

NATIONAL PROGRAMME ON TECHNOLOGY ENHANCED LEARNING (NPTEL)

July 2003 – June 2007

Project Document

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Indian Institutes of Technology (IIT Bombay, Delhi,
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And

Indian Institute of Science, Bangalore.

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Additional Publications: (available from the NPTEL Website)

1. **Module-wise Syllabi for All NPTEL Courses.**
2. **Lecture titles of video courses recorded till June 30, 2006**
3. **NPTEL National Workshops –Summary of Programmes**
4. **Feedback from one of the workshops (two documents)**

Section 1: Background

1.1. Introduction

The National Programme on Technology Enhanced Learning (NPTEL), a project funded by the Ministry of Human Resource Development (MHRD) was first conceived in 1999 to pave the way for introducing multimedia and web technology to enhance learning of basic science and engineering concepts. Significant infrastructure has been set up earlier for production of video-based teaching material by the Indian Institutes of Technology (IIT) and Technical Teacher Training Institutes (TTTI). In the first phase of the NPTEL project (June 2003-June 2007), seven IITs and the Indian Institute of Science (IISc) have worked together to develop web and video based material for basic undergraduate science and engineering courses in order to enhance the reach and quality of technical education in the country.

The concept of multimedia based courses with high potential of interactivity has become a popular and a viable option for both the developed and the developing nations, though for different reasons. Offering multimedia courses in technology-assisted modes has not only become invaluable for the learner, but also an attractive and creative option for faculty. Such courses have the potential to enhance the on- and off-campus learning experience for students and in a distance learning mode. Technology opens up several interesting avenues for innovation in design and delivery of courses as also for sharing expertise among faculty in different parts of the world. In India, where a large number of private institutions have entered the field of engineering education with inadequate faculty support and training, the project is aimed at providing a standard for academic content for both the teacher and the student.

Many of the courses, especially basic core courses in science and engineering are similar across the IITs and to a lesser extent across many institutions in the country. Most institutions offer programme in traditional branches of engineering with a large number of similar courses forming a substantial part of the undergraduate curriculum. There is clearly a lot of advantage in sharing the development work in these courses. The NPTEL initiative in this regard is to help institutions all over the

country to substantially increase the number and quality of the engineering graduates.

1.2. Technology Enhanced Learning (TEL)

The objective of TEL is to enhance the way students learn concepts, to enhance the learning component and to reduce the tedious and mechanical aspects of some of the current learning methods through the use of technology in a variety of forms:

- a) Computer applications include:
 - Computer-Assisted Instruction (CAI) that uses the computer as a self-contained teaching machine to present individual lessons.
 - Computer-Managed Instruction (CMI) that uses the computer to organize instruction and track student records and progress. The instruction itself need not be delivered via a computer, although CAI is often combined with CMI.
 - Computer-Mediated Education (CME) consisting of applications that facilitate the delivery of instruction. Examples include networked classrooms, electronic mail, discussion boards, real-time computer conferencing and World-Wide Web (WWW) applications.
- b) Voice - Instructional audio tools that include interactive technologies of telephone, audio conferencing, and the passive (i.e., one-way) audio tools of tapes and radio.
- c) Video - Instructional video tools that include still images such as slides, pre-recorded moving images (e.g., film, videotape), and real-time moving images combined with audio conferencing (one-way or two-way video with two-way audio).
- d) Print – instructional print formats that include textbooks, study guides, workbooks and case studies.

1.3. The IIT Initiative

Technology enhanced learning initiative involving IITs and Indian Institutes of Management (IIMs) was first proposed by IIT Madras in the year 1999, immediately following a Workshop on Technology Enhanced Learning (WoTEL) conducted in Chennai in collaboration with Carnegie Mellon University (CMU), Pittsburgh, USA. The

vast experience of CMU in setting up a successful virtual university in Mexico was useful in drawing up the initial proposal which envisaged four initiatives, namely providing distance education, developing interactive and electronic resources for core courses for undergraduates, conducting joint Ph. D. programmes and setting up a digital library focused on the role of technology in knowledge accumulation, storing and disseminating content for education in three sectors: university, industry and government.

A formal Memorandum of Understanding (MoU) between five IITs, four IIMs and CMU established a Virtual Centre for Technology Enhanced Learning (VCTEL). It was the first initiative in which all IITs and IIMs shared a common vision and proposed to work together to improve the quality of science, engineering and management education all across the country by offering courses through VCTEL. This proposal was submitted to MHRD in 1999 and revised several times.

1.4. The Current Programme

The Ministry of Human Resource Development, Government of India considered a modified proposal favorably and approved funding of 20.47 crores (204.7 million) of Indian Rupees in Phase I for three years from June 2003 till June 2006. Due to the complexity and the heterogeneous nature of the Partner Institutions with respect to Multimedia and video production capabilities the project was given a one year extension till June 30, 2007 when it has been completed. The digital library project was de-linked from the proposal and funded separately. Indian Institutes of Management have been provided additional funding for distance education in core areas of management. Seven IITs and the Indian Institute of Science have been working together in Phase I to develop web and video based material for basic undergraduate science and engineering courses in order to enhance the reach and quality of technical education in the country. In order to facilitate the distribution of course material, two modes of operation have been suggested, namely, digital video lectures of courses and web based courses. 110 video based courses and 129 web based courses have been prepared for distribution to Institutions in India by December 2007. The courses have been made available from July 2006 as and when they are complete with video lectures being broadcast through the Eklavya channel provided by Gyan Darshan (Door Darshan Television, Govt of India enterprise). The web courses are currently available through the official NPTEL website <http://nptel.iitm.ac.in>. Efforts are underway to provide free access to video lectures

through Google-YouTube as video-on-demand for anyone with broadband connectivity.

Section 2: The National Programme on Technology Enhanced Learning

2.1 Objectives

The broad aim of the project NPTEL is to facilitate the competitiveness of Indian industry in the global markets through improving the quality and reach of engineering education. The operational objective of NPTEL is to make high quality learning material available to students of engineering institutions across the country by exploiting the advances in information and communication technology. The target group for this project consists of students and faculty of institutions offering undergraduate engineering programmes in India. The educational goals are:

- Make video lectures in a format appropriate for broadcasting that would provide quality content through the Technology channel named the Eklavya channel by the previous Honorable Minister for Human Resource Development in recognition of the first student of distance education named in the great Indian epic Mahabharata thousands of years ago.
- Create web-based (e-learning) material and make it available in the form of a portal / DVDs that would be tailored to meet the needs of engineering students across the country.
- Create a website for NPTEL activity.
- Make e-learning material available in the web for the video lectures to supplement class room teaching.
- Advise target institutions with regard to the software/hardware requirements for benefiting from the national project.

NPTEL has developed curriculum based video courses (110 new courses and 109 existing courses encapsulated in digital video format) and web-based e-courses (129). This has been undertaken by IITs (Seven) and IISc Bangalore as Partner Institutions (PI) and other selected premier institutions as Associate Partner Institutions (API) through a collaborative effort.

2.2 Action Plan

- 1) A National Programme Committee (NPC), constituted by the MHRD has played an advisory role for NPTEL. The constitution of NPC is given in **Annexure 1**. It has the overall responsibility for policy decisions under this Programme. The Committee has ensured inter-institutional coordination at the national level by nominating at least one Coordinator for the NPTEL project in each Partner Institution (PI) (Seven IITs and IISc). NPC has also functioned as a grants-in-aid committee and has recommended release of funds under the Programme in a phased manner.
- 2) A Programme Implementation Committee (PIC), constituted by the MHRD has held the executive authority for all activities under the NPTEL. The constitution of the PIC at the time of closure of the first phase is given in **Annexure 2** along with all those who served the committee since its inception. All NPTEL coordinators are members of the PIC. **Annexure 3** contains the list of current NPTEL coordinators along with their predecessors.
- 3) The PIC constituted a subject level expert group in July 2003 for each of the subjects covered under the programme and nominated Principal Discipline Coordinators (PDC) based on subject matter to ensure harmonization of curriculum so as to maximize the number of students who will benefit from this initiative. A definite mechanism for assurance of quality and certification of courseware produced under the programme was also put in place.
- 4) There are two national coordinators, one for video courses and another for web courses who are members of both the NPC and PIC. They have been coordinating with all PIs and APIs and all faculty preparing content and have provided standards of design and format arrived at by the PIC. In addition, one faculty from each of three target Institutions chosen has been nominated to be a member of the PIC by the Ministry of Human Resource Development.
- 5) Each PI has a TEL Committee (TC) consisting of faculty from different departments/centres. This Committee has been promoting the use of technology, both internally and externally, to enhance learning effectiveness.
- 6) An NPTEL Project Cell (PC) has been created in each Institute. The cell has
 - created special classrooms fitted with networked computers
 - developed expertise in multimedia production through the digital format and in developing courseware for the Internet,

- developed a support system - essential hardware and software, and with the support of a software programmer, communication designer and instructional editor- to help the faculty in the design, implementation, and assessment of effective learning systems and
 - recruited technical staff for support in programming, designing, editing, documentation and maintenance and to conduct training programmes for the faculty.
- 7) The faculty comprising the subject-level expert group were nominated from each Institute for the six disciplines, namely, core courses, civil engineering, computer science and engineering, electrical engineering, electronics and communication engineering, and mechanical engineering. The PDCs and the subject matter expert group in each discipline have drawn up the detailed curriculum for each discipline in consultation with the faculty in each PI and have been interacting with faculty in their institutes and in the APIs to ensure content development with minimal duplication.
 - 8) Effective training and learning programmes have been organized in order to enable the faculty both to understand and leverage this technology and to recognize that in the long run TEL techniques are effective and represent a saving in time and effort.
 - 9) All courses developed under the project have been thoroughly reviewed by experts in the area nominated by the subject coordinators' group. The review has been incremental and has provided sufficient mid-course correction strategy to faculty who are involved in the content development.
 - 10) Workshops for faculty on web design and choice of appropriate software were conducted in the initial stages. The TC of each PI has ensured that all project associates in the PC underwent training in the use of standard software. In addition, one or two associates in each Institute have been trained in programming and designing two and three dimensional professional animation software, Java, network and server management packages for web courses and interactive web design.
 - 11) During the second year of the project, workshops were conducted for teachers from other institutions who would like to use the contents. The course development team interacted with the teachers closely and made relevant changes in the content to enable its use by the largest spectrum of faculty outside IITs.

