

**A Project Report**

entitled,

**“Setting up of New  
Indian Institutes of Technology”**

Submitted to

Planning Commission  
Government of India  
New Delhi

By

The Ministry of Human Resource Development  
Government of India  
New Delhi

August 20, 2006

# Table of Contents

Section No.	Title	Page No.
1	Summary of Project	3
2	Introduction	5
3	Need & Justification	9
4	Academic Model of New IITs	13
5	Project Description in Brief	17
7	Financial Considerations	33
8	Specific Action Plan	36
9	Closure Remarks	39

## Section 1

### Summary of Project

The economy of a country consists primarily of three sectors - agriculture, manufacturing and services. Education is a key element of the infrastructure required to develop all the three sectors of the economy. In particular, higher technical education is certainly a key element of the emerging knowledge economy. India will be a preferred destination for engineering services as well as engineering R&D. India is also emerging as a hub of automotive component manufacturing. It is hoped that India will also be a hub of manufacturing in many other sectors of engineering. It is necessary to invest in training high-quality manpower if India has to seize the emerging opportunity and ensure a rate of growth of about 9 to 10 per cent. Government of India has, therefore, proposed to set up three new Indian Institutes of Technology during the eleventh five-year plan period.

The higher technical education system in India is the largest in the world. It has about 1700 engineering educational institutions and about two million students. The number of graduates per year is about 400,000. For such a large system, there is a need for additional centers of excellence. The seven IITs, twenty NITs, three IIITs, and a few other institutes do not provide sufficient opportunities to talented young students. In year 2006, for 5000 seats of IITs, it is to be noted that 300,000 students appeared for the entrance examination. For the 5,000 selected students, one can say that 5,000 equally talented and deserving students got left out due to lack of opportunity. This situation will be corrected to some extent by establishing three additional IITs. It is hoped that, in future, more such institutions can be established based on the need of the society.

The present proposal outlines the details of establishing three new Indian Institutes of Technology. Each institute will be incorporated in the IIT Act and will

be along the same lines as the existing IITs. Each institute will be established over a period of six years with a total outlay of Rs. 560 crores. The non-recurring component of this outlay shall be Rs. 352 crores and the recurring component shall be Rs. 208 crores over a period of six years. The total scheme outlay will be Rs. 1680 crores.

Each IIT will have B. Tech., M. Tech. and Ph. D. programs. When fully established, each IIT will have 2000 B. Tech. students, 500 M. Tech. students, 400 Ph. D. students and 100 post-doctoral fellows. The faculty strength will be 300 and the support staff strength will be 450. It is expected that the institutes will be able to minimize administrative overheads by outsourcing some of the municipal services of the campus.

The new IITs will have several unique academic features. These IITs will promote a culture of interdisciplinary education and technology development activities. The overall academic structure will consist of schools and not departments. Thus, the Institute will have schools of Natural Sciences, Engineering Sciences, Humanities and Social Sciences, Design & Creative Arts, Management Sciences and Health Science & Technology.

The governance structure of each IIT will be along the same pattern as the existing IITs. Besides the Board of Governors, Finance Committee, Academic Senate and Building & Works Committee, it is proposed that each IIT will have a Research & Technology Development Council. This body will be able to provide the policy guidance for research and development activities. Through this body, the Institute will be able to strengthen a culture of research driven by academia-industry and government.

India is emerging as a superpower in many areas. It is felt that in higher technical education, India has established a mark with IITs. If this brand gets strengthened further, India will also be a strong nation in the field of education, in general, and higher technical education, in particular.

## Section 2

### Introduction

Education is a key element of infrastructure for the growth of a society. The educational infrastructure has several layers such as primary education, secondary education, technical education and higher education. The economic strength of a society depends on the standard of educational infrastructure, in general, and the quality of technical education, in particular. Any society must ensure a free, creative and high-caliber university environment so as to produce successful captains of that society. The higher education system consists of three major components - (i) liberal arts and social sciences, (ii) technical and professional fields and (iii) basic and natural sciences. In India, the growth in the field of technical and professional education over the past 50 years is phenomenal. This growth has fuelled the developments in the fields of engineering and information technology. However, this development needs to be reviewed in view of global competition as well as an increase in demand for trained quality manpower from industry for design and manufacturing.

The economy of a country has three segments - agriculture, manufacturing and services. For a small country like Singapore, the economy can survive and even prosper with only one or two segments. However, for a large country like India, the economy has to progress on all three segments. In order to achieve an overall rate of growth around 8 to 10 percent, it is imperative that all three segments have to progress simultaneously. The services sector, including IT, requires well trained, technical manpower. The manufacturing sector requires significant investments in infrastructure as well as an excellent cadre of design and manufacturing engineers. The agriculture sector also needs personnel who are familiar with modern techniques. In short, a well-trained technical manpower is a key element for the overall progress of the economy.

India can be proud to have the largest technical education system in the world. Today, the country produces about 370,000 graduates in engineering per year. This can be compared to China producing 270,000 graduates per year and U.S.A. producing about 70,000 graduates per year. In India, the intake of students in technical education is about 500,000 per year. The number of technical institutions in India is about 1700. The country has a three tier structure of higher technical education. The IITs and IISc form the first tier. The NITs, IIITs as well as national institutions such as Institute of Technology at BHU, Zakir Hussain College of Engineering at AMU, Jadavpur University, JNTU constitute the second tier. The Government Engineering Colleges as well as Private Engineering Colleges form the third tier. The growth of technical education in India over the past twenty-five years is phenomenal. This growth has also brought along some serious concern of quality as well as efficiency. Many experts have expressed serious concern about the state of technical education in India.

The country could boast of a set of fine institutions for technical education in the pre-Independence era. Roorkee University, Guindy College, VJTI, COEP are some examples. Even eminent world-class engineers such as Sir M. Visvesvaraya emerged during that period. However, the state of affairs has declined in the recent past. In spite of the fact that establishments in space, nuclear and defense areas have come up in the past fifty years, the quality of engineers and scientists has deteriorated considerably. The country has established a large manufacturing base in automotive, aerospace, chemical, metallurgical and electrical goods. However, the country has not developed a strong base of design capabilities. Furthermore, many young engineering graduates are lured away by software industry. Therefore, there is a paucity of quality manpower in the manufacturing sector. It is opined that China shall be the hub of manufacturing and India shall be the hub of IT. However, such a situation is not tenable for sustainable overall growth of the country. It is necessary to increase the number of quality manpower in design and manufacturing during the coming years.

