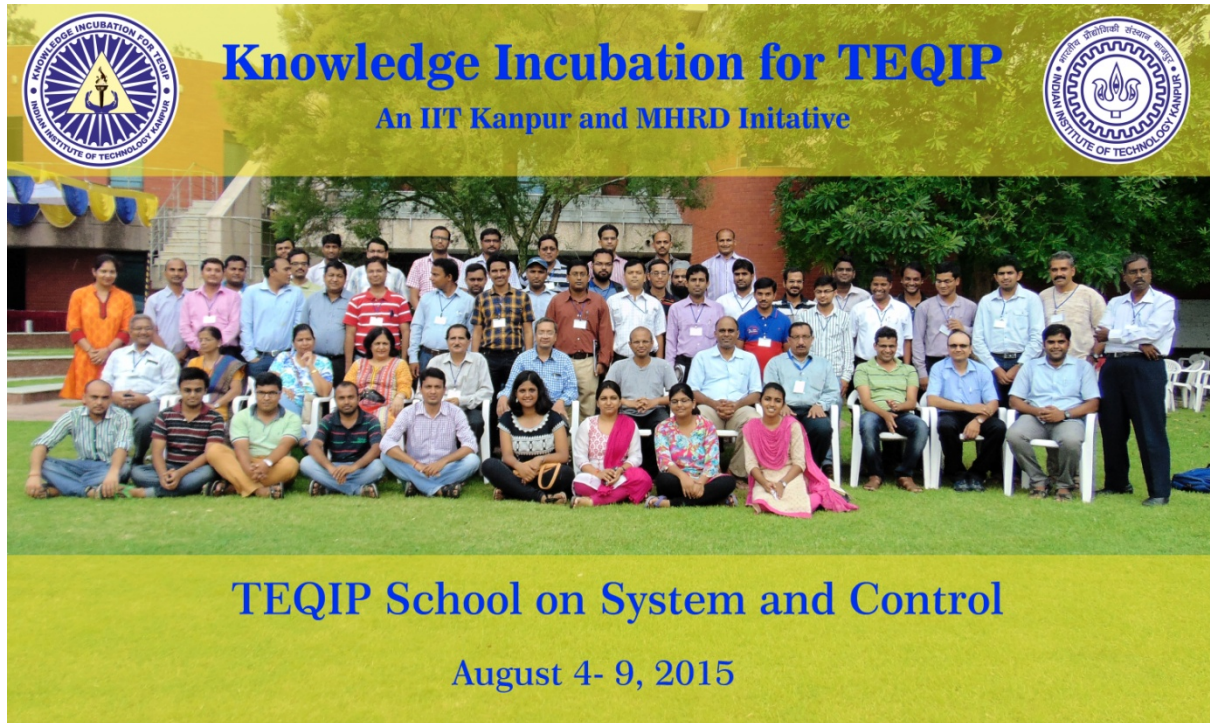




KNOWLEDGE INCUBATION FOR TEQIP, IIT KANPUR

## TEQIP School on System & Control

2015



This 6 day workshop held at IIT, Kanpur aimed at the basics along with tutorial lessons on control systems to the various participants. It also exposed the participants to contemporary technological applications. Experts from areas like intelligent control, robust control, control and guidance of autonomous vehicles, coordinated control, computer vision and machine learning, and game theory delivered lectures on a variety of topics. As part of this programme, eminent speakers were invited for a series of popular talks related to applications to control systems.