- 12) Four National workshops were conducted in Indian Institute of Information Technology and Management (for IIT Madras, January 5-6, 2007), Indian Institute of Technology Delhi (March 30, 2007), Indian Institutes of Technology Guwahati and Kharagpur in Guwahati (May 19-20, 2007) and Indian Institute of Technology Kanpur (June 27-28, 2007). Well over 500 teachers, several Vice-Chancellors and a number of Principals from many engineering Institutions all over the country participated in the workshops along with numerous faculty coordinators from various IITs who developed course contents. The feedback form used in some of these workshops reprinted in **annexure 4**.
- 13) Existing facilities for video recording in the Educational Technology Cells (ETCs) of three IITs (Delhi, Kharagpur and Madras) have been upgraded using funds allocated in the project. In addition new video recording studios with state-of-the-art recording and video-editing facilities have been created in all IITs and IISc Bangalore under this project. A uniform format is being emphasized for video courses so that they can be delivered as capsules for the Eklavya channel and for streaming the content through video server for access outside the specific broadcast schedules. The conversion of video lectures to streaming lectures is currently being undertaken in the PIs ahead of the second phase of NPTEL project. Video archives of lectures are currently available in all PIs. **Annexure 5** consists of pictures from some of the PIs on the infrastructure created with NPTEL funds.
- 14) A web studio has been created in each of the PIs and standardized hardware and software maintained for content creation for the web based courses.
- 15) A website has been created detailing the activities of the NPTEL and materials are being distributed through Compact Discs (CD) / Digital Video Discs (DVD).
- 16) The list of 110 video courses and 129 web based courses was finalized in consultation with all member institutions and content development has been completed in nearly all of them. They are constantly being updated in the website.

2.3 Target Groups and Their Needs

- The primary target group is students and faculty of institutions offering undergraduate engineering programmes.

- As the colleges are affiliated to a university, and different universities have different curricula and syllabi, one set of learning material would not meet the needs of all engineering colleges. Even when the topics are the same in a learning unit, the scope of the topic could be different from one university to the other.
- Students would accept and use the learning material only if it is according to their syllabi, and conventions followed are the same as in their prescribed textbooks. Hence, even if the topics are the same, the content needs particularization with regard to each university. This constitutes significant amount of work. In this area, faculty from APIs would be encouraged and offered financial incentives to interact with TCs in the PIs for creating the necessary variants from a model modular content.
- The quality of learning is dictated by evaluation. In most universities evaluation is through public examination and students are expected to write “standard” answers. The design of support material has taken this factor into consideration while concentrating on student learning.
- Good international textbooks are prescribed and available at low cost. But students in many colleges often find the methodology adopted in them to be quite difficult. Both teachers and students in these colleges would like to have support materials in the web in this regard.

2.4. Identification of Course Contents

Course contents were identified through the following process:

- Choose universities with a large number of affiliated colleges, paying attention to their distribution across the country. The syllabi of major affiliating Universities such as Anna University (Tamil Nadu), Jawaharlal Nehru Technological University (Andhra Pradesh) and Visvesvaraya Technological University (Karnataka) were examined along with the model curriculum of the All India Council of Technical Education.
- Subjects common in many Universities were selected to ensure that the undergraduate core curriculum development is reasonably complete.

- The syllabi of these common courses were pooled for development work to be shared across all PIs.
- Modules were identified (not more than three classroom sessions worth of material) and their minor variants (with regard to scope) to account for the needs of the identified universities (This is a major task which was undertaken by teams of specialists, with the support of faculty from the APIs wherever possible).

Five branches of engineering (Civil, Electrical, Electronics and Communication, Computer Science and Engineering, and Mechanical) were addressed in the first phase. Each Institute identified the courses in which it would like to participate as video (V) or Web (W) based content contributor. The core courses common to all these disciplines including basic science and engineering were addressed by a core courses group also formed of members from all PIs. The courses were allotted to PIs as per the following:

The TEL coordinator from each Institute prepared a list of courses for which he obtained the consent of faculty from that PI. The discipline coordinators in each discipline met and then determined the allocation of courses to PIs. The TEL PIC finalized the allotment of courses to the Institute. In content creation each PI was also able to involve faculty from other PIs with experience and willingness to jointly develop the course with its own faculty and encourage it as much as possible. However, the PIs were responsible for the delivery of courses assigned to them.

2.5. E-Learning Material

The following summarizes the programme for web supplement materials:

- E-Learning material have been created in such a form that it can be expanded and updated continuously. Currently it consists of one or more of the following:
 - Localization of examples
 - Elaboration of key concepts and theorems to facilitate clearer understanding
 - Case studies to provide more comprehensive design experience than that offered by simple numerical examples
 - Examples that require the use of different categories of engineering knowledge under different sets of assumptions

- Question banks to assist instructors to design good tests and examinations
 - Additional reading material for underperforming students, especially those with difficulties with English
 - Additional reading material for over-achievers
 - Historical information and anecdotes related to specific topics
 - Creation of the e-learning material in those formats which ensure that the content creation and course management platforms are decoupled.
- Simple course management packages that provide features like e-mail queries by students, bulletin board and Frequently Asked Questions (FAQ) are being incorporated.
 - Every module was prepared preferably by a team of faculty.
 - The material is organized to create CDs/DVDs to meet the needs of students of different universities.
 - The same material can be suitably restructured for printing if needed.

2.6. Video Material:

The following summarizes the programme for video lectures:

- The course consists of around 40 video lectures.
- Each video lecture is of one hour duration.
- To enhance the longevity of the video lectures, it was suggested that they should not be too specific to syllabi but should be confined to core concepts. Its contents were suggested to be distinct from text book and web support material.
- The video lectures utilize a multitude of facilities of the video medium such as chalk-and-talk, tablet writing, power point, two and three dimensional animations, interactive codes etc.
- The lectures were intended to motivate the student by emphasizing why he/she must study a topic in a subject, and often related to industrial practice as appropriate.

- Creation of video lecture units was not tied necessarily with the scheduling of regular courses in the Institution.

The review process is similar to that of web material.

2.7. Deployment and Follow-up Services

The following actions have been taken towards the deployment of the web and video courses for the benefit of students teachers and professionals.

- Host the e-content on a web site that students have free access to.
- E-content can be made available in the form of CDs/DVDs.
- Colleges will be encouraged to host these materials on one of their servers and allow students to access.
- E-content can be converted into print form and then distributed at a low cost. But this format will not allow the flexibility of e-material, where one can navigate from one point to the other in a module, and also, when the courses contain animations or interactive templates or both.

Some or all of the following simple course management features are being introduced, namely

- Keeping track of the extent of usage of the material (feedback for the project)
- Collecting feedback, from both students and faculty, on the content
- Answering specific queries on the subject.

This would require creation of an elaborate structure and network that can be sustained beyond the project period as well.

Engineering institutions all over the country will be encouraged to obtain NPTEL contents and make them available to their faculty and students in their campus intranet. All video courses will also be provided to them in a format ready for streaming in campus networks as videos-on-demand. The minimum hardware configuration needed for this purpose is suggested in **Annexure 6**. A fee will be collected from private institutions which will be used to provide technology support and content up gradation in the immediate future.

Section 3: Project Activities

3.1. Identification of Courses and Faculties

One of the first tasks of NPTEL was the identification of faculty and courses in all the disciplines mentioned above. The first meeting of the PIC in May, 2003 in New Delhi adopted the procedure introduced earlier and finalized the names of the faculty coordinators in each discipline from each PI. Also all activities in each discipline were coordinated by PDCs chosen by the PIC. The names are given in the Annexure 4. The following tables give the final list of courses in Web/Video format prepared by faculty in each discipline along with their names and affiliations A table is given below which describes courses distributed as web or video across various PIs: This is followed by a more comprehensive list of courses discipline-wise and Institute-wise.

