

**QUALITY CIRCLE FOR
KNOWLEDGE
INCUBATION UNDER
TEQIP (KITE)
AT IIT BOMBAY**

**AN MHRD- TEQIP
INITIATIVE
2014-2016**

A REPORT

1 December 2015

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Dynamically updated site detailing MHRD-TEQIP-KITE at IIT Bombay: http://www.cdeep.iitb.ac.in/TEQIP.php	

EXECUTIVE SUMMARY OF ACTIVITIES PLANNED AND CONDUCTED UNDER QUALITY CIRCLE FOR KNOWLEDGE INNOVATION UNDER TEQIP (KIT) AT IIT BOMBAY 2014-2016

MAJOR ACTIVITIES CONDUCTED:

1. Research Scholars and Alumni Symposium (RSAS–2014): conducted on 7, 8 March 2014. More than 50 TEQIP participants, overall more than 100 external participants including other IITs, eminent speakers: more than 200 participants overall including internal IITB participants. Intended to be a first step to making a positive difference to the PhD Programmes in our Institutes, particularly TEQIP Institutes and IITs.
2. One-Day Workshop on ‘Wavelets and Applications’ as a pedagogical initiative in a Graduate level elective subject, conducted on Sunday, 13 April 2014 with VJTI, a TEQIP Institute. Meant to demonstrate pedagogical practices in teaching advanced mathematical subjects in an engineering curriculum. About 15 TEQIP participants interacted with about 90 IIT Bombay students and faculty.
3. A ‘pedagogy lecture series’ in IDP-ET at IIT Bombay based on studies done in our Interdisciplinary Programme on Educational Technology (IDP-ET), involving students and faculty of reputed institutes in and around Mumbai. This is a continuing effort in IDP-ET, IIT Bombay.
4. TEQIP Design and Degree Show (DDS) organized by Industrial Design Centre (IDC) 27-29 June 2014: About 100 TEQIP Participants from various TEQIP Institutes. Meant to introduce principles of engineering and industrial design to students at all levels. A very well appreciated annual event, conducted specially for TEQIP Institutes this year.
5. A workshop titled “Recent Advances in Chemical Engineering Research” was organized from 2-4 July, 2014 at Dept. of Chemical Engineering, IIT Bombay. More than 100 TEQIP participants. Meant to give a glimpse of cutting edge research and to influence the Ph.D. Programmes in Chemical Engineering and related fields.
6. Workshop on Ocean and Atmospheric Sciences organized under the aegis of MRHD-TEQIP-KIT on 18, 19 July 2014: About 40 TEQIP participants from VJTI Mumbai, COEP Pune, SGGS Nanded. Meant to introduce faculty and students of these TEQIP

Institutes to research areas and graduate Thesis areas of work, centered around this very important area of national importance.

7. Several technology and equipment upgradation initiatives have been undertaken at the Centre for Distance Engineering Education Programme (CDEEP), IIT Bombay in keeping with the requirements of educational outreach. Now, with the initiation of the GIAN scheme of MHRD, TEQIP-KITE is likely to use the resources enhanced at CDEEP to make available, some of the lectures, to TEQIP Institutes in particular. To study the technology of distance education, two Masters' level dissertations have been completed on Scalable Video Coding (SVC) Technologies for Distance Education with the supervision of Prof. Vikram M. Gadre (TEQIP-KITE Coordinator at IIT Bombay). We have worked towards the procurement of cloud services in CDEEP, IIT Bombay and have looked into technological issues pertaining to the use of such cloud based services with a view to examine how they can be used effectively in a set up meant for educational outreach.
8. The first Annual Conference 'Sammilan' on 'Youth Empowerment for Social Development' conducted under MHRD-TEQIP-KITE, IIT Bombay by the IIT Bombay Faculty + Student Body 'Abhyuday' on 16, 17 August 2014. This was meant to be a conscious interaction between faculty and students of several TEQIP Institutes with faculty and students of IIT Bombay, to identify what could be done to channelize the energies of the youth in these technical institutes towards making a positive difference in society with different kinds of initiatives.
9. A one-day MHRD-TEQIP-KITE workshop on the Student Mentor Programme was conducted on 1 September 2014 at IIT Bombay for several faculty and students of VJTI, Mumbai, a TEQIP Institute. This was meant to explain the structure of the Student Mentor Programme at IIT Bombay to the participants at VJTI and to encourage VJTI to initiate such a programme in that Institute, as an example of good academic-administrative practice.
10. MHRD-TEQIP-KITE Water Sector Workshop on 12 September 2014 which involved about 30 faculty participants from various TEQIP Institutes primarily in Maharashtra. This focused on the technology alternatives to address the problems of water resources all over the state, as a technological challenge to be taken up jointly by IIT Bombay and the identified TEQIP Institutes, with help and support from government and private sources.
11. A pedagogical initiative workshop in the core course on 'Signals and Systems' to illustrate a 'co-operative learning paradigm' on Sunday, 2 November 2014. A one-day workshop was organized under MHRD-TEQIP-KITE on this day with several participating faculty and students from four TEQIP Institutes: VJTI, Mumbai; COEP, Pune; BATU, Lonere; Govt College of Engineering, Aurangabad. The workshop was arranged in the form of an evaluative exhibition on the application of Signals and Systems, to illustrate how the applications of relatively abstract concepts in Signals and Systems can be explored as a co-operative endeavor by faculty and students together.
12. A Focused Research and Development Workshop in Mechanical Engineering was conducted at IIT Bombay for over 100 TEQIP participants on 21, 22, 23 December 2014. The theme of this workshop was the several areas of current research and developmental interest in Mechanical Engineering, where TEQIP Institutes could take advantage of the expertise available at IIT Bombay. Several faculty members and graduate students of TEQIP Institutes attended this workshop and benefited from it.