The IIT system has established a strong brand for undergraduate education in engineering. One of the key elements of this success is the Joint Entrance Examination. This entrance test and subsequent selection process is impeccable. The process ensures that bright students are selected without any compromise. They are then put in a liberal, free academic environment and challenged intellectually to learn the most demanding concepts of science and engineering. This kind of education imbibes a sense of intellectual confidence in IIT graduates. The education is so foundational that even though the graduates of IITs go in for other professions such as management or business, they continue to shine as the top, star performers. The sense of “can do it” confidence is instilled in the IIT curriculum and IIT campus environment. The successful alumni of IIT system is a galaxy of star studded canvas of Indian achievers spread all over the world.

The Indian society is hungry for more IIT-like education for its star value. In year 2006, about 300,000 students appeared for the Joint Entrance Examination (JEE) and only 5,000 were selected. This is a very steep filter and is frustrating to many in Indian society. There are as many as another 5,000 students who are equally brilliant but could not make it into the first 5,000. In fact, the next 15,000 are as good as the first 5,000. It is really necessary to provide IIT education to these deserving candidates as well. In other words, the pyramid of selection tapers very sharply at the top and should be broadened. The only way it can be achieved is by enlarging the intake of existing IITs or setting up satellite campuses of existing IITs or setting up new IITs. Ideally, it is desirable to have an intake of 20,000 students for undergraduate programs at IITs. At present, it is 5,000. In short, there is an urgent need to correct this situation. It is strongly felt that setting up of new IITs is a desirable strategy to expand the base of IIT education.

The IIT system started in 50's and early 60's with five IITs - Kharagpur, Chennai, Mumbai, Kanpur and New Delhi. Later on, IIT Guwahati was established in early 90's. The University of Roorkee was converted to IIT in late

90's. This entire system is admitting about 5,000 undergraduate students from a group of 300,000. The expansion of capacity of the first five campuses was carried out in 90's. The strength was almost doubled. Now, the system is envisaged to expand its capacity by 54%. In short, the intake will go up to 8,000. Even then, it is found that several talented young students will be deprived of an opportunity to get quality education. If three to five institutes are started then each institute could admit about 1,000 so that it will be possible to add 3,000 to 5,000 students. In other words, the total system at the end of eleventh five year plan period could admit about 12,000 students. There are about seven institutions identified by Government of India for up-gradation to the level of IITs. These institutions together could ramp up their intake to a level of 8,000 at the end of eleventh plan. In short, the total intake at the end of eleventh plan period will be about 20,000 approximately.

The Scientific Advisory Council to the Prime Minister (SAC - PM) has strongly recommended establishing three premier technical institutions such as IITs for engineering education and research. For a country like India, it is necessary to have more than three such institutions. However, taking into account the financial constraints and taking into account the enormity of the task, it is suggested that based on the experience of these three institutions, the Government of India should consider establishing additional institutions in future.

The present report examines the feasibility of setting up of three Indian Institutes of Technology. The present situation is analyzed in detail. The need analysis has been carried out and presented in this report. Several points of justification have been mentioned. The description of the project along with the preliminary cost estimates has been given. A road-map of implementation has also been described for the project.

## Section 3

### Need & Justification

India needs to develop a strong engineering base of economy. The present boom in the sector of services will be short-lived if neighboring countries catch up on offering cheap labor rates as well. The manufacturing base of Indian economy needs to be strengthened. Such a strengthening needs a new ethos of innovation and manufacturing entrepreneurship. In order to nurture these values, it is necessary to set up new academic institutions which will promote a new brand of engineering culture. It is felt that a new generation of Indian Institutes of Technology should develop the post-graduate education for innovation and manufacturing entrepreneurship.

Technology development is a key driver of new economy. Most of the technology development work is carried out by the institutes of technology in any country. It is carried out as a tripartite efforts on behalf of industry, Government and academia. The Samtel Centre established at IIT Kanpur is an excellent example of how globally competitive technology can be developed in India using such a collaborative effort. Academia and industry will have to come together to develop new technology. The new technology, in turn, will spin off new economy. The new economy replaces the old sectors and maintains the overall vitality of the economic activity of a country. In short, present IITs and new IITs must give emphasis on technology development and should develop a new methodology of innovation. It is strongly felt that new IITs will have the freedom and motivation to develop these new values.

The new IITs should develop appropriate paradigms of engineering education. The engineering science based education, presently practiced in many institutions, is strongly class-room oriented. Students are not confident of working with their own hands in laboratories, studios and workshops. The spirit of

apprenticeship is missing. The focus on “learning by doing” should be developed so as to motivate students for innovation and entrepreneurship. The concept of 4-i, Innovation, Implementation, Integration and Incubation, is necessary as a basis of engineering education. Such a paradigm shift can be considered along with the concept of Information Science Based Engineering Education. The present IITs have perfected the model of Engineering Science Based Education. One should preserve this concept. However, it is necessary to reform it further. The new IITs, it is hoped, will experiment with some of the new concepts and bring about a change in the philosophy of technical education.

It is interesting to note that during last decade of 20<sup>th</sup> century and the first five years of the present century, a dramatic rise in higher technical education has taken place in countries like China, Korea, Singapore and Japan. These developments are important for India’s global competitiveness. For example, during the period from 1995 till 2003, the number of Ph. D. admissions in China grew from 8,139 to 48,740. During the same period of 1995 to 2003, the Ph. D. admissions in India grew from 3000 to approximately 5000. For the year 2004, the number of scientific publications from China is reported to be 57,378. While for the year 2004, the number of publications from Korea happens to be 24,464 and for India, the corresponding number is 23,338. It is interesting to note that the registration of new doctoral students in science and engineering in the year 2003 from China is 9000, while the corresponding number for India is 4000. If this trend continues, India will be far behind its Asian neighbors in higher technical education. It is necessary to produce a significant number of graduates, in general, and post-graduates, in particular, for several branches of engineering sciences.