## Topics Discussed

- Automatic Control: A Historical Perspective + Possibilities in Intelligent Control
- Introduction to robust control
- System Modelling for robust control design
- Design of the path-tracking control system using SISO loop shaping
- Disturbance rejection: SISO disturbance observe for speed dependent disturbance
- Modelling & control design
- Planned investigation: Robustification of the path tracking control system
- Robot manipulator kinematics and dynamics
- Data driven Approaches for system identification, monitoring and control
- Dynamic control strategies
- Intelligent Tools: Neural and Fuzzy Systems
- Visual control and Adaptive Critic
- Kinematics Control Strategies
- Computer Vision and machine learning for Inventory Control
- Introduction: what is a game, types of games mixed strategies, examples: solution concepts and results: minimum solutions Nash equilibrium
- Dynamic games: introduction, information sets, threats, solutions
- Introduction to coordination and consensus and multiagent system
- Introduction to guidance, Some History, basic Components
- Equation of Motion, Relative Velocity, Framework, Interception and Avoidance
- Overview of guidance laws
- Some application based on Recent
- Introduction to Graph and Matrix Theory
- Mathematical Model of a Quadrotor Kinematics and Dynamics
- Rate and attitude Control, Position Control and Trajectory tracking
- Nonlinear Control Strategies for quadrotor
- Consensus Algorithm and formation control
- **Popular Talks-**
- Recent Advances in Internet of Things (IOT) Research Direction, Applications & Emerging Services
- Smart robots
- Mangalaayan
- Machine learning

## List of Speakers

- Prof.LaxmidharBehera, IIT Kanpur
- Prof. A T Methew, NIT Calicut
- Prof. Ram Potluri, IIT Kanpur
- Prof.Mangal Kothari, IIT Kanpur
- Prof.NischalVerma, IIT Kanpur
- Prof. S R Sahoo, IIT Kanpur
- Prof.DebasishGhose, IISc Bangalore
- Prof.Ankur Kulkarni, IIT Mumbai
- Dr. Rajeev Shorey, Cincinnati, USA & Bangalore, India
- Dr. Santa Kumar, IIT Indore
- Dr. Abhishek, IIT Kanpur
- Prof. C D Sridhar, ISRO Bangalore
- Dr. Swagat Kumar, TCS Innovation lab, New Delhi
- Prof.Sankar K Pal, ISI Kolkata

## Participating Institutes

Institute	Number of Participants
H B T I, Kanpur	1
IET, Lucknow	8
College Of Engineering, Pune	2
Z.H.C.E.T, AMU, Aligarh	18
SVNIT, Surat	1
BVM Engineering College	1
Visvesvaraya National Institute Of Technology, Nagpur	6
RCC Institute of Information Technology,	3
BMSCE, Bangluru	3
M J P Rohilkhand University, Barielly	1
Government Engineering College, Bilaspur	2
NIT Kurukshetra	9
Pondicherry Engineering College	2
KNIT, Sultanpur	2
BIT Mesra	2
UIET, Punjab University	2
Jadavpur University	3
NIT, Raipur	2
PEC University of Technology, Chandigarh	1
Thiagarajar College of Engineering, Madurai	1

IIT, Delhi	3
IT, Roorkee	2
IIT, Guwahati	1
<b>Total</b>	<b>76</b>

## Workshop Schedule

### August 04, 2015

Time	Event
8:00 – 8:30 AM	<b>Registration</b>
8:30 – 8:45 AM	<b>Inauguration</b>
8:45 – 9:00 AM	<i>High Tea</i>
9:00 – 10:20 AM	<b>Automatic Control: A Historical Perspective + Possibilities in Intelligent Control</b> <i>Prof. Laxmidhar Behera</i>
10:20 – 12:00 PM	<b>Introduction to Robust Control</b> <i>Prof. AT Methew</i>
12:00 – 1:20 PM	<b>System Modelling for Robust Control Design</b> <i>Prof. AT Methew</i>
1:20 – 3:00 PM	<i>Lunch Break</i>
3:00 – 4:20 PM	<b>Design of the Pathtracking Control System using SISO loopshaping</b> <i>Prof. Ram Potluri</i>
4:20 – 4:40 PM	<i>Tea Break</i>
4:40 – 6:00 PM	<b>Disturbance rejection: SISO disturbance observe for speed dependent disturbances</b> <i>Prof. Ram Potluri</i>
6:00 – 7:30 PM	<b>Popular Talk: Recent Advances in Internet of Things (IOT) Research Direction, Applications &amp; Emerging Services</b> <i>Dr. Rajeev Shorey</i>