List of NPTEL Courses by the Institute and by the Discipline

Institute	IIT B		IIT D		IIT G		IIT K		IIT KG		IIT M		IIT R		IISc	
Discipline	W	V	W	V	W	V	W	V	W	V	W	V	W	V	W	V
Core	3	0	2	3	3	0	4	3	0	1	5	3	0	3	0	1
Civil	3	3	3	2	3	2	3	3	3	3	5	3	1	3	5	0
Computer	1	2	2	3	3	0	2	4	4	4	6	3	0	0	5	1
Electrical	2	2	2	3	0	0	2	3	5	6	3	2	0	0	2	2
Electronics	4	4	1	3	4	1	4	3	3	5	1	4	2	0	2	1
Mechanical	3	2	3	3	3	2	4	4	3	3	4	4	3	3	3	0
Total	16	13	13	17	16	05	19	20	18	22	24	19	06	9	17	05

W- Web, V- Video

List for total number of Web and Video Courses by Discipline - Wise

S. No.	Discipline	Web	Video
1.	Core	17	14
2.	Civil	26	19
3.	Computer	23	17
4.	Electrical	16	18
5.	Electronics	21	21
6.	Mechanical	26	21
Total		129	110

3.1.1 Core Sciences and Engineering

Institute	Course	Web/ Video	Faculty Coordinators
IIT Bombay	Engineering Chemistry I	W	Prof. B. L. Tembe (Coordinator) Prof K. Mangala Sunder (IITM)
	Mathematics I	W	Prof. Inder K. Rana
	Engineering Physics II	W	Prof. D. K. Ghosh
IIT Delhi	Engineering Chemistry II	W	Prof. H. M. Chawla Prof. R. N. Ram
	Environment and Ecology	W	Prof. (Ms) Anuradha Sharma Prof. V. B. Upadhyay
	Applied Mechanics	V	Prof. R. K. Mittal Prof. Sanjeev Sanghi
	Material Science	V	Prof. S. K. Gupta
	Management Science I	V	Prof. (Ms) Anuradha Sharma
IIT Guwahati	Mathematics III	W	Prof. M. Guru Prem Prasad Prof. Durga C. Dalal
	Engineering Physics I (theory)	W	Prof. Alike Khare Prof. Pratima Agarwal Prof. S. Ravi

	Engineering Physics I (Experiment)	W	Prof. Alike Khare Prof. Pratima Agarwal Prof. S. Ravi
IIT Kanpur	Numerical Analysis in Computer Programming	W	Prof. Rathish Kumar Prof. V. Raghavendra Prof. M. K. Kadalbajoo Prof. P. B. Sunil Kumar (IITM)
	Mathematics II	W	Prof. Peeyush Chandra Prof. Arbind K. Lal Prof. Alok K. Maloo Prof. V. Raghavendra Prof. G. Santhanam
	Basic Electronics	W	Prof. Y. N. Singh
	Engineering Mechanics	W	Prof. Manoj K. Harbola
	Engineering Mechanics	V	Prof. Manoj K. Harbola
	Mathematics I	V	Prof. Swagato K. Ray Prof. Shobha Madan Prof. P. Shunmugaraj
	Engineering Physics II	V	Prof. V. Ravishankar Prof. S. Raychaudhuri
IIT Kharagpur	Physics I – Oscillations and Waves	V	Prof. S. Bharadwaj
IIT Madras	Engineering Chemistry I	V	Prof. K. Mangala Sunder
	Basic Electronics and Lab	V	Prof. T. S. Natarajan
	Numerical Analysis and Computer Programming	V	Prof. P. B. Sunil Kumar
	Basic Electronics and Lab	W	Prof. T. S. Natarajan
	Management Science I	W	Prof. M. Thenmozhi
	Management Science II	W	Prof. R. Madhumathi
	Environmental Chemistry	W	Prof. M. S. Subramanian

	Engineering Chemistry III	W	Prof. S. Sankararaman Prof. N. Narasimhamurthy Prof. K. M. Muraleedharan Prof. Santosh Gharpure
IIT Roorkee	Engineering Physics I	V	Prof. Jagdish Rai Prof. Ishwar Singh Prof. G. D. Verma Prof. K. L. Yadav
	Mathematics II	V	Prof. H.G. Sharma Prof. Sunita Gakkhar Prof. Tanuja Srivastava
	Mathematics III	V	Prof. P. N. Agarwal Prof. Tanuja Srivastava
IISc Bangalore	Management Science	V	Prof. K. B. Akhilesh

3.1.2 Civil Engineering

Institute	Course	Web/ Video	Faculty Coordinators
IIT Bombay	Structural Analysis I	W	Prof. R. S. Jangid
	Foundation Engineering	W	Prof. Dipankar Choudhury
	Transportation Engineering I	W	Prof. Tom V. Mathew
	Structural Analysis II	V	Prof. P. Banerjee
	Fluid Mechanics	V	Prof. T. I. Eldho
	Soil Mechanics	V	Prof. B. V. S. Viswanadham
IIT Delhi	Strength of Materials	W	Prof. Ashok Gupta
	Environmental Air Pollution	W	Prof. Mukesh Khare
	Mechanics of Solids	W	Prof. Y. Nath
	Structural Analysis I	V	Prof. Ashok Gupta
	Civil Engineering Materials	V	Prof. B. Bhattacharjee

IIT Guwahati	Construction Planning and Management	W	Prof. Arbind Kumar Singh
	Fluid Mechanics	W	Prof. Subhashisa Dutta Prof. N. Sahoo
	Soil Mechanics	W	Prof. Baleshwar Singh
	Design of Steel Structures	V	Prof. Damodar Maity
	Hydraulics	V	Prof. Arup Kumar Sharma
IIT Kanpur	Water and Waste Water Engineering	W	Prof. Purnendu Bose
	Advanced Transportation Engineering	W	Prof. Partha Chakraborty Prof. Animesh Das
	Modern Surveying Techniques	W	Prof. Onkar Dikshit
	Environmental Air Pollution	V	Prof. Mukesh Sharma
	Water Resources Engineering	V	Prof. Rajesh Srivastava Prof. P. Mohapatra
	Surveying	V	Prof. Bharat Lohani
IIT Kharagpur	Structural Analysis II	W	Prof. L. S. Ramachandra
	Design of Concrete Structures	W	Prof. J. N. Bandyopadhyay
	Water Resources Engineering	W	Prof. Dhrubajyoti Sen
	Strength of Materials	V	Prof. S. K. Bhattacharyya
	Introduction to Transportation Engineering	V	Prof. Bhargab Maitra Prof. K. S. Reddy
	Engineering Geology	V	Prof. Debasis Roy
IIT Madras	Design of Steel Structures I	W	Prof. A. R. Santhakumar Prof. S. R. Satish Kumar
	Design of Steel Structures II	W	Prof. A. R. Santhakumar Prof. S. R. Satish Kumar
	Pre-stressed Concrete Structures	W	Prof. Devdas Menon Prof. A. Sen Gupta

	Hydraulics	W	Prof. B. S. Thandaveswara Prof. B. S. Murthy
	Infrastructure Planning and Management	W	Prof. A. Veeraraghavan
	Construction Planning and Management	V	Prof. K. N. Satyanarayana Prof. K. Ananthanarayanan
	Pre-stressed Concrete Structures	V	Prof. Devdas Menon Prof. A. Sen Gupta
	Water and Waste Water Engineering	V	Prof. Ligy Philip Prof. C. Venkobachar Prof. B. S. Murty
IIT Roorkee	Surveying	W	Prof. J. K. Ghosh
	Foundation Engineering	V	Prof. G. Mahendra Singh Prof. N. K. Samadhiya Prof. Priti Maheswari
	Advanced Transportation Engineering	V	Prof. Rajat Rastogi
	Modern Surveying Techniques	V	Prof. S. K. Ghosh
IISc Bangalore	Fundamentals of Environmental Geotechnology	W	Prof. T. G. Sitharam Prof. P. V. Siva Pullaiyah
	Optimization Methods	W	Prof. D. Nagesh Kumar
	Reliability Engineering	W	Prof. G. L. Sivakumar Babu
	Composite Materials	W	Prof. P. C. Pandey
	Computational Hydraulics	W	Prof. M. S. Mohan Kumar

3.1.3 Computer Science and Engineering

Institute	Course	Web/Video	Faculty Coordinators
IIT Bombay	Design and Analysis of Algorithms	W	Prof. Abhiram G. Ranade Prof. Ajit A. Diwan

			Prof. Sundar Viswanathan
	Software Engineering	V	Prof. Rushikesh K. Joshi Prof. Umesh Bellur Prof. N. L. Sarda
	Design and Analysis of Algorithms	V	Prof. Abhiram G. Ranade Prof. Ajit A. Diwan Prof. Sundar Viswanathan
IIT Delhi	Introduction to Problem Solving and Programming	W	Prof. S. Arun Kumar
	Principles of Programming Languages	V	Prof. S. Arun Kumar
	Computer Graphics	W	Prof. Prem K. Kalra
	Data Structures and Algorithms	V	Prof. Naveen Garg
	Computer Architecture	V	Prof. Anshul Kumar
IIT Guwahati	Computer Organization and Architecture	W	Prof. Jatindra Kumar Deka
	Data Structures and Program Methodology	W	Prof. S. V. Rao Prof. Pradip K. Das
	Theory of Automata and Formal Languages	W	Prof. Diganta Goswami
IIT Kanpur	Compiler Design	W	Prof. Sanjeev K. Aggarwal
	Computer Organization and Architecture	W	Prof. Bhaskar Raman
	Introduction to Problem Solving and Programming	V	Prof. Deepak Gupta
	Theory of Automata and Formal Languages	V	Prof. Somenath Biswas
	Parallel Algorithms	V	Prof. Phalguni Gupta
	Bioinformatics Algorithms	V	Prof. Somenath Biswas
IIT Kharagpur	Computer Networks	W	Prof. Ajit Pal
	Software Engineering	W	Prof. Rajib Mall
	Artificial Intelligence	W	Prof. S. Sarkar Prof. P. Mitra