Education system in any country is linked with the pressure of the job or career market. There has been a phenomenal growth in the jobs required in IT sector. The NASSCOM report projects a need of 10,00,000 graduates by 2010. However, a peculiar situation has arisen in the country. All engineering graduates get their training in any branch of engineering such as Civil Engineering or

Aeronautical Engineering etc. However, right after graduation, they join jobs in IT sector. The need of this sector is so huge that new recruits are given a crash course, called Finishing School, and are inducted in the job hurriedly. In fact, many institutions can show that students after graduation are joining jobs in financial sector or IT sector. If high quality engineering jobs with appropriate financial compensation are made available then this trend will be altered. The new IITs should address the issue of developing appropriate engineering branches. These branches should be such that they provide the right kind of training to students. Also, students should make use of their training while searching for a job or a career.

The Government of India will have to review the entire supply chain of technical education from school education to job market in engineering. The Quality Improvement Program has successfully trained a large number of teachers from engineering colleges. This effort needs to be up-scaled so as to produce a cadre of quality teachers of engineering colleges. The concept of a Virtual Technical University is under consideration of Government of India. This institution will coordinate with existing technical institutions and train the existing cadre of teachers of engineering colleges. It is hoped that the post-graduate degree holders from existing and proposed IITs will be able to take up faculty positions in NITs and other engineering institutions. The shortage of quality faculty in NITs and other engineering colleges can be met successfully by establishing new IITs.

India will be preferred destination for engineering research and development in years to come. Several national and international R&D organizations will set up shops in India. Many international corporations such as General Electric, General Motors, Eaton Corporation, Honeywell, Pratt & Whitney, Airbus and Boeing are establishing their design and manufacturing R&D in India. The engineering services sector is also rising very rapidly. It is expected that the yearly turnover of this sector will rise to 25 - 30 billion US dollars in the coming decade. The R&D as well as engineering services sectors will demand

quality manpower comparable to world standards. It is hoped that new IITs along with the existing IITs will play a pivotal role in crystallizing the development of India as a hub of engineering R&D as well engineering services.

Engineering and science education as well as research is becoming increasingly interdisciplinary in nature. The present structure of departments in the university system as well as existing IITs has become so rigid that it is difficult to have faculty members with joint appointments to form an interdisciplinary group. Students are not allowed to credit courses in a flexible manner. Research projects with joint supervision from different departments are not carried out easily. This results in stifling the growth of new ideas. The proposed academic model of new IITs will showcase a new way of education and research. Once established, it can be spread around to other institutions and universities as well. In short, the spirit of boundary-less academics will be encouraged in these institutions.

Besides interdisciplinary research in an institution, it is also essential to promote linkages between IITs, industry and national research laboratories. With a consortium of such kind, it is possible to develop new products and technologies for societal issues of transportation, healthcare, education, communication, energy, water resources, environment, and materials. It is interesting to note the development of technology developed by a group of IITs, RDSO and industrial organizations. The new sensors as well as communication devices can transform the technological level of Indian Railway system. Such efforts need to be strengthened as well as up-scaled. It is hoped that new IITs will focus on technology development in the areas of national importance.

The need of new IITs for increasing demand for seats both at the undergraduate as well as postgraduate level is well recognized. It is felt that the new IITs will fulfill this demand in a partial manner.

## Section 4

### Academic Model of New IITs

The academic model of an educational institution is a critical element while designing the structure of that institute. The academic model of present IITs evolved from the university system as well as the system of engineering colleges. However, it must be said that IITs developed a strong base of engineering science based education. The concept of a core program followed by a professional program was unique at that time. The core program emphasized not only on natural sciences but also exposed students to humanities as well as social sciences. In other words, the foundation is very broad and rigorous in IIT system. The professional program has three components - compulsory courses, elective courses and project work. These courses are mainly from the department where a student is likely to specialize. Unfortunately, the present academic model does not promote interdisciplinary or cross-disciplinary learning. The present model does not emphasize synthesis and creativity elements. It is heavily titling towards training in analysis. The present model of IITs does not focus on personality development of the individual in terms of values, ethics, social sensitivities, and global awareness.

The new IITs, it is proposed, should promote a borderless academic environment. The distinction between different branches of engineering should be dissolved. The education and training should promote interdisciplinary learning. It should provide flexibility to a student to tailor a program according to his or her requirements. In short, it will provide a “buffet” of courses. A student can create his or her own dish. In order to ensure that such a change does not jeopardize the progress of a student in the professional world, it is proposed a branch will be assigned. However, each student will be able to design his or her curriculum with a major and a minor field of engineering or science. In other words, a student of Aeronautical Engineering can have Aerodynamics as major

and Applied Mathematics as minor. A student of Computer Science can have Software Engineering as major and Product Design as minor. It is necessary to provide many choices to students. It allows students to think and take a decision. Hopefully, these decisions will not be influenced by parental pressures. Also, students will develop their individuality. At present, there is a tendency for students to copy each other's identities. It is desirable that students should be able to make their own choices.

The second unique feature of the academic model of new IITs would be an emphasis on creativity. This is essential for inculcating a spirit of discovery and innovation. In order to develop such a spirit, it is proposed to have courses which will fuse technology and arts. These courses on creativity will be available both at the core level as well as professional level. The courses on product design and development will follow after the basic foundation of training in creativity has been imparted. It is said that most of the training in present IITs develop only the left side of the brain. The new IITs will hopefully look at the development of left side of the brain as well.

As an organization, it is proposed to have the concept of schools than departments. It will encourage academic staff to work together in an interdisciplinary environment. The following schools are proposed in every IIT.

