CHAPTER 2. LITERATURE REVIEW

This chapter presents the survey of the computer education in various countries regarding the policy, economy, society’s reactions, educator’s commitment, their reactions and other related subjects.

The INFORMATION AGE is making many changes in society. Unfortunately, the benefits of this INFORMATION AGE are not experienced worldwide. As the developing nations struggle to keep pace with the global economy, the gap between developed and developing countries grows greater. Developing countries are struggling to improve health care, increase in per capita income and enhance the quality of life for their people. As the third world countries are participating partners in the global economy, progressing takes place along with the other developed countries.

Now, most of the third world countries allot large percentage of their budget for education compared to the other needs like economic investment, health programs, transportation, defence and communication systems etc. Here they are trying to use the available money such that computer education can become an effective tool.

2.1 Status of Computer Education in various countries

2.1.1 Status of computer education in Australia:

Roderick C.H. Sims (1993) states that though the population is scattered across the country in Australia, the people have the tendency to implement the latest technology throughout the community. So a demand for many alternative forms of education and support for remote settlements to maintain urban rural links effectively. Additionally the support for education is provided by both the federal government and individual departments of education within the states.

One of the major issues in the Technical and Further Education (TAFE) project is that of developing the competencies and their relevance to the work environment. While the industry is defining the competency standards for training and restructuring their activities,
the academic sector is debating the merits of computer based teaching. A curriculum development centre in Australia has developed the teacher guide, student guide, competency guide and assessment guide and maintaining consistency for testing at all times.

Most of the TAFE project colleges and institutes provide distance or open learning systems through telecommunication and satellite technology, materials are delivered to any remote locations and monitored by a centrally located teacher. As the Australian environment is available for any type of interactive facilities, the teachers are able to design and develop interactive courseware materials for their specific area through the authoring system. As TAFE demands more resources to provide education and training the teacher plays a major role in administration and delivery of subjects.

As the Australian higher education is aiming a nationally based one, considerable effort has been made in reassessing modes of delivery and implementing alternative strategies for teaching and learning which means, a resurgence in the viability of computer based training and education. Apart from the environment suitability for supporting technology, there is a significant co-operation between private and public sectors to ensure that the work done shared by the practitioners and developers. So, this support ensures the advantage to work towards the most efficient and effective means through research and application to support education and training with technology. This co-operation provides vendors, an opportunity to display the latest technologies for educative purposes. Various organizations have joined and created an Asia-Pacific Info Tech in training and education (APITITE) group to exchange as well as support the education and training with the technology. Australia promotes the use of technology for training and education.

Though, enough potential is available through educational technology tools such as multimedia, one of the limitations is the need of the dedicated teachers to use them or exploit them fully for their effectiveness.

2.1.2 Status of Computers Education in Brazil:

Eduardo O.C. Chaves (1993) Professor, University of Campinas, Brazil (1993) says that because of military rule and other problems in the country, Brazil found it difficult to go
with other countries in computer education. Brazil began defining its informatics policy based on a contention that the Brazilian market was the national property and all the 100% is reserved for their own market without any import unless it is essential. So, the country produced super-mini computers and peripherals and the government provided fiscal incentives and other related measures for the Brazilian companies to expand and to become self-sufficient without depending upon other countries or firms outside. Government bureaucrats defined four market segments that boost the production in agriculture, small and medium industries, health services and education. In 1981, the first Brazilian seminar on informatics was conducted with the presence of educators representing the best universities. However, because of various wrong policies of the then military government, the educators reacted negatively. When the military went out of the government, the educators in 1992 reviewed the national policy of informatics and tried to change it accordingly with growth of other nations and world in that area.

Information has become the raw material *par excellence* of most workers and the society is able to recognize that the ingredient is information and not the computer. Although it is undeniable that the computer has had a decisive impact on the increase of information, it is more a consequence than a cause of the information age. The model of education in Brazil, is discipline-centred, content-focused. Instead of an education-centred on the teaching of the content of the traditional disciplines, it has created rich learning environments to learn the process, develop the abilities, understand the values in their totality, to make them capable of permanent learning. Given the increasing ease with which anyone communicates, the home, job and the places of leisure have become very effective learning environments.

To familiarize the children with technology, it has been made that they learn to
i. decide which kind of information is relevant to their needs,
ii. find where the information is located,
iii. assess the information they find and receive,
iv. analyze and relate it to other pieces of information they already have,
v. organize intelligently, file it and retrieve it easily,
vi. present it concisely and attractively.

So, the educators are able to see that the technology is used to educate in the richest and fullest sense that the mind can envision.
2.1.3 Status of Computer Education in Bulgaria

Ivan Stanchev (1993) states that Bulgaria gradually developed electronic and computer industries in co-operation with other East European Countries and started to produce main frames that are compatible with IBM 360. It conducted National Youth School Computer Programme in 1976 and International Federation of Info Processing (IFIP) conference on ‘Informatics in Schools’ in 1977. In 1985 International Conference called ‘Children in Info Age’ was organized to develop the informatics and computer education related to education with the participation of teachers, psychologists, programmers, hardware designers etc. The Ministry allotted about US $ 0.4 million that is 1% of the total yearly expenditure.

During 1985-1988, more than 16,000 school were provided with micro-computers and
1. a 120 - hour course in informatics was made compulsory in all secondary
   schools.
2. published textbook in informatics
3. prepared teachers’ handbooks and
4. published of a large number of study aids and other materials.
5. under staff development programme, about 17000 teachers were trained in
   these area of 36 hours course of 1 week duration 2300 finished one month
   course, 650 finished three months course and 350 finished one year course.
6. training chairs in the Departments of Mathematics were established in
   training college throughout the country.
7. research education was organized in some of the higher educational
   institute.

Bulgaria is the initiator and active participant in a number of international undertakings
in the field of computerization of education. The conference on Children in the Info Age has
become very popular. Also Bulgaria is an active member of UNESCO’s international
informatics programme. Many countries followed the Bulgarian model in the training.

Though the national, regional, state and local policies for introducing computers have
largely responded to pressures from outside education. Bulgaria has played significant role
in the realisation of computer education as an integrated tool for learning information
technology to make the impact on the content, role of the teacher, school and classroom
organisation. The above model was applied to Bulgaria and got the output as follows:
2.1.4 Computer Education in China:

Chinese informatics policy: As New Information Technology (NIT) is a tool for development as well as for dependency, Chinese authorities have stressed the importance of linking education, economic development and science and technology. China recognised the importance of IT. To achieve self-reliance, it emphasized the urgent need of industrial production of integrated circuits, peripherals and domestic softwares monitored by bureau for management of computer industry. With this framework, training personnel and popularizing the application of computers were done by universities and research institutions.

As the industry, agriculture, defence, science and technology need modernization, China made contractual agreements with foreign equity participation. This joint ventures increased local knowledge, provide import substitution and enhance the compliance in the world's market (Stewart 1988). In May 1990, about 160 high technology enterprises had been established in Beiging's Silicon Street. This area has a large number of educational institutions and about 100 research institutions to assist. To further development, the state has introduced incentives and thus NIT is seen as help to solve the country's economic backwardness by increasing educational efficiency and producing computer literate citizens, while maintaining self-reliance goals in tact.

A national policy on computers in education has been made in China with the following:-

a) priorities, procedures & contents
b) hardware & software
c) teacher training
e) institutionalization (Makrakis, 1988)

The implementation of computers in education was made on stages through policy determination, indigenisation and computer literacy.

Vasilos Makrakis and Lin yuan-tin (1993) state that the computers were perceived by Chinese policy makers and educators as important inputs for improving teaching-learning processes, tools for overall national development. As the computer education is a complex and multi-dimensional issue that involves a range of factors associated with the political, social, economical and cultural domains and characteristics of a given society.
2.1.5 Computer education in Denmark:

'The Info Society Year 2000' report of 1994 made to work for the technology-supported education with a specific focus on professional training to establish a centre of technology supported education in Denmark, according to Stefen (1993).

The report planned to bring all the learners under the IT. So, it has become a natural part of teaching according to the needs of the learner. IT has been introduced from primary level to all levels. Thus the training of teachers and their qualification in IT has been introduced. IT integrated research projects were introduced at various institutes. Through "Learn IT" project, CD-ROMs were made and sent to schools for use and were asked to develop similar materials in all topics and use them in the internet for other regions.

2.1.6. Information Technology in Germany:

Germany has adopted the following five points in an action plan from 1996:

1. Internet access for all the school children.

As on October 1998, nearly 8500 schools were linked up to the Internet. It had planned to link all the schools in four years duration. This provides the children research their homework topics on the Internet at a less cost.

2. Launching of the new system INTERNET 2.

At present, the Internet is fully utilized. Since the advanced Internet 2 is faster, reliable and more secure with interactive medium and Germany is fully utilizing.

3. Providing the Security for business transactions on the Internet:

The E-Commerce is fully used now. With the Multimedia Law enacted, the rules of the government made Germany to be at the top compared to other countries and fully modernized because of adopting the digital technology.

4. Established thousand new multimedia companies.

As the number of multimedia companies were growing in each year, reached the target of 1000 companies in four years duration.

5. Job centres for tele-working:

This tele-working sector creates new employment as well as modernizing or upgrading. Also, it was planned to have a 'virtual job centre' for tele-working.
In the 1999 budget, the government provided more funds (Approx. 985 Million DM) for the IT and Communications section. Multimedia growth was 8.4%. Support for innovative services was the top priority. In the world, Germany is in the third rank after USA and Japan. It is planned to overtake these two and planned to become number one in 2006. For research and development, Germany is spending nearly 10%, Japan 9%, France 7%, U.K. 5%, USA 17%, Sweden 26%.

2.1.7 IT education in Japan:

Japanese educational policy of 1988 has shifted to IT in order to respond to the information society. The ‘Basics of information’ has been introduced at the lower secondary curriculum. And in 1990, under the name of ‘Information studies’, the multimedia usage started due to its features of interactivity, non-structured data compilation, enrichment of data by the users and possible free operation of the material by the learners at their ease.

The major projects leading to the establishment of a sound way of using IT in education, fully supported various financial co-operations, other ministries and major corporations.

2.1.8 Computer education in U.K.:

United Kingdom has started IT in the early 1980s by providing funds to majority of the schools and developed the concept of software and training. Initially some dedicated teachers developed the software and used the machines to teach computer studies. Then the word-processor came in handy to develop class-room teaching and learning easier and the learners could contribute their creation through this screen publishing and sharing of information among themselves and others through the Internet. Thus IT has become an integral part in the curricula. And the ‘IT capability’ was introduced to

i. use information sources and IT tools to solve problems
ii. use IT tools and information sources to support learning in a variety of contexts
iii. understand the implications of IT for working life and society.