### August 5, 2015

Time	Event
9:00 – 10:20 AM	<b>Modelling and Control Design Examples</b> <i>Prof. AT Methew</i>
10:20 – 10:40 AM	<i>Tea Break</i>
10:40 – 12:00 PM	<b>Planned Investigation: Robustification of the Path-tracking Control System</b>

	<i>Prof. Ram Potluri</i>
12:00 – 1:20 PM	<b>Robot Manipulator- Kinematics and Dynamics</b> <i>Dr. Santa Kumar</i>
1:20 – 3:00 PM	<b>Lunch Break</b>
3:00 – 4:20 PM	<b>Data Driven Approaches for System Identification, Monitoring and Control Part</b>
4:20 – 4:40 PM	<b>Tea Break</b>
4:40 – 6:00 PM	<b>Dynamic Control Strategies</b> <i>Dr. Shanta Kumar,</i>
6:00 – 7:30 PM	<b>Popular talk</b> <i>Dr. Swagat Kumar</i>

### August 6, 2015

Time	Event
9:00 – 10:20 AM	<b>Intelligent Tools: Neural and Fuzzy Systems</b> <i>Prof LaxmidharBehera</i>
10:20 – 10:40 AM	<b>Tea Break</b>
10:40 – 12:00 PM	<b>Data driven Approaches for System Identification, Monitoring and Control Part 2</b> <i>Prof NischalVerma</i>
12:00 – 1:20 PM	<b>Visual Control + Adaptive Critic</b> <i>Prof LaxmidharBehera</i>
1:20 – 3:00 PM	<b>Lunch Break</b>
3:00 – 4:20 PM	<b>Kinematic Control Strategies</b> <i>Dr. Shanta Kumar</i>
4:20 – 4:40 PM	<b>Tea Break</b>
4:40 – 6:00 PM	<b>Computer Vision and Machine Learning for Inventory Control</b> <i>Prof NischalVerma</i>
6:00 – 7:30 PM	<b>Popular talk</b> <i>Prof. Sankar K. Pal</i>

### August 7, 2015

Time	Event
08:30 –9:50 AM	<b>Introduction: what is a game, types of games, mixed strategies, examples; Solution concepts and results: minimax solution, Nash equilibrium</b> <i>Prof. Ankur Kulkarni</i>

09:50 – 10:10 AM	<i>Tea Break</i>
10:10 – 11:30 AM	<b>Dynamic games: introduction, information sets, threats, solutions</b> <i>Prof. Ankur Kulkarni</i>
11:30 – 12:50 PM	<b>Introduction to Coordination and Consensus in multi-agent system</b> <i>Prof. R. S. Sahoo</i>
12:50 – 1:30 PM	<i>Lunch Break</i>
1:30 – 3:00 PM	<b>LAB VISIT</b>
3:00 – 4:20 PM	<b>Team problems and open questions</b> <i>Prof. Ankur Kulkarni</i>
4:20– 4:40 PM	<i>Tea Break</i>
4:40– 6:00 PM	<b>Introduction to Guidance, Some History, Basic Components</b> <i>Prof Debasish Ghose</i>
6:00– 7:30 PM	<b>Popular talk</b> <i>Prof. Sankar K. Pal</i>
7:30 PM, Onwards	<i>Workshop Dinner</i>

### August 8, 2015

<b>Time</b>	<b>Event</b>
08:30 – 9:50 AM	<b>Equations of Motion, Relative Velocity Framework, Interception and Avoidance</b> <i>Prof Debasish Ghose</i>
09:50 – 10:10 AM	<i>Tea Break</i>
10:10 – 11:30 AM	<b>Overview of Guidance Laws</b> <i>Prof Debasish Ghose</i>
11:30 – 12:50 PM	<b>Some Applications based on Recent</b> <i>Prof Debasish Ghose</i>
12:50 – 1:30 PM	<i>Lunch Break</i>
1:30 – 3:00 PM	<b>LAB VISIT</b>
3:00 – 4:20 PM	<b>Introduction to Graph and Matrix Theory</b> <i>Prof S R Sahoo ,IIT Kanpur</i>
4:20– 4:40 PM	<i>Tea Break</i>
4:40– 6:00 PM	<b>Mathematical Model of a Quadrotor - Kinematics and Dynamics</b> <i>Dr. Abhishek</i>
6:00– 7:30 PM	<b>Popular talk</b> <i>Dr. C D Sridhar</i>

