

National Programme on Technology Enhanced Learning

Frequently Asked Questions (FAQs)

This is a summary of the National Programme on Technology Enhanced Learning funded by the Ministry of Human Resource Development, Government of India and executed jointly by all the seven Indian Institutes of Technology and the Indian Institute of Science. The information given here refers to the project period from the years 2003 to 2007. It has been provided by

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FAQs

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1. What is NPTEL?

NPTEL is an acronym for National Programme on Technology Enhanced Learning which is an initiative by all seven Indian Institutes of Technology (IITs) and Indian Institute of Science (IISc) for creating course contents in engineering and science.

In 1998, a delegation of Directors of IITs and Indian Institutes of Management (IIMs) along with faculty visited several American Universities to explore technology enhanced learning (TEL) and distance education prospects for Indian institutions. This resulted in a subsequent workshop in India in May 1999, organized jointly by the Indian Institute of Technology Madras and Carnegie Mellon University (CMU) Pittsburgh, USA in which five IITs, four IIMs, several IT giants and government representatives participated. Four major projects were identified, namely, content creation for core science and engineering courses, setting up digital library, online and interactive programme for doctoral education in the IIMs and the creation of a virtual University for open and distance learning.

After several rounds of discussions over the next three years, a proposal jointly put forward by the IITs and IISc was formally approved by the Ministry of Human Resource Development (MHRD), Government of India in the year 2003 and was limited to the area of content creation. Under this proposal, contents for 100 courses as web based supplements and 100 self-contained video lecture courses would be developed by all the eight partner institutions in the next three years. Five engineering branches (Civil, Computer Science, Electrical, Electronics and Communication and Mechanical Engineering) and core science courses that all engineering students are required to take in their undergraduate engineering programme in India were chosen, initially. The project was known as National Programme for Technology Assisted Learning (NPTAL) but was later renamed as the National Programme for Technology Enhanced Learning (NPTEL).

The video courses in the programme would comprise of approximately 40 one-hour lectures for each course and the web supplements would contain sufficient materials that a teacher can cover in approximately 40 lecture-hours. The contents would be based on the model curriculum suggested by All India Council for Technical Education (AICTE) and the syllabi of major affiliating Universities such as Anna University (Tamil Nadu), Jawaharlal Nehru Technological University (Andhra Pradesh) and Visvesvaraya Technological University (Karnataka). MHRD sanctioned Rs. 15 crores (150 million Indian Rupees) in June 2003 and both the project deliverables and the funding were later enhanced to release 129 web and 110 video courses for a total budget of Rs. 20.5 crores (205 million Indian Rupees) . The first phase of the project was formally launched on September 3, 2006 by the Honourable Minister for HRD Shri. Arjun Singh in a function held in IIT Madras. All web contents are currently available

through the web site <http://nptel.iitm.ac.in> and are continuously updated; the video courses are broadcast through Eklavya channel, a 24/7 television channel provided by Doordarshan, Govt. of India exclusively for educational broadcasts. Efforts are being made to stream video lectures with the help of Google and YouTube.

2. Why NPTEL?

There are many important reasons some of which are given below:

- The basic objective of science and engineering education in India is to devise and guide reforms that will transform India into a strong and vibrant knowledge economy. In this context, the focus areas for NPTEL project have been i) higher education, ii) professional education, iii) distance education and iv) continuous and open learning, roughly in that order of preference.
- In India there are approximately 5,00,000 (five lakhs or half a million) students who have been joining the engineering programme annually for the last few years. Industry estimates that less than ten percent of them are employable soon after their graduation. Manpower requirements are much higher than this figure (and are believed to be at least an order of magnitude more). There are more than 1500 private engineering colleges which have been started in the last twenty years and a substantial fraction of them in the last ten years. A majority of them do not have the minimum required number of well-qualified teaching faculty in each discipline. Despite this, many of them offer technological programs such as information technology, biotechnology, nanotechnology etc. which are highly interdisciplinary programs, and continue to neglect traditional science and engineering disciplines which are fundamental constituents of such interdisciplinary programs. There is an alarming level of neglect of sound pedagogical principles which are fundamental to discovering such super technologies.
- The number of teachers that get trained every year is less than 2 percent of what we actually need. The teacher-to-student ratio for a good learning ambience in educational institutions is roughly between 1:10 and 1:16. Given that India needs approximately 1,60,000 teachers for engineering education for a student population of about twenty lakhs (two million), institutions of higher learning in India are barely able to train more than 4000 teachers every year and offer them jobs. Over and above, teaching career for them is also among the least attractive alternatives in the current socio-economic setup.
- Technology for learning and teaching is already available and the cost per computer power/performance levels of technology tools will only go down with time. Indian students are much more comfortable with cell phones, computers and internet based

communication such as e-mail, chat etc. Creating a technology-based learning medium and content delivery through the internet is thus a natural method for faculty to impart in the young minds concepts of science and engineering which have shaped human lives for the last two hundred years or more.