The learners of the age of 14 to 16 years are made to develop greater responsibility for using IT, work competently and effectively with a range of IT tools and materials acquiring the latest features and reflect critically on their own and others’ use of IT.
The schools are regularly inspected for the developing multimedia machines, video-conferencing units, video editing suites, Internet connections etc. BBC provides a good expertise to produce valuable curriculum material. As a part of exchange of information, U.K. and South Africa are sharing and exchanging information to refine their thinking and decide their knowledge on education.

In UK, the National Curricula is used to lay down the broad outlines and detailed specification of the needs of the learners integrating the IT as a part.

2.1.9 Computer education in U.S.A.

Though the educators planned to prepare the students for the IT society, pressure has been put up by the American corporations to develop curricula that are more integrated to a workforce based economy according to Richard (1993). Parents also started to pressurize the institutions to teach IT for their wards. Thus in all institutes the IT has been introduced even at the lower secondary level.

Distance learning in the United States delivers approximately 90,000 courses at various levels of college and university. Among the current and perspective operators of virtual classroom are the established universities that want to expand their reach without expanding their physical plants.

2.1.10 COMPUTER BASED INSTRUCTION MODEL IN DEVELOPING COUNTRIES

Many countries, both developed and underdeveloped, are looking to Computer-based Instruction (CBI) as a means of maximising impact of the amount spent per student. As Computers and other technologies are expensive to acquire and maintain, many countries, however, struggle to justify these expenses.

A model is proposed for analyzing and planning for the use of CBI with the following assumptions, in the developing countries.

a) CBI is a powerful tool that has considerable potential to increase the effectiveness and efficiency of Education and Training in developing countries.
b) CBI is neither a unitary nor well-defined construct, and implementing CBI in developing countries will require modifications in many facts of Education, including Instructional Objectives, Teachers-learner relations, Scheduling and location and Testing and Grading.

c) CBI has sufficient potential for affluent countries, international funding agencies and multinational corporations to support CBI research and development in these countries.

d) Efforts to introduce CBI into developing countries should be informed by a careful analysis of the factors that will influence its implementation, effectiveness and efficiency.

Purpose:
A Model for analyzing the potential of CBI in the Education and Training has been made based on the following ten factors:

1. Economic Conditions.
2. Educational traditions and support for Formal education within the Society.
3. Socio-political conditions that influence education.
5. Work-force requirements.
6. Teacher Status and Skills, Knowledge and Attitudes.
10. Status with Donor Organisations.

The Criteria for this Model were applied to a Country, viz. Bulgaria and got the output as follows:

On the positive side, Bulgaria possesses quite strong educational traditions and Cultural openness to innovation and Technology. This country leads the Eastern Bloc nations in Instructional Innovation and Materials. The workforce needs retraining and the aspirations support innovation approaches to Instruction.

On the negative side, Bulgaria's immediate economic prospects are dim and the long term plans are unclear. As the political stability was unpredictable, the future of this
model could not also be predicted. A massive and ambitious change could occur with respect to CBI development can be made only by Donor organisations around the globe.

This CBT criteria model represents an approach to Education and Training with profound implications for changing, existing instructional systems design procedures that encourage the examination of all factors.

The above ten factors are worthwhile to consider in any situation.

2.2 COMPUTER TRAINING IN THE INSTITUTIONS

With the Information Super Highway spreading its wings on the present society, once a sophisticated and scientific tool, the costly ‘giant’ computer has become everyone’s inexpensive tool in any application at present. As computers proliferate, the computer schools and institutions follow suit. Over the last decade, computer education has outgrown even the optimistic projection. The advancement in the New Technology forced everyone, at present, to use the computer irrespective of the field. Thus the computer education has been introduced at various levels in Schools, Polytechnics, Colleges and Private Institutions. Several students as well as parents opt for computer courses in Polytechnics and Colleges as they think it is an easy ‘scoring subject’ and easy to get the well-paid jobs. They realize that these are not true only on the completion of the course and so they enroll in private institutions paying high fees in getting some hands-on practical experience after their regular institution training. Training involves a lot of practice. After the Higher Secondary Schools, the students are provided 3 to 4 years doing a course either in Polytechnics, College or Private Institutions as shown below:

**COMPUTER TRAINING FOR STUDENTS**

<table>
<thead>
<tr>
<th>POLYTECHNICS</th>
<th>COLLEGES</th>
<th>PRIVATE INST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness – 3 months</td>
<td>B.Sc – 3 years</td>
<td>Certificates – 6 months</td>
</tr>
<tr>
<td>Utilities – 3 months</td>
<td>M.Sc – 1.5 years</td>
<td>Utilities – 6 months</td>
</tr>
<tr>
<td>Languages – 3 months</td>
<td>PGDCA – 1.5 years</td>
<td>PGDCA – 1.5 years</td>
</tr>
<tr>
<td>Computer Science – 3 years</td>
<td>B.Tech – 4 years</td>
<td>Diploma – 2 years</td>
</tr>
<tr>
<td>Computer Enng. – 3 years</td>
<td>M.Tech – 1.5 years</td>
<td>Packages – 6 months</td>
</tr>
<tr>
<td>PGDCA – 1.5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Hardware &amp; Maintenance – 3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Applications – 3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; Business Management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

30
As each country has its own definition or concept of computer education for technicians, the curriculum has been implemented in their own ways due to their economical investment, political stability, health programmes, transportation, defence and communication system etc. In this context, one cannot say which one is best or poor. Each country is trying to utilize the available finance such that computer education can become an effective tool irrespective of their socio-political imbalances.

Also, the developed and underdeveloped countries are looking for the expenses towards the computer education as a means of maximizing the impact of the amount spent per-student and justifiable to get an effective quality of life for their people.

Based on the above ten factors, the status or position of any country towards the computer education can be drawn. It represents an approach to computer education and training with profound implications for changing the existing instruction design procedures that encourage the examination of all the factors which are worthwhile to consider in any situation.

When this model is applied to India, the following inferences were drawn. In spite of an average economic conditions, India is able to invest or allot some finance for computer education and able to bring a comparable level to other countries and India could produce more software personnel in developed countries.

As the technology is available through on-line, the lack of technology is not at all existing.

More number of institutions are available for computer education throughout the country at technician and engineer levels.

As more and more industries being modernized, the workforce requirement is high compared to earlier periods.

As the computer is a modern teaching tool, the teachers have to be trained in computer knowledge, skill and attitude towards the computerization as well as usefulness to the society.

The training organizations have to support the staff development. The government as well as industries should provide enough funds for the same. Central government provides staff training through Department of Electronics (DOE), Indian Society for Technical Education (ISTE), Technical Teachers Training Institutes (TTTI) and other organizations. Also the state governments provide quality improvement programmes for their staff and funds under World Bank assistance for the purchase of hardware and software.
Since India is a multi-lingual, multicultural country, the computer education should be carefully implemented without affecting the cultural sensitivity.

Due to liberalization, privatization and globalization policies of the central government, enough support or provisions should be provided by the society. Both the public and private sectors are trying to utilize the opportunity to improve the computer education and produce better computer personnel. Even though the policies vary in the political parties, the computer education is going ahead for better future.

Various agencies are able to provide the formal computer education without deviating from the tradition of the society, i.e. manual labour support is not removed.

Donor organizations support is minimal. In some cases, some parent-teacher associations, industries provide finance for the computer hardware and software purchases, training and absorption.

After a study of the merits, features and implementation of the IT policies of other countries, the Government of India has formulated the IT policy in the year 2000 as follows:

Drive IT, Target IT and IT for All by 2008.

This IT plan contains 108 action points on IT and software development aimed at the above three basic objectives. Some of the policies are:

i. To increase the PC availability in the education sector, it has recommended easy financial schemes to enable every student, teacher or school to have access to computers.

ii. To have Internet connection to all the schools, polytechnics and colleges by the year 2003.

iii. National council of IT Education comprising representatives from the industry and academics to define the required courses in view of the rapid developments in IT.

iv. Teach the Teachers program for staff development.
### Comparison of Computer Courses in Educational Institutions

<table>
<thead>
<tr>
<th>Computer Science (B.Sc, M.Sc.-College)</th>
<th>Computer Engineering (Degree – College Diploma – Polytechnic)</th>
<th>Computer Applications (PGDCA/Diploma / ME / MCA/ M.Tech. College / Polytechnic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>Applied Science</td>
<td>Application of theories Languages/utility packs</td>
</tr>
<tr>
<td>Theory- Oriented</td>
<td>Production – Oriented</td>
<td>Practice- Oriented</td>
</tr>
<tr>
<td>Software-Oriented (At a middle level)</td>
<td>Hardware- Oriented (At a middle &amp; higher level)</td>
<td>Mostly Software- Oriented</td>
</tr>
</tbody>
</table>

#### 2.3 Need of the Standards

As the programmes are planned at various levels by different States, the industries face difficulty in offering suitable employment because of the variation in knowledge and skills. So, some of the national bodies brought in standards to have the basic knowledge and skill that are needed to employ directly without any induction programme for their skills. Thus the need of the standard arose and had been evolved by the agencies such as DoE, MAIT, NCST and MSCE. The polytechnics education has been compared to these standards and levels have been fixed. These agencies came in between the supply and demand of the trained professional and set up standards which are reflecting the industrial needs. These standards are given below.
In 1996, two schemes of standardization were introduced to the users, viz. industries. The first step was taken by the manufacturers Association of Information Technology (MAIT). It announced an empanelment scheme for the computer training institutes which was based on a certain minimum infrastructure necessary to conduct computer classes.

In addition to this, MAIT has specified a set of code of ethics that have to be followed by the Institutes. These include ethics of advertising, dealing with the students, dealing with the employers, etc. MAIT empanelment thus created regulation on quality across areas. However, this has been more in terms of ethical issues like maintaining quality of advertisements.

The second scheme is the DOEACC. Though this scheme is under the Department of Electronics, it is claimed that there is no direct interference from the Government. The
scheme is under the supervision of Computer Society of India (CSI) and Institute of Electronics and Telecommunication Engineers (IETE).

The DOEACC scheme takes up the standardization of the course content that is taught in the institutions. The curriculum starts at the ‘O’ level and move to ‘C’, ‘B’ and ‘A’ levels and the students coming out of the of the accredited institutions should have the same level of understanding of the subject.

To do this, the CSI and IETE have formulated syllabi. All students from all over India will be evaluated on this, so as to assess their knowledge on a common yardstick. The syllabi for these examinations have been designed with the help of an advisory committee that includes representatives from the industry. The examinations are conducted from July 1991. The details of the scheme is shown below:-

DOEACC - A scheme of Government of India, DOE and AICTE taken up to develop the qualified and competent manpower for IT. The scheme provides educational opportunities in computer for 10 +2 qualified candidates through Institute or Organization in the non-formal sector (Private/Government) which are accredited to conduct specified course(s) based on norms and criteria regarding credibility, space required for training, faculty, infrastructure, quality of training, teaching aids, adopting Government policies, reasonable fees etc. in the following manner:

DOEACC Yard Stick

- The institute should be running computer courses for at least two full years.
- It should own the premises; if hired, should be on a long term of at least 10 years.
- Must maintain own Hardware and Software at the site.
- Not more than 2 students to be detained on one terminal or PC.
- The minimum Carpet area should be more than 150 sq. mts to accommodate one computer class room of 25 students, one lab for training and a library.
• Faculty must have at least 3 permanent members who have been with the institute for at least 6 months, maintain a rate of 4:1 for full time staff to student ratio should be 1:25.