13. A workshop on the use of Information and Communication Technology (ICT) in the pedagogy of engineering education was conducted from 5 – 9 January 2015, collaboratively with the ‘Teach Thousands of Teachers’ Initiative of NMEICT with remote participants. TEQIP participants, who participated live at IIT Bombay numbered about 5.
14. A two-day workshop on pedagogy and research in the area of Electromagnetics was coordinated and conducted by Prof. S. V. Kulkarni, Electrical Engineering on 23, 24 January 2015. The area of electromagnetics has always been a fundamental area of electrical engineering and there has been a growing need in recent years to expand the expert base in this area among academicians. This workshop initiated an important movement in this direction and gave the much needed impetus to academicians in TEQIP Institutes, to build up this field of expertise in their respective departments. The workshop was well attended, with over 70 TEQIP participants.
15. The National Communications Conference (NCC) was conducted at IIT Bombay on 27, 28 February and 1 March 2015. This flagship conference in the area of Communications was conducted in collaboration with MHRD-TEQIP-KITE this time in IIT Bombay. Over 30 TEQIP Institute participants were supported by this National Conference.
16. A Research Scholars’ Confluence (ReSCon 2015) was conducted on 20, 21 March 2015 as a ‘next version’ of the very successful Research Scholars and Alumni Symposium (RSAS) conducted in March 2014, with over 40 TEQIP participants.
17. A two-day workshop on the Student Mentor Programme was conducted on 28, 29 March 2015 at CDEEP, IIT Bombay in collaboration with VNIT, Nagpur which is a TEQIP Institute. About 20 participants from VNIT attended this workshop and interacted with about 30 participants from IIT Bombay.
18. A second pedagogy workshop on the Applications of Wavelets was conducted on Sunday, 12 April 2015 at the Department of Electrical Engineering, IIT Bombay. This was inspired by the success of a similar event in April 2014 and this time, the event was even more successful and better attended, with over 70 TEQIP participants from various TEQIP Institutes in different parts of Maharashtra.
19. A three day workshop on Mathematics in Engineering, coordinated by Prof. Sachin Patwardhan, Chemical Engineering, was conducted from 13-15 May 2015. This addressed the much needed issue of how mathematics needs to be dealt with in an engineering curriculum. This had over 40 participants from TEQIP Institutes.
20. A workshop on Sliding Mode Control was conducted from 28 May to 1 June 2015 by Prof. Bijnan Bandyopadhyay, Systems and Control Engineering. This had 7 TEQIP participants from various TEQIP Institutes.
21. A major endeavor to build and demonstrate a laboratory course in Digital Signal Processing (DSP): System Design and Implementation was undertaken, following the initial steps in November 2014. This lasted throughout the Autumn Semester of the Academic Year 2015-16 and culminated in a 5-day workshop on the pedagogy of DSP: System Design and Implementation from 2-6 November 2015. The establishment of several DSP system examples was partially supported through MHRD-TEQIP-KITE and the 5-day workshop was organized jointly with support from MHRD-TEQIP-KITE at IIT Bombay and some TEQIP Institutes in Gujarat. This had about 50 TEQIP participants from Maharashtra and Gujarat.

22. A team of graduate and undergraduate students from IIT Bombay worked with a team of undergraduate students in the 'Unnat Bharat Abhiyaan (UBA)' from the College of Engineering, Pune, a reputed TEQIP Institute, to identify rural development needs in a few villages near Satara in Maharashtra. Together, they visited the villages Kapshi, Koregaon and Dhondewadi and worked out some measures to address the villagers' water conservation needs and agricultural needs through technology and social steps. This was an important step in encouraging the students of IIT Bombay and TEQIP Institutes to work together, towards national growth in the rural sector and we hope it will lay the foundation for stronger collaborative activities of this kind between IIT Bombay and TEQIP Institutes.
23. From MHRD-TEQIP-KITE at IIT Bombay, we have initiated collaborative research, developmental and pedagogical endeavours between the TEQIP Centres of Excellence in Maharashtra and IIT Bombay. Towards this objective, Prof. Vikram M. Gadre visited the Centres of Excellence at SGGS Nanded and College of Engineering, Pune (COEP) in July and August 2015 respectively. Further, representatives of these centres of excellence participated in the deliberations during the inauguration of the National Centre for the Technology for Internal Security (NCETIS) at IIT Bombay on 21 September 2015 and in a course for NTRO officials on 30 October 2015, to identify how such R&D collaborative activities could be taken forward to benefit national security. Several other areas of possible multi-partite collaboration between the TEQIP Centres of Excellence and IIT Bombay have been identified and some initial steps taken.

AUXILIARY ACTIVITIES CONDUCTED:

- i. A half-day workshop on 'Signal Processing with Wavelets', with several participants, faculty and graduate (Masters' and PhD) students for VJTI, Mumbai on 23 December 2013 afternoon. We identified the points on which the Conclave/ Symposium of Research Scholars should be built, in March 2014 and also identified a team of Research Scholars and Faculty from institutes in and around Mumbai, to work with our own PhD Students
- ii. On Saturday, 12 April 2014, a focused group meeting was conducted between some faculty and students of IIT Bombay and IIT Kanpur in CDEEP, IIT Bombay to look at scalable video coding technologies, particularly with emphasis on the requirements of educational outreach at CDEEP.
- iii. On 20 May 2014, a meeting was held with the State Project Facilitation Unit (SPFU) of TEQIP in Maharashtra. The TEQIP Officials in Maharashtra, specifically Prof Avinash Amte and Prof Ashok Pise have been apprised of the activities planned/ conducted under the aegis of MHRD-TEQIP-KIT at IIT Bombay. Several Heads of TEQIP Institutes were also present during this meeting and they have also been apprised of these activities. Their cooperation and active participation has been sought to make these activities a success. The State Officers, Dr Abhay Wagh and Dr Mahajan were chairing the meeting and they directed the SPFU and TEQIP representatives to extend their full cooperation to IITB in making MHRD-TEQIP-KIT at IITB successful.
- iv. A Student Mentor Programme has been initiated at VNIT, Nagpur, a TEQIP Institute. The Principal Investigator visited VNIT Nagpur on 4 April 2014 and discussed the

progress and plans for this Programme with their Dean, Academic Programmes and some another coordinating faculty member.

- v. A meeting with some faculty members from the College of Engineering Pune (COEP) was convened on 10 July 2014, to work out the plan for MHRD-TEQIP-KIT initiatives in detail, particularly those related to pedagogical initiatives.
- vi. A visit by Prof. V.M. Gadre to a village called Kapshi, near Satara in Maharashtra on 29 September 2014, to ascertain the remarkable progress made by the initiative of the villagers in water conservation, organic farming and social upliftment. This was planned as a precursor to the collective involvement of faculty and students of TEQIP Institutes in Maharashtra, through the National Service Scheme (N.S.S.) part of the curriculum, to address social needs and problems. Considerable progress on this has been made and described at Major Activity 22 above.
- vii. A meeting of Prof. V.M. Gadre and the IIT Bombay Student Mentor Coordinators, with faculty and students of M.S. Ramaiah Institute of Technology (MSRIT), Bengaluru, Karnataka, mapped to IIT Bombay under MHRD-TEQIP-KITE, on 13 October 2014 to initiate the establishment of a Student Mentor Programme at MSRIT. This is again intended to be a move towards a benefic academic-administrative practice.
- viii. A meeting of Prof. V. M. Gadre with faculty and students of VNIT, Nagpur dealing with the Student Mentor Programme at VNIT Nagpur, on 14 November 2014. The students mentor programme at this TEQIP Institute has made considerable progress and the academic functionaries of VNIT – including the Dean, Academic Programmes have agreed to work with IIT Bombay to help promote and establish this programme at other TEQIP Institutes under MHRD-TEQIP-KITE. This meeting inspired the 2-day workshop conducted at IIT Bombay, jointly by MHRD-TEQIP-KITE, IIT Bombay and TEQIP, VNIT in March 2015.
- ix. A visit by Prof. V. M. Gadre to the Centre of Excellence in Signal and Image Processing at the College of Engineering, Pune on 20 November 2014, in his capacity as Advisor to that centre, to review and plan the activities of that centre, as also to work out specific collaborations with MHRD-TEQIP-KITE, IIT Bombay over the coming months. This was followed by a detailed visit to the same Centre of Excellence on 29 December 2014 to fortify this initiative.
- x. A half day exhibition and display of Digital Signal Processing System Designs on 12 November 2014, at IIT Bombay involving graduate students of IIT Bombay, some faculty from IIT Bombay and representatives of the State Project Facilitation Unit (SPFU) of TEQIP. This was a ‘dry run’ and planning event for a larger pedagogical initiative in Digital Signal Processing to be conducted in the coming year. The options and details of such a pedagogical initiative were discussed during this half day event and a plan was made to work out an appropriate activity in Digital Signal Processing (DSP). This has culminated in the major pedagogical initiative to build and demonstrate a DSP: System Design and Implementation Course and involve TEQIP participants in the conduct of such a course through the Autumn Semester 2015-16, described as Major Activity 21 above.
- xi. Prof. Vikram M. Gadre and some of his students visited some of the TEQIP Institutes, as also some other non-TEQIP Engineering Institutions in Maharashtra during the 2-month period July-August 2015, to participate in the technical workshops/ symposia organized by these. This was in the spirit of increasing the interaction between IIT Bombay students

