workshops***	***Content***	***none***
How can IITK effectively help you prepare for teaching?	05	09	03	00
How can TEQIP help improve your teaching?	➢ By organizing workshops/PG students & teachers & short term courses for UG students. ➢ Conducting workshops. ➢ Attending such courses will definitely help us in reorienting our teaching and also generate ideas for project work. The networking with people will also improve our domain. ➢ Access to e-library, e-journals, and experimental facilities of IITK can be provided by some means. ➢ By providing e-courses and by organizing workshops.			

Research

Questions	***Definitely***	***Maybe***	***No***
Would you like to visit an IIT for a visiting-faculty/ post-doctoral fellow, if offered (viaTEQIP)?	09	03	00
Would you like to share/use research infra-structure at IITK, if made available?	11	01	00
Would you like to conduct collaborative research with IITK?	11	01	00
Would you like lectures by experts (Indian and international) on niche research areas/topics?	12	00	00
Do you want special-topic conferences?	06	04	00
How can TEQIP help improve your research?	➢ Providing supports for attending conferences to present papers or attending the conferences. ➢ Got the scope to know about the research challenges and open problem. ➢ Such programs give us the opportunity to meet with people working in our area of interest and to know first-hand information about the research and developments related to area of interests. ➢ By organizing such workshops. ➢ Organize events for of the art research areas and research happening around the world and access to all e-resources of IIT's to TEQIP Institutions. ➢ Conducting workshops and e-lectures. ➢ By allocating small funds to the researchers for their small projects in robotics.		
Additional Questions for TEQIP 3rd Phase:			
1)Would you want in the 3rd phase of TEQIP paid access to high end experimental facilities in specific institution?	➢ 9 candidates says yes.		
2)Would you be interested in having end state art of activity TEM, SHRTM etc at specific institution (in the TEQIP fold so that all TEQIP institution can access) ?	➢ 10 candidates says yes.		

Student Feedback

Workshop

Questions	***Excellent***	***Good***	***Ordinary***
Clarity of communication about workshop	20	03	00
Organization of the sessions	16	07	00
Quality of lectures	17	06	00
Quality of posters	10	13	00

Effectiveness of discussions	11	11	01
Effectiveness of learning experience	15	08	00
	Appropriate	***Short***	***Long***
Duration of workshop	20	01	01
	Definitely	***Maybe***	***No***
Would you like to have more such sessions?	21	01	00
Would you like e-lectures by experts on special topics?	22	00	01
Suggest specific topic that you would like additional expert lectures on	➢ Material characterization, computational material science. ➢ Prosthetics & Orthotics for Human subjects ➢ SPD of metals & alloys nano science &nano engineering. ➢ Bond Graph modelling sensors & Actuators. Design & Simulation of Robotics system. ➢ Mainly related to the microcontrollers programming used in robotics. ➢ EMB/EEG based control robotics ➢ Something in computer science ➢ Severe plastic deformation, friction stir processing ➢ Parallel Robot. ➢ Image base recognition system. ➢ Modelling & control design ➢ Micromachining ➢ Mobile robots ➢ Control of flexible manipulator (position & vibration control by visual serving) ➢ Mobile robotics		
Additional Suggestions	➢ Lab sessions could be longer ➢ Increasing lab sessions. ➢ Workshop is really very knowledge enhancing and very well organized. ➢ To the electronics point of view some lectures on embedded systems. ➢ At least one lab session every day.		