• Competent faculty with a Ph.D / M.Tech / MCA or B.Tech in Computers.

• Fees charges should be reasonable, justifiable & commensurate with the infrastructure and facilities offered.

• Should have modern teaching aids such as Video Projection etc.

• Should have reservation according to Government Policies.

The scheme provides the requisite flexibility for individuals to quality in steps, to an equivalence of an M.Tech Degree without interfering with other studies or work as shown in the following figure:

Note: "A" level is a subset of "B" level.
At present, there are four levels of Training courses ‘O’, ‘A’, ‘B’ and ‘C’ and they are categorized as: O – foundation, A – advanced diploma, B – graduate, C – post-graduate.

The scheme has been implemented through DOEACC control center and examinations are conducted by CSI and IETE. DOE has a registered society namely DOEACC society, to implement the scheme in an integrated manner including examinations.

Though standardization has seeped in, something still seems to be wrong with the direction in which the training is going. The boom in the PC industry signaled the arrival of the computer industry. As time went by, it has become difficult to keep track of the institutes that were mushrooming throughout the country. However, despite their large numbers, it is alleged that these institutes have been largely unable to meet the demands of the industry or the user.

However, overall scenario on the training is not encouraging. Though the private institutes often change their curricula, they meet the demands of the industry to a certain extent compared to Polytechnics, Colleges and Universities.

The society has members from AICTE, MHRD, UGC, Educational field and the industry. The examination are conducted twice a year in all major cities. The coaching institutes are issued with an accreditation certificate to run the courses. At present, a number of organizations, have recognized these certificates and qualifications by public and private sectors, good. The MHRD has issued a special notification in march 95, regarding the recognition of these DOEACC exams of various levels O, A, B and C for recruitment. As the demand for the computer education is more, many private institutes are given their accreditation with the following norms:

The scheme is yet to make its full impact certificates will be revoked when they could not maintain the prescribed standards of DOEACC. But this scheme suffers due to lack of statutory backing and follow up of adequate publicity.

Another scheme has been introduced by the NCST (National Centre for Software Technology) a Govt. society for conducting tests for competence in software technology at various levels as follows.

'O' level for B.E / B.Tech. / MCA / PG Diploma in software.
'C' level for BSC (Comp. Sc.) / Graduates with 3 to 6 months course
'E' level for entry level to all graduates for their aptitude.
However, this makes the user of society difficult to select or recognize, the best one among these three schemes.

**Standardization of Training**

Through standardization has been developed, there is no periodical review by industries. The boom in the PC industry signaled the arrival of computer training industry. As the private institutes often update their curricula, they could meet the demand of the industry to a certain extent compared to regular colleges and universities, which revise their curricula once in 5 years.

DOE accreditation and recognition of courses is an academic affiliation. It opens up job opportunities in the public and private sector. MAIT empanelment also helps the student in acquiring jobs with the industry. The industry is ready to give preferential treatment to students from the empaneled institutes. Some of the institutes blend the learning in their long term courses. These measures, to a certain extent help the students with assured employment after their long term programmes which are lacking in the Govt./Universities due to rigid programmes. Already MAIT’s scheme has received acknowledgement from some of the major vendors. But under practical conditions, a student coming out of the training institutes is not at all comparable to a student who is a graduate or a post-graduate in Computer Science from a recognized institute.

A person trained to make a career in this fast moving industry should be able to convert new technology into new application areas ideally, the new breed of trained computer professionals should be a good mix of the expertise in subject matter and management qualities. MAIT and DOE standards are an attempt to ensure the skill levels across the country.

Standards would be more beneficial to the user for the industry and the students if the long term requirement of the kind of trained manpower is kept uppermost in mind, while designing training schemes.
Career path and the standard level of the programme as per DOEACC, NCST:

<table>
<thead>
<tr>
<th>Job Title</th>
<th>DOEACC</th>
<th>NCST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmer Asst.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Junior Programmer</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Web Designer</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EDP Asst.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Data Entry Operators</td>
<td>0</td>
<td>E</td>
</tr>
<tr>
<td>Programmer</td>
<td>A</td>
<td>E</td>
</tr>
<tr>
<td>Asst. to Data Base Manager</td>
<td>A</td>
<td>E</td>
</tr>
<tr>
<td>Teaching faculty</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>Lab Demonstrator</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>IT Staff</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>System Analyst</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>IT Staff (Junior)</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>Software Engineer</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>Training Faculty</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>R and D Scientist</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>EDP Manager</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>Project Manager</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>System Manager</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>Consultant</td>
<td>C</td>
<td>I</td>
</tr>
<tr>
<td>R and D Staff</td>
<td>C</td>
<td>G</td>
</tr>
<tr>
<td>IT Staff (Senior)</td>
<td>C</td>
<td>G</td>
</tr>
</tbody>
</table>

NOTE:

'O' level - ITI, Certificate
'A' level - Diploma
'C' level - Graduate/University

'G' level - Graduate level (Degree)
'I' level - Intermediate level (Diploma)
'E' level - Entry level (ITI)

'B' level - Degree

Depending upon the expertise and experience in IT, any of the jobs can be obtained by I or G group.

2.4 IT TRAINING IN THE NEW WORLD

Based on the development of hardware, software, the training were planned in polytechnics in the computer education. As the technician has to work at levels of hardware or software, he should have been taught both hardware, software and their application. So, the polytechnic curriculum should contain or cover all the basics of hardware, software and their utilities.
Even though the development have been identified as phases, the polytechnic curriculum is not keeping them as separate identities but imparting the knowledge in all areas in a balanced manner.

The entry of computer made to organize training programmes for the awareness of computer and its applications since 1970 resulting in the following phases.

Phase 1: During the inception of the computer industry in 70's when computer were standalones and coming of new technology to hit the country, Training concentrated on teaching basics of PC and its operation and some languages like COBOL, BASIC, dBase etc. (Programmer were developed).

Phase 2: In 1980's, as IT became popular, India used its programming expertise. So training institutes extended the course syllabi to include programming skills in C, C++, PASCAL etc. (Programmer were developed in this phase).

Phase 3: In 1990's, when IT usage became all pervasive, the industry demanded that people should have programming knowledge, well versed with the applications. So training concentrated less on 'Programming' but more on applications development, system development, system integration etc. ( - Useful as tools).

Phase 4: Due to Internet, Multimedia, at present, the demand is for the development of application and content creation, specialization in particular areas of corporate needs. (Used for more applications and as tools).

From these four phases, three models in computer education emerged as

1. Computer literacy model
2. The end-user training model
3. Professional training model

1. Computer literacy model:

As the computer is existing in all walks of life, everyone had realized the importance of knowing computer. As the computer is not in the curriculum, this awareness need training is on demand even from housewives to school children. But this demand will disappear in short time as the Government is taking steps to equip computers in all schools and colleges in
phases in main cities/urban. However, there will be this demand in semi-urban and rural areas.

As the formal education on IT skills have not done so far, the private training institutes are growing steadily and are raring to become private universities with well established infrastructure. The current training model is fragmented, into two wherein the formal education system is equipping students with the knowledge base and the private training institutions are responsible for providing the people with the skill sets. As the government and educational bodies are planning computer education to all levels, this training model would undergo lot of changes.

Hybrid models where the private training institutions would partake in creating the knowledge base as well as the career-oriented, end users training and basic computer literacy. However, these private institutions are not equipped to provide the graduate level. And the future models may be a combined effort of these private institutions and the formal education system.

Industry-Institute collaboration:

In this industry-institute collaboration, institute will try to utilize the industry's infrastructure to solve many resource problems. Here both sides are benefited. However, the PTIs do not want to venture in this.

2. End-user training model:

Due to the proliferation of IT applications into various facets of life and their integration into mainstream, the third and fourth phases made the user as supreme. End-user training model comprises imparting education to students on how to use IT in finance, marketing, advertising, content creation in multimedia and web publishing, films, audio and video editing etc.

Now end-users and power users are about 90% of the IT users. This model provides 0.5 million jobs out of 0.8 million entry-level jobs every year. This is huge market.

Two kinds of skills are imparted here:
1. The skill to use generic software packages as an aid to perform other mainline activities. Here the candidates undergoing training learn how to use the computer in their career efficiently. As a professional, one need to know what more he can add to the qualification to increase his market value.

2. Skill to use the career-oriented packages such as Photoshop or Coreldraw for advertisement agencies etc

Combining Skill and knowledge:

If the private university bill is passed in the Parliament, the PTIs may try to provide university level training. Though, at present, many PTIs are running high level programmes equivalent to degree level, they cannot award degrees and so not recognized by the industries.

3. Professional Training model:

This has emerged from the first two phases, concentrates on the imparting of hardware use of IT skills. This will continue to remain, with the new technologies getting incorporated into the curriculum of private training institutes.(PTIs).

The courses at PTIs are designed with a lot of input from Software industry and they are providing an alternative to the engineering degrees. Here, the courses aim to provide information systems (IS) development skills to the students who find jobs in corporate sectors.

These skills encompass the design, development and implications of IT. Previously, there was only Electronic Data Processing (EDP) department and Management Information Services (MIS) department that came with the development of complex applications. And a need arose to maintain and implement the systems. Thus, training model like Enterprises Resource Planning (ERP), Year 2000 (Y2K) and mainframe training came. But these courses are only transient and will not be a long-term requirement.

Some feel, as the Government has not provided all the schools with the computers, the PTIs can carry very well for sometime. And some feel, even if the Government provide computers in all schools, still the demand for awareness will sustain for some more time. In any case, the above three models will take care of the demands on any account.
2.5 NEW WAYS OF LEARNING

To impart the knowledge, we use many teaching aids in this modern scientific world. Among the various aids, the latest one namely the 'computer' is an excellent one for any type of learner whether he/she is slow, average or fast. As this involves audio-visual instructions and the interactions that a learner can have with it makes a wonderful aid. The following are their features, limitations and other effects.

- Computer Assisted Instruction (CAI)
- Computer Based Training (CBT)
- Educational Television (ETV)
- Video-on-demand
- Multimedia (MMLP)
- Multimedia CD-ROMs
- Information super high-way
- Web-Based Learning
- E-Learning

A. COMPUTER ASSISTED INSTRUCTION (CAI)

Computers are mainly used for assisting the instructions to learn fast. This is known as Computer Assisted Instructions (CAI). Pasupathi (1994) states that CAI is utilized for

- Drill and Practice
- Tutorial used and dialogues
- Information handling aids and
- Simulations and games
- Computer as a subject of instructions.
- Virtual laboratory

The CAI in its simplest form deals with drilling and practice teaching/learning process. The levels of sophistication vary from multiplication tables practice at the primary level to elaborate training and programmed learning packages, now common on industrial and other vocational training programmes.