and faculty and those from such institutions, a part of the MHRD-TEQIP-KITE mandate. These visits also led to the initiation of joint research, developmental and pedagogical endeavours between IIT Bombay and the TEQIP Centres of Excellence in Maharashtra described at Major Activity 23 above. In addition, a PhD student of Elect Engg, IIT Bombay, Peeyush Sahay, employed at LRDE Bengaluru, visited M S Ramaiah Institute of Technology (MSRIT), Bengaluru and interacted with their PhD students, in March 2015.

- xii. PhD Students registered under the College Teacher Category at IIT Bombay have been supported in various ways in their research, as a broader objective of TEQIP-KITE.
- xiii. Two faculty members from IIT Bombay namely, Prof. Ashutosh Gandhi and Prof. N. Vishwanathan worked on a collaborative project between the MHRD-TEQIP-KITEs of IIT Bombay and IIT Kanpur, to review the pedagogy and curriculum in Metallurgical Engineering and Materials Science and allied subjects in TEQIP Institutes. This culminated in a workshop, conducted at NIT Srinagar, in October 2015.
- xiv. Prof. Vikram M. Gadre was invited by the State Project Facilitation Unit (SPFU), Rajasthan on 6, 7 November 2015 to participate in the deliberations on how to enhance TEQIP Academic Activities in the TEQIP Institutes of Rajasthan. He delivered a talk there and identified specific initiatives to be taken in consultation with SPFU officials. He also set up a dialogue between faculty of IIT Jodhpur, some senior persons from the industry in Rajasthan and SPFU Rajasthan to meet this objective.
- xv. MHRD-TEQIP-KITE collaborated with the Massive Open Online Course (MOOC) Initiative at IIT Bombay to support, in part, the creation of one of the MOOC courses on the EdX/ IITBombayX platforms, pioneered by Padmashree Prof. Deepak B. Phatak of IIT Bombay. This course entitled 'Signals and Systems' was instructed by Prof. Vikram M. Gadre. While most of the support came from Prof. Phatak's NMEICT project, some of the support for Teaching Associates was provided from MHRD-TEQIP-KITE. In future, it is proposed that this collaborative effort for creation of MOOCs should grow.

FURTHER MAJOR ACTIVITIES PLANNED:

- 24. A meeting and workshop between stakeholders from the TEQIP Institutes and the industry. During this meeting and workshop, we would also like to take up suggestions, issues, ideas that emerged from RSAS-2014, ResCon2015 and the inauguration of NCETIS. We expect to embark upon this endeavor during a review meeting of the TEQIP Centres of Excellence, to be conducted at IIT Bombay in the first week of December 2015.
- 25. More pedagogical workshops on basic undergraduate and preliminary graduate subjects centered around: Engineering Mathematics, Signals and Systems, Control Engineering, Digital Signal Processing as a starting point for more pedagogical initiatives in the future.
- 26. A Workshop on 'Simulation Tools in Electronic Systems' planned in January 2016. This will be coordinated by Prof Mahesh Patil of the Dept of Elect Engg, IIT Bombay and conducted by a few faculty members from IIT Bombay, possibly using educational technology tools developed in the Interdisciplinary Programme on Educational Technology at IIT Bombay.

27. Enhancement of the Centre for Distance Engineering Education (CDEEP) and the Interdisciplinary Programme on Educational Technology (IDP-ET), IIT Bombay in terms of facilities, equipment, manpower, resources and activities which will also cater to TEQIP Institute Interactions, will continue this year too.
28. Making engineering curricula more socially relevant and incorporating technical and technological rural/ urban challenges faced by the country in the curricular activities of TEQIP Institutes – taking further from the Main Events listed at SI No 8, 10, 22 above, the auxiliary event listed at vi above and evolving a more comprehensive plan to be implemented slowly.
29. Student Mentor Programme – a very successful academic-administrative system at IIT Bombay to be adapted to other TEQIP Institutes, keeping local practices and systems at these Institutes in mind. Already initiated at VNIT Nagpur. Already proposed at VJTI Mumbai, MSRIT Bengaluru, G H Rasoni College of Engineering through workshops/ meetings with their faculty and students. This should help multiply faculty efforts at reaching out to students in need of help and create a much better academic environment on the whole, in TEQIP Institutes. The broader purpose of the Student Mentor Programme is to involve meritorious students of the TEQIP Institutes in realizing the TEQIP objectives and to facilitate building an academic-administrative system, aimed at realizing this objective
30. A National Conference SWICON in the area of Power Systems and Power Electronics is being organized with partial support from MHRD-TEQIP-KITE in the last week of November 2015.
31. An international symposium on Proteomics is being conducted with the leadership of Prof Sanjeeva Srivastava of the Dept of Biosciences and Bioengineering, IIT Bombay. A workshop to be organized as a part of this event is being conducted in collaboration with MHRD-TEQIP-KITE, IIT Bombay.
32. Planning sectorized activities on a long term basis, jointly between IIT Bombay and TEQIP Institutes, particularly involving the TEQIP Centres of Excellence. As of now, a few such sectors have been identified, based on themes known and identified to be of national importance:
 - (a) Defence related – Signal Processing and Communication
 - (b) Technology Alternatives for rural and urban development.
 - (c) Industrial design and product innovations
 - (d) Ocean and Atmospheric Sciences
 These themes will be mentioned and discussed during a review meeting of the TEQIP Centres of Excellence, to be conducted at IIT Bombay on 1/2 December 2015.

Main pedagogical objectives envisaged and being pursued:

The following academic skills are envisaged to be cultivated at first instance, as a consequence of the pedagogical initiatives. Efforts have already been made in several ways, several events conducted over the past two years and these will continue:

- (a) Engineering Mathematics Competencies – beginning with undergraduate engineering mathematics and going right up to the engineering mathematics competencies required

for graduate study and research, particularly emphasizing the broad disciplines of Electrical Engineering, Computer Science and Chemical Engineering.

- (b) Competencies in a few selected curricular subjects in a typical undergraduate curriculum, for these three disciplines.
- (c) Exposure to some current areas for research and developmental work to graduate students in these three areas of Electrical Engineering/ Electronics, Computer Science & Engineering and Chemical Engineering.
- (d) Communication and Presentation Skills – which are needed in writing Theses, Dissertations, making presentations, giving talks, participating in group discussions and other similar situations in professional life.
- (e) Creation of Massive Open Online Courses in collaboration with the other educational outreach projects at IIT Bombay.