- School of Engineering & Technology
- School of Design & Creative Arts
- School of Management
- School of Health Science & Technology
- School of Natural (or Basic Sciences)
- School of Humanities and Social Sciences

The approach of learning, in proposed IITs, will be by “doing”. Emphasis will be placed on development of skills in majority of courses. This approach

along with training in creativity will create a new cadre of young graduates who will be able to design new products and develop new technologies. In order to develop skills, it is necessary to have a different kind of infrastructure. Besides class rooms, it will be necessary to have several laboratories or studios or workshops for students. The facilities at these places should encourage students to learn by themselves. Students should focus on a goal of acquiring a skill and practice extensively so as to not only learn the skill but imbibe it as a habit. In this fashion, the education is not simply giving information but is shaping the persona of students.

All educational institutions will soon have to compete at the global scale. With a decreasing trend of enrollment of students in western countries for engineering courses, it is expected that engineering education in Asia will become more critical. Students graduating from Asian institutions will be called upon to serve any where in the world. In order to meet such an eventuality, the academic program should be designed to develop a graduate who will be able to perform successfully on the world stage. For this goal, the communication skills of students should be excellent. The new IITs should ensure that the communication skills or soft skills are well developed in the academic programs both at undergraduate as well as postgraduate level.

The world is now a global village. The social forces are no longer local but exhibit global linkages. In order to understand one self as well as the world around an individual, it is necessary to have some education on aspects of life such as, for example, mind, ethics, values, jurisprudence, relations, society and time. All such courses should not be in discourse manner but should involve active skill development of students. It should be possible for students to visit different places and interact with society and learn some specific issues. It should be possible to understand from projects. Students should be trained on doing such projects either in a group or as an individual.

Project work will be very important in the proposed academic model. The project will be worth four courses as compared to worth two courses in the present IITs. It shows that learning through project is far more effective. In order to develop skills, each course will have some activities which may be in project form. Some projects will be carried out as a group and some projects will be carried out as an individual. It is expected that students will get some exposure to international scene in these projects. It may be possible to form a collaborative project with a student group from other country. The emphasis on international experience is desirable in an academic program

The overall curriculum will consist of the following elements.

Core of Natural Sciences	6 out of 10 courses
Core of Engineering & Technology	10 out of 15 courses
Professional Courses - Major & Minor	16 out of 24 courses
Elective Courses	4 out of 20 courses
Project	4 courses
Total	40 courses

It has been observed that students of IITs do not develop interests in sports or culture. In order to appreciate the activities of sports and culture, students will be provided a card called Extra-curricular Performance Card. This card will be given along with the grade card of a student. This card will enlist the contributions and involvement of the student in sports and cultural activities during the entire four year period. It will be given due recognition. It is expected that students will develop a good portfolio of their extra-curricular activities.

## Section 5

### Project Description

In this section, a description of the project is given. The overall goals, vision and mission is described in the section - Charter. The description of the undergraduate as well as postgraduate academic programs is given in the section - Academic Programs. A brief outline of the research activities envisaged in the proposed Institute is given in the next section. The Institute is expected to develop linkages with industry and national laboratories through a Quality Improvement Program. A description of this Program is also given. The new IITs will give emphasis on quality rather than quantity. The staff structure, student strength and faculty strength as proposed is described in the subsequent section. The proposed Institutes will be residential Institutes. The infrastructure will however be minimal with lesser load on the Institute administration. The governance structure of the Institute will be along the lines of other national institutions of excellence in India. The proposed governance structure is described next.

### The Charter

#### (a) Objectives

- To create world-class institutions for under-graduate and post-graduate education in engineering, and sciences with an intellectually alive atmosphere of research
- To create a unique technical institute for technology development in the country in which education will be totally integrated with state-of-the-art research

- To create, therefore, a four-year B. Tech. program in engineering and sciences following ten-plus-two curriculum
- To create the postgraduate programs in engineering and sciences at Master's as well as Doctoral level
- To create a cadre of high-caliber, internationally well-known faculty members which will be devoted to teaching as well as research and technology development activities in engineering, sciences and humanities.

#### **(b) Goals**

- To impart technical education that will nurture creativity
- To provide education and training in order to charter new grounds and break compartmentalization of traditional disciplines and sub-disciplines of engineering, sciences and humanities
- To make possible a flexible, border-less curriculum in which a student, say interested primarily in electrical engineering, should have no difficulty in taking courses in, say mathematics
- To strengthen the quality of the base of the pyramid of core program of natural and engineering sciences and gradually build up its apex of inter-disciplinarity
- To create awareness in career opportunities for well-rounded Master's and Doctoral degrees in all aspects of engineering and

sciences, followed by specialized training during the final year of the curriculum

- To expect that about 30% of the graduates of B. Tech. programs will carry-on for M. Tech. programs and 20% of the graduates of the Master's Program will carry-on in pursuit of a doctoral stream in focused sectors, while the rest will leave with a quality stamp to join other organizations
- To plan to provide such preparatory training to about 80% of the final year class such that the graduates will be ready to join a plethora of career opportunities that exist for engineers and scientists in government organizations such as the Department of Atomic Energy (DAE), Council of Scientific and Industrial Research (CSIR), Indian Space Research Organization (ISRO), Defense Research & Development Organization (DRDO), teaching profession in colleges and universities and other sectors of the society at large
- To network the new IITs with the existing IITs as well as national laboratories, and industries in the neighborhood in order to make optimal utilization of resources, both in terms of expensive laboratory facilities as well as teaching talents
- To develop a doctoral Program which will admit students with Bachelor's degrees making possible a parallel entry of select group of students who have had their undergraduate science education elsewhere
- To develop a doctoral Program that will also admit student with Master's degrees either from IITs or from elsewhere

- To build a strong core faculty that will be able to synergize research and technology development with teaching and education
- To develop first-class teaching and research laboratories in order to emphasize the point that engineering is ‘creative’ and ‘experimental’; the focus on experimental research would be to charter uniquely novel areas, not found elsewhere, applicable to technology and industry; the development of research Program should be such that theorists would be naturally inclined to carry out collaborative research in conjunction with experimentalists

## **Academic Programs**

The academic Programs of an educational institution determine the character of that institution. The proposed IITs will have three main academic Programs - (i) a four-year B. Tech. program, (ii) a two-year M. Tech. program and (iii) a doctoral Program.