A1. Drill & Practice :

The CAI gives the repetitive practice at certain exercises, for example, spellings, calculations and so on. Of course, some may think that why should an expensive computer
be used for this when it can be done with paper and pencil. But in computer, one advantage is, it never tires and there is no fatigue. The CAI package can be run at any time and any number of times. So, even the slowest learner can be brought to a higher level within a short time by practice.

A2 Tutorials:

This type of CAI leads the learner to acquire the knowledge involved by offering explanations and different levels of help when the problems are encountered. This will aid the revision for the average learner and will give reinforcement to slow learners. As this is of individualized nature, it restricts the number of learners who can use this package. The widespread classroom use was not possible until network systems are provided. The teachers should take more initiative and generate more learning packages.

A3 Simulations:

At times, some of the concepts or postulates are used with prepared programs for an impractical or difficult learning situations more amenable to the class room. Thus the program gives simulation to the difficult situation. So a simulation to the representation or acting out of real-life process. For example, consider a spaceship leaving the earth and goes to orbit. The micro-computers graphic facility gives an ideal medium for any teacher wishing to illustrate the teaching points with animated diagrams. A simple program for this purpose would give an animated representation of spaceship going to space and taking up orbit. If the program is improved further, even the rocket flare, its sections being jettisoned and its booster rockets in operation to stabilise the orbit etc. can be shown. This set up would be described as a simulation - launch of the spaceship is acted on the screen. The program might be based on the mathematical model which incorporated consideration of mass, velocity, launch trajectory and so on and it would still be a simulation. But, if the user is allowed to vary the parameters involved and thus investigate how the ship behaves in different situations, it becomes a modeling program. Both the simulation and modeling are powerful classroom resources. Thus many different situations which would be difficult or hazardous can be brought into classroom through the programs and educate the learners. Thus, the screen is used as an electronic blackboard. This board exploits the facility for
graphics on the micro-computer and provides the teacher with a dynamic illustration of quite complex concepts or events.

A4 Virtual Laboratory:

Virtual laboratory which is an offshoot of CAI/CAL allows the learners to understand the operation of handling laboratory equipment, take precautions, using variables, draw graphics, verify laws without sensing or touching actual equipment. Though it is a simulation, it gives the real learning of all activities that are required in the laboratory. This provides the opportunity to handle any equipment without damaging or meddling with them. This virtual laboratory is based on the innovation of Virtual Reality that creates a real three directional environment on the computer screen.

A5 Games:

Sometimes the logical thinking and the problem solving skills can be taught through games instead of conventional teaching. This is very much easy in the computer. Some of the adventure stories can be made into programs and make the learners interact or make decisions at the critical points and manage the situation, think properly and face the result. Thus the experience teaches them to be alert always and making correct decisions. This will later develop into a managerial skill in any situations. A crossword game will improve the English vocabulary. Similarly, a search program of a particular word or a letter or filling up the blanks in a certain story will improve the knowledge of English.

A6 Information Handling:

The computer has a large storage of memory. Hence any data can be put in the memory and it can be retrieved at any time very easily, if the input is put in proper format. Thus the data base arrangement is done on any topic. The students/learners can be shown the rapid information storage and retrieval capabilities. Some of the real-life situations such as stock inventory, banking transactions, students records, airline booking, the price of particular item in various places etc. can be put in the database and can be taken out in various ways.
Word-processing package which does all the jobs that a normal secretary does in an office. The spreadsheet package gives the accounting and budgeting records for any amount of data in the banks or office. These word processor and the financial spreadsheet analysis packages can give very practical support to commerce teachers to prepare children for jobs in the so-called electronic office.

A7 Computer:

The above applications just described are given to anyone who is interested in using the computer alone and not interested about its working or its hardware which is inside the computer. But for those who are interested in the design of computer or the working of computer, a separate subject of study is given. This is also taught through the computer instruction. It is proved that this method of instruction is more powerful than any other conventional teaching methods. The software program/packages are already available in the market for various machines in this area.

Thus CAI teaches similar to live teachers or other media but it has some more features like,

- a saving in the time it takes to learn.
- students responds favorably to CAI.
- computer use in branching an individualizing instruction.
- true, natural instructional dialogue is possible.
- perform processing of data in the shortest time

The CAI has some more advantages compared to other media such as

- Secure, store and process the information about the learner’s performance prior to and / or during instructions ie. for monitoring.
- Store large amounts of information and make them available to the learner more rapidly than any other medium.
- Provide programmed control of several media, such as films, slides, TV and demonstration equipment.
- Give the teacher/author an extremely convenient technique for designing and developing a course of instruction.
- Provide a dynamic interaction between the student and the instructional program not possible with most other media.
CAI is a potential means of making instruction, a truly individualized process. While
the Programmed Instruction (PI) and language laboratories are also individualized
instruction, they take only the first baby-step in that direction by allowing the student to
proceed at his own rate. Mass media approaches have provided an illusion of economy.
Though this medium is costlier than others are, this CAI could individualize materials
electronically rather than by hand.

LIMITATIONS:

The main drawback of using the computers is its cost. As the technology developed,
the personal/home computers (micro-computers) have already come into the market and
their cost is comparatively less than the previous computers. More CAI packages are
available in the world market on various subjects at various levels. If the teachers wish to
lessen their workload, they can generate a variety of lessons into programs which can be
easily implemented for the defined objectives. As more number of firms started to produce
the computers hardware and software packages, the cost is coming down and this limitation
will go at any time.

Government of India in 1983 has started a CLASS project (Computer Literacy and
studies in schools) to introduce the concept of computer awareness and its involvement in the
learning process. This project was introduced in the secondary school level and has been
extended to lower ages throughout the country in various subjects and the packages from
other countries were also used with modifications to Indian situation. Thus the computer used
to provide information, motivate learning through the use of animation and graphics, and to
convey complex concepts by the process of simulation. The intention is not to dispense
away the teacher, but to enhance the ability of the teachers to educate more effectively. This
will be proved further when enough Computer Assisted Learning (CAL) packages are
available in all the subjects at various levels. So the teachers can now concentrate on
generating the CAI packages for use.

B. COMPUTER BASED TRAINING (CBT)

Similar to CAI, another method of instruction is CBT and this is mostly used in the
case of industries for training purpose to increase the manpower.
Need:

The change in life and environment because of the computers.

Because of the information technology, education to rural masses, adults, teacher training, technical training programmes (as the computer is integrated in every aspect of education) have to be adopted to utilize this new technology.

The rush at the polytechnics and colleges shows the growing emphasis on the improved method of education.

Advantages:

Provides better interactive conversation between the learner and the computer.

Being interactive training, the computers can use more mathematical and logical abilities than an ordinary teacher.

Provides an opportunity to improve/update whenever the fault occurs to improve the information through interaction.

Computer student interaction allows better graphic facilities as the computer can draw better pictures than a teacher.

Through drill and practice, the computer creates problems at random and tests the students.

The progress of the learner is monitored then and there and allows them to progress at his own pace/speed.

This acts as an information support tool, such as to measure in science laboratory, analyze data, graph the equation, perform calculations etc. to the learner.

Environment simulations provide a structural universe in terms of its operational rules, cause-effect relations and environmental limits.

To improve language - writing in English or any language.

Career planning for students can be done using their attitudes, aptitudes and interest.

Computer Managed Instruction (CMI) provides the teacher to monitor the learners’ progress easily and give the required tutorial, without affecting the progress of others.

Complete data on instruction, learners, examination system etc. can be stored and retrieved at any time for educating anyone learner.
Scheduling of classes can be made easily based on the utilization of resources available (i.e., teachers, class rooms, text books etc).

Reduces training cost drastically.

ISSUES:

The availability of CBT in Indian environments conditions.

The assessment of technological achievements of tele-teaching, knowledge-based teaching tools, distance learning use of hypermedia in education and so on.

Lack of infrastructure, non-availability of funds, non-achievement of class projects, lack of appropriate manpower, good quality of computer education to make the best use of available resources.

Lack of awareness on educational software and scope offered by the computer for effective teaching and learning.

C. ETV or TELE-EDUCATION:

This gives a high quality education to the large masses who do not have access to classrooms and good standards of education near by.

(Example: Zee TVs programmes on computer awareness has been watched by 50,000 executives, housewives, students and over 6500 to avail practical sessions and interact in their near by training centres.)

Limitation (at present) – To be used only for Introductory session and specific skill updates. Thus this can be overcome with the advent of interactive TV facilities expanded.

D. VIDEO – ON – DEMAND.

In Orlando, the city in US, an experiment was conducted with 40,000 videos were connected to through network to 4000 households. A mammoth video server was utilized to store all the videos and provided on-line access. Though this experiment was done for, "Entertainment purpose, it can be extended to "Edutainment" of tomorrow.

Another project has been taken up by a leading developer (of video courses) in USA to make available the curriculum of 100 top-of-live courses on Internet for 30 million users.

By this, every release of educational video on the corporate and personal networks will enable the community to use the Software immediately as it hits the computer.
E. MULTI-MEDIA LEARNING PACKAGES:

The combination of Audio, Video and Graphics and images and data on their computer called Multimedia that provides the learning facilities from functional skills to computers safety.

The limitations in CAI, CBT can be removed by employing more number of teaching aids. So, the combination of many audio-video components is termed as multi-media learning package.

Multi-media packages of instruction include various components like structured lectures, team teaching, seminars, slides, taped commentary, workbook presentation, discussions, practical work, summary of materials and others. This ensures the mastery learning. In India, studies have been made on the effectiveness of multi-media by S. Mahajan (1992), M.K. Basu (1981), M.B. Menon(1984), V.P. Vardhini (1982) and others.

They have found that the multi-media approaches were effective with regard to achievement of instructional objectives and mastery level of learning upto 80 percent. Judicious combination of methods and media were found to be effective in achieving designed results. (P.K. Sahoo, Educational media research, 1994). Also, the above studies have found that multimedia packages were effective at school stage, college stage and teacher training stage. The multi-media packages were found to be effective with regard to cost and time.

Most of the media studies have proved the effectiveness of print based media, mechanical media and electronic media superior to or equally effective to the traditional methods/media based instruction. This multi-media approaches is the self-instructional activities type. Because of this positive effectiveness, the instruction can be extended to distance education situation also and can cater to a large size of the learners.