	Real Time Systems	W	Prof. Rajib Mall
	Computer Networks	V	Prof. Sujoy Ghosh
	Artificial Intelligence	V	Prof. S. Sarkar Prof. Anupam Basu
	Internet Technology	V	Prof. Indranil Sengupta
	Data Communication	V	Prof. Ajit Pal
IIT Madras	Object Oriented System Design	W	Prof. D. Janaki Ram
	Introduction to Database Systems and Design	W	Prof. P. Sreenivasa Kumar
	CAD for VLSI Design I	W	Prof. Shankar Balachandran Prof. V. Kamakoti
	CAD for VLSI Design II	W	Prof. Shankar Balachandran Prof. V. Kamakoti
	Principles of Communication	W	Hema A. Murthy
	Computer Networks	W	Hema A. Murthy
	Database Design	V	Prof. Srinath Srivasthava (IIITB) Prof. D. Janaki Ram
	Computer Graphics	V	Prof. Sukendu Das
	Discrete Structures	V	Prof. Kamala Krithivasan
IISc Bangalore	Digital Systems	W	Prof. N. J. Rao
	Microprocessors and Microcontrollers	W	Prof. Krishna Kumar
	Operating Systems	W	Prof. P. C. P. Bhatt
	System Analysis and Design	W	Prof. V. Rajaraman
	Data Communications	W	Prof. H. S. Jamadagni
	System Analysis and Design	V	Prof V. Rajaraman

3.1.4 Electrical Engineering

Institute	Course	Web/ Video	Faculty Coordinators
IIT Bombay	Control Engineering	V	Prof. S. D. Agashe

	Power Electronics	V	Prof. B. G. Fernandes Prof. Kishore Chatterjee
	Power System Protection	W	Prof. S. A. Soman
	Power Systems Operation and Control	W	Prof. A. M. Kulkarni
IIT Delhi	Control Engineering	W	Prof. M Gopal
	Industrial Drives	W	Prof. K. Rajagopal
	Embedded Systems	V	Prof. Santanu Chaudhary
	Bio-Medical Engineering	V	Prof. S. Anand
	Circuit Theory	V	Prof. S. C. Dutta Roy
IIT Kanpur	Power Systems Analysis	W	Prof. Arindam Ghosh
	High Voltage Engineering	W	Prof. Ravindra Arora
	Intelligent System	V	Prof. Laxmidhar Behera
	Modeling and Simulation	V	Prof. Laxmidhar Behera
	Power Systems Operation and Control	V	Prof. S. N. Singh
IIT Kharagpur	Basic Electrical Technology	W	Prof. G. D. Roy Prof. N. K. De Prof. T. K. Bhattacharya
	Industrial Automation and Control	W	Prof. S. Mukhopadhyay Prof. S. Sen
	Illumination Engineering	W	Prof. N. K. Kishore
	Power Electronics	W	Prof. D. Kastha Prof. D. Prasad Prof. N. K. De Prof. S. Sengupta
	Embedded Systems	W	Prof. Amit Patra Prof. Rajib Mall Prof. A. Routray
	Chaos, Fractals and Dynamic Systems	V	Prof. S. Banerjee
	Energy resources and Technology	V	Prof. S. Banerjee

	Industrial Instrumentation	V	Prof. Alok Barua
	Industrial Automation and Control	V	Prof. S. Mukhopadhyay
	Illumination Engineering	V	Prof. N. K. Kishore
	Power Systems Analysis	V	Prof. A. K. Sinha
IIT Madras	Electrical Machines I	W	Prof. Krishna Vasudevan Prof. G. Sridhara Rao Prof. P. Sasidhara Rao
	Electrical Machines II	W	Prof. Krishna Vasudevan Prof. G. Sridhara Rao Prof. P. Sasidhara Rao
	Industrial Instrumentation	W	Prof. V. Jayashankar
	Electromagnetic Fields	V	Prof. Hari Ramachandran
	Electrical and Electronic Measurements	V	Prof. V. Jagadish Kumar
IISc Bangalore	Non-Conventional Energy Systems	W	Prof. L. Umanand
	Numerical Analysis	W	Prof. Vittal Rao
	Industrial Drives	V	Prof. K. Gopakumar
	Basic Electrical Technology	V	Prof. L. Umanand

3.1.5. Electronics and Communication Engineering

Institute	Course	Web/ Video	Faculty Coordinators
IIT Bombay	Optical Communication	W	Prof. R. K. Shevgaonkar Prof. D. K. Ghosh
	Signals and Systems	W	Prof. V. M. Gadre

	VLSI Design	W	Prof. A. N. Chandorkar
	Transmission Lines and EM Waves	W	Prof. R. K. Shevgaonkar
	Broadband Networks : Concepts and Technology	V	Prof. Abhay Karandikar
	Information Theory and Coding	V	Prof. S. N. Merchant
	Transmission Lines and EM Waves	V	Prof. R. K. Shevgaonkar
	Digital Communication	V	Prof. D. Manjunath
IIT Delhi	Semiconductor Devices	W	Prof. G. S. Visweswaran
	Wireless Communication	V	Prof. Ranjan Bose
	Principles of Communication	V	Prof. Surendra Prasad
	Digital Signal Processing	V	Prof. S. C. Dutta Roy
IIT Guwahati	Digital Circuits	W	Prof. Anil Mahanta Prof. Roy Paily Palathinkal
	IC Technology	W	Prof. Roy Paily Palathinkal Prof. Indrajit Chakraborty
	Probability and Random Processes	W	Prof. Prabin K. Bora
	Electromagnetic Fields	W	Prof. Ratnajit Bhattacharjee
	Basic Electronics	V	Prof. Chitralkha Mahanta
IIT Kanpur	Digital Signal Processing	W	Prof. Govind Sharma
	High Speed Semiconductor Devices	W	Prof. Anjan Kumar Ghosh
	Microcontrollers and Applications	W	Prof. Shyama P. Das
	Digital Image Processing	W	Prof. (Ms) Sumana Gupta
	Analog Circuits	V	Prof. B. Mazahari Prof. J. John Prof. R. N. Biswas
	Optical Communication System	V	Prof. Yatindra N. Singh

	Signals and Systems	V	Prof. K. S. Venkatesh
IIT Kharagpur	Multimedia Processing	W	Prof. Somnath Sengupta
	Communication Networks and Switching	W	Prof. S. L. Maskara
	Digital Communication	W	Prof. R. V. Rajakumar Prof. S Chakrabarti
	Probability and Random Variables	V	Prof. Mrityunjay Chakraborty
	Digital Systems Design	V	Prof. D. Roychoudhury
	Digital Image Processing	V	Prof. P. K. Biswas
	Digital Voice and Picture Communication	V	Prof. S. Sengupta
	Adaptive Signal Processing	V	Prof. M. Chakraborty
IIT Madras	Principles of Communication	W	Prof. V. Venkat Rao
	Digital Circuits and Systems	V	Prof. S. Srinivasan
	Solid State Devices	V	Prof. S. Karmalkar
	High Speed Devices and Circuits	V	Prof. K. N. Bhat
	VLSI Circuits	V	Prof. S. Srinivasan
IIT Roorkee	Basic Electronics	W	Prof. Pramod Agarwal
	Analog Circuits	W	Prof. Pramod Agarwal
IISc Bangalore	Information Theory and Coding	W	Prof. Pavan S Nuggehalli
	Basics of VLSI	V	Prof. H. S. Jamadagni
	VLSI Design	W	Prof. H. S. Jamadagni

3.1.6 Mechanical Engineering

Institute	Course	Web / Video	Faculty Coordinators
IIT Bombay	Advanced Strength of Materials	V	Prof. S. K. Maiti

	Robotics	W	Prof. C. Amarnath Prof. B. Seth Prof. K. Kurien Isaac Prof. P. S. Gandhi Prof. P. Seshu
	Dynamics of Machines	W	Prof. P. Seshu Prof. K. Kurien Isaac Prof. C. Amarnath
	Heat and Mass Transfer	W	Prof. U. N. Gaitonde Prof. S. V. Prabhu
	Robotics	V	Prof. C. Amarnath Prof. B. Seth Prof. K. Kurien Isaac Prof. P. S. Gandhi Prof. P. Seshu
IIT Delhi	Product and Production Management	W	Prof. Arun Kanda Prof. S. G. Deshmukh
	Computer Aided Design and Manufacturing	W	Prof. Anup Chawla Prof. P. V. Madhusudan Rao
	Kinematics	W	Prof. Sudipto Mukherjee Prof. A. K. Mallik (IITK)
	Kinematics	V	Prof. Sudipto Mukherjee Prof. A. K. Mallik (IITK)
	Project and Production Management	V	Prof. Arun Kanda
	Computer Aided Design and Manufacturing	V	Prof. Anoop Chawla Prof. P. V. Madhusudan Rao