The four-year B. Tech. program will take students after 10+2 years of school training. Brilliant students will be selected based on their performance in the Joint Entrance Examination test. Students will be provided a menu of courses. Each student will be required to accumulate certain number of credits in engineering sciences, natural sciences, humanities & social sciences, and creative arts. However, beyond this minimum coverage, a student can specialize in a major area as well as a minor area. A student will be able to design his or her specialization in a unique manner. The Institute will ensure that courses covering all areas of specialization are offered every semester in sufficient number.

The spirit of education in the proposed institution is “research-based learning”. Students will be exposed to laboratory work in an intensive manner.

Besides formal lecture hours, each student will be required to undergo some training in laboratories. After this training, each student or a group of students will undertake some technology development activity so as to explore their ideas, suggestions, and proposals. Such an approach will provide in every course a window of activities for research. Unfortunately, the present structure of learning where research is considered an exclusive domain of students who have gone through a huge number of courses is a myth. In some cases, a person with less formal knowledge may come up with a brilliant idea provided the person has been confronted with a situation in a creative manner. Doing research is a way of thinking and developing technology is a way of practice turning into a habit. One needs to learn it. If one learns it earlier, it is better.

The master's and doctoral programs will establish a new icon of research in the country. The master's program will be conducted in close cooperation with industry. Some courses will be offered by industry. Sponsored candidates from DRDO, RDSO, DAE and ISRO will be encouraged. The doctoral program will involve course work, qualifying examination, state of the art seminar, thesis work, open seminar and thesis examination. Besides a thesis supervisor, a committee will be constituted for each candidate so as to oversee the progress of research work. The quantum of course work will vary depending on the background of a student. The doctoral students will be encouraged to work in a group. It is essential to understand that ambitious research activities need to cultivate a team spirit of research. Besides a research project of an individual, students will be involved in several professional activities such as seminars, workshops, presentations and review meetings. In other words, a part of the training on research organization and research management will be embedded in the academic Program. All doctoral students will be asked to assist faculty members in some teaching assistance during the course of the doctoral Program. This will develop linkages between undergraduate and postgraduate students. As already mentioned, in addition to the master's students, some outstanding students with Bachelor's degree will be permitted to pursue the doctoral Program.

The academic activities of the Institute will be interdisciplinary in nature. However, the Institute shall have following major areas.

- Natural Sciences
- Engineering Sciences
- Humanities & Social Sciences
- Design & Creative Arts
- Management Sciences
- Health Science & Technology

Students and faculty will be encouraged to form groups involving more than one area. The thrust areas of research will require fostering an environment of interdisciplinary nature.

<b>PROGRAM</b>	<b>SCHEDULE</b>
<b>B. Tech.</b>	July 2006 (Academic Year 07-08)
<b>M. Tech.</b>	July 2007 (Academic Year 08-09)
<b>Ph. D.</b>	July 2007 (Academic Year 09-10)
<b>Post-doc Fellows</b>	July 2008 (Academic Year 12-13)

**Table 1 Introduction of Different Academic Programs**

## **Research & Technology Development Activities**

Indian research and technology development activities suffer from many maladies. Countries like Korea, Israel, and Taiwan have shown successfully how research Programs can be used effectively to transform the economy of a nation. It is now possible to develop a chain of activities from knowledge generation to wealth creation. Vision of research with such characteristics needs to be developed in Indian universities. It is hoped that the new IITs will be successful in ushering such a vision in Indian academic environment.

Many leading technological universities in the world nurture ambitious research Programs and facilities, for example, JPL at Caltech, Lawrence Livermore at Berkeley and Railway Research Facility at Aachen. Establishment of such facilities propels the university research environment at a different level. In India, even though large research establishments have been established by Government, an academic technical university is not able to set up such national or international research facilities. Once again, the new IITs will have a strong sponsored research activity. The Institute will endeavor to develop a research and technology development atmosphere with sizable infrastructure.

Group activity is a key element of any modern research environment. Many research activities require expertise of experimental, computational and analytical abilities. Such a requirement can be fulfilled by forming a group of post-doctoral fellows, doctoral students, summer trainees, and undergraduate students. The work environment of such a group requires excellent interpersonal relations and complimentary skill sets. In many cases, one needs to learn as to how to share the resources and facilities in a group. The new IITs will encourage as a policy an environment of group research.

Research activities require large funding. Funds of such a magnitude need to be raised through sponsored research activities. The new IITs will strive to develop a strong sponsored research Program right from its inception. In order to develop such a Program of research successfully, the Institute will establish an apex body such as Research Council. It will develop the agenda of research at the Institute level. It will initiate and champion mega-research projects. Research policy framework will be developed by such a council. Besides faculty members of Institute, the membership of the research council will include eminent technologists and scientists from India as well as abroad. Representatives from industry and funding agencies are also expected to be members of the research council.

The new IITs will establish a strong reputation of research through the publication record of its faculty and students. Strong emphasis will be placed on publishing the results of research activities in international and national journals. India is losing its position in publication record vis-à-vis China, Japan, Korea, Europe and America. It is essential for Indian academic community to understand that academic research is an index of performance at the international level. The degree of excellence will depend on the publication record of students and faculty. The Institutes should explicitly strive to maintain a high standard in terms of its publication record. The agenda of the research Program as well as the quality of resources and infrastructure will determine the performance of the new IITs.

## **Continuing Education and Quality Improvement Program**

The new IITs are conceived to be national Institutes. It shall have a stature of a centre of excellence in engineering and natural sciences. It is expected that Government and other funding agencies will invest significantly in such institutions. The new IITs will serve as a trigger to boost the quality of engineering research and education in India. The new IITs will serve as catalytic agents for other engineering colleges and NITs to change the overall situation of engineering education and research in the country. This can be accomplished in an evolutionary manner. Once the Institutes are well established, they will provide opportunities to faculty and students of other universities as well.