Learning

Questions	***Yes***	***No***
Do you get enough class projects?	20	00
Is the learning adequate?	21	00
Do you have sufficient resources for laboratory	15	01

What is your area of specialization?	➢ Machine design. ➢ Material Science & Engineering. ➢ Electronics/ Biomedical Engg. ➢ Material Science ➢ Automations & Ind. Robotics. ➢ Quantum, Nanotech. ➢ EMB based rehabilitation robotics. ➢ Robotics & AI, ES ➢ Computer science. ➢ Parallel manipulator ➢ Vision/image processing ➢ Instrumentation ➢ Robotics ➢ Computer vision/visual serving. ➢ Bond Graph Modelling, Mobile Robotics. ➢ Manufacturing Science & Technology.		
	Sufficient	***inadequate***	
Is the library/journal support/e-connection adequate?	15	01	
	Definitely	***Maybe***	***No***
Would you like to have common (TEQIP) repository of course material?	20	01	00
Would you like to visit IITK to attend specialized courses?	23	00	00
Would you like MOOCS/e-resources based courses?	13	05	00
How can TEQIP help improve your learning?	➢ By performing such courses in future for quality education and configuration of such esteemed workshop in the field of Robotics. ➢ Providing these type of lecture & more lab sessions. ➢ By improving more of lab sessions. ➢ It can arrange various workshops on different topics like this. ➢ The learning can be enhanced if a provision is made to invite individual expert along with lectures by research. ➢ By workshop video lectures ➢ By having such type of workshops ➢ By allowing us to attend more & more events & by asking to generate similar work. ➢ By organizing a workshop we get exposure. ➢ Providing adequate fund to NITs. ➢ What's the going on in TEQIP, inform us frequently.		

Research

Questions	***Definitely***	***Maybe***	***No***
Would you like to visit an IIT for a short visit /internship/post- doctoral stint ,if offered (via TEQIP)?	22	01	00
Would you like to share/use research infra- structure at IITK, if made available?	21	02	00
Would you like to conduct collaborative research with IITK faculty?	22	01	00
Would you like lectures by experts (Indian and international) on niche research areas/topics?	22	01	00
Do you want special-topic conferences?	22	01	00
How can TEQIP help improve your research?	➢ By performing such events across the nation and in every institute. ➢ Conducting these types of session at out institute (NIT's) too. ➢ Conducting similar workshop in different fields of research. ➢ TEQIP can provide the various specialized faculties to students to conduct specific research. ➢ More than the workshop certain technical programmes may be organized like to be posted as technical assistant that may benefit building the practical part. ➢ Through TEQIP many talks of expert persons have been arranged so definitely, its helpful. ➢ Attending this kind of workshop enhanced our research ➢ By conducting workshops & seminar like these. It would definitely help me in my research. ➢ By providing not only facility, but providing experience of the others who are in same field form long time. ➢ By providing us knowledge through conducting workshop and seminars. ➢ By offering students with various courses. ➢ By organizing advance of level workshop on specific topic. (related to robotics) ➢ Providing more fund to NITs. ➢ It should be transparent to anyone		
Additional Questions for TEQIP 3rd Phase:	***Yes***	***May be***	

Would you want in the 3rd phase of TEQIP paid access to high end experimental facilities in specific institution?	06	02
Would you be interested in having end state art of activity TEM, SHRTM etc at specific institution (in the TEQIP fold so that all TEQIP institution can access) ?	06	01

Outcome

The workshop was successful as it fulfilled the objective of making the participants aware of the state-of-the–art research in the field of advanced robotics. This was possible through the numerous keynote lectures and talks and supporting lab session.The keynote lectures delivered are as follows:

- Robotics for Military Applications by ***Dr. Alok Mukherjee,***
- Robotics Competition Based Education in Engineering (RoCK-BEE) by ***Dr. S.K. Saha***
- Towards Autonomous Navigation in Dynamic Scenes by ***Dr. M. Krishna***
- Robot Applications with Sensing & Intelligence by ***Dr. P.K. Pal***
- Advanced Assistive Robotics by ***Dr. Tomohiro Shibata***

The various topics covered are: fundamentals issues in robot kinematics, dynamics, motion planning, sensors & actuators, image analysis, control techniques, mobile robots, parallel robots, underwater robots, multi-robot co-ordination and formation control. Open discussions were encouraged on the subject matter during the lecture deliveries. Thus the topics covered the various aspects of robotics ranging from space exploration to underwater exploration. The feedback of the participants is encouraging and motivating, suggesting to have more such kinds of workshops in the future with elaborated and extensive laboratory sessions.