An example of the success of these pedagogical initiatives: Inspired by the pedagogical events on Signals and Systems and Wavelets organized under MHRD-TEQIP-KITE at IIT Bombay, the College of Engineering Pune (COEP), a TEQIP Institute of repute in Pune, organized a similar event for several institutes in and around Pune on 28 October 2015. This was an important fallout of the TEQIP-KITE initiative and was exactly what we are looking for, that TEQIP Institutes take inspiration from the TEQIP-KITE events organized and multiply their effect in other places in the country.

DETAILS OF ACTIVITIES PLANNED AND CONDUCTED FOR QUALITY CIRCLE KNOWLEDGE INNOVATION UNDER TEQIP (KITE) AT IIT BOMBAY

2014-2016

Under the TEQIP (KITE) Initiative of the Ministry of Human Resources Development (MHRD), IIT Bombay has planned and conducted several activities pertaining to pedagogy, educational outreach, educational and institutional academic system reform, research and developmental activities of a collective nature involving TEQIP Institutes and other educational institutes of repute, in and around Mumbai, in Maharashtra and sometimes from various parts of the country outside Maharashtra as well. We are pleased to describe below, the endeavours planned and undertaken, the follow up planned for the activities undertaken, the outcome and the mechanism of appraisal that we envisage for some activities.

While this is a list of activities and endeavours as we see on this date, it is likely that we shall also initiate other activities in due course, as and when further possibilities arise, the budget is available and ideas occur to us through discussion with stakeholders. We intend to continue updating information at the following site: <http://www.cdeep.iitb.ac.in/TEQIP.php> pertaining to activities in MHRD-TEQIP-KIT at IIT Bombay. The site currently has recordings of most of the important events conducted under MHRD-TEQIP-KITE at IIT Bombay and one could download complete videos of events to get a feel of the proceeds. As of date, we have just adequate budget to sustain the activities already planned and we will not be able to undertake new ones until a renewed budget is available.

From MHRD and the TEQIP Establishment, we look forward to cooperation and assistance in disseminating this plan, to TEQIP Institutes. We also seek the assistance of the TEQIP establishment in asking the concerned Institutes to participate wholeheartedly in these endeavours and to make them fruitful, with their active efforts and inputs. On 29 April 2014, 6 May 2014, 18 July 2014, 17 October 2014 and 12 December 2014, meetings were held at New Delhi to discuss the progress of the TEQIP-KITE at the IITs and to evolve plans for further interaction and collective endeavours.

On 20 May 2014, a meeting was held with the State Project Facilitation Unit (SPFU) of TEQIP in Maharashtra. The TEQIP Officials in Maharashtra, specifically Prof Avinash Amte and Prof Ashok Pise have been apprised of the activities planned/ conducted under the aegis of MHRD-TEQIP-KITE at IIT Bombay. Several Heads of TEQIP Institutes were also present during this meeting and they have also been apprised of these activities. Their cooperation and active participation has been sought to make these activities a success. The State Officers, Dr Abhay Wagh and Dr Mahajan chaired the meeting and they directed the SPFU and TEQIP representatives to extend their full cooperation to IITB, in making MHRD-TEQIP-KITE at IITB successful. The activities planned under MHRD-TEQIP-KIT at IITB henceforth, up to April 2015 had been discussed with the TEQIP participants and their keen participation, cooperation and involvement has been sought and promised by them. We have continued to have meetings with the State level officers, Prof Avinash Amte and Prof Ashok Pise, even subsequently and

have been receiving continued cooperation from them in our TEQIP-KITE activities. We are glad that several participants from TEQIP Institutes in Maharashtra have participated in the recent activities that were organized and we hope this trend of active participation from TEQIP Institutes continues. On 25 November 2014, a meeting was held with the State Steering Committee of TEQIP to discuss the possible ways forward in MHRD-TEQIP-KITE endeavours and the state officials have continued to express support in this direction. We intend to organize a meeting of the State Project Facilitation Unit (SPFU) of Maharashtra with the TEQIP Centres of Excellence and TEQIP-KITE in December 2015, to plan for the way forward in collaborative endeavours between these three kinds of academic-administrative bodies.

On 13 October 2014, a meeting was also held with a representative of the State Project Facilitation Unit (SPFU) of Karnataka to seek their co-operation and participation in conducting MHRD-TEQIP-KITE events in TEQIP Institutes in Karnataka. SPFU, Karnataka also expressed its co-operation in these endeavours. On 7 November 2015, the Coordinator participated in a workshop organized by SPFU, Rajasthan to determine how TEQIP activities in Rajasthan can be enhanced and how the IITs can play a role there. SPFU, Rajasthan has also agreed to cooperate and participate actively in MHRD-TEQIP-KITE.

1. Activity One:

(Status: Already conducted in two successive years)

Research Scholars and Alumni Symposium (RSAS – 2014)

Research Scholars' Confluence:

The first major event that has been conducted under the aegis of TEQIP KITE, is a Research Scholars and Alumni Symposium at IIT Bombay on 7, 8 March 2014. The details are at the internal IIT Bombay link:

<http://gymkhana.iitb.ac.in/~rsc/rsas/>

A summary is provided for convenience here.

We, at IIT Bombay, plan to undertake a major initiative, under MHRD TEQIP KITE, to examine the PhD Programmes in premier Institutes of the country, beginning with IIT Bombay and the premier Institutes, particularly those supported by TEQIP, in and around Mumbai/ Maharashtra. We look at this endeavour as complementary to the other initiatives, which are already being undertaken at the other MHRD TEQIP KITE Nodal Centres in the other IITs. In this event on 7 March 2014, we are very happy to inform, that we had participation from more than 100 participants from other premier Institutes, including TEQIP supported Institutes and an equal number from the IITs, including our own IIT Bombay. This meant over 200 participants, even to make a conservative estimate. In addition, some prominent PhD Alumni from IIT Bombay addressed the gathering, to speak about important issues concerned with PhD and after.

This is to identify important issues that confront PhD Students and Supervisors all over and delineate steps, that would make a difference to PhD Programmes in the country. This is, as we know, an important component of TEQIP-Phase II, we daresay, one of the most important parts. Not to leave it just here, we plan to use a report on this event to

organize further events under MHRD TEQIP KITE later, to take this mission forward, namely making our PhD Programmes in the country more attractive, effective and reputed, in little ways that we can. We would also like to use this process to make the PhD Programmes more relevant to the needs of our country if we can, at least in small ways. Encouraging entrepreneurship in the PhD Student community and in the overall community of students, has also been a theme of this workshop.

A report on RSAS-2014 is attached at **Annexure-1**.

Prior activities conducted, culminating in this major event:

- (a) We held a half-day workshop with several participants, faculty and graduate (Masters' and PhD) students in collaboration with VJTI, Mumbai on 23 December 2013 afternoon. We identified the points on which the Conclave/ Symposium of Research Scholars should be built, in March 2014 and also identified a team of Research Scholars and Faculty from institutes in and around Mumbai, to work with our own PhD Students to make this happen. Our Organizing Team from IIT Bombay has involved these volunteers closely thereafter, in planning the event and its deliverables.
- (b) We have held several internal deliberations and workshops thereafter, at IIT Bombay, to work out the details of the event. These internal deliberations, meetings and planned internal activities were conducted during the period 23 December 2013 to 6 March 2014.