Today's students are ready to plunge in and learn through media-rich, learning-by-doing and learning-by-participation environments. Therefore, teachers have to become facilitators and designers of learning experiences, processes and environments. They have to use intelligent software agents which browse the network through search engines to provide information seamlessly. They have to seek the students and enable them in a short period of time in order to make this country a developed nation. Therefore, India has no choice but to offer massive online education (to sustain current levels of student influx). It is an emerging market and is also a major business opportunity.

3. Is it along the lines of OCW (Open Courseware by Massachusetts Institute of Technology, USA)?

The answer is yes and no. The goals are the same, but the processes are different. Open courseware project by the MIT (seen through its website <http://ocw.mit.edu>) was a brilliant and painstaking effort by its former President Dr. Charles M. Vest, to make available the course materials by Professors of MIT freely to the rest of the world. There was a phenomenal degree of skepticism among MIT professors about the project when he made the announcement. Since then, the transformation of many of them has been remarkable indeed. The philosophy was and has been, to promote the creation of open resource material from some of the best faculty in the world and to encourage teachers and educators in the rest of the world to use them as reference materials without violating basic intellectual property rights. OCW also encourages self-learners. It is a laudable exercise no doubt and has recorded millions of visits by students and teachers all over the world.

NPTEL also has proposed to provide open course materials for engineering and science students and teachers (freely). The similarities between OCW and NPTEL start and end here. The differences between the two programmes are highlighted below.

- NPTEL is a curriculum development exercise and is directed towards providing learning materials in Science and Engineering by adhering to the syllabi of All India Council for Technical Education and the slightly modified curricula of major affiliating Universities such as Anna University, Jawaharlal Nehru Technological University and Visvesvaraya Technological University which control more than 50% of Engineering Institutions in the country. Because of the variations in the syllabi among Universities

in India, the faculty have modularized their courses into core concepts which every one of these institutions may teach and topics which are add-ons to the course. The courses are well structured and are elaborate with details wherever the faculty members have felt the need. **Institutions are encouraged to build their own versions of NPTEL courses based on their curriculum design using the NPTEL materials and collective experience of all IITs and IISc in TEL.** They are meant to fill the large gap that exists between the current expertise level of faculty in IITs/IISc and those in private and other government aided engineering institutions in India.

- Secondly, the initiative is a joint exercise between eight competing top teaching/research institutions in India, and there is very little duplication of contents among them in the first phase. It is a difficult exercise indeed to come out with a coherent philosophy towards teaching and learning but teams work better than individuals. Though in the future phases, duplication of course materials between different IITs/IISc will happen, similar to the existence of many excellent text books on the same subject, the focus would be to build at least one version of each course offered in all of Science and Engineering in India, from B.Tech. / B.Sc. to Ph. D. programs.

- The third major difference between MIT OCW and NPTEL is that NPTEL courses will be taken to the teachers through many workshops being conducted at present for them and will be continued in the future, hopefully for every course. The interaction between teachers in various colleges and the course developers in IITs/IISc is a mandatory requirement for NPTEL. These workshops are aimed at inviting/collecting suggestions and feedback from teachers/users and to incorporate as many of them as possible in courses.

- The fourth aspect is to build in the immediate future, a course-specific web space for each course where students, teachers and other users anywhere in the world would be encouraged to create threaded discussions. In this area, direct interaction among students all over the world and teachers would be encouraged through a bulletin-board approach/threaded discussions with the help of moderators who would be appointed for this purpose. The purpose is to eventually build a digital library for each subject and create Frequently Asked Questions (FAQ) for the section. It would be difficult to maintain such an activity by the faculty of IITs/IISc alone as moderators and therefore several possible avenues are being explored for supporting such sites with faculty outside of IITs/IISc.

- The last important difference between NPTEL and OCW is that there are 110 video

(approximately 4500 hours) lecture courses from phase I and there will be about 400 video lecture courses (with about 16000 hours of lectures) at the end of phase II. In addition, IITs have large repositories of video lectures prepared already from their own efforts outside of NPTEL and these are also being made available as free and open educational resources for all. When this is completed, this will be the largest single repository of technical courses in the world in the streaming video format and will be helpful to everyone who is interested in enhancing his/her learning.