**August 9, 2015**

<b>Time</b>	<b>Event</b>
09:00–10:20 AM	<b>Rate and attitude Control, Position Control and Trajectory tracking</b> <i>Prof Mangal Kothari</i>
10:20–10:40 AM	<b>Tea Break</b>
10:40–12:00 PM	<b>Nonlinear Control Strategies for quadrotor</b> <i>Prof Mangal Kothari</i>
12:00– 1:20 PM	<b>Consensus Algorithm and Formation Control</b> <i>Prof S R Sahoo</i>
1:20– 3:00 PM	<b>Lunch Break</b>
3:00 – 4 :20 PM	<b>LAB DEMO</b> <i>Prof LaxmidharBehera &amp; Prof Ram Potluri</i>
4 :20 – 4 :40 PM	<b>Tea Break</b>
4:40 – 6 :00 PM	<b>LAB DEMO</b> <i>Prof LaxmidharBehera</i>
6 :00 – 7 :30 PM	<b>OFF</b>

## Summary of Faculty Feedback

### Workshop

<i>Questions</i>	<i>Excellent</i>	<i>Good</i>	<i>Ordinary</i>
Clarity of communication about workshop	21	5	
Organization of the sessions	23	3	
Quality of lectures	17	9	
Quality of posters	6	11	
Effectiveness of discussions	14	12	
Effectiveness of learning experience	18	8	
	<i>Appropriate</i>	<i>Short</i>	<i>long</i>
Duration of workshop	18	2	4
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have more such sessions?	22	2	2
Would you like e-lectures by experts on special	20	5	
Suggest specific topic that you would like additional expert lectures on	<ul style="list-style-type: none"> <li>➤ System Identification</li> <li>➤ Signal processing and Warm intelligence</li> <li>➤ Power Electronics, Power Systems</li> <li>➤ Embedded System, Automation</li> <li>➤ Non Linear Robust Control</li> <li>➤ System Identification and Modelling</li> <li>➤ Optimization techniques and soft computing tools</li> <li>➤ Computer Science and Engineering</li> <li>➤ Core areas in Control Theory</li> <li>➤ Optimal Control and Adaptive Control</li> <li>➤ How to develop and write programmes on Neural Network and pre-processing technology</li> <li>➤ Game theory, ANN and Fuzzy</li> <li>➤ Multi Agent System</li> <li>➤ VLSI and Microelectronics</li> <li>➤ Discrete Control System</li> <li>➤ Fraction order control system Design and Modelling</li> <li>➤ Intelligent Control Applications</li> <li>➤ Sliding Mode Control</li> </ul>		



Additional Suggestions

- Duration of the course might have been expanded.
- One week might have been devoted to cover the basics and another one to cover advanced topics.
- Lab view and its industrial application of Industrial Instrumentation might have been given.
- Some Industrial visit and Sight seen might have been arranged.
- Examples on applications of ANN, Fuzzy and Game theory.
- Not to give more topics rather than elaborated one or two topics.
- Hands on Lab session was less.
- Reduce Aerospace content and adding Power Electronic Control Aspects.
- Workshop would have been more effective if contents was based on PG syllabus.
- Simulation based lab may be conducted for one or two class.