(Case Study): A pharmaceutical and Chemical Company of Bombay got the ISO 9000 Certificate ahead of 8 months schedule as they educated their employee through a Multimedia programme about their organizational pattern involving the executives managers and workers and others.
F. MULTIMEDIA CD-ROMs:

Instead of using various aids separately the same can be integrated and put them in a single medium like computer floppy or CD-ROM. It will further reduce the cost and increase the effectiveness more. So, MMLP in CD-ROMs are powerful than any other medium. The present MMLP through the computer, in CD-ROMs and internet provides all the above in easier and faster way to learn anything at anytime and anywhere.

The utilization of different media like video, audio, print media and information technology to produce video, animation and sound in a computer system is MULTIMEDIA. Multimedia revolutionized the functions of any personal computer. Multimedia can be defined as a convergence of computing graphics, digital texts, sound and telecom technologies, which allow the user to see any video clipping or film, hear any music or play realistic computer games. As the interactivity is the heart of the multimedia applications that provides an excellent help, the multimedia is preferred over all the other traditional information dissemination audio visual tools to impart the education and training. As the education and training have different levels of knowledge and skill, the degree of interactivity in multimedia also differs as per the applications.

In 1978, a group of electronics companies have decided to store the large volume of information, both audio and video, in a small disc digitally known as Compact Disk Read Only Memory (CD-ROM). Initially, the CD-ROM disk stored 650 mega bytes and now it stores more because of the latest technology. Thus the CD-ROMs have become industry's preferred medium for software and multimedia content distribution. It is a store of information, education and entertainment. This is a boon to the education. The CD-Rom is useful to create a presentation, computer based tutorial programmes. The technology has developed the users to create their own compact disks making it possible for them to use this storage medium in more ways for educational purposes.

Though some of the teachers are aware of these new methods of teaching –learning process, many are not. So, orientation courses to these methods are to be conducted for their full utilization for effectiveness of knowledge, attitudes and skill. Some of the problems arising out of these methods are the lack of training to use these package, paucity of funds, the infrastructure in that polytechnics. Probably these will be waning mostly by the
introduction of Internet provision to all the polytechnics in the State in the near future by Government and other agencies. Learning Resources Development Centre.

To minimize the financial problem, a LRDC at State level can be started and prepare the MMLPs by the polytechnic teachers through workshops, seminars and projects. The central assistance and the training know-how can be fully utilized in preparing more number of MMLPs in the form of CD-ROMs and distributed to all polytechnics at lesser cost as in Denmark. This will help the teachers and learners to use the course CD-ROMs for their improvement as well as to improve the quality of these packages. Through the World Bank Assistance programme recently in this State, 5% of packages have been prepared which is not adequate as the programmes and courses are more in the diploma and post-diploma level.

G. INFORMATION SUPER HIGHWAY:

This provides multiple options for learning to take place directly through

E- Mail
Internet
Pulling down learning text or videos
From video servers
Video conferencing or
Video telephoning.
3. WEB-Based Learning:

Web-based teaching has the advantage of learning without lecturers. Earlier, CBT packages were used for this purpose.

Advantages:

Creating a WBT module is very easy as incorporation of multimedia through HTML is simple task.

Students can use this WEB easily for training on using the web browser to use any WBT package.

WBT packages can be installed on the web server only but can be accessed by all the students.

Easy delivery of training to users.

Instant multi-platform capabilities.

Easy update of content

Shift from costly programming to interface and content design

Requires technical support

Option for installation on private network for security or greater bandwidth.

Multitasking capability suitable for electronic support system (EPSS)

Limitations:

Limited formatting of content in current browsers

Bandwidth/browser limitations may restrict instructional methodology

Limited bandwidth means slower performance for sound, video and intensive graphics.

WBT can be used for real-time and non-real-time as follows:
The dissemination of information started initially with ‘Gurukulum’ in early days within a closed space. The teacher and the taught were close and always together to get or receive information. As the technology advanced and the population expanding, the teaching-learning process has widened and the new ways of learning were found out through various audio-visual techniques for easy and effective learning. With the advancement in communication, the education has been implemented through closed circuit television and then on open air transmission of TV programmes such as UGC programmes, GYAN DARSHAN in India for mass education. And this has paved the way of distance learning through Radio and Television. Though, initially, it was mostly one-sided communication in which the learner could not talk to the teacher for any clarification in case of any doubts. But this was eliminated through interactive type of learning by audio and video conferences. Though the cost is high on transmission, the benefit or the result is very high and wide as it reaches more learners. The term ‘distance learning’ is more or less meaningless when the teaching-learning takes place through, ‘world wide web’ (www). This www bridged the physical distance between the teacher and the learner irrespective of the distance and their physical presence wherever in the world. This www facilitates instant
dissemination of course materials to any part of the world at anytime, anywhere. This creates a classroom like, real-time, face-to-face interactive learning through the Internet.

As Education should be available

just in time,

just enough to educate and not irritate and

just at the right pace to suit the learning speed of every individual,

one of the above new ways of learning must be adopted.
2.6 RAPID EXPANSION OF THE TECHNOLOGY
(STATE-OF-THE-ART TECHNOLOGIES)

Today, everyone is surrounded not only by the theories and ideas but by the Hi-tech gadgets, equipment and lifestyle. It will be difficult to live in future without these inventions. This continuous improvement on the technological front has brought forth extreme revolution and spectacular state-of-the-art technologies in IT. Some of them are given below.

Fig. 2  STATE-OF-THE-ART TECHNOLOGIES

2.6.1. DVD:

The Compact Disc has blossomed in to DVD (Digital Versatile Disk) which is digitized one and eight times of CD's capacity. These deliver the ultimate video & audio with a smooth, jitter free high definition video on the PC or big screen TVs, enhanced picture quality and an incredible digital sound audio.

This has 17 GB capacity, that is, 20 times of CD ROM and a playing time of approximately 480 minutes or 8 hours. These have a data transfer rate of 9.8 Mbps, than CDs 1.44 Mbps to 3.6 Mbps rates. The combination of a vast storing space, high data transfer rate, and efficient compression code means that DVD movies, games etc. can offer a
much wider and richer variety of interactive video choice. DVD drives now come with the ability to read the CD-R and CD-Rewritable media. Nowadays, CD-ROMs available with 5x CD-ROM drive and Dolby Digital Surround Sound.

2.6.2 IRIDIUM:

The Iridium system is a global wireless communications network that employs 66 Low Earth Orbit (LEO) satellites in conjunction with land-based wireless system to enable subscribers to communicate using hand held telephones and pagers virtually anywhere in the world. This system will improve the present confused and incompatible cellular scenario. The Iridium has designed a service that will route calls through land based systems when customers are with in the coverage area of its roaming partners. Outside of these local cellular coverage areas, users can stay connected via the global Iridium satellite network. This system ensures one digital phone service that keeps everybody connected regardless of where he travels on the earth. There will be one telephone number and one telephone bill wherever he goes in the world. This will be more ideal for worldwide access from remote areas and travelling professionals and globetrotting executives. And about 150 countries have signed up for offering Iridium services.

2.6.3 INTERNET 2:

The Internet 2, advanced to the Internet, is the new generation of network application in support of Scientific Research, Distance Education, Higher Education etc. to connect initially for 126 US Universities, which are now linked world over, as the existing net, world wide web etc. are jammed/crowded due to business and commerce, this Internet 2 has been developed to meet the emerging academic requirements in Research, Teaching and Learning. This will not replace the existing Internet, but goes along with it for specific purposes.

The University Corporation for Advanced Internet Development (UCAID) membership and Internet 2 participation are open to any University that commits to provide on campus facilities for any advanced application research and development. Though the cost may be high, at present, it will be less in the coming years because of more participants and the improvement in technology and users.
2.6.4 E-COMMERCE

E-Commerce is an amalgamation of number of business and IT concepts. It rides over the network technology, moves from intranets to internet, presents a variety of GUIs (graphic user interface) to the end users, connects to a host of servers and brings about a number of possibilities to implement business models of different types over the web sites.

2.6.5 MICROSOFT NET MEETING:

Net Meeting allows to share programs running on one’s computer with other Net Meeting participants even when the programme is not installed in his/her computer. Any participant in a conference can remotely view and control shared programs. Net Meeting (* White board, Chart, File Transfer and Shared Chip Board Tools) allows groups of people to conduct meetings, share information and annotate diagrams, text, comments in a shared work space that is two or more people participating in real time, interactive conferences even when they are separated by countries or continents. Thus Net Meeting delivers the real time, live conference experience.

* White board — allows online meetings of participants to draw pictures and Write text to illustrate one’s idea.

Chart — allows online meetings to send typed messages to each other participant. ‘Whisper’ feature provides text message to a particular person in the conference.

File Transfer — allows to send a file to all the participants in a meeting by dragging the file to Net Meeting Window.

Clip Board — provides a common chip board for participants. When one Person copies data to the clip board, others can paste in their Computers.

So, geographical separation no longer stop any two persons meet, share views, see each other and exchange information except of touching and feeling each other.
2.6.6 BLUE TOOTH TECHNOLOGY:

Blue Tooth is a Universal Radio Interface that enables portable electronic devices (Computer, PDAs, Modems, Mobile Phones, Mini Disk Players, Note Books etc.) simultaneously and without wires to connect to and communicate with up to 7 units with the following advantages and functions.

- The phone functions as Intercom in the office (no telephone charge), Cordless in the home (fixed line charge), Mobile phone while on the move (Cellular charge).
- Use of portable PC to surf the Internet anywhere regardless of connection to any of ISDN, PSTN, LAN etc.
- Accesses E-mail while the portable PC in the brief case. When the PC receives an E-mail message, it will be notified by the mobile phone. Browsing is also possible.
- Automatically synchronizes the Desktop Computer, Portable PC, Mobile Phone and updates the files in all.
- Increases sense of freedom through cordless mouse and keyboard connections to PC, Printers, Scanners or peripheral devices.

2.6.7 SPEECH RECOGNITION SYSTEMS:

This makes another freedom from keyboards and mice. This recognize and digitize the human speech. It takes the dictation directly that is keyed into the computer. Any document can be composed by speaking through mike and even edit or access information by speaking a command rather than navigating through menu. This will be more useful in Web Browsing. It is more secure for E-commerce applications and will be initiated only when the voice matching is satisfactorily executed.

2.6.8 MS WINDOWS CE:

Windows CE developed by Microsoft is an open, scalable Windows platform for a broad range of communications, entertainment and mobile communicating devices. The Windows CE platform is an operating system that allows new categories of business and non-PC consumer devices to communicate with each other, share information and connect to the Internet.
The Windows CE operating system is a 32 bit multi-tasking, multi-threaded Operating System that has an open architecture design to enable a variety of devices. A standard communication support, in the CA, allows access to Internet to send or receive E-mails or browse the Web. This adds a new definition to communications, entertainment and mobile computing that allows 'Talk' to each other and share information and access to Internet.