Despite these differences between MIT OCW and NPTEL, it is important to recognize that the goals of these two programmes are absolutely the same- educate, get educated with technology and prosper. In India, the means have to be different given the complexity of the problem of education. In the future OCW and NPTEL will likely work together through a consortium of open education and it is hoped that IITs/IISc will see this as an opportunity to foster relations among giants in teaching and research and enable the whole world to prosper. It will be a true globalization if it happens.

4. How is NPTEL implemented?

The Ministry has constituted two committees, the National Programme Committee (NPC) headed by the Joint Secretary, Higher Education, MHRD and the Programme Implementation Committee (PIC), headed by Professor M. S. Ananth, Director IIT Madras and Professor in Chemical Engineering. The MHRD committee (NPC) consists of expert members from academic bodies such as University Grants Commission (UGC), All India Council for Technical Education (AICTE), Indira Gandhi National Open University (IGNOU), Technical Teachers Training Institute (TTTI) and Indian Institute of Information Technology and Management Kerala (IIITM-K) besides other members. Two national coordinators (one for web courses and another for video courses) are also members of the NPC. It oversees policy matters and financial sanctions. The PIC has members from all IITs/IISc who are NPTEL Coordinators in each IIT/IISc and members from representative user institutions. It oversees implementation of the programme. Some of the NPC members are also members of the PIC.

The PIC members spent a lot of time in the first eighteen months or so, to create a permanent structure which would enable the smooth functioning of the project in several phases and permit rotation of responsibilities. Members of the PIC are faculty members in IITs and IISc who have full time academic responsibilities such as classes, Ph. D./M. S./M. Tech/M. Sc. scholars doing projects, research, consultancy etc. A number of them are overall TEL coordinators who coordinate all developments in their respective Institutes. In addition, they

meet once every three months or so to study the progress and issues related to coursework development.

In each IIT/IISc one or two faculty members in each of the disciplines were identified as subject coordinators. They identified faculty volunteers from their departments for developing content for specific courses and to coordinate the content development part for all such courses. In addition, for each discipline one or two faculty members were nominated as Principal Discipline Coordinators (PDC) to coordinate content creation in their discipline across all seven IITs and IISc. There are six disciplines and six subject level committees. The discipline coordinators met with the PDC and examined the curriculum for that discipline, identified all courses that needed to be developed and ensured distribution of courses across all the Institutes. There are many courses in which more than one faculty member in IITs / IISc who agreed to develop contents and thus there are teams of faculty members for them. Organizational exercise was initially much more massive than was anticipated at first, but, it has led to a set up which can sustain TEL activities in each institute for a longer period than that of Phase I. In addition, this exercise created much-needed software, hardware and human infrastructure as well as support for faculty members to develop web based and video based courses.

Another important issue is the content organization itself and the non-uniformity in styles, teaching pedagogies and experiences of more than 300 faculty members involved across eight institutions. All the seven IITs compete against each other fiercely in the field of undergraduate education, among other things. Criteria were evolved as to what would constitute a minimum web/video course and all faculty members were requested to use them as guidelines. It is thus a team of 350 or more faculty members with Professor M. S. Ananth as the overall coordinator which agreed to disagree on details but also make course contents at the same time for a national cause.

5. What is there for industries in NPTEL?

Pretty much everything, if they are looking for all-round, well-educated, conceptually sound graduates as opposed to people with specific skill set. Even in the latter case, NPTEL has something to offer for each skill set. However, a lot more work needs to be done with the industry's support for the next two or three years. The following may be considered to be emerging as opportunities for the industry with the development of courses under NPTEL.

IT industries have such strong growth possibilities in India and offer pay scales commensurate with the growth that the Indian student population is no doubt attracted to them. If we add to that the management skills that many finance and human resource enterprises are

looking for, it is easy to realize that much of the engineering admission and the hype associated with it is a myth, including IITs. So many graduates cross over after four years to other professions that the industries in the area of manufacturing/design/ infrastructure development have been taking a beating in the number of well qualified undergraduates they can hire. A majority of NPTEL courses are however in the hard, traditional subjects that these industries need trained people on. Therefore, it is very much in their own interests, sustenance and growth to adapt these courses to train student population and offer them better financial rewards and career opportunities. The courses are well structured and their organization of fundamental concepts can be supplemented by industrial experts with their case studies and techniques relevant to the industry. This will be taken up in the current phase of NPTEL.