## Teaching

Which subjects do you teach?	<ul style="list-style-type: none"><li>➤ Process Control and Optimization</li><li>➤ Signals and System, Communication Systems and Signal Analysis</li><li>➤ Sliding Mode Control</li><li>➤ Robot Dynamics and control,Optimal Control</li><li>➤ Circuit Theory and Control</li><li>➤ NN Fuzzy logic, Control System and Energy Management and Auditing</li><li>➤ DSP and System Identification</li><li>➤ Electronic and Communications , Electrical Instrumentation</li><li>➤ Microprocessor, CSA and Digital Electronics</li><li>➤ Power System Control and Operations.</li><li>➤ Neural Network and Digital Signal Processing</li><li>➤ Numerical Analysis lab and C-programming</li><li>➤ Industrial drives and applications</li><li>➤ Controls and Signal Processors</li><li>➤ Modern control Systems aand Linear Control System</li><li>➤ DIP, Data Structure</li><li>➤ Power Electronics and Machines</li><li>➤ ADSP, Estimation and identification technique, soft Computing</li><li>➤ Modelling</li></ul>
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What is average student to teacher ratio in your institute?	➤ 1:15 ➤ 1:12 ➤ 1:11 ➤ 1:20 ➤ 1:15 ➤ 1:3 ➤ 1:15 ➤ 1:15 ➤ 1:20 ➤ 1:50 ➤ 1:15 ➤ 1:15 ➤ 1:30 ➤ 1:12 ➤ 1:15 ➤ 1:12 ➤ 1:15 ➤ 1:15 ➤ 1:10			
<b>Questions</b>	<b>YES</b>	<b>NO</b>		
Do you have additional support for teaching (tutors, graders, teaching Assistants, etc)?	12	12		
Do you give class projects for UG classes?	19	5		
Do you give class projects for PG classes?	14	8		
Do you have sufficient resources for laboratory courses?	15	9		
	<b>Sufficient</b>	<b>Inadequate</b>		
Is the library/journal/e-connection support adequate?	14	9		
	<b>Definitely</b>	<b>May be</b>	<b>No</b>	
Would you like to have common (TEQIP) repository of course material?	21	1		
Would you like to visit IITK to participate in and develop course material (existing or new)	20	3		
Would you like to participate in creation of the repository material (course files/lab.	20	3		
	<b>e-courses</b>	<b>Workshops</b>	<b>Content</b>	<b>None</b>
How can IITK effectively help you prepare for teaching?	15	22	10	

<p>How can TEQIP help improve your teaching?</p>	<ul style="list-style-type: none"> <li>➤ Workshops on regular topics may be conducted during winter and summer recess.</li> <li>➤ Discussion oriented workshops where we can exchange our teaching experience.</li> <li>➤ Permitting for FDPS</li> <li>➤ Working as visiting researchers at renowned Institute and attending courses at IITs.</li> <li>➤ More pedagogy material should be available and also Online classrooms and Online lectures of expert can be shared at other institutes also.</li> <li>➤ By putting problem solving tasks for the audience and also TEQIP can implement it by Organizing some dedicated subjects workshops.</li> <li>➤ Expert hands on training sessions apart from lectures.</li> <li>➤ Such Courses improves alot to our teaching methodology.</li> <li>➤ By providing infrastructure support</li> <li>➤ By exposure of new topics and ways of teaching styles.</li> <li>➤ Industrial Visits, Lab visits and Pedagogy Classes and workshops.</li> <li>➤ By providing frequent visit to the faculty.</li> <li>➤ By giving NPTEL videos lecture and also all the e-courses lecture video to our department.</li> <li>➤ Through FDP joint projects and joint research assignments.</li> <li>➤ Encouraging teaching , learning, Collaborating research, organizing development programme and inviting us to attend these programs in apex institutes like IITs and parallely funding for setting up modern laboratory.</li> <li>➤ TEQIP has helped to create infrastructure, learning resources and funding for R&amp;D activity.</li> <li>➤ Gives exposure to excellent quality of course material teaching at institutes of higher learning like IITs.</li> </ul>
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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)?	22	2	
Would you like to share/use research infrastructure at IITK, if made available?	25	1	
Would you like to conduct collaborative research with IITK?	24	2	
Would you like lectures by experts (Indian and international) on niche research areas/topics?	24	2	
Do you want special-topic conferences?	23	2	1

How can TEQIP help improve your research?