IIT Guwahati	Engineering Mechanics	W	Prof. U. S. Dixit
	Mechanical Vibrations	W	Prof. Rajiv Tiwari Prof. S. K. Dwivedy
	Engineering Mechanics	V	Prof. U. S. Dixit
	Fluid Machinery	W	Prof. A. K. Das
	Vibration Engineering	V	Prof. Rajiv Tiwari Prof. S. K. Dwivedy
IIT Kanpur	Kinematics of Machines	V	Prof. A. K. Mallik
	Dynamics of Machines	V	Prof. Amitabha Ghosh
	Fluid Mechanics	W	Prof. Gautam Biswas Prof. S. K. Som (IIT Kgp)
	Finite Element Method	V	Prof. C. S. Upadhyay
	Finite Element Method	W	Prof. P. M. Dixit
	Materials Selection and Design	W	Prof. Bishakh Bhattacharya
	Fluid Mechanics	V	Prof. Sanjay Mittal Prof. R. Srivastava
	Fluid Machinery	W	Prof. Gautam Biswas Prof. Subrata Sarkar Prof S. K. Som (IITKgp)
IIT Kharagpur	Manufacturing Processes II	W	Prof. A. B. Chattopadhyay Prof. A. K. Chattopadhyay Prof. S. Paul
	Design of Machine Elements I	W	Prof. S. K. Roychowdhury Prof. B. Maiti Prof. G. Chakraborty
	Refrigeration and Air Conditioning	W	Prof. M. Ramgopal
	Manufacturing Processes II	V	Prof. A. B. Chattopadhyay Prof. A. K. Chattopadhyay Prof. S. Paul
	Design of Machine Elements I	V	Prof. B. Maiti Prof. G. Chakraborty

	Refrigeration and Air Conditioning	V	Prof. M. Ramgopal
IIT Madras	Mechanical Measurements and Metrology	W	Prof. S. P. Venkateshan
	Applied Thermodynamics	W	Prof. T. Sundararajan Prof. J. M. Mallikarjuna Prof. U. S. P. Shet
	Machine Design II	W	Prof. K. Gopinath Prof. M. M. Mayuram
	Strength of Materials	W	Prof. M. S. Sivakumar
	Mechanical Measurements and Metrology	V	Prof. S. P. Venkateshan
	Applied Thermodynamics	V	Prof. T. Sundararajan Prof. J. M. Mallikarjuna Prof. U. S. P. Shet
	Machine Design II	V	Prof. K. Gopinath Prof. M. M. Mayuram
	Advanced Operations Research	V	Prof. G. Srinivasan
IIT Roorkee	Strength of Materials	W	Prof. S. C. Sharma
	Manufacturing Processes I	W	Prof. H. S. Shan Prof. S. R. Gupta Prof. Pradeep Kumar
	Industrial Engineering	W	Prof. Pradeep Kumar Prof. H. S. Shan (retd.) Prof. P. K. Jain
	Strength of Materials	V	Prof. Prof. S. P. Harsa Prof. B. K. Mishra
	Manufacturing Processes I	V	Prof. D. K. Dwivedi Prof. Indradeep Singh Prof. Pradeep Kumar
	Industrial Engineering	V	Prof. Pradeep Kumar Prof. D. K. Dwivedi Prof. P. K. Jain

IISc Bangalore	Basic Thermodynamics	W	Prof. Pradip Dutta Prof. K. Srinivasan
	Heat and Mass Transfer	W	Prof. Pradip Dutta
	Materials Science	W	Prof. Satish V. Kailas

3.2 Infrastructure Development

3.2.1. Video

The software and hardware required for both the video and the web program were identified based on the facilities which exist in IIT Kharagpur, IIT Delhi and IIT Madras. The equipment consists primarily of Sony Digital Video (Camcorders) and associated non-linear editing equipment. All video equipments have been installed and all IITs and IISc have been recording lectures routinely. Pictures of video studio created by the PIs under the NPTEL project are included in **Annexure 5**. The PIs have added state-of-the-art non-linear video editing facilities which can produce video materials with broadcast quality. Industry-leading software such as AvidXpress, DPSVelocity and Final Cut from Apple are some of the professional software used for video editing.

3.2.2 Software and Hardware for Web Courses

Web content requires considerable design and quality production. Though one would like to use and suggest as much free software as possible, the lack of compatibility between different operating systems and lack of uniform standards are major issues with open software. Those who have strong anti voices to the above statement are all professional developers themselves or their expertise in this matter was built over several years. There is a big learning curve for most faculty and students with open systems. Also strict adherence to quality control, IEEE (Institute for Electrical and Electronics Engineers, Inc.) and Internet standards (which are built in a layer that one does not have to worry about) and professional support that institutions can receive from commercial software developers, are too important factors to ignore. One must also note that most of the "good" freeware eventually transform to shareware and finally to commercial products. Hence the Programme Implementation Committee which met at IIT Delhi in May 2003 and later at IIT Kharagpur in August 2003 authorized the national web coordinator to suggest the required hardware and professional software for web courses based on the experience IIT Madras has had in creating the web studio for its own faculty to design and offer courses in the web. Software programs suggested below are among the best in the market and have been obtained by PIs based on volume discount prices negotiated under the umbrella of NPTEL.

- A set of Macromedia (now an integral part of Adobe Inc.) suite containing the following six commercial products discounted heavily for academic Institutions in India, namely Authorware Professional 6 (Academic license), Dreamweaver MX, Flash MX, Fireworks MX, Director 8.0, and Freehand 10
- Mathtype by Mathtype Inc. which is a web based equation editor
- Adobe Acrobat Standard for making pdf files
- Adobe Photoshop and Illustrator for photo and video editing
- 3D Max Studio by AutoDesk Inc. for three dimensional animations and digital movies
- A web server (E-learning platform) such as WebCT, Blackboard, Acado for hosting courses. IIT Kanpur has developed its own open source e-platform called Brihaspati which was developed by Professor Y. N. Singh in the Electrical Engineering Department under a Ministry of Information Technology Project on e-learning. The server Acado, also developed by Alumni of IIT Kanpur under the direction of its former Professor in Electrical Engineering (Professor K. R. Srivathsan, currently Director, IIITM Kerala) is not only a web server but has other administrative functions built in and is the least expensive among full-fledged commercial e-servers as above. There are a large number of open source and free learning management systems available from the web which can be used for each IIT's own program of creating web content and supplements for its own students besides hosting the NPTEL course contents.
- One web server (hardware for the project as part of the Web program). IIT Madras has purchased two 64-processor (128 GB RAM and 4 TB storage space) SunFire 15K from Sun Microsystems Inc. for its projects on e-learning and digital library and has allocated a large domain of one of these servers for hosting NPTEL contents under open access. The NPTEL website is currently accessed from this server. Mirrors of NPTEL website are being set up in all PIs.

3.3. Creation of NPTEL Web Site and Its Mirrors

A website with the following URL (Uniform Resource Locator) was registered with the Computer Centre of IIT Madras for hosting NPTEL programme. The URL is <http://nptel.iitm.ac.in>. The website contains extensive information about the programme including the curricula on the basis of which the courses have been

designed. All web courses that have been developed under the first phase of the NPTEL project are currently available freely from this site for everyone. Each web course is also associated with a discussion forum for generating interactions between faculty developers and users and also for peer to peer interactions among users. This document is also available from the website as a Pdf file.

Mirror sites of the IIT Madras website are being created all over the country and a simple mirror site integration and updating protocol will be employed to continuously update mirrors.

The website <http://nptel.iitm.ac.in> was launched officially earlier on September 3rd by the Honourable Minister for HRD, Shri. Arjun Singh in a function held in IIT Madras. From September 5, 2006, it has been updated with course materials periodically. Visitors to this website were earlier requested to register themselves free of charge. The site is being continually updated and within ten months from its launch date in September, more than 1,60,000 users have registered and more than 5,80,000 visits have been recorded. This is a sign of the expectations building up among the users and their interest in using the contents developed so far. The profile of the users is given below, and covers geographically 140 countries or more (numbers rounded to nearest 100).