Is the development of NPTEL course content out-of-phase with the current employment trend? The answer is no. Through discussions with senior professionals, many software and IT managers in software companies, it has been observed that subject-level training, comprehension and analytic skills of a majority of graduates that they hire from private colleges are quite inadequate and fall far short of expectations. Engineering institutions must design and offer programs which are both need-based (as, for example, the IT/ Management industry today) and which impart sound education in core areas of engineering and science at all levels. IITs have been excelling in this for the last so many years that their graduates are able to adapt themselves for the choices of their employers in a short period of time. Through NPTEL, a part of the IIT training, flavour and the rigour with which they are given is made available to teachers and student community at large. Therefore, the IT and core engineering industries can join hands to do the following:

- Design comprehensive tests and assignments as well as student assessment online in related, engineering- based course contents in most branches so that the student skill sets are improved.
- Sponsor local teams with the NPTEL faculty for training teachers and students to think on analytic methods of study as opposed to mere rote learning which the current University examination system seems to promote.
- Design parameters for effective learning of any given subject and offer expert training to colleges to ensure that students do this in addition to their University examinations. Reward mechanism for students can be created.
- Contribute to the process of creation of contents in several new courses by faculty in IIT/IISc and create courses which are not part of the AICTE curricula but which would address the short and long term training requirements of industries. This would enable better interaction and understanding of mutual requirements of academia and

industry.

NPTEL offers to colleges a program suited to them, but done with IIT/IISc flavour, rigour and accuracy. Therefore, private institutions need to adapt these courses with the help of industries to train some of their new teachers and to produce more well-trained and all-round graduates. This process does not have to wait till we complete other course work. It must be done in parallel. The value addition can be enormous if only right partnerships are formed between industry and academia.

IITs have been excelling in this for the past so many years that many of their graduates have carried forward and excelled all over the world in their own organizations or as successful entrepreneurs. IITs are also often blamed by many people and institutions that they do very little for India though they already get the crème de la crème as their students. However, the pre-eminence of IITs and IISc in India did not happen naturally, since at the time of creation of IITs, several well established Universities were offering the best engineering and science programmes in the country. Through years of support by a few foreign countries and through their own programmes, IITs are where they are now and are closely watched by everyone else in the country and the world. It is important to note that there are at least four to five times the population of successful IIT entrants who are as good as any other in the IITs and who did not succeed in the Joint Entrance Examination (JEE) (and therefore could not get admission into IITs). They have been studying in all the rest of the institutions in the country. Also, the reputations of IIT were not built overnight. It has taken them forty or more years to be where they are. NPTEL is an opportunity for IITs and IISc to interact with the rest of India in a direct manner. The role of industry is therefore absolutely crucial!

6. What is the current status of the project?

In phase I, which was completed recently, course materials have been developed for 129 web courses and are accessible free of charge through the website <http://nptel.iitm.ac.in> . A large number of them have been completed and reviewed by two or three faculty / teachers from colleges and their suggestions have been incorporated. The access is free and open subject to copyrights. We are moving towards implementing Creative Commons license in this programme. Several mirror sites are also being added for improving access to course contents.

Lecture contents will be made available for 110 video courses by the end of March 2008 with about 40 one-hour lectures in each course. Both the web and video courses cover five major engineering disciplines and the core science curriculum that all engineers must have, and are distributed as follows:

Discipline	Web	Video
Core Science	16	14
Civil Engineering	26	19
Computer Science & Engineering	23	17
Electrical Engineering	16	18
Electronics and Communication Engineering	22	21
Mechanical Engineering	26	21
Total	129	110

The content generation is very nearly, evenly spread across all eight institutions. IIT Roorkee and Guwahati have taken a lighter load in this project in the first phase as they both are nascent IITs and have considerably less number of faculties than other IITs.

The video content is available only in the tape format at present and IITs/IISc are working to convert them into MPEG-4 format with a bit-rate of 512 kbps with H.264 compression for streaming through the Internet. The finance for this was not factored out in the proposal for Phase I for several internal reasons, but it is a part of Phase II proposal. We are also experimenting with Google Inc and a partnership between NPTEL and Google-YouTube may be established soon to embed streaming video in the programme. However, the Eklavya channel schedules these lectures on a 24/7 basis, and is coordinated by Professor Kushal Sen, IIT Delhi. He can be contacted at kushal@textile.iitd.ernet.in. Please visit the homepage of IIT Delhi (<http://iitd.ernet.in>) to learn more about Eklavya. The web courses are being updated periodically and are maintained by Professor Mangala Sunder Krishnan in IIT Madras (mangal@iitm.ac.in or mangala_sunderk@yahoo.com). Several issues pertaining to download formats, zipped files etc. raised by many users are being addressed at present.