- Interaction with faculty member at IIT Kanpur has opened up new areas of research. The teachers at IIT Kanpur motivated through their research and dedication of teaching.
- By providing assistance in terms of funding research projects attending conferences funding for creating research facilities.
- By funding for a R&D lab and also assess some specific journals other institute.
- By funding money for lab visit to IIT Kanpur in summer.
- By allowing participation in workshop, student projects and attending conferences.
- Provide ME students collaborative PG project.
- Exposure to latest research areas.
- By giving a chance of one/two years internship in these Institutes specifically the IITs.
- By allowing us to give more funds to buy equipment which costs around Rs 50 lacs and more.
- By providing Infrastructure support.
- By providing opportunity to interact with experts and gain knowledge on recent advancements on the topics of interest.
- If there is a possibility of reducing the workload at our institute it could be very beneficial.
- By incorporating the algorithms implementation on hardware in real time application. This is the area where most of researchers are facing the problems.
- Some experimental set up which is available at IIT can be made available to us for experimentation and validation of research work.
- More opportunity of working at IIT.
- Providing facility to interact with renowned researchers.
- Joint research projects may be a good option where a part of a big projects may be given to other colleges.

## Summary of Student Feedback

**Total Attendance : 26**

Workshop

<i>Questions</i>	<i>Excellent</i>	<i>Good</i>	<i>Ordinary</i>
Clarity of communication about workshop	14	12	00
Organization of the sessions	16	10	00
Quality of lectures	16	10	00
Quality of posters	8	18	00
Effectiveness of discussions	14	12	00
Effectiveness of learning experience	13	13	00
	<i>Appropriate</i>	<i>Short</i>	<i>long</i>
Duration of workshop	13	6	6
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have more such sessions?	22	2	00
Would you like e-lectures by experts on special topics?	23	00	00
Suggest specific topic that you would like additional expert lectures on	<ul style="list-style-type: none"> <li>➤ Decoding using factor graphs, Mobile Robotics, Computer networks and wireless communication, Internet of things.</li> <li>➤ Hybrid Vehicles.</li> <li>➤ Exclusive lectures on control theory(Non-linear).</li> <li>➤ Game Theory.</li> <li>➤ Solar energy and PU module decision.</li> <li>➤ UAV.</li> <li>➤ Neural Networks.</li> <li>➤ Soft computing.</li> <li>➤ Exclusive system identification lectures.</li> <li>➤ Topics related to Control aspects of Smart grid.</li> <li>➤ Graph and Matrix agent system.</li> <li>➤ Intelligent control by Dr Behera.</li> <li>➤ Non linear controller design for mobile robot to avoid disturbance.</li> <li>➤ Advanced Robotics and Mechanism.</li> <li>➤ Bio Instrumentation.</li> <li>➤ Application of control in Bio-Medical field.</li> </ul>		

Additional Suggestions	<ul style="list-style-type: none"> <li>➤ More such courses should be organize on Communication and Information System(ECE).</li> <li>➤ It will be more helpful if more videos and demo of the model include.</li> <li>➤ May provide notes and study material corresponding to the courses and lectures.</li> <li>➤ The sessions may have been organized in a less hectic manner ,i.e no. of sessions in a day could be reduced.</li> <li>➤ Food should have variety.</li> <li>➤ One week workshop should be on two subjects at the maximum including learning and implementation.</li> <li>➤ Duration of class in a day should be reduce.</li> <li>➤ Lab time should be more.</li> <li>➤ There should be hands on practice sessions in lab with matlab.</li> <li>➤ Some kind of research internship so that NIT-PhD student can be benefited more.</li> </ul>
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### Learning

<b><i>Questions</i></b>	<b><i>Yes</i></b>	<b><i>No</i></b>
Do you get enough class projects?	20	3
Is the learning adequate?	23	1
Do you have sufficient resources for laboratory	16	6
What is your area of specialization	<ul style="list-style-type: none"> <li>➤ CAD-CAM</li> <li>➤ Smart grid</li> <li>➤ Automation and Stochastic Control</li> <li>➤ Fuzzy logic Controller</li> <li>➤ Control of Mobile Robots</li> <li>➤ Control System (identification)</li> <li>➤ Instrumentation and Control Engg.</li> <li>➤ Distributed Control</li> <li>➤ Pours System Management</li> <li>➤ Neural Network</li> <li>➤ ANN</li> <li>➤ Control, Energy</li> <li>➤ Electric Vehicle</li> <li>➤ Communication and Information System</li> <li>➤ Mobile Robots</li> </ul>	