Follow-up events:

- (a) **Immediate: In Activity Two below**, we plan to have a **major meeting and workshop between stakeholders from the TEQIP Institutes and the industry**. During this meeting and workshop, we would also like to take up suggestions, issues, ideas that emerged from RSAS-2014. We look forward to initiating at least one or two concrete steps, if not more, towards the betterment of Ph.D. Programmes in our country beginning with these deliberations. After one year or so, we look forward to an appraisal of the steps taken in this direction in the concerned Institutes, by Performance Auditors/ Mentors of these TEQIP Institutes. We would like their inputs and advice on what should be done to take this initiative further. In some of the subsequent TEQIP-KITE events, we have taken small steps in this direction although we would still like to have a much more comprehensive event if feasible.
- (b) **Research Scholars' Confluence (ResCon) conducted in March 2015:** A similar event to RSAS-2014 was conducted, with more structure and detailed preplanned objectives, in March 2015. This was conducted jointly under the aegis of MHRD-TEQIP-KITE and the Industrial Research and Consultation Centre (IRCC) at IIT Bombay. The details of this event were inspired by the report compiled for RSAS-2014. We have had a meeting with the officials looking after the Centre for Excellence in Signal and Image Processing at COEP, Pune on 20 November 2014 to plan this event.

2. Activity Two: (Status: Planned as a Follow-up to Activity One and emerging from the general mandate of TEQIP-II:)

Industry-Academia Collaboration at Project Institutions under KIT Programme:

As a part of the continued emphasis of the Ministry for Human Resource Development (MHRD) on broadening and deepening of industry-institute relations at TEQIP-II institutions, MHRD has recommended that KITE also becomes an active tool in bridging the gap between TEQIP institutions and potential industry partners, for collaboration on a range of activities including, but not limited to, R&D and external consultancy projects, student placements, adjunct/expert faculty, joint curriculum development/customized industry-specific module and industry representation in institutional governance bodies (BoGs). We intend to incorporate this activity into our TEQIP KITE Structure if possible in TEQIP-Phase II or at least in TEQIP-III.

Such a TEQIP-II Industry-Academia Collaboration Review Workshop at IIT Bombay will now be held at a later date, after working out a cohesive strategy for Institute-Industry Interactions under the Programme. We would like to convene this event as soon as possible with the assistance of the TEQIP Establishment and the MHRD. Active involvement of NPIU and the SPFUs will be needed to make this event happen.

Proposed Outcome: During this event, we would also like to present a summary of the experiences and ideas emerging from RSAS-2014 and ResCon-2015. We would like to identify concrete steps that should be taken in several of the TEQIP Institutes, to strengthen and improve PhD (Graduate Academic) Programmes in the country and to address the other industry-academia collective issues.

Appraisal Mechanism: We look forward to these initiatives being examined and monitored by the Mentors and Performance Auditors associated with the concerned TEQIP Institutes and to their providing feedback to our Quality Circle (KITE) so that the next phase of this endeavor in TEQIP-II and TEQIP-III can be planned and executed.

3. Activity Three:

(Status: Several activities already conducted, as detailed below and still in progress)

Pedagogy/ Research Training and academic interaction, in focused areas of engineering and technology:

We identified three disciplines initially, in which we intend to build up pedagogical initiatives: (a) Electrical Engineering (b) Computer Science and Engineering and (c) Chemical Engineering. This was to complement the disciplines identified by IIT Kanpur, for example. Subsequently, other disciplines at IIT Bombay also participated in these initiatives. It was planned to do this in collaboration with renowned Institutes in and around Mumbai/ Pune. These include VJTI Mumbai, COEP Pune, VIT Pune and some others. In addition, faculty members from the Department of Electrical Engineering, Department of Computer Science and Engineering and Department of Chemical Engineering have been identified, who would work with the Principal Investigator, to plan and execute these activities.

In Electrical Engineering, it is planned to have focused workshops/ conclaves in the following basic areas:

- (a) Circuits and networks
- (b) Signals and Systems
- (c) Digital Signal Processing

It is planned to organize focused workshops in Mumbai, Pune and also other cities with TEQIP Institutes as feasible, to deliberate on the instruction and knowledge dissemination in these subjects and to share and compare the pedagogical practices followed in various Institutes. We intend to examine both, the content and delivery of these subjects, in an engineering curriculum.

In connection with subjects like these and others, a major issue that arises, is the fundamental training required in **Engineering Mathematics**. Engineering Mathematics is a very important component of the Engineering curriculum in many Institutes. This component needs a great deal of work to achieve effective delivery and to inculcate a long lasting proficiency among students and researchers, in using mathematical concepts for engineering and technology. The connection between the Mathematics prescribed in a typical Engineering curriculum and the actual engineering principles that follow, is often not clear and there is often a gap between what a typical Department of Mathematics perceives as a requirement and what the Departments of Engineering and Technology perceive. In MHRD-TEQIP KITE, we have planned to have a focused activity to address this lacuna. We could take, for example, the three subjects mentioned above, as ‘case studies’.

Activities already conducted and action taken to date, towards this component of the plan:

- (a) A **meeting with some faculty members** from the **College of Engineering Pune (COEP)** was convened on **10 July 2014** to work the plan out in detail.
- (b) Have identified the upgradation required in our own laboratories for this purpose and we have been pursuing the required procurement and upgrade.
- (c) Wavelets and Multiresolution/ Multirate Signal/ Image Processing: On account of the special interest that the Principal Investigator has, in the subject of wavelets, multirate/ multiresolution signal/ image processing, it is proposed to have a major pedagogical activity on this theme supported out of these funds. A **One-Day Workshop on ‘Wavelets and Applications’ has been conducted on Sunday, 13 April 2014** with VJTI, a TEQIP Institute. This One-Day Workshop on 13 April was a **prelude to a larger workshop on the same theme** involving, more TEQIP Institutes in the coming Academic Year 2014-2015. This larger event was conducted almost exactly one year later on 12 April 2015 and it involved a much larger number of participants (over 70) and a larger number of TEQIP Institutes (5) as against smaller numbers in the first event.
- (d) Prof. Aditya Abhyankar, Dean, Faculty of Technology, University of Pune and the Principal Investigator are already collaborating on a textbook on the theme of Wavelets, which is taking shape.