There are many ways to improve the quality of engineering education and research in other institutions. Under Quality Improvement Program scheme (QIP Scheme), the new IITs can admit some talented young teachers of other institutions in their masters and doctoral programs. Such persons will be provided full financial assistance as well as modest housing on the campus of IIT. After completing their academic program of IIT, these QIP scholars will be under an obligation to serve their parent institution for a specific period of time. In order to

carry out some research at their parent institution, such staff members will be provided some research funding.

Technology is an ever-happening field. New developments and products emerge on a continual basis. Students and faculty of IITs need to be exposed to such fields. By organizing a series of continuing education courses of one or two week duration at IIT, it will be possible to sensitize the academic community at large. Speakers for continuing education Programs could be the faculty of IIT as well as experts from India and abroad specializing in the sunrise areas of science. Such programs can be delivered using the satellite and distance education technology. It is, therefore, necessary to develop the infrastructure of technology enhanced learning at IIT.

Technologists and faculty members of other universities can be invited to participate in the activities of IIT as visiting scientists or adjunct faculty members. During their visits, such scientists can participate in the research programs of IIT.

The quality improvement program will form an interface division of IIT with other universities and institutions. It will require appropriate infrastructure as well as organization. It is expected that the new IITs will join the apex committee of IITs to set out the policies, approve the programs and monitor the quality of all activities. The apex committee will have representation from other universities, laboratories and industries from the region where the Institute is located. A national Institute such as IIT will evolve a cooperative and collaborative spirit with other institutions. The quality improvement program will be the wing of the Institute for such a purpose.

The new IITs should take a lead in establishing strong professional development activities. It should be possible to organize a series of workshops, seminars and road shows for the development of technology being carried out at IITs. A strong industry-academia interaction is desirable at the new IITs.

## **Student, Faculty and Staff Strength**

The new IITs shall be centers of excellence for engineering education in India. The undergraduate program shall be the B. Tech. program. The new IITs will offer M. Tech. as well as Ph. D. programs. When fully established, the Institute will admit 500 U. G. students per year. To begin with the batch will be of 200 students and it will be gradually increased to full strength in a period of six years. So the Institute will have the strength of 2000 U. G. students assuming the program to be of four year duration. The M. Tech. program shall also be an important element of the new IITs. When fully established, the program will have an intake of 250 students per year. So, the strength of this two-year program will be 500.

The doctoral program is an important element of the Institute. IIT will have a strong doctoral program. In order to develop such a program, IIT will admit students after Bachelor's degrees as well as after Master's degree. It is expected that about 80 to 100 students will be admitted in the doctoral program when the Institute is fully established. . Considering that a student takes about four or five years to complete a doctoral Program, it is expected that the total student strength of the doctoral Program, when it is fully established, shall be about 400.

Engineering education and research is now increasingly dependent on the research being carried out by the post-doctoral fellows. At present, the strength and quality of a post-doctoral program is not satisfactory in India. It is hoped that the new IITs will strive to establish a strong post-doctoral fellowship program. When fully established, this program will have the strength of 100. A post-doctoral fellow will be in the program for a period of maximum three years and minimum six months. The research agenda for each fellow will be well articulated. Each fellow will be provided a monthly stipend and housing on the campus. The post-doctoral fellows will carry out the research as well as assist in running the laboratories and carrying out laboratory instructions.

The Institute will have a sanctioned strength of 300 faculty members. To begin with, the Institute will start with a group of 30 faculty members and build up the full strength over a period of five to six years. The selection will be on a highly critical basis. The applications will be invited from all over the world. The faculty members will be provided incentives in the form of initiation grants, travel subsidies, joint appointments etc. People of Indian origin and holding dual citizenship may also be considered for visiting or sabbatical positions. In fact, it is recommended that people from SAARC region, who wish to join and who have outstanding academic record, may also be considered. The Institute shall strive to build excellence and the cornerstone of this quality will be based on the quality of faculty.

The support staff is a crucial element of Institute manpower. Indian institutions in general suffer from an overburdened strength of this category of manpower. It is strongly suggested that IIT will keep the support staff strength to a minimum. As per the norms of Government of India, the support staff strength is recommended to be 450. The Institute should outsource many services and avoid employing staff on a permanent basis for all functions. To begin with the strength of 45 would suffice. The full sanctioned strength of 450 can be reached in a period of five years.

<b>Title</b>	<b>Yr 1</b>	<b>Yr 2</b>	<b>Yr 3</b>	<b>Yr 4</b>	<b>Yr 5</b>	<b>Yr 6</b>
<b>B. Tech.</b>	200	250	300	400	450	500
<b>M. Tech.</b>	-	50	80	150	200	250
<b>Ph. D.</b>	-	-	20	40	60	80
<b>Post-doc Fellows.</b>	-	-	-	10	20	30
<b>Total</b>	200	300	400	600	730	860

**Table 2      Year-wise Student Intake and Student Strength**

<b>Title</b>	<b>Yr 1</b>	<b>Yr 2</b>	<b>Yr 3</b>	<b>Yr 4</b>	<b>Yr 5</b>	<b>Yr 6</b>
<b>Students</b>	200	850	1900	2600	2750	3000
<b>Faculty</b>	30	50	90	150	210	300
<b>Staff</b>	35	75	150	250	375	450

**Table 3      Year-wise Strength of Students, Faculty and Staff**

## **Institute Infrastructure**

The each of the new IITs shall be a residential Institute. It is proposed that an Institute of such a stature shall require an area of 500 to 600 acres. The campus will house the academic area, the residential area for students and the residential area for faculty and staff. The campus will be developed and maintained by outsourcing the services of security, maintenance, mess services, horticulture, local transport etc. The post-doctoral fellows will be provided studio apartments. A guest house will be essential for visitors, and visiting faculty members. The guest house will have two sections. One section will cater to the guests who are visiting for a couple of days. The other section will cater to those visitors who are likely to stay for a month or two. The housing for such guests will include more facilities of cooking and storage. The Institutes will endeavor to provide appropriate facilities of health care at the level of a primary health clinic. The Institutes will also provide elementary as well as secondary schooling facilities to the children of faculty, staff and married students.