2.6.9 DIGITAL CAMERA:

The Digital process simplified the process of photo shooting, click a photograph, read it directly in the PC for any editing and post it on the Web. This is a natural extension of the digital image storage and manipulation technology. Here, the image is recorded on a 4MB erasable chip and then stored directly on a magnetic disk. Then transfer this image to the PC either through a link or a floppy disk. The processing speed is less than 2 second when compared to 10 hours or more for photo shooting and processing. It weighs only 225 to 300 grams. This is very good in terms of speed and convenience but high cost. However, it will come down because of competition of various companies shortly.
The following table gives a summary of the developments in CPU (Central Processing Unit) in the hardware and software area for its applications:

<table>
<thead>
<tr>
<th>Year</th>
<th>Model</th>
<th>Development Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>PC Collector's item</td>
<td>First Operating System support: DOS 1.0 single sided Floppy Disk. PC updated ROM  PC 640 K, memory updated ROM hard disk. PC/XT first version PC/XT portable</td>
</tr>
<tr>
<td>1983</td>
<td>PC Junior</td>
<td>DOS 2.0, Support for batch files, devices drivers, file handles, sub directories, 360 KB double sided floppy disks.</td>
</tr>
<tr>
<td>1984</td>
<td>PC AT</td>
<td>DOS 3.0, Support for 1.2 MB high density floppy disks, user-controlled file attributes. PC AT revision 1 PC AT, 30 MB hard disk Enhanced Key board, Speed governor PC convertible Intel 386 CPU-16,20,25,33MHz</td>
</tr>
<tr>
<td>1986</td>
<td>PC XT, 286, Sub model 2</td>
<td>Support for 3.5 inch floppy disk PS/2, model 60, sub model 5 DOS 3.2 PC/XT revision 2 PS/2 model</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
<td>Details</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>1987</td>
<td>PS/2, model 50, sub model 4 PC/XT revision 1</td>
<td>DOS 3.3, Updates foreign language character support, nested batch files, 4 serial ports (2 upgraded to 4), speed 19200 baud (9600&gt;19200)</td>
</tr>
<tr>
<td>1987</td>
<td>286 DPS released</td>
<td>PS/2 introduced by IBM</td>
</tr>
<tr>
<td>1987</td>
<td>Intel 80486 Spec. finalized 3.5 &quot; Disc introduced</td>
<td>MS released Windows/386</td>
</tr>
<tr>
<td>1988</td>
<td>Intel 386 released</td>
<td>DOS 4.0 released</td>
</tr>
<tr>
<td>1988</td>
<td>IBM launches the As/400</td>
<td>Support for disk partitions greater than 32 MB, Provision for visual shell.</td>
</tr>
<tr>
<td>1990</td>
<td>Portable CD-ROM drive</td>
<td>Word Star for Windows</td>
</tr>
<tr>
<td>1990</td>
<td>Tandy's PC Fax system</td>
<td>MS Office on CD-ROM</td>
</tr>
<tr>
<td>1990</td>
<td>Tiny 20 MB removable HDD</td>
<td>First ISDN net at Bangalore</td>
</tr>
<tr>
<td>1991</td>
<td>IBM 386 SX note book</td>
<td>Word 3.0 for Windows</td>
</tr>
<tr>
<td>1991</td>
<td>Fast high capacity drives</td>
<td>DOS 6.0 for Networking Services</td>
</tr>
<tr>
<td>1991</td>
<td>Intel launch of 586</td>
<td>New Specs. For MMPC</td>
</tr>
<tr>
<td>1992</td>
<td>Intel renames P5 to PENTIUM</td>
<td>NT PC has been launched</td>
</tr>
<tr>
<td>1992</td>
<td>IBM launches new PCs Intel classic Pentium CPU (From 60 To 200 MHz)</td>
<td>IBM launches OS/2 Warp in India</td>
</tr>
<tr>
<td>1994</td>
<td>EPSON introduces new (Colour)</td>
<td>Core flow by Corel</td>
</tr>
<tr>
<td>1995</td>
<td>Intel Pentium Pro. CPUs 150, 166, 180, 200 MHz</td>
<td>Windows 95, Word, Excel, Access, Power Point</td>
</tr>
<tr>
<td>1996</td>
<td>Cyrix 6x86 CPU, 133, 150 MHz</td>
<td>More finance packages released</td>
</tr>
<tr>
<td>1997</td>
<td>Intel Pentium with MMX technology 166,200,233 MHz</td>
<td>NT 4 , Internet Information Server 2.0 Evaluation of Window 98</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>NT 5 released</td>
</tr>
</tbody>
</table>
Intel Pentium II CPU 233, 266, 300 MHz
AMD K6 CPU 166, 200, 233, 266 MHz
IDP Win Chip – CPU 180, 200 MHz
Cyrix 6 x 86 MX CPU 150, 166, 188, 208 MHz

1998
Jan. Intel Pentium II - 66 MHz bus Windows 98 released

Apr. AMDK6 + 3D - 333 MHz
    " - 300, 350 MHz
    " - 100 MHz bus
    " - 350, 400 MHz
Cyrix M II - 300, 333 MHz
IDT c6 + - 300 MHz
Intel Celeron - 266 MHz Windows 98 released in the

Aug. Intel Celeron CPU - 300, 333 MHz market
Pentium II (Xeon) - 450 MHz

1999
Jan. Pentium III - 550 MHz TV in PCs launched

2000
Windows 2000 launched in Feb. the market

2001 Pentium IV - 1.0 GHz
Pentium IV - 1.2 GHz
2.8 SURVEY OF THE EQUIPMENT DUE TO RAPID CHANGES

2.8.1 Network Computer (NC): This is an alternative to PC having the following features

Decreases cost of buying, maintaining and owning a PC.

Cost will be around $500 (as on August 1998).

No Software is to be installed/upgraded/bought.

Performs all functions (Word Processing, Database and Spreadsheet etc).

A simple browser is enough to perform the above functions as all the companies are networked on the lines of Internet. Otherwise, applications can be down-loaded from the Server.

Easy to use Computer and inexpensive to maintain.

No Hard disk and so no recording is possible.

This NC contains a Work Station having 4 MB RAM, a low cost RISC CPU, Keyboard and a Mouse. Option of Floppy Disk. Ability to connect to the Internet through a central computer by a Modem/Ethernet, SVGA monitor or Home TV. This central computer stores all the software and user data to download whenever required and save the data. As the NC comes in a sealed case design, there is no hardware changes cannot be made by the user and he is free from incomplete hardware or hardware upgradation.

2.8.2 Network Personal computer (NPC):

Uses a range of processors from entry level to Pentium II in a sealed Case design.

No Floppy Drive or CD ROM Drive, no Hardware expansion slots.

Has smart Hard Disc prevents data loss.

Runs on Operating Systems such as Windows.

Can down load Software from the Central Computer.

Users of this NPC:

i. Corporations:

As the cost is reduced most corporate will navigate to this. It exists along with other PCs.
ii. Education:
Acquisition cost of PCs is very low. So one PC per student is possible. Hence faster improvement in educating the learners.

iii. Developing Countries:
Cost of acquisition and ownership is easy. Improved computing with others because of Telecom infrastructure of Internet.

iv. Consumers:
Ease of use and simplicity of the NC makes more people to the computer world.

As the price tag is low, and low cost of maintenance, NC will be attractive. Since it uses a low-cost CPU, it may not be possible to use packages like CAD, Accounting etc. For this, PC should be used. Hence NC will only complement and cannot replace them totally. It will be like the terminals used in LAN.

2.8.3 INTELLIGENT NETWORKS (IN) – Developments in telecom

Initially, in the Intelligent Network (IN), the intelligence resided in the switch. As the new services were introduced, this switching has become complex. As switch software has become more and more complex, a simple solution was to take the service logic away from the switch and place it in the Central computer that serve the network. The switches would hold interfaces that sent and received information through this central computer.

At present, the Intelligent Network market is inhabited by a mix of computer software and telecom. Free phone (toll free) and premium rate services are examples of certain Intelligent networks features developed using off-switch computing.

Advantages -

Intelligent network features include Universal Personal Telecommunication (UPT) or one number services, and Virtual Private Networks (VPN). UPT introduces the concept of the mobile terminal routing calls by various schemes to subscribers regardless of where they are:

VPNs allow services to be available over a wide area instead of on a switch by switch basis thus allowing four digit internal dialing and other features such as call hold, call forward and three way connecting through the public network. AIN (Advanced Intelligent Network) has come to differentiate the simple intelligent networks services (free phones).
Intelligent Network Components:

Intelligent Network includes the Service Switching Point (SSP)
- Service Control Point (SCP)
- Service Creating Environment (SCE)
- Service Data Point (SDP)
- Service Management System (SMS) & Intelligent Peripheral (IP)

Service Switching Point (SSP) - It is an element installed at the local exchange when a call requests an intelligent network service, by dialing a calling code that access a telephone service, the SSP sends the request over the signaling network to the SCP that uses Common Channel Signaling System 7 (CSS 7). It then awaits instructions on how to handle the call.

Service Control Point (SCP) - It is an intelligence behind an intelligent network. Receives requests sent by SSP processes and issues replies such call routing instructions for SSPs. It is immaterial the number of SCPs or where each switch has an SCP that it can access.

Service Data Point (SDP) - A database that connects and supplies an SCP with data.

When large data is to be stored, an UPT system contains several cross-referenced phone numbers for hundreds of thousands of customers. IP provides custom services for interaction between a user and the intelligent network. At present, this is voice processing, coupled with services such as speech and number recognition for wireless networks.

SCE & SMS - While SCE a design and modeling environment to develop and test new services before loading them on an SCP, SMS handles central network management for SCPs and is used to introduce and distribute new software throughout the network.

IN billing is similar to the toll operator billing. So in networks, where operator assistance, call collect and third party billing are incorporated into the billing infrastructure and enter the subscriber's invoice. IN involves capturing information and adding charges to subscriber invoices. Many current billing systems are inflexible and IN equipment needs accountability to generate reports. Technically, in the IN, the problems lies in incorporating existing voice and fax messaging interactive voice response and other network elements.
The Telecommunication Informatics Networking Architecture (TINA) standard purposes -

1. To merge AIN and telecommunication management with computer industry’s object oriented software and client / server distributed computing concepts
2. To remove these functions from their link to the underlying transport network.

TINA’s object definition language is a superset of OMGs (object management group), CORBA (common object request broker architecture) interface design language, using additional concepts for grouping stream interfaces and service attributes to support real time traffic in large networks.

TINA’s charter is to fill the role as the services-and-management platform for TATM and multimedia broadband services, i.e. Managing and providing the internet services and telecom infrastructure.

TINA is to co-exist and co-operate with all the existing IN services.

TINA -consortium (TINA-C), founded in 1993 consists of 40 telecom engineers and IT companies across the world at Bellcore, US as its headquarters.

TINA defines and validates as software architecture that allow communication services to be introduced efficiently in areas where computing, entertainment and telecom industries are merging.