- (e) The Principal Investigator participated in an Academic Council Meeting at VIT Pune, in February 2014, where the Directors of the College of Engineering Pune (COEP) and VIT Pune: respectively Prof A. D. Sahasrabudhe and Prof. Jalnekar were also part of the meeting. The plan for these events under TEQIP KITE at IIT Bombay was explained to them formally during this meeting and they have both agreed to work out collaborative events with IIT Bombay on pedagogy and training.
- (f) We have admitted a Ph.D. Student at IIT Bombay in the December 2013 round of admissions, in the Interdisciplinary Programme on Educational Technology, who is expected to address this theme in his Doctoral Research as well. He shall be supervised by the Principal Investigator (Prof. Vikram M. Gadre).
- (g) The Principal Investigator initiated the creation of a **Massive Open Online Course (MOOC) course on Signals and Systems** and this activity was pursued over the Summer of 2014, continued in the remaining part of the calendar year 2014 and then culminated in a MOOC offering during the Calendar Year 2015. This activity was supported largely by the NMEICT Project with Padmashree Prof Deepak B. Phatak and to a smaller extent out of the TEQIP-KITE funds. In future, we expect to have a larger collaboration with the MOOC initiative, as and when it evolves in the national mandate.
- (h) A **pedagogical initiative** workshop in the core course on ‘Signals and Systems’ to illustrate a ‘co-operative learning paradigm’ was conducted at IIT Bombay on **Sunday, 2 November 2014**. A one-day workshop was organized under MHRD-TEQIP-KITE on this day with **several participating faculty and students from four TEQIP Institutes**: VJTI, Mumbai; COEP, Pune; BATU, Lonere; Govt College of Engineering, Aurangabad. The workshop was arranged in the form of an evaluative exhibition on the application of Signals and Systems, to illustrate how the applications of relatively abstract concepts in Signals and Systems can be explored as a collective, co-operative endeavor by faculty and students together.
- (i) A ‘**proof of concept**’ or ‘dry run’ **half day workshop and exhibition** of system building exercises in the realm of Digital Signal Processing was organized at IIT Bombay on **12 November 2014**. This was meant to be a precursor to a larger pedagogical initiative planned in Digital Signal Processing in the Calendar Year 2015.
- (j) A two-day workshop on Pedagogy and research in the area of electromagnetics was coordinated and conducted by Prof. S. V. Kulkarni, Electrical Engineering on 23, 24 January 2015. The area of electromagnetics has always been a fundamental area of electrical engineering and there has been a growing need in recent years to expand the expert base in this area among academicians. This workshop initiated an important movement in this direction and gave the much needed impetus to academicians in TEQIP Institutes, to build up this field of expertise in their respective departments. The workshop was well attended, with over 70 TEQIP participants.

- (k) A three day workshop on Mathematics in Engineering, coordinated by Prof. Sachin Patwardhan, Chemical Engineering, was conducted from 13-15 May 2015. This addressed the much needed issue of how mathematics needs to be dealt with in an engineering curriculum. This has over 40 participants from TEQIP Institutes.
- (l) Two faculty members from IIT Bombay namely, Prof. Ashutosh Gandhi and Prof. N. Vishwanathan worked on a collaborative project between the MHRD-TEQIP-KITEs of IIT Bombay and IIT Kanpur, to review the pedagogy and curriculum in Metallurgical Engineering and Materials Science and allied subjects in TEQIP Institutes. This culminated in a workshop, conducted at NIT Srinagar, in October 2015.
- (m) A major endeavor to build and demonstrate a laboratory course in Digital Signal Processing (DSP): System Design and Implementation was undertaken, following the initial steps in November 2014. This lasted throughout the Autumn Semester of the Academic Year 2015-16 and culminated in a 5-day workshop on the pedagogy of DSP: System Design and Implementation from 2-6 November 2015. The establishment of several DSP system examples was supported through MHRD-TEQIP-KITE and the 5-day workshop was organized jointly with support from MHRD-TEQIP-KITE at IIT Bombay and some TEQIP Institutes in Gujarat. This had about 50 TEQIP participants from Maharashtra and Gujarat.

Appraisal Mechanism:

When we conduct these events, we have used participant feedback to appraise the effectiveness of the events. We would also like to involve the Mentors and Performance Auditors of the respective Institutes to follow up on the take-aways to the Institutes, from these workshops. We have received excellent feedback from participants on the workshops conducted on 13 April 2014, 2 November 2014, 12 April 2015 and 2-6 November 2015.

Important success of these initiatives: Inspired by the pedagogical events on Signals and Systems and Wavelets organized under MHRD-TEQIP-KITE at IIT Bombay, the College of Engineering Pune (COEP), a TEQIP Institute of repute in Pune organized a similar event for several institutes in and around Pune on 28 October 2015. This was an important fallout of the TEQIP-KITE initiative and was exactly what we are looking for, that TEQIP Institutes take inspiration from the TEQIP-KITE events organized and multiply their effect in other places in the country.

4. Activity Four:

(Status: Significant action taken and still in Progress)

Initiatives to enhance facilities, outreach technology research activities in our Centre for Distance Engineering Education Programme (CDEEP) and academic activities in our Interdisciplinary Programme in Educational Technology (IDP-ET): The major part of the execution of MHRD-TEQIP-KIT activities would be through CDEEP, IDP-ET and the departments identified in Activity Three above. We have

several initiatives planned for upgradation of facilities, services, mechanisms, manpower and staff employment structure, in CDEEP and IDP-ET at IIT Bombay. We have begun our endeavours to strengthen these two arms of the Institute, with this support.

Actions already taken in this direction:

- (a) One important thing that we plan to do is to move to a **cloud based paradigm for storage and communication in our distance education framework**. We have already initiated the purchase process by putting up an indent and sending out an enquiry to potential vendors for cloud based facilities. The purchase process has made progress after our previous report. Negotiations are on with identified vendors to take the matter further by ensuring that the migration to a cloud based paradigm would be in line with our own technical needs. It will also initiate research and developmental activity pertaining to cloud based communication in this context. The Purchase Order has been issued to the selected vendor who is now operating to set up the cloud service.
- (b) In our Department of Electrical Engineering, we have been carrying out research and developmental activities pertaining to **Scalable Video Coding, with a particular emphasis on distance education**. It has, for a long time been on our agenda to support a major research and developmental initiative on the theme of multimedia communication, with an emphasis on distance education and educational outreach and we shall use a part of these funds to build up an Inter-Institutional R&D effort on this theme. A white paper on this theme had been circulated between faculty of some of the IITs in February 2013, last year and it is attached in **Annexure-2**. We have had a dialogue with faculty members working in this area at IIT Kanpur, who have agreed to collaborate. **On Saturday, 12 April 2014, a focused group meeting was conducted between some faculty and students of IIT Bombay and IIT Kanpur in CDEEP, IIT Bombay to take this initiative further**. We also plan to involve IIT Kharagpur, IIT Delhi, IIT Ropar and IIT Guwahati, if there is interest, after preliminary discussions with faculty members in related areas in these IITs. Discussions have subsequently taken place with individual faculty in this research area from the other IITs and this initiative is now being built upon. At IIT Bombay, Prof Vikram M. Gadre has supervised Masters' Dissertation (project) work and a PhD Thesis on this broad theme.
- (c) We have initiated an internal '**pedagogy lecture series**' in IDP-ET at IIT Bombay, which we plan to bring before other TEQIP Institutes. We have had two workshops under this series to date. We have **planned more workshops internally and after some maturity has been achieved, then we would like to have a larger workshop involving TEQIP Institutes** and other reputed Institutes, in and around Mumbai and all over Maharashtra.
- (d) One **Educational Technology Workshop** was conducted as an MHRD-TEQIP-KITE event under the 'Teach Thousands of Teachers' Activity under NMEICT in January 2015. Some of our students were also supported through MHRD-TEQIP-KITE, to participate in the T4E Educational Technology Workshop.