7. How will NPTEL help the community?

Course contents will be useful for teacher training and through them improve the quality of students. In addition the course materials (both web and video) are freely accessible by everyone independent of their geographic location. These courses can be used by professionals for updating their academic background. Open and distance education using NPTEL contents

are long term prospects for IITs. The contents will hopefully help evolve criteria for focused learning and a common set of standards for professional education in India through participation by everyone concerned under this platform. There are several assumptions however, for the above to happen, namely,

- the course contents will be used by teachers and students outside IITs and IISc because they are quite standard and modular and are written by some of the best teachers in India,
- Universities in India will recommend NPTEL material to students and do something more also, namely, set examination questions from them. This ensures adoption and
- industry will recognize that this is a unique programme and must be supported, because of the potential for improving quality of their intake. NPTEL faculty will incorporate feedback and evaluation by the users and continuously update the course contents for the next several years, in the same manner that they have been doing for their own teaching.

All of these must happen simultaneously. Otherwise this process will become another one for creating a digital content repository without qualitative and quantitative assessment on usefulness and improvement through continuous feedback.

8. What are the mechanisms for promoting NPTEL?

Several mechanisms have been proposed. Professor K. R. Srivathsan, Director, IIITM Kerala, Professor Anup K. Ray, Professor of Educational Technology in IIT Kharagpur and Professor Paul Goodman, Professor of Psychology and Director, Institute for Strategic Development, Carnegie Mellon University, Pittsburgh, USA have contributed substantially to the evolution of NPTEL process through their vast experience in TEL. There are many others too. The following current/future programmes may be mentioned as providing the mechanisms to promote NPTEL among students and teachers.

- Conduct course specific workshops by bringing the faculty who developed the course with teachers who are likely to use the lecture material. In the future, a few representative students from many user institutions may be invited to participate in these workshops and give their feedback.
- Conduct workshops in selected regions all over the country so that a large body of students can also participate and learn the process of usage.
- Create subject index and keyword search for both video and web materials so that students can search for relevant materials across courses through a search engine.
- Create course-specific bulletins/discussion boards in the web site so that students can

ask questions about the course material. Open learning will be supported by permitting answers by interested students and teachers and with occasional moderation of discussions by course developers.

- Create a course-specific Edupedia (similar to the powerful concept of Wikipedia) with the help of qualified teachers across the country and a digital library relevant to course materials and make them available in the course area.
- Create course specific FAQ through all of the above.
- Encourage teachers in various colleges to adapt the materials to prepare localized versions suitable for the examination system of that college.
- Share the expertise on e-learning, content development, content dissemination with interested Institutions so that they can set up their own e-learning portals.
- Distribute the NPTEL content-both web and video to any interested institution for its internal use.
- Set up a video-on-demand facility in IITs and IISc with sufficient exclusive internet bandwidth for making video lectures available in the streaming format. This will help not only the students and teachers but also industry professionals and open learners.

9. Who owns the copyrights of the contents of NPTEL?

The copyrights are owned jointly by the MHRD, IITs/IISc and the faculty. MHRD has encouraged faculty to convert their electronic content to text books in various engineering and science subjects (which will not affect what is freely available). The rest of the issues are being studied carefully at present. Barring a few courses, the rest of the material will be distributed under a Creative Commons license in the future.

10. Wherein lies the future?

India is a vast country whose engineering student population outnumbers every other country, except possibly China. The objectives in Phase II are to create contents for science and engineering courses in all major disciplines as well as specialized and newly developing interdisciplinary subjects for which there is very little academic expertise in private colleges. In addition, helping colleges through workshops and discussion boards for implementing NPTEL content in their curriculum will be undertaken as a primary and most important activity. IIT/IISc faculty would be encouraged to incorporate feedback from user community in their courses and update them.

It is one of the fundamental goals of the project to bring in all the best teachers in the country under the umbrella of NPTEL and record their lectures/seek their collaboration with

IITs/IISc and make their courses available for the community under free and open sources agreement. There is already a move to create open virtual laboratories in the Internet for engineering subjects initiated by IIT Delhi which is extremely important for our country. Another primary objective is to forge strong ties with major academic initiatives worldwide such as MIT OCW, Commonwealth of Learning, British Open University, Australian Open Universities and Digital Library initiatives (to mention a few) and with industry for developing new technological tools for learning and dissemination. The number of things that must be done simultaneously is enormous. IITs and IISc must rise to the challenge of education in India posed by the unprecedented and rapid economic growth and the opportunities it provides for globalizing the pool of scientific and technical talent in the country. Together everyone WILL prosper.

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