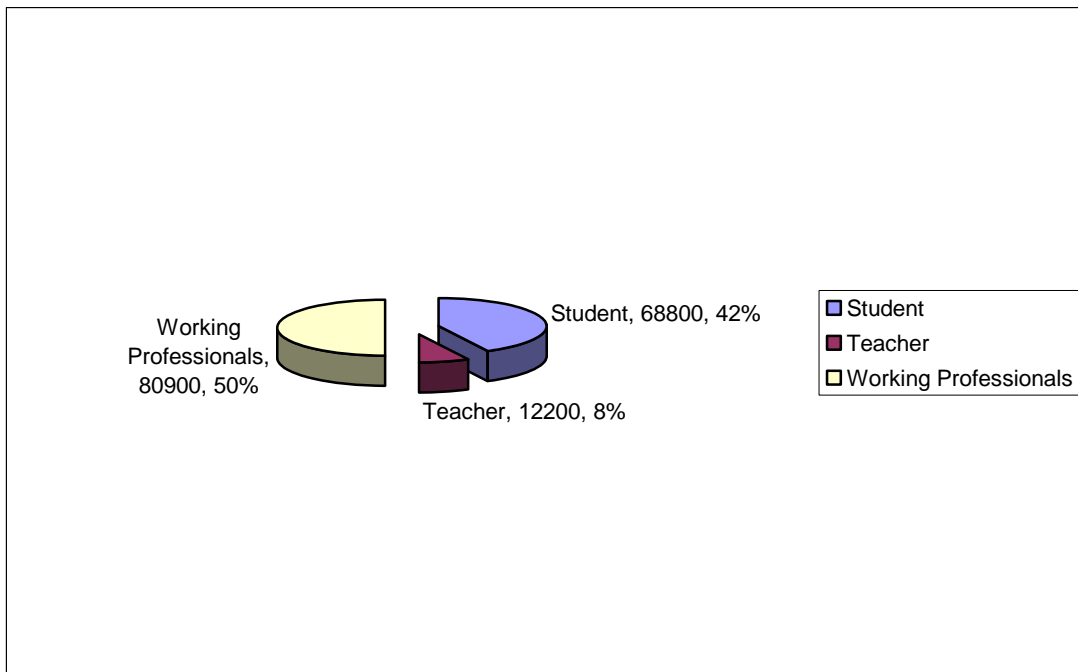


Fig.1 User Category (till July 2007)

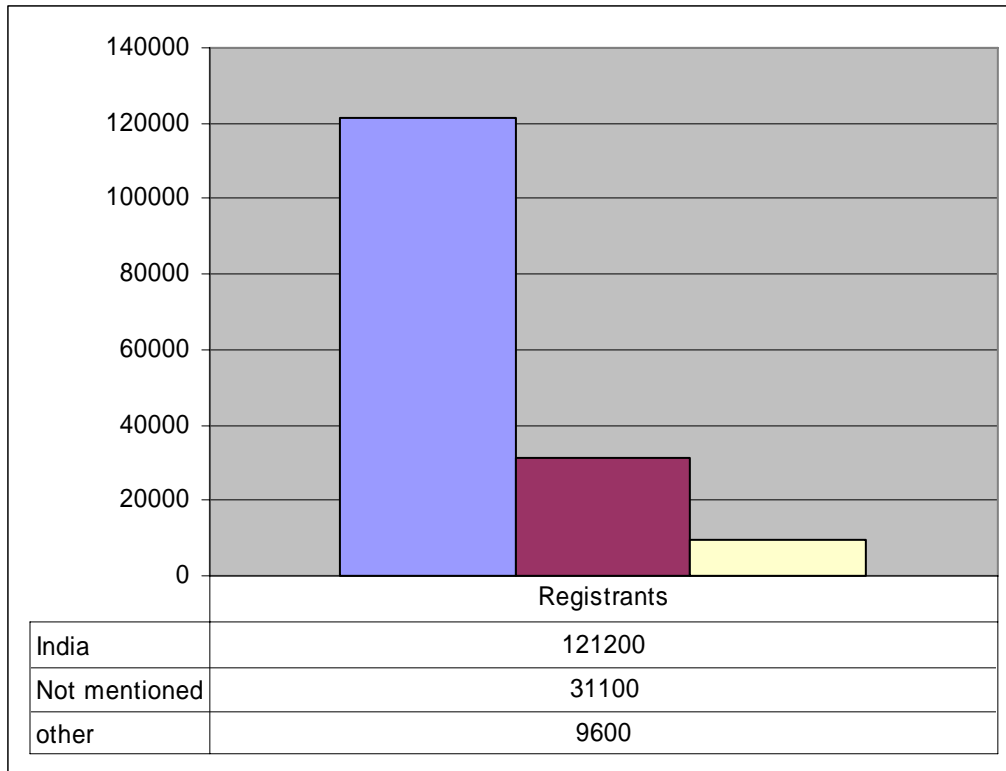


Fig. 2 User distribution (global, till July 2007)

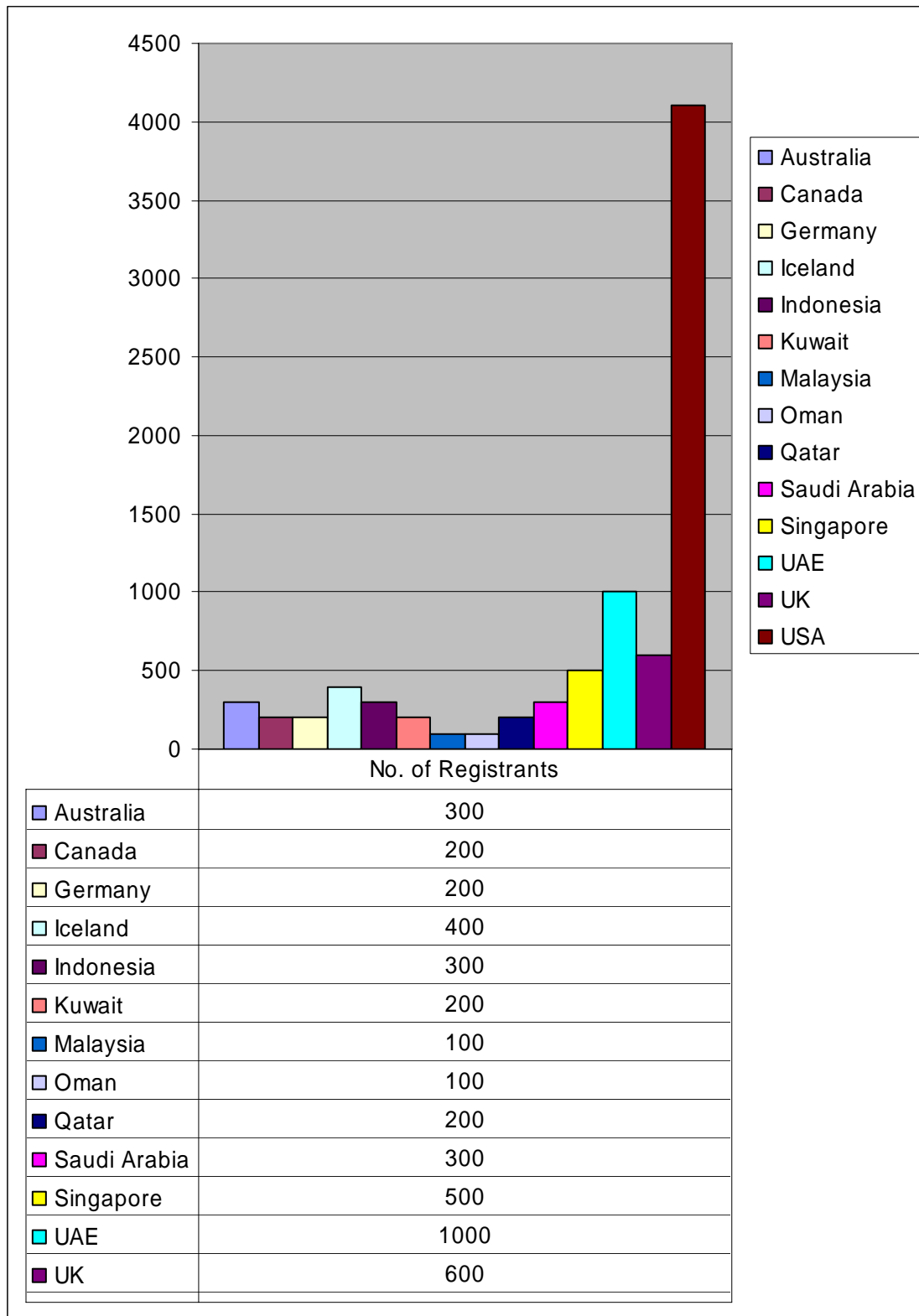


Fig. 3 User Distribution (International, till July 2007)

More than 90 percent of the users are from India and they are distributed among three classes, namely, teachers (8%), students (42%) and working professionals (50%). The users outside of India are mostly from the United States, United Arab Emirates, Singapore, United Kingdom and Australia with the remaining being distributed globally. The number of registrants to this website has been seeing a steady increase on a daily basis and the trend is only likely to continue. The practice of registering new users and restricting access through login id and password has been withdrawn since November 2007. Users can freely browse the contents and are requested to provide their e-mail optionally if they wish to participate in feedback, discussions etc.

3.4. National Workshops Conducted

Several workshops have been conducted under the auspices of NPTEL. A workshop on web content development has been conducted in IIT Madras on August 25-26, 2003 to introduce to the faculty coordinators, simple web design and creation of static and dynamic course content. It also addressed the issues on copyrights of authors on the web. The proceedings of the workshop have been digitally recorded and made available to all PIs for distribution to all the faculty developing courses for the NPTEL. IIT Kharagpur conducted a Web content development workshop in November 20-21, 2003 for its faculty along similar lines. IIT Guwahati has also conducted a session with the help of the national web coordinator for its faculty on December 8, 2003.