5. Activity Five:

(Status: Two activities conducted, more in Progress)

Planning Activities around the ‘Approach Note’ circulated by Prof. Milind Sohoni:

Prof. Milind Sohoni, Department of Computer Science and Engineering, and Head, Centre for Technology Alternatives for Rural Areas, had made a proposal to revamp the curricular structure of Institutions, while taking into account the needs of the country, enclosed at **Annexure-3**. This endeavor has been planned as a part of the activities of TEQIP KITE at IIT Bombay.

Action already taken under this component: One Project Manager, Ms Nalini Shankar, joined IIT Bombay, for the execution of this activity, under the supervision of Prof. Milind Sohoni and worked for one year with the following job description:

Role: Project Manager (Ms. Nalini Shankar)

Following is the Concept Note to define the broad objectives and the role of the Project Manager working on Activity Five particularly, of the IIT-B TEQIP KITE project.

OBJECTIVES:

- To develop modules/ interventions which develop field knowledge and analytical skills of the students.
- To build mutually beneficial collaborations between IIT-B and regional colleges, with respect to research and for projects.
- To strengthen areas related to development in sectors such as Water, Energy, SMEs, Urban and Rural Planning.

METHODOLOGY:

a) PHASE I:

Understand TEQIP- Study of TEQIP documents and processes, past and present traditions, pedagogy etc. Study of other papers on the design of TEQIP I & II.

b) PHASE II:

Visit and interact with regional colleges and understand their expectations from such a collaboration:

- Aspirational
- Developmental
- Field experience
- Existing Mechanisms
- Key Faculty members

c) PHASE III:

- Design interventions and get the buy in from IIT-B and the local colleges for their support in delivering the initiatives.
- Mechanism to integrate with the Regional Stakeholders and on-going programmes as part of the intervention.

d) PHASE IV:

Implementation, Evaluation and Standardization of the Design Intervention.

Workshops conducted:

Two workshops have been conducted at IIT Bombay pertaining to this theme:

- (a) One workshop was conducted on 12 September 2014, termed a ‘Water Sector Workshop’ involving several TEQIP Institute Faculty. The theme was to identify, in collaboration with representatives of the government, private enterprises and educationists, the means and methodology to build parts of a curriculum which would address the specific need of water conservation and usage. This was meant to be part of a larger endeavour to make curricular changes in TEQIP Institutes, to enable students and faculty to address important social and environmental needs.
- (b) Another two-day workshop was conducted on 16,17 August 2014 between the Faculty-Student Body ‘Abhyuday’ of IIT Bombay and participants from TEQIP Institutes, to look at the feasible mechanisms for Youth Empowerment for Social Development. The **report** for this event is attached at **Annexure-4**.

Semester-long Project conducted: A team of graduate and undergraduate students from IIT Bombay worked with a team of undergraduate students in the ‘Unnat Bharat Abhiyaan (UBA)’ from the College of Engineering, Pune, a reputed TEQIP Institute, to identify rural development needs in a few villages near Satara in Maharashtra all through the Autumn Semester of the Academic Year 2015-16. Together, they visited the villages Kapshi, Koregaon and Dhondewadi and worked out some measures to address the villagers’ water conservation needs and agricultural needs through technology and social steps. This was an important step in encouraging the students of IIT Bombay and TEQIP Institutes to work together, towards national growth in the rural sector and we hope it will lay the foundation for stronger collaborative activities of this kind between IIT Bombay and TEQIP Institutes. A report on this activity is attached at **Annexure-5**.

6. Activity Six:

(Status: Started, several activities conducted, in progress)

Student Mentor Programme at TEQIP Institutes and Institutes of Repute: The Principal Investigator has been closely involved in setting up a comprehensive Student Mentor Programme at IIT Bombay. It has been found that the Student Mentor Programme is a very powerful way to rear a positive feedback mechanism for student growth, by involving well respected and carefully chosen senior students to mentor junior students. Further, we would like to develop some programmes that cater to the personal and professional growth of weak students and/or students who come from a less privileged background. In IIT Bombay, the Student Mentor Programme has one arm that does entirely this. The important gain from a Student Mentor Programme is that it multiplies manifold, the positive work done by faculty members in the

direction of student welfare and in achieving the objectives of TEQIP. We plan to encourage similar initiatives in other Institutes. The underlying philosophy is to involve chosen members of the Student Community to multiply faculty efforts in realizing academic and institutional objectives.

Action taken towards this component:

- (i) A programme of this nature has been initiated at VNIT, Nagpur, a TEQIP Institute. The Principal Investigator visited VNIT Nagpur on 4 April 2014 and discussed the progress and plans for this Programme with their Dean, Academic Programmes and another coordinating faculty member. He visited VNIT again on 14 November 2014 to assess the progress of this Student Mentor Programme and was delighted to see that it was now a well-established and well appreciated programme in that Institute. What is more, the Institute functionaries from VNIT were willing to work with IIT Bombay to take this kind of a programme to other TEQIP Institutes.
- (ii) We have identified the Student Mentor Coordinators from IIT Bombay and a team of students, who would collaborate with them, to interface with their counterparts from other Institutes, to make this happen. In principle, this outreach for the Student Mentor Programme has been made a part of the plan for the Student Mentor Programme at IIT Bombay itself.
- (iii) A one-day MHRD-TEQIP-KITE workshop on the Student Mentor Programme was conducted on 1 September 2014 at IIT Bombay for several faculty and students of VJTI, Mumbai, a TEQIP Institute. This was meant to explain the structure of the Student Mentor Programme at IIT Bombay to the participants at VJTI and to encourage VJTI to initiate such a programme in that Institute, as an example of good academic-administrative practice.
- (iv) A meeting of Prof. V.M. Gadre and the IIT Bombay Student Mentor Coordinators was organized with faculty and students of M.S. Ramaiah Institute of Technology (MSRIT), Bengaluru, Karnataka, mapped to IIT Bombay under MHRD-TEQIP-KITE, on 13 October 2014 to initiate the establishment of a Student Mentor Programme at MSRIT. This is again intended to be a move towards a benefic academic-administrative practice.
- (v) A two-day workshop on the Student Mentor Programme was conducted on 28,29 March 2015 at CDEEP, IIT Bombay in collaboration with VNIT, Nagpur which is a TEQIP Institute. About 20 participants from VNIT attended this workshop and interacted with about 30 participants from IIT Bombay.

7. Activity Seven:

(Status: Conducted)

National Workshop on Some Modern Aspects of Control Engineering: The Co-Principal Investigator, Prof. Bijan Bandyopadhyay, Erstwhile Professor-in-charge, Continuing Education Programme, organized a National Level Academic and Research Workshop on some modern developments in Control Engineering, specifically Sliding Mode Control. A reputed foreign expert, working in this field, delivered lectures, with a number of TEQIP participants. This event was organized jointly by CDEEP and the Office of the Continuing Education Programme.

8. Activity Eight:

(Status: Conducted)

TEQIP KITE participation in National Communications Conference (NCC–2015): NCC-2015 was organized at IIT Bombay on 27, 28 Feb and 1 March 2015. Several participants from TEQIP Institutes were supported to attend and participate in NCC-2015 from TEQIP-KITE.