Computing architecture describes the ‘plugging’ of software objects intro distributed processing environment.

Services architecture defines how services should be provisioned, accessed and used.

Network defines how network resources are ordered and used to establish end-to-end connections.

Management architecture gives specifications for issues related to configuring, accounting, performance and security.
TINA defines 'sessions' that can be any number of activities to achieve a purpose. Eg. ACCESS session defines the entrance into TINA services, allowing the user to access, make requests and retrieve information.

TINA defines three types of mobilities for future Universal Mobile Telecommunications Systems (UMTS)
- Personal mobility
- Terminal mobility
- Session mobility.

Personal mobility allows a subscriber to use services independent of their network point of attachment and specific equipment.

Terminal mobility makes use of terminals independent of the point of attachment to the network and exists today in the form of UPT.

Session mobility allows service sessions to follow the participant, i.e. That a subscriber can suspend a session and resume at a different terminal at a later point of time, i.e. The subscriber can request for information and access it ready at the next time.

**USER DOMAIN:**

```
\[\text{USER} \rightarrow \text{Retailer Domain} \rightarrow \text{Management of Services} \rightarrow \text{Service 1} \rightarrow \text{Service 2} \rightarrow \text{Service 3} \rightarrow \text{Service N}]
```

Connections, Networks, Resources

```
\[\text{USER} \rightarrow \text{Terminals} \rightarrow \text{Network Domain} \rightarrow \text{Content Domain}]
```
Figure gives an example of the TINA-C operating for service delivery to users through a telecom network. The user domain represents users and the terminal equipment. The content domain stands for those who produce/license content for wholesale use, such as multimedia information providers. The network domain represents a network operator, such as PTT, who provides the underlying connections to deliver the content. The retailer domain talks about brokers of information services who present and sell the available information services to the customer.

This Chapter provided a review of literature regarding the impact of computer in various countries, the various methods and media that can be adopted for instructional purposes, the technological pressure on education, status of the art-of-the technology and the basic skills required for the technician due to rapid change in technology. The impact of computer education is to anticipate the evolution through sound planning, implementation and research.

Eventhough the new technology provides varieties of the teaching-learning techniques, this involves heavy finance implications that cannot be met by individual polytechnic. Hence, it is suggested a center called LRDC (Learning Resource Development Center) can be set up at State level for developing and providing service to all polytechnics.
### 2.9.1 Road map for a career in S/W development

**Skills Requirement for software development are:**

1. **Personality traits**
   - communication skills
   - Problem solving abilities
   - Ability to work in a team
   - Ability to learn new skills fast

2. **Foundation Courses**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>TOPICS</th>
<th>Provision in</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer Fundamentals</strong></td>
<td>Basis of computer operation</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Usage of application packages such as</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>MS Office suite</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Internet usage</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Number systems</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Operating systems</strong></td>
<td>Functions of operating system</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Basics of DOS, Windows 95/98, UNIX etc.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Programming languages</strong></td>
<td>Fundamentals of procedural and object oriented programming, and knowledge of C &amp; C++</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Data Structures algorithms</strong></td>
<td>Basics of data structure, stack, list, queue, free, graph Searching and sorting algorithms</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Database management</strong></td>
<td>Fundamentals of database management systems, especially RDBMS such as Oracle, Sybase, DB2, Informix etc</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Multimedia</strong></td>
<td>Basics of graphics, audio and video storage and transmission and their file Formats</td>
<td>No</td>
</tr>
<tr>
<td><strong>Computer Networking</strong></td>
<td>Client/sever architecture</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Basics of LAN, WAN and protocols</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>TCP/IP protocol suite</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Internet application protocols such as</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMTP, FTP &amp; HTTP</td>
<td></td>
</tr>
<tr>
<td><strong>S/W Engineering Principles</strong></td>
<td>Software development life-cycle</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Software product quality and process quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Software quality management standards</td>
<td></td>
</tr>
<tr>
<td>Job</td>
<td>Knowledge and use</td>
<td>Required SKILL</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MULTIMEDIA: Author, Programmer</td>
<td>Macromedia Director Authorware</td>
<td>Logical thinker  &lt;br&gt;Creative  &lt;br&gt;Open to ideas  &lt;br&gt;A team person  &lt;br&gt;Interested in Music, special effects  &lt;br&gt;Good at comprehension and communication</td>
</tr>
<tr>
<td>Graphics Designer, Visualizer</td>
<td>Adobe Photoshop  &lt;br&gt;3D studio Max  &lt;br&gt;Fractal painter  &lt;br&gt;Dream weaver, Fireworks  &lt;br&gt;Web server knowledge</td>
<td>Creative and innovative  &lt;br&gt;Open to ideas  &lt;br&gt;A team person  &lt;br&gt;Ability to translate ideas to computer graphics</td>
</tr>
<tr>
<td>Sound engineer</td>
<td>Sound edit  &lt;br&gt;Wave studio</td>
<td>A music lover  &lt;br&gt;Creative with sound  &lt;br&gt;Master of innovation  &lt;br&gt;Alive to the moods of Music  &lt;br&gt;Comfortable with Technology</td>
</tr>
<tr>
<td>Animator</td>
<td>3D studio Max  &lt;br&gt;2D studio Max  &lt;br&gt;Lightwave 3D  &lt;br&gt;Softimage</td>
<td>Wildly imaginative  &lt;br&gt;Master of innovation  &lt;br&gt;Creative in sound, design and special effects</td>
</tr>
<tr>
<td>Video Engineer</td>
<td>Adobe Premier</td>
<td>Interest in photography and filming  &lt;br&gt;Interest in music, Special effects  &lt;br&gt;Open to ideas  &lt;br&gt;Innovative  &lt;br&gt;Good command over Language, Creative mind</td>
</tr>
<tr>
<td>Writer</td>
<td>Word processor</td>
<td></td>
</tr>
<tr>
<td>Role</td>
<td>Software/Tools</td>
<td>Qualities</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Web Designer</td>
<td>Photoshop 5.5</td>
<td>Dynamic Thinker</td>
</tr>
<tr>
<td></td>
<td>CorelDraw9</td>
<td>Team worker</td>
</tr>
<tr>
<td></td>
<td>Adobe Illustrator 8</td>
<td>Highly Creative</td>
</tr>
<tr>
<td></td>
<td>Dreamweaver</td>
<td>Open minded</td>
</tr>
<tr>
<td></td>
<td>Flash 3</td>
<td>Good Communicator</td>
</tr>
<tr>
<td></td>
<td>Fireworks</td>
<td>Continuously Updated</td>
</tr>
<tr>
<td></td>
<td>Director</td>
<td>A keen Net Surfer</td>
</tr>
<tr>
<td></td>
<td>HTML JAVA</td>
<td></td>
</tr>
<tr>
<td>Content Creator</td>
<td>Standard Office Application on Computers</td>
<td>A Good Command</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A strong Language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactive Personality</td>
</tr>
<tr>
<td>Database Administrator</td>
<td>Oracle and databases</td>
<td>Highly analytical</td>
</tr>
<tr>
<td></td>
<td>Meticulous</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assimilating Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demographics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Worker, Net surfer</td>
<td></td>
</tr>
<tr>
<td>Programmer</td>
<td>HTML JAVA, PERL</td>
<td>Technically sound</td>
</tr>
<tr>
<td></td>
<td>CGL, JAVA BEANS</td>
<td>Logical Thinker</td>
</tr>
<tr>
<td></td>
<td>CORBA, COM, DHTML AND ASP Technologies Knowledge</td>
<td>Implement ideas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good Communication</td>
</tr>
<tr>
<td>Web Master</td>
<td>UNIX, Linux, Win NT</td>
<td>Mind of one</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technically sound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical Experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aware latest info-tech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Web-site security</td>
</tr>
</tbody>
</table>

**SOFTWARE:**

<table>
<thead>
<tr>
<th>Role</th>
<th>Skills/Experience</th>
<th>Qualities</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Leader</td>
<td>Project management s/w Leadership experience Updated Info-tech</td>
<td>Programmer first Motivator</td>
<td>Yes</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Experience Programmer Business Management Degree</td>
<td>Good Manager Good training admini Motivator of team</td>
<td>Yes</td>
</tr>
<tr>
<td>Software Engineer, Programmer</td>
<td>Technically sound Engineer in</td>
<td>Any discipline Good Com</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Mathematical Thinker
Implement Ideas
Experience in
Info-tech, Interactive
Analytical

**Advanced Computing**
- MCA, ME or Ph D
- Experience in
  Software
  Development
- Info-tech Expert
- Academically Strong
- Continuously Updated
- No

**HARDWARE AND NETWORKING:**

**Networking Engineer**
- Knowledge of
  Computers
- CNE or MCSE
- Analytical
- Technically sound
- Yes

**Customer Support Executive**
- Diploma / ITI
- Thorough Knowledge
  Live Problems
  of computers and
  hardware
- Patient and helpful
- Yes

**Customer Support Manager**
- Computer knowledge
- Networking procedures
- Dynamic Person
- Interactive Person
- Good Training
- Ability to Motivate
- Good Administration
- Technically sound
- Update the latest trends
- Yes

**Operations Associate**
- Yes
- Internet concept,
  Installation procedure
  Maintenance of
  Websites, contents
- Good communication
- Evaluation of news items
- Dealing with customers and vendors

**System Analyst**
- HTML design and
  Development, Java script,
  Java servets, JSPs, Java Beans,
  Dreamweaver, MS SQL server,
  SQL, HTTP, FTP, security etc
- Basic computer H/W, peripheral
  connections, network knowledge,
  UPS, scanners etc. Engineering degree holder
- Yes
<table>
<thead>
<tr>
<th>Course Name</th>
<th>Job Description</th>
<th>Pre-requisite or Human</th>
<th>Content to be learnt</th>
<th>Future Use or Job Resource</th>
<th>In diploma or post-diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing Basics</td>
<td>To attend basic operation</td>
<td>Fresh/first timer, Basic</td>
<td>Basic PC terms, DOS, Windows, English knowledge</td>
<td>Any type of job in an office</td>
<td>Dip.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MS-Office, Internet Browsers, e-mail, Net surfing</td>
<td>or job-work</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spread sheets, Presentations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H/W and Networking</td>
<td>To attend the calls, on tour mostly, fixing computer crashes, S/W clashes, a challenging job to solve problems in hardware and software</td>
<td>Very patient, have a knack of trouble-shooting with all sorts of customers, thorough knowledge of computers working of computers working and installation procedures</td>
<td>PC structure, PC Components, Use &amp; installation of cards, cables and peripherals, trouble shooting techniques</td>
<td>Setting up &amp; maintenance of individual PCs and organisational networks, to attend works for some companies that take up AMC in various offices/places</td>
<td>Dip. Post-</td>
</tr>
<tr>
<td>Customer Support Executive</td>
<td>Installing new S/W on installed m/c and provide after sales service Service</td>
<td>Helpful, good in problem-solving, technically sound</td>
<td>Technical working knowledge of Computers Basics of H/W, assembling of PCs systems, installing peripherals, installing Operating system and applications. (Diploma / TTI level)</td>
<td></td>
<td>Dip.</td>
</tr>
<tr>
<td>Customer Support</td>
<td>In-charge of customer satisfaction commercially</td>
<td>Technically and commercially</td>
<td></td>
<td></td>
<td>Dip.</td>
</tr>
</tbody>
</table>
Manager

smooth running of organisation

sound, up to date
in all technically,
happenings, dynamic
practical and
interactive in all,
Good with training
and retaining people,
motivating, team capacity
good administration
experience.