	<i>Sufficient</i>		<i>inadequate</i>
Is the library/journal support/e-connection	17		1
	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to have common (TEQIP) repository of course	17	5	00
Would you like to visit IITK to attend	22	1	00
Would you like MOOCS/e-resources based	16	5	1
How can TEQIP help improve your learning?	<ul style="list-style-type: none"> <li>➤ Laboratory resources should increase.</li> <li>➤ IEEE transactions access to be allowed in more Institutions.</li> <li>➤ More such schools should be conducted frequently.</li> <li>➤ By continuing to organize such event and spread research from IIT campus to other colleges and university as well.</li> <li>➤ Giving an opportunity to attend best professor lecture.</li> <li>➤ Conducting more Internship programme.</li> <li>➤ By acknowledging about work done in new areas and giving a platform to interact with like-minded.</li> <li>➤ By increasing numbers of day and limiting time duration of the program per day.</li> <li>➤ By interaction with experts of respective domain.</li> <li>➤ By providing online courses and material.</li> <li>➤ By organizing short term courses about microcontroller programming.</li> <li>➤ Arranging industrial visits.</li> <li>➤ It gives the idea of the level of research which is going on in our country.</li> <li>➤ TEQIB concept is very nice which gathers student and faculty from different institute at same level.</li> <li>➤ It's a very good and impressive idea.</li> </ul>		

Research

<i>Questions</i>	<i>Definitely</i>	<i>Maybe</i>	<i>No</i>
Would you like to visit an IIT for a short visit /internship/post- doctoral stint ,if	22	00	00
Would you like to share/use research infrastructure at IITK, if made available?	20	2	00
Would you like to conduct collaborative research with IITK faculty?	19	3	00
Would you like lectures by experts (Indian and international) on niche research	20	2	00
Do you want special-topic conferences?	13	9	00

<p>How can TEQIP help improve your research?</p>	<ul style="list-style-type: none"> <li>➤ By conducting such schools in Communication and Information System.</li> <li>➤ Making more lab resources available at Institute.</li> <li>➤ Allowing Collaborative research at IIT via TEQIB on student selected topics.</li> <li>➤ By increasing the amount for all the colleges that comes under the TEQIB.</li> <li>➤ May provide online courses on special topics.</li> <li>➤ Organizing such workshop and popular talks.</li> <li>➤ Take the research to other colleges.</li> <li>➤ Provide us lab facility, workshop program and other interactive program for research.</li> <li>➤ Improving resources at our own College or University and of course assistance from IITs.</li> <li>➤ By availing access to research from IITs and IISc and also by providing a chance to interact with experts.</li> <li>➤ Provide some laboratory program relating to my topic by the TEQIP.</li> <li>➤ TEQIP facilitates us to improve our research by interaction with experts, getting information of new state-of-art technologies.</li> <li>➤ Specialized courses for specified areas may be arranged.</li> <li>➤ By arranging for interdisciplinary research and collaborations across different colleges.</li> <li>➤ It collect every level of educational person at same level and to discuss their problem to unite work.</li> <li>➤ By providing appropriate funding for research work.</li> </ul>
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## **OUTCOME**

TEQIP School on Systems and Control 2015 has been successfully organized during Aug 4-9, 2015 at IIT Kanpur. Fifty one participants from approximately 20 academic institutes across India participated in this technical event. Ten speakers that included four invited speakers from other institutes gave a crash course on almost every aspect of systems and controls. In particular, areas such as intelligent control, robust control, control and guidance of autonomous vehicles, coordinated control, computer vision and machine learning, and game theory were dealt comprehensively by the experts. Presentation of these talks in the form of tutorial lessons provided an in-depth exposure to the participants so as to enable them to enhance their research aptitude. Many contemporary applications in robotics, UAVs, health monitoring, missile launching and guidance, smart grid etc were covered. Besides popular talks on Internet of Things, Machine Learning, Smart-robots and Mangalayan added spices to the wholesome experience of the participants.