9. Activity Nine:

(Status: Several conducted, more such planned)

Targeted visits and workshops with participants comprising of both, faculty/ students of IIT Bombay and faculty/ students of TEQIP Institutes: One of the activities slated under TEQIP KITE at IIT Bombay is to have groups of faculty/ students from IIT Bombay visit some of the TEQIP Institutes to interact with the faculty/ students of those Institutes and to have corresponding visits from such TEQIP Institutes to IIT Bombay. This would serve as a miniature ‘Exchange Programme’.

Accordingly, Prof. Vikram M. Gadre and some of his students visited some of the TEQIP Institutes, as also some other non-TEQIP Engineering Institutions in Maharashtra during the 2-month period July-August 2015, to participate in the technical workshops/ symposia organized by these.

- (a) One such workshop has been conducted by the Department of Chemical Engineering, for research scholars and postgraduate students in general, from TEQIP Institutes, on 2, 3, 4 July 2014. This activity has been coordinated by Prof Sachin Patwardhan, Department of Chemical Engineering, IITB. A report on this workshop is presented below:**

A workshop titled “Recent Advances in Chemical Engineering Research” was organized from 2-4 July, 2014 at Dept. of Chemical Engineering, IIT Bombay. The workshop was organized by Prof. Sachin C. Patwardhan through Knowledge Incubation Centre, TEQIP-Phase-II Project. This three day workshop was planned to introduce budding researchers in chemical engineering to the emerging research areas in chemical engineering science. The workshop consisted of overview lectures on recent advances in

- Complex Fluids (Prof. Partha Goswami)
- Bio-systems and Biomaterials Engineering (Prof. Supreet Saini)
- Colloids and Interfacial Engineering (Prof. V. A. Juvekar)
- Nano –science and Nano-Materials Engineering (Prof. Mukta Tripathy)
- Process Systems Engineering (Prof. Yogendra Shastry)
- Reaction Engineering and Separation Processes (Prof. A. K. Suresh)
- Research using Computational Simulations (Prof. Ateeque Malani)
- Climate Studies (Prof. Chandra Venkataraman)

In addition, visits to research laboratories in Dept. of Chemical Engineering and central sophisticated instrumentation facility were organized to provide exposure to the research infrastructure at IIT Bombay. Also, an informal interaction session was organized with research scholars in the department, to acquaint the participants to the research culture in the department.

One hundred and three graduate (2nd year master's and Ph.D.) and senior undergraduate students in Chemical Engineering from LIT Nagpur, VNIT Nagpur, ICT Mumbai, BATU Lonere, T.K.I.T. Warnanagar, J.D.I.E.T., Yawatmal, U.I.C.T. Jalgaon and SGGGS I.E.T. Nanded attended this workshop. The participants thoroughly enjoyed exposure to the frontier areas of research in chemical engineering and visits to the research labs. During the feedback session at the end of the workshop, a large section of participants indicated that they have seriously started thinking of pursuing a career in research.

(b) **A similar event was planned and conducted in Mechanical Engineering during the period 21-23 December 2014.** This event was also well attended by TEQIP participants, Over 100 TEQIP participants benefited from this workshop.

10. Activity Ten:

(Status: Conducted)

TEQIP Design and Degree Show (DDS) organized by Industrial Design Centre (IDC) 27-29 June 2014: The Industrial Design Centre (IDC), IIT Bombay organizes a Design Degree Show (DDS) every year for its graduating students. In the Calendar Year 2014, IDC has conducted this event under the aegis of MHRD-TEQIP-KITE with targeted participation from TEQIP Institutes, on the three days 27, 28, 29 June 2014. A detailed video record of this event shall has been made available on the MHRD-TEQIP-KITE website of IIT Bombay.

11. Activity Eleven:

(Status: Conducted)

Workshop on Ocean and Atmospheric Sciences organized under the aegis of MRHD-TEQIP-KITE on 18, 19 July 2014: Prof. E. Chandrasekhar, Department of Earth Sciences, has coordinated and conducted a workshop on Ocean and Atmospheric Sciences on 18, 19 July 2014 with participation from TEQIP Institutes. The aim of this workshop was to evolve an important new research area, which can also engage several faculty and students from TEQIP Institutions and other places as well. This workshop would be relevant to one of the important objectives of MHRD-TEQIP-KIT, namely, to encourage IIT Bombay to serve a role of leadership in exposing other Institutes to new areas of research and developmental activity. The proceeds were well appreciated by the participants of this workshop.

12. Major Activity Twelve:

(Status: Planned) 'Sectors or Verticals' under MHRD-TEQIP-KIT: As we discussed during the meeting on 6 May 2014, the SPFU, Maharashtra were also apprised of the 'verticals' that are invited from the IIT Bombay zone, during the meeting of 20 May 2014.

Accordingly, we have immediately identified five 'verticals' with IITB Coordinators (the three tier structure referred to in the minutes of that meeting) which can be proposed from the IITB MHRD-TEQIP-KITE.

A. A vertical on Signal Processing and Multimedia Communication with particular emphasis on Defence requirements and Educational Outreach Requirements: together with the Centres of Excellence at COEP Pune, SGGS Nanded and also possibly, VNIT Nagpur. Prof Vikram Gadre will coordinate this vertical, with participation from other colleagues in Signal Processing and communication at IITB. He is also on the advisory committee of two of these centres and that role would enable this collaboration to happen. This collaboration is now active under the joint participation of these TEQIP Centres of Excellence in the National Centre for Technology of Internal Security (NCETIS) recently inaugurated at IIT Bombay with Prof Abhay Karandikar as the Professor-in-charge.

B. A vertical on Technology Alternatives for development, with curricular innovations and reforms in this direction, with several TEQIP Institutes in Maharashtra - including the ones at Nanded, Karad, Mumbai, Pune, Aurangabad - Prof Milind Sohoni will coordinate this vertical with CTARA, IITB colleagues.

C. A vertical on Ocean and Atmospheric Sciences with Specialized observation, experimentation and analysis techniques with the Centre of Excellence in Nonlinear Dynamics at VJTI and one CoE at Pune, also with COEP interacting with the Institutes in Pune dealing with the subject. This will be coordinated by Prof E Chandrasekhar, Earth Sciences, IIT Bombay.

D. A vertical on Industrial Design along with TEQIP participants identified during the MHRD-TEQIP-KITE IDC Design Degree Show end-June 2014. This will be coordinated by Prof B K Chakravarthy of IDC (currently Head, IDC).

As we go along, we may also find other possible verticals to be submitted for consideration once the TEQIP participation has been ensured and the IITB faculty coordinators have shown definite interest.

LIST OF ANNEXURES

1. Report on RSAS-2014
2. Scalable Video Coding – A Possible Technological Direction in Educational Outreach
3. Approach Note on Relevant Technology Initiatives in the Curriculum – Prof Milind Sohoni
4. A report on the event for Youth Empowerment for Social Development conducted on 16, 17 August 2014.
5. A report on the Joint Activity between TEQIP-KITE at IIT Bombay and the Unnat Bharat Abhiyaan Team of College of Engg Pune.