Sr. No.	Item	Plinth Area (in sq.m.)
1	Academic Complex	
1.1	Academic-cum-Administrative Building	8,000
1.2	Lecture Hall Complex (includes some Class Rooms)	8,000
1.3	Laboratory Complex (includes some Tutorial Rooms)	16,000
1.4	Core Laboratories and Central Facilities	3,000
1.5	Computer Centre	3,000
1.6	Conference Complex / Auditorium	6,000
1.7	Student Activities Centre / Cafeteria	4,000
1.8	Library	5,000
	Sub-total	53,000

**Table 4-a Space Requirement - Academic Complex**

Sr. No.	Item	Plinth Area (in sq.m.)
2	Residential Complex	
2.1	Student Hostels with common facilities	80,000
2.2	Faculty Housing	40,000
2.3	Guest House	6,000
2.4	Community Center	3,000
2.5	Commercial Center, Health Center, Campus School	4,000
	Sub-total	133,000

**Table 4-b Space Requirement - Residential Complex**

The academic area of the Institute will consist of lecture and tutorial rooms, faculty offices, laboratory spaces, cafeteria, meeting rooms, spaces for

administrative support services, library, computer centre, mechanical and electronic fabrication laboratory, offices for Director and other officials, senate hall, auditorium and space for continuing education Programs. The Institute will provide expansion in both vertical and horizontal directions. The campus will be provided sufficient green cover. The campus will be developed taking into account the measures of energy conservation, rainwater harvesting, waste water treatments etc. A primary health care centre as well as a small shopping centre along with banking and postal facilities will be provided on the campus.

The Institute will need laboratory equipment as well as computing equipment. The list of such equipment will be based on the academic curriculum of the Institute as well as the research Program to be developed by the faculty of the Institute. It is expected that the inventory of such equipment will grow as the Institute grows in terms of number of faculty and the academic Programs. It is expected that all laboratories and buildings will be fully developed over a period of eight years. The financial support for such planned activities will be provided partially by MHRD.

Sr. No.	Item	Amount (in Rs. Lacs)	Amount (in Rs. Lacs)
1	<b>Academic Laboratory Equipment</b>		
1.1	Engineering Sciences	40,00.00	
1.2	Natural Sciences	15,00.00	
1.3	Humanities & Social Sciences	3,00.00	
1.4	Management Sciences	7,00.00	
1.5	Design & Creative Arts	10,00.00	
1.6	Health Science & Technology	7,00.00	
	Sub-total		<b>82,00.00</b>
2	<b>Central Facilities</b>		
2.1	Computer Centre	15,00.00	
2.2	Central Workshop	15,00.00	

2.3	Library	24,00.00	
	Sub-total		<b>54,00.00</b>
<b>3</b>	<b>Miscellaneous</b>		
3.1	Furniture	3,00.00	
3.2	Audio-visual Equipment	2,00.00	
	Sub-total		<b>5,00.00</b>
	<b>Total</b>		<b>141,00.00</b>

**Table 5      Assessment of Equipment Requirements**

## **Institute Governance**

The new IITs will be governed by the Indian Institute of Technology Act. These institutions will come under the purview of IIT Council. Each IIT will be governed by a Board of Governors. The Board will be constituted by Government of India. The Ministry of Human Resource Development will provide the necessary financial support for plan as well as non-plan expenditure of the institute. Each Institute shall follow the norms of Government of India as regards reservations for seats as well as recruitment of staff members. Each IIT will frame the statutes and shall have them approved by the Visitor.

The Board of Governors will be headed by a Chairman. The Chairman will be appointed by Government of India. The Board will consist of representatives from academia, industry, scientific laboratories, Government agencies such as space, defense research, atomic energy, environment science, information science etc. It will also have representation from respective state governments. The Director of the Institute will be a member of the Board. The secretary of the Board will be an appropriate official of the institute.

The Director of the Institute will be the chief academic as well as executive officer of the Institute. The Director will be an eminent educationist with proven academic and leadership qualities. The Director will be appointed by the Board

on the recommendation of Government of India. The Director will have the tenure of five years which can be extended by the Board. The Director can serve the institute up to the age of 65.

The Board will have a Finance Committee which will be chaired by the Chairman of Board of Governors. The Building and Works Committee will be a standing committee of the Board. It will be chaired by the Director of the Institute. The academic senate of the institute will also be a standing committee of the Board. It will be chaired by the Director of the Institute. Each IIT will have a Research (& Technology Development) Council. It will be chaired by the Director of the Institute. The Institute will have a set of Deans such as Dean of Students, Dean of Academics, Dean of Research. All other functions such as administration, accounts, purchase, library, computer center etc. will be managed by a group of officials.

The Institute will be governed by norms set up by the Board. On matters where policies are not explicitly defined by the Board, the Institute will follow the norms set out by MHRD, Government of India, from time to time.

## Section 7

### Financial Considerations

The proposed Institute will be developed in two phases. For the first six years, the Institute will be funded in project mode. After this phase is over, it will be funded as per the modified block grant scheme of Government of India.

The overall cost of the project for the period of first six years is estimated to be Rupees Five Hundred Sixty crores per Institute. **The total project cost for three IITs would be Rupees One Thousand Six Hundred Eighty crores.** This funding will cover the cost of buildings, the cost of equipment, books, the cost of development of infrastructure such as roads, water, electricity, waste disposal etc. It will also cover the recurring expenditure of salary, consumables, journal subscriptions etc. A tentative table of these cost estimates is given below.