IIT Madras conducted two workshops in 2004 in which approximately 90 faculty members in various disciplines from colleges in the South zone participated and were appraised of the development of course work. Their feedback was later incorporated by course developers. IISc Bangalore and IIT Bombay have also conducted two workshops each for faculty users in the respective states and nearby area. Four national level workshops were conducted after launching the NPTEL programme by the ministry. Several workshops will be conducted in the near future for faculty members in the use of interaction and feedback by students who might use the developed content. The utilities of Content Management System (CMS) and Learning Management System (LMS) will be explained. It will also expose them to the modular design of learning and encourage them to work closely with course coordinators for tailoring the contents for their institutions. This series will be in all six disciplines and

will be spread between PIs. A workshop will be held on emerging e-learning standards to all faculty coordinators of the NPTEL project in IIT Madras in the near future. The web site <http://nptel.iitm.ac.in> will post all announcements.

4. Annexures

Annexure 1. National Programme Committee (NPC) (2003-2007)

1. Shri Ravi Mathur, Joint Secretary (Technical Education) MHRD – Current Chairman
2. Prof. M. S. Ananth, Director, IIT Madras & Chairman, PIC, NPTEL
3. Two TEL Coordinators from the Resource Institutions (by rotation)
4. Representative of the Department of Information Technology
5. Nominee of the Chairman, University Grants Commission
6. Nominee of the Chairman, All India Council of Technical Education
7. Director, Technical Teacher's Training Institute, Chandigarh
8. Prof. K. Mangala Sunder, IIT Madras, National Coordinator-Web based Courseware
9. Prof. Kushal Sen, IIT Delhi, National Coordinator - Video based Courseware
10. Prof. N. J. Rao, CEDT, IISc Bangalore
11. A Nominee of Indira Gandhi National Open University
12. Prof. K. R. Srivathsan, Director, Indian Institute of Information Technology and Management, Kerala
13. Financial Advisor MHRD or his nominee
14. Director, MHRD as Convener.

The Committee's mandate is as follows:

1. Approve the Programme Implementation Plan to be prepared by the PIC
2. Function as a grants-in aid committee and release funds under NPTEL to PIs based on their need and level of participation
3. Constitute subject-level expert group (s) (for each of the common core subjects, namely, electrical, mechanical, civil, electronics and communication and computer science and engineering) to ensure harmonization of curriculum
4. Ensure quality and certification of courseware produced under the programme
5. Finalize deployment of the developed learning material
6. Establish procedures for Copyright and Intellectual Property Rights (IPR) and related issues
7. Ensure inter-institutional coordination with other Ministries/ Departments and AICTE at the national level and assume overall responsibility for all activities under this programme and

8. Take decisions on all other matters related and incidental to policy matters.

The Chairman, with the permission of the Committee, may co-opt or invite such other person(s) as deemed appropriate to participate at any of its meetings as its special invitees. The Committee shall meet at least half-yearly. The department of Secondary & Higher Education would provide necessary secretarial and other assistance to the Committee.

Annexure 2. Programme Implementation Committee (PIC) (2003-2007)

1. Prof. M. S. Ananth, Director, IIT Madras - Chairman
2. Representative of the MHRD
3. ALL TEL Coordinators from the PIs
4. Director, National Institute of Technology, Calicut
5. Prof. D. Acharya (formerly Vice-Chancellor, Biju Patnaik University of Technology, Rourkela, Chairman, AICTE, New Delhi) Director, IIT Kharagpur
6. Prof. K. Rajani Kanth, Head, Information Technology Department, M. S. Ramaiah Institute of Technology, Bangalore
7. Dr. Pradeep Kaul, Director, Consortium of Educational Communication (University Grants Commission)
8. Prof. Kushal Sen, IIT Delhi, National Coordinator - Video based Courseware
9. Prof. K. Mangala Sunder, IIT Madras, National Coordinator - Web-based Courseware
10. Prof. K. R. Srivathsan, Director, Indian Institute of Information Technology and Management, Kerala
11. Prof. N. J. Rao, CEDT, IISc Bangalore.

This Committee shall be responsible for:

1. Preparation of the Programme Implementation Plan. This document shall define specific goals and activities, identify resources needed, delineate responsibilities and establish procedures and norms for programme activities, set up a time-table for action, outline mechanisms for quality assurance of the developed courseware and forecast outcomes with a definite time line.
2. Allocation of activities to different resource institutions and ensuring inter-institutional coordination
3. Selection of courses both for video (new as well as updating existing) and web-based development [at least 100 existing video courses to be updated and a minimum of 100 new video courses and a minimum of 100 web-based courses to be developed]
4. Finalization of equipment support for PIs

5. Taking decisions on standards, conventions & notations and all aspects related to instructional design to ensure consistency in the entire effort
6. Finalization of courseware development, authoring and simulation tools
7. Devising strategy for updating courseware developed already
8. Recommendation of a package of financial and academic incentives for faculty to motivate them to participate in courseware development
9. Planning and organizing orientation and training programmes and workshops
10. Collecting and collating reports in a predetermined format, and providing the needed interface with the Ministry and National Programme Committee
11. Advising on strategy for deployment of the developed learning material
12. Advising on Copyright and IPR issues
13. Ensuring timely and effective implementation and
14. Overseeing all other matters related and incidental to implementation of the programme.

The Chairman with the permission of the Committee may co-opt or invite such other person(s) as deemed appropriate to participate at any of its meetings as its special invitees. The Committee shall meet at least once every three months. Expenses for travel of outstation members will be met from the grants provided under this programme.

Annexure 3. NPTEL Coordinators for Each Participating Institution (2003 onwards)

Institute	Names	E-Mail Address
IIT Bombay	Prof. R. K. Shevgoankar Prof. Kannan Moudgalya	rks@ee.iitb.ac.in head.cdeep@iitb.ac.in
IIT Delhi	Prof. Kushal Sen	kushal@textile.iitd.ernet.in
IIT Guwahati	Prof. Anupam Dewan (till 2005) Prof. Rajiv Tiwari Prof. Arbind Kumar Singh	adewan@iitg.ernet.in rtiwari@iitg.ernet.in arvind@iitg.ernet.in
IIT Kanpur	Prof. Gautam Biswas Prof. Satyaki Roy	gtm@iitk.ac.in satyaki@iitk.ac.in
IIT Kharagpur	Prof. A. K. Ray Prof. Bani Bhattacharya	akray@cet.iitkgp.ernet.in banib@cet.iitkgp.ernet.in
IIT Madras	Prof. M. Singaperumal Prof. K. Mangala Sunder	msingam@iitm.ac.in mangal@iitm.ac.in
IIT Roorkee	Prof. Vinod Kumar (till 2004) Prof. Pradeep Kumar (till 2006) Prof. B. Mohanty	vinodfee@iitr.ernet.in kumarfme@iitr.ernet.in bmohanty@iitr.ernet.in
IISc Bangalore	Prof. N. J. Rao (till 2006) Prof. K. Gopakumar	chairman@mgmt.iisc.ernet.in kgopa@cedt.iisc.ernet.in

Annexure 4 Feedback from Workshops.

The four National workshops which were conducted for a little more than 500 faculty members from engineering institutions all over the country were designed to provide one-to-one interaction between them and the subject matter experts from IITs and IISc. The participants were requested to give their feedback on the values addition that the NPTEL course materials might provide and the extent to which the institutions would adopt the course materials.

The following feedback forms were designed to be used in all the four National workshops. The outcome from one such workshop has been made available as a separate document along with this.

Participants Feedback form

NPTEL Workshop

Techno park, Trivandrum

Jan 5-6, 2007

The Participants

Kindly help us in effective implementation of the NPTEL web course materials by answering all the questions in this survey.

General

1. Would you like to identify yourself/remain anonymous for the purpose of this survey?

Yes / No

If yes, please provide: If No, please proceed to Q.2

- a. Your name
- b. _____
- c. Your contact address / phone no.
- d. _____
- e. Your institutional affiliation

- f. _____
- g. Email address _____
- h. _____
- i. Your current position and discipline of interest. (Please tick all that apply)

<input type="checkbox"/>	Core Sciences
<input type="checkbox"/>	Civil Engineering
<input type="checkbox"/>	Computer Science and Engineering
<input type="checkbox"/>	Electrical Engineering
<input type="checkbox"/>	Electronics and Communication Engineering
<input type="checkbox"/>	Mechanical Engineering

2. How did you come to know of NPTEL?
- a. Through the announcement of this workshop.
- b. Other – Please specify. _____
3. Would you be interested in making the course content available locally in your institutional intranet?

Yes / No

4. What subject(s) do you teach?

5. Did you find supplementary contents for the course(s) you teach?

Yes / No

Article I.

6. What topics would you like to suggest for further content development?

7. Does your institution provide facilities for localized content development in electronic forms?

Yes / No

Article II.

8. Would you participate in the process of course development in your specific subject areas?

Yes / No

9. Please describe in a few sentences the infrastructure available for curriculum development and internet facilities in your institution.