3. Multimedia
Author/ Programme

comfortable with
technology, a
logical thinker,
Creative, having
music knowledge,
have a flair for
special effects.

Macromedia
Director
Authorware

(ii) Sound
Engineer

A music lover,
creative with
Sound, effective,
Innovative, Cool
with technology.

Sound Edit
(Mac)
Wave studio

(iii) Animator

Expert innovator
with wild
imagination,
creative

3D studio Max

(iv) Video
Engineer

Works with live
video and change
into usable
format for the
product

Good in photo-
graphy, filming,
music and
special effects,
open to new ideas.

Adobe
premier

(v) writer

Conceptualise
the story,
presentation
and script
writer

Imaginative
creative, fluent
strong knowledge
base in the required
area

Any word
processor
MS Word
Web-e-Commerce

(i) Web Designer

Quick dynamic thinker, a team person, strong with design, graphics and Animatory, up-to-date with latest, keen Net surfer

Photoshop 5.5
Corel Draw,
Adobe Illustrator
and Dream Weaver.
Flash 3, Fireworks,
Director, HTML.
JAVA

No

(ii) Programmer

Develops programmes that are used at the site.

Technically sound, logical thinker, up-to-date technologist in internet tools.

Web design, web development and management technologies.

No

No design, publishing databases and web servers.
Courses include: JAVA Perl, CGI, JAVA Bean HTML, Web programming CORBA, COM, DHTML ASP.

Data Base Administrator

Sorts, collects, records information in Databases, designs secure databases and links them to program

Highly analytical, meticulous, dedicated logical, high on assimilation good with demographics, a good Team worker, a keen Net surfer

Oracle knowledge of other DBases
Post-

Dip

Software Programming:

(i) Software Engineer

Lead or Develop s/w Programs and programmers

Technically sound, Communicative, Analytical, having hands-on experience-awareness of latest in IT, Practical, interactive with all.

Engineering in any branch or MCA programming
Dip.

(ii) Project Leader

Responsible for guiding and executing the New projects in

Strong in Techno- logy, interactive, a good motivator carry people along updated
Dip.
## PRIMARY SKILL SET

### SKILL SETS

<table>
<thead>
<tr>
<th>Area of Work</th>
<th>Skill set required</th>
<th>Applications</th>
<th>Provision in Diploma or Post-diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software maintenance</td>
<td>COBOL, RPG, As400/mainframe, Linux and C, Software maintenance tools such as SCCS</td>
<td>Y2K, Eurocurrency, maintaining legacy software</td>
<td>PD</td>
</tr>
<tr>
<td>Software quality</td>
<td>Development experience for two years; quality standards such as ISO 9000, SEI-CMM, PERSONAL Software Process (PSP)</td>
<td>Quality management across organisation / division</td>
<td>NO NO</td>
</tr>
<tr>
<td>Application Engineering</td>
<td>SAP, PEOPLES OFT, Baan, Oracle Financials, Manufacturing / HRD / Functional experience in areas such as Production, Finance, material management</td>
<td>Enterprise resource planning for large organization</td>
<td>YES YES</td>
</tr>
<tr>
<td>Application Software</td>
<td>C/C++/VC++ in DOS, Windows UNIX environments</td>
<td>Development of application Software for IT user organisations, educational software development</td>
<td></td>
</tr>
<tr>
<td>Database management</td>
<td>Any RDBMS; Front-end tools such as Developer 2000, Power Builder, VC++ etc. ODBC, data warehousing tools.</td>
<td>MIS applications, data mining data warehousing</td>
<td>YES YES</td>
</tr>
<tr>
<td>Network computing</td>
<td>HTML, CGI Script, Java/JavaScript/VJ++ ODBC, CORBA, DCOM</td>
<td>Dynamic Web page creation, internet applications, internet comment distributed computing</td>
<td>YES</td>
</tr>
<tr>
<td>Emerging areas of IT</td>
<td>VRML, Computer graphics Knowledge engineering Speech processing</td>
<td>Virtual reality, interactive video, entertainment software Expert systems, pattern recognition systems speech recognition, speech synthesis.</td>
<td></td>
</tr>
<tr>
<td>Software tools Development</td>
<td>Highly specific to the tool to be developed: Compiler design principles</td>
<td>Compiler development, cross comp Development, 'third party' controls for existing development tools</td>
<td>PD</td>
</tr>
<tr>
<td>Telecom and Computer Telephony Integration (CTI)</td>
<td>Telecom protocols such as GSM, ERMES, No.7 Signalling, ISDN, ATM</td>
<td>Mobile communication, paging systems, interactive voice response systems, call centers.</td>
<td>-</td>
</tr>
<tr>
<td>Systems Software Development</td>
<td>C Internals of operating systems</td>
<td>Device drivers, networking software, object oriented operating systems, virtual instrumentation</td>
<td>YES</td>
</tr>
<tr>
<td>Firmware Development</td>
<td>Realtime operating systems such as PSOS, OS-9, VX Works, C</td>
<td>Process control applications, telecommunications systems, realtime systems such as Speech recognition, monitoring systems, instrumentation</td>
<td>NO</td>
</tr>
<tr>
<td>Systems Administration</td>
<td>UNIX shell programming, RDBMS administration tools, netowkr management tools, internet server administration, intranet administration, Web Server administration</td>
<td>Administration of systems networks and databases across an organisation or campus</td>
<td>YES</td>
</tr>
</tbody>
</table>

7. **Secondary Skill Set**

<table>
<thead>
<tr>
<th>Primary Skill Set</th>
<th>Secondary Skill Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDBMS</td>
<td>Unix...NT</td>
</tr>
<tr>
<td>RDBMS</td>
<td>Java tools</td>
</tr>
</tbody>
</table>

8. **Updating/Stay learning as the technology changes so rapidly.**
**Table 1: SOME TRADITIONAL TELECOM JOB TITLES**

<table>
<thead>
<tr>
<th>MANAGER LEVEL</th>
<th>TECHNICIAN LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Manager</td>
<td></td>
</tr>
<tr>
<td>Network Planning Manager</td>
<td></td>
</tr>
<tr>
<td>Network Designer</td>
<td></td>
</tr>
<tr>
<td>Network Design Manager</td>
<td></td>
</tr>
<tr>
<td>Network Application Development Manager</td>
<td></td>
</tr>
<tr>
<td>Network Application Development Specialist</td>
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<tr>
<td>Video Communication Manager</td>
<td></td>
</tr>
<tr>
<td>Video Communication Specialist</td>
<td>Voice Communication Technician</td>
</tr>
<tr>
<td>Data Communication Manager</td>
<td></td>
</tr>
<tr>
<td>Data Communication Specialist</td>
<td>Data Communication Technician</td>
</tr>
<tr>
<td>Network Services / Support Manager</td>
<td></td>
</tr>
<tr>
<td>Help Desk Manager</td>
<td>Help Desk Specialist / Technician</td>
</tr>
<tr>
<td>Network Security Manager</td>
<td></td>
</tr>
<tr>
<td>Network Operations Manager</td>
<td>Network Security Technician</td>
</tr>
<tr>
<td>Network Data Administrator</td>
<td>Network Operations Technician</td>
</tr>
<tr>
<td>LAN Service / Support Manager</td>
<td></td>
</tr>
<tr>
<td>LAN Installation / Maintenance</td>
<td>LAN Service/Support Technician</td>
</tr>
<tr>
<td>LAN Manager / Administrator</td>
<td>LAN Installation Maintain Technician</td>
</tr>
<tr>
<td>Control Centre Manager</td>
<td>Control Centre Technician</td>
</tr>
</tbody>
</table>

**Table 2: SOME NON-TRADITIONAL TELECOM JOB CAREERS**

- Consultant on specific network products.
- Fault tolerance specialists/consultant.
- Independent NW planner/design/installer.
- Independent technical support/specialist.
- Independent trainer for specific NW products.
- NW cabling consultant/installer.
- NW security consultant.
- System integration consultant.
- Turnkey NW solutions vendor.
- Wireless communication specialist/consultant.
A. TEACHERS:
- List of faculty
- Bio-data of faculty
- Salary details
- Teaching schedule
- Monitoring of the wards
- Staff development requirements
- Software developments
- Consultancy

B. STUDENTS:
- Bio-data institution wise, branch wise
- Admission procedure
- Progress in their studies
- Software developments
- Student academic records

C. EXAMINATION CELL:
- Exam schedule
- Preparation of panels of paper setters, evaluators etc.
- Tabulation of marks
- Declaration of results
- Issuance of certificates
- Analysis of results, outcomes or inferences
D. LIBRARY:
- List of books, journals, films, cassettes
- Issues and receipts of books etc.
- Classification of books, cassettes, CD-ROMs and journals etc.
- Budget orders, purchase and payment for books, journals, periodicals etc.

E. FINANCE:
- Details of plan and non-plan allocation, expenditures, estimates
  Plan – activities under 5 year plan
  Non-plan – Activities under previous plan/outside present plan
- Institute wise allocation and expenditure regarding water, electricity etc.
- Salary details of all the staff

F. HOSTEL:
- List of inmates and their bio-data
- Monthly expenditure, stores inventory
- Monthly mess dues, arrears
- Establishment details
- Staff details, requirements, pay, PF, retirement benefits

G. OFFICE:
- Routing financial activities
- Office procedures, codes and conduct
- Salary details of all the staff
- Preparation of reports at various levels from daily to yearly
- Database of all the staff

H. STORES:
- Stores inventory
- Receipts, issues, requirements, monitoring of all the articles related to the institute.
- Purchase procedures, documents
- List of suppliers, agents and other details to purchase.

I. ADMINISTRATION:
- Reports on progress of the department, institute etc.
- Arrangements of meetings, analysis of reports and other policy decisions.
- Providing the necessary resources to all departments as per the new technology.
- Optimum utilisation of resources, directions, recommendations
- Admission of students in the institute.

• Notification of advertisement for entrance test.
• Details of seats availability in each branch, institute, courses offered.
• Procedure and details regarding entrance test.
• Receipt of application and allocation of test places etc.
• Conduct of entrance test, result, counseling etc.
• Details of fees and admission to each institute.