Sr. No.	Item	Amount (in Rs. Lacs)
1	Buildings in Academic Complex Area ( 53,000 sq. m. @ Rs. 12,000 per sq. m. average)	63,60.00
2	Buildings in Residential Complex Area ( 133,000 sq. m. @ Rs.10,000 per sq. m. average)	133,00.00
3	Internal roads and paths, Storm water drains, Landscaping and horticulture operations	5,00.00
4	Electric supply, Generating Sets, External Lighting and Data Networking	4,40.00
5	Water supply with water tanks and distribution network, Waste water treatment systems	3,00.00
6	Boundary wall	2,00.00
	Total	211,00.00

**Table 6 Cost Estimates of Different Infrastructure Items**

Item	1	2	3	4	5	6	Total
Equipment	1100	2500	3200	3000	2400	1900	14100
Infrastructure	1800	3200	4500	5000	3600	3000	21100
<b>Total</b>	<b>2900</b>	<b>5700</b>	<b>7700</b>	<b>8000</b>	<b>6000</b>	<b>4900</b>	<b>35200</b>

**Table 7 Year-wise Capital Investment (Amount in Rs. Lacs)**

Item	1	2	3	4	5	6	Total
Pay and Allowance	800	1000	1600	2200	2300	2500	10400
Outsourcing Expenses	400	500	750	1000	1100	1200	4950
Estate Maintenance	-	150	200	300	300	450	1400
Equipment Maintenance	-	-	100	400	450	550	1500
Utility Charges	100	150	200	300	300	350	1400
Miscellaneous	100	200	150	200	250	250	1150
<b>Total</b>	<b>1400</b>	<b>2000</b>	<b>3000</b>	<b>4400</b>	<b>4700</b>	<b>5300</b>	<b>20800</b>

**Table 8 Year-wise Recurring Costs (Amount in Rs. Lacs)**

Item	1	2	3	4	5	6	Total
Capital Costs	2900	5700	7700	8000	6000	4900	35200
Recurring Costs	1400	2000	3000	4400	4700	5300	20800
<b>Total</b>	<b>4300</b>	<b>7700</b>	<b>10700</b>	<b>12400</b>	<b>10700</b>	<b>10200</b>	<b>56000</b>

**Table 9 Year-wise Total Investment (Amount in Rs. Lacs)**

<b>Item</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>Class Rooms</b>	-	20%	50%	80%	100%	-
<b>Laboratories Construction</b>	-	15%	45%	65%	85%	100%
<b>Hostels</b>	-	30%	60%	80%	100%	-
<b>Residences</b>	10%	20%	40%	60%	80%	100%
<b>Estate Development</b>	15%	50%	90%	100%	-	-
<b>Equipment Purchase</b>	15%	30%	45%	60%	80%	100%

**Table 10 Year-wise Progress of Project Expected**

It is expected that the block grant of the Institute will be fixed on the overall requirements as well as the expenditure during the sixth and seventh year of the Institute.

## Section 8

### Specific Action Plan

In order to consider the proposal and initiate an action plan, the following is a suggested sequence of events.

- Approval of the proposal by Planning Commission, Government of India. (3 months)
- Identification of industry partners / industry members of the society through apex industry associations. (2 months)
- Registration of each IIT under IIT Act. (2 months)
- Selection of the Chairman, Board of Governors. (2 months)
- Constituting the Board of Governors (1 month)
- Appointment of the Director of the Institute. (3 months)
- Transfer of land for the campus of the Institute. (1 month)
- Transfer of funds by Government of India, industry partners etc. (4 months)
- Identification of the Architect for developing the master plan of the campus. (2 months)
- Site preparation and construction of boundary wall. (4 months)

- Forming a senate and establishing the admission procedure, fee structure etc. (3 months)
- Preparation of the course of study document giving the details of the academic curriculum, semester-wise courses, course contents, lecture-wise break-up, recommended text books etc. (4 months)
- Submission of an application to UGC / AICTE for deemed university status. (2 months)
  
- Approval of the building plans. (3 months)
  
- Tendering and identification of contractors. (3 months)
  
- Construction of buildings - Phase I - consisting of class rooms, laboratories, hostels, quarters etc. (24 months)
  
- Recruitment of first batch of faculty members. (8 months)
  
- Development of library, computer center, laboratories and networking. (15 months)
  
- Notification for admission of the first batch of students. ( 1 months)

It may be noted that the above-mentioned activities can be executed in a parallel mode. If all is done as per the schedule indicated above, it is expected that the first batch of students can be admitted with effect from July 2007.

The entire development of the campus can be executed in phases. Phase 0 can complete the roads, electrical connectivity, water connection, waste water treatment, storm water as well as rain water harvesting, preliminary landscaping etc. Phase 1 will complete some class rooms, laboratories, hostels, guest house, administrative offices and quarters. With the completion of Phase 1, the campus

can start functioning. Till such a time, the Institute may have to function from a temporary location. Phase 2 and subsequent phases can be completed based on the growth of the institution.

## Section 9

### Closure Remarks

Indian society and Government invested significantly in education sector after Independence. Establishment of IITs, IIMs, RECs (which are now NITs), new central universities, TTIs, and many other national establishments came up to meet the demand of high quality manpower. The IITs and IIMs have earned a reputation of excellence all over the world. The emerging scenario of globalization demands new strategies to be adapted for development of manpower. The emphasis on quality will be necessary. Even though India boasts of a large size of higher education system, it is difficult to make any claims of quality in higher education. It is, therefore, necessary to establish some additional role models of higher technical education along the lines that have succeeded so far. Hence, the present proposal of establishing three new IITs is an appropriate step on behalf of Government of India.

The proposal to establish three new IITs is a strategic decision for emerging global competition. The new IITs will herald a new culture of technology development in higher technical education. The decision has been taken after extensive discussions in the academic community. The issue has been fully endorsed by the Scientific Advisory Council to Prime Minister. Many academic societies have been suggesting that such institutions be established to improve the status of higher technical education and research. The change will bring in many benefits to Indian society. It will generate manpower for emerging industries, science departments and laboratories. These institutions will attract talented technologists from abroad back to their homeland. It will generate more avenues of assured quality career for young students. For those who wish to pursue a career in education and research and who would like seek an admission to a national level institution, these institutions will offer an excellent option.

Each institution will have a total student strength of 3000 and faculty strength of 300. The post-doctoral fellowships will be 100 and the support staff will be 450. Each institution will require a budget of Rs. 560 crores in project mode for a period of six years. Each institution will then be covered by the block grant scheme for further funding.

It is suggested that the first batch of students be admitted starting July 2007.

Prepared by:  
Prof. Sanjay G Dhande  
Director, IIT Kanpur