Course specific feedback

Use a scale of 1–7 (1– Poor, 2- Strongly disagree, 3- Disagree, 4- Neutral, 5– Agree, 6- Strongly Agree, 7- Excellent)

1. Course materials are relevant to your University program.	<input type="checkbox"/>
2. Courses materials are clear and understandable.	<input type="checkbox"/>
3. Course materials are modularized for you to use parts of them as stand-alone teaching materials.	<input type="checkbox"/>
4. Courses materials contains sufficient visuals and images	<input type="checkbox"/>
5. Course materials contain sufficient animations and illustrations.	<input type="checkbox"/>
6. Course materials are sufficiently interactive.	<input type="checkbox"/>
7. The difficulty level for the students is appropriate for the subject considered.	<input type="checkbox"/>
8. You would like to design courses in a similar fashion in your area (as open resources)	<input type="checkbox"/>
9. The course layout on the web facilitates easy access.	<input type="checkbox"/>

Feedback on the arrangement:

1. Communications regarding the workshop were promptly made to you.

Yes / No

2. Your accommodation arrangements are satisfactory.

Yes / No

3. Conference venue provides the necessary ambience for your active participations?

Yes / No

4. You would like to participate in a similar workshop in which other IITs/IISc faculty who contributed to NPTEL would be present.

Yes / No

5. You would recommend to other faculty in your institute, participation in similar future workshops.

Yes / No

Thank you very much for the time taken.

We look forward to interacting with you in the future.

Participants Feedback form

NPTEL Workshop

Techno park, Trivandrum

Jan 5-6, 2007

Feedback form – 2

1. Please describe how you propose to use the course contents from NPTEL

2. Please state what needs to be added to the course contents / how they need to be modified for enabling your use.

3. Would you like to be part of a team for further intensive interactions with course developers? Please give your thoughts on how this can be achieved.

4. Would you be interested in setting up web based NPTEL discussion forum in your college / encourage your students for participation in the forum to be set up by NPTEL?

5. Would you be interested in designing Frequently Asked Questions (FAQs) for NPTEL courses of your interest?

6. In order to increase effective usage of NPTEL courseware, question banks are needed. Would you participate in this process?

7. On the current workshop format, please give your thoughts on the following:
 - a. Workshop organization
 - b. Sequence of presentations
 - c. Relevance of presentations
 - d. Adequate time for expression of your views/ appropriate response to your queries
 - e. Parallel sessions – how useful they were how they can be restructured etc.
 - f. Facilities at the conference site and reception/help offered.
 - g. Any other
8. If you think that this workshop, to be replicated in the immediate future, should be in different format, please suggest alternatives.

Annexure 5: Infrastructure Created using NPTEL

This gives below some of the facilities which were created in various IITs and IISc Bangalore through funds provided for the development of courses and the hardware.

IIT Bombay:





IIT Delhi





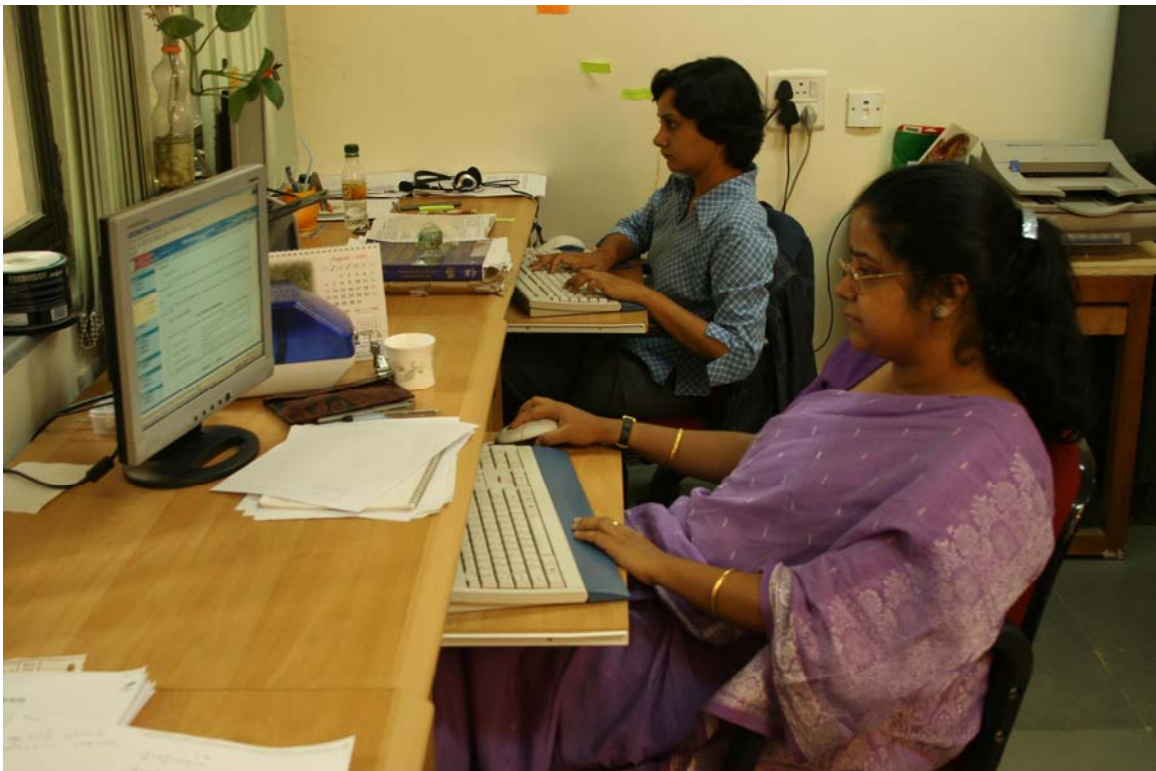
IIT Guwahati





IIT Kanpur





IIT Kharagpur





IIT Madras





IIT Roorkee



IISc Bangalore





Annexure 6 Hardware Configuration Recommended for User Institutions (to host NPTEL video-on-demand in the intranet)

This Annexure provides information for setting up local sites for NPTEL web and video content in engineering institutions in India.

Network Infrastructure:

The institutions need to have a local area network set up either using cables (100 mbps) or using fibre-optic cable (1-10 gbps) with about 50 nodes for concurrent access. Desired environment: 200 or more nodes connected to the network.

Hardware needed:

A server with minimum memory support of 2 GB and preferably between 4 and 8 GB. Storage capacity should be a minimum of 2 terabytes and expandable for future additions. RAID (Redundant Array of Independent (or Inexpensive) Disk) is a must. SATA (Serial Advanced Technology Attachment) 250 GB to proprietary 750 GB per hard disk configurations are acceptable). The storage is usually available as SAN storage. This will host all video files.

Desired environment:

Dual processors/cluster of processors (4-6) each with about 2 GB.

UPS (Uninterrupted Power Supply) rating between 2-4 KVA expected and air conditioning and other clean lab requirement for the servers.

Software:

OS is specific to the vendor that the college may choose. Windows, Linux, Solaris and Mac are all working environments. Streaming video server is a must and should be integrated with the purchase of the hardware. NPTEL video contents **will be made available in MPEG4 format with H.264** compressions at 512 kbps bitrate. Current free players which support viewing are Real player, Quick Time (windows/Mac) and VLC players. Hence the OS should be chosen accordingly Windows media player 9 may need additional codecs. Check with the hardware vendor that the streaming software and the players that they suggest conform to this requirement. Web content does not need additional hardware but a few free players (that can be downloaded from the internet) such as Flash player, mathML player might be needed. A learning Management system such as Moodle may be installed in the server and the contents streamed through the LMS for better accountability and monitoring. It is not a must, however. Each software vendor may also offer other suites of software which must be evaluated by the college for the

requirements.

Distribution of video content:

IITs / IISc. will arrange for copying of hard disk and distribution. Colleges will be informed of the procedure to contact the nearest IIT / IISc. for content transfer. The web content will be available by the end of December 2007 and the video contents by March 2008.

Human resource requirement:

At least two faculty members in each institution to supervise the activity and two project associates to maintain the server centre. The faculty and the associates will be the nodal individuals if the Institution wants to contact NPTEL content developers.

Announcement of workshops will be made from time to time through the website

<http://nptel.iitm.ac.in>.

List of Abbreviations (Acronyms) Used

API	Associate Partner Institution
CAI	Computer Assisted Instruction
CD	Compact Disc
CEDT	Centre for Electronics Design and Technology
CME	Computer Mediated Education
CMI	Computer Managed Instruction
CMS	Content Management System
CMU	Carnegie Mellon University
DVD	Digital Video Disc
ETC	Educational Technology Cell
FAQ	Frequently Asked Question
GB	Giga Byte
IEEE	Institute for Electrical and Electronics Engineers, Inc.
IIITB	Indian Institute of Information Technology Bangalore
IIITM	Indian Institute of Information Technology and Management, Kerala
IIT	Indian Institute of Technology
IIM	Indian Institute of Management
IISc	Indian Institute of Science
IPR	Intellectual Property Rights
LMS	Learning Management system
MHRD	Ministry of Human Resource Development
MoU	Memorandum of Understanding
NPC	National Programme Committee
NPTEL	National Programme on Technology Enhanced Learning
PC	Project Cell
PDC	Principal Discipline Coordinator
PI	Partner Institution
PIC	Project Implementation Committee
RAID	Redundant Array of Independent (or Inexpensive) Disks
SATA	Serial Advanced Technology Attachment
TB	Tera Byte

TC TEL Committee
TEL Technology Enhanced Learning
TI Target Institution
TTTI Technical Teachers Training Institute
UPS Uninterrupted Power Supply
URL Uniform Resource Locator
V Video
VCTEL Virtual Centre for Technology Enhanced Learning
W Web
WoTEL Workshop on Technology Enhanced Learning
WWW World Wide Web