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INTRODUCTION
CHAPTER-1

INTRODUCTION

Engineering is the activity of man by which he seeks to control and direct the resources of nature to his own use and benefit. Taken on this broad basis, it constitutes one of the main endeavours of man and is quite distinct from his other activities such as his achievements in politics and Government, in artistic expression or his religious aspirations, and his reaching out to the unknown. It traces its beginnings almost to the dawn of human existence on this planet and would embrace the craft of the prehistoric hunter and his primitive attempts to make and use weapons. It would cover the endeavours of man to master materials available from the Stone Age and Eotechnic Era onwards.

The ancients who come within recorded history have some very considerable engineering works to their credit. Many can still be seen in whole or in part, such as the pyramids of the Egyptians, the magnificent temples and public buildings of the Assymans, of the Greeks and the Romans, the irrigation systems of the Egyptians and the Romans, and the remarkable roadways, still the basis of some of the English roads today after 2,000 years have passed.

Throughout this long period of development, science, which is the understanding of basic principles, played but a small part. Knowledge, largely gained from experience, was passed from generation to generation, mainly through a priestly caste, as a body of known and established fact.

It was not until the fall of Constantinople in 1453, and the revival of learning that followed it, that men's minds began to appreciate the importance of a knowledge of natural laws in supplementing the techniques and skills already developed.

At one time India was noted for the superior quality of its science and technology. Mohenjo-daro, for instance, provided good examples of our knowledge of town planning, civil engineering and architecture. Even earlier, the Rig Veda spoke about canals and dams. When Alexander the great invaded this country, among the things he took away were steel ingots, suggesting an era when India produced steel
of fine quality. Later on, a blight seemed to have descended on the country. While India decayed, other countries progressed.

Several causes have been at work in India to bring about a gradual decay in this country. In the first place, technical efficiency used at one time to be a matter of hereditary endowment; and one's birth determined one's profession as well. In the second place, the State except during the last few years never paid enough attention to technical education. Till 1940 technicians were trained mainly for administrative needs. Moreover, the training of the hand has long been neglected in favour of the intellect and we have been accustomed to place technical education third in our educational values. We attached the greater importance to University education and then to secondary education. Only after these two come what we call technical education. Thus, technical education was grossly neglected.

But this feeling is fast disappearing and the wave of enthusiasm in favour of technical education has been steadily rising in the country. This education is considered as essential for better earnings. Parents and students undergo great sacrifices and personal inconveniences for a degree or diploma in engineering because of the great opportunities it offers in life. Infact, India is today fully conscious of the importance of Machine, Movement and Energy - the three dominant forces that characterize twentieth century civilization. The modern wars have also shown that victory depends more upon skill then courage and that workshops are ineffective without millions of trained hands. India is trying to rise to the occasion. She has fully realized that for the development of her vast material resources including her untapped mineral wealth, water and agricultural potentialities and for the nationalization of her key industries, it is urgent to provide the greatest facilities for training up an army of technicians.

1.1. MEANING OF TECHNICAL EDUCATION:

Technical Education is one of the most potent means for creating skilled and technical manpower for the developmental tasks of various sectors of the economy. It forms one of the most important and crucial components of human resource development with great potential for adding value to products and services, for contributing to national economy and for improving the quality of life of the people. It incorporates a technological dimension which is a vehicle for development. Technical education may itself imply high costs, but such high costs, being directly
related to development, should be viewed as an essential productive investment, yielding valuable return to society and contributing to socio-economic development. The Scientific Policy Resolution (1958) rightly, states "The key to national prosperity apart from the spirit of the people, lies, in the modern age, in the effective combination of three factors—technology, raw-materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources and reduce the demands on capital".

The science and technical education and research in India have made significant contributions to the overall development of the country. From a merely agriculture based society in the early forties, India is today rated among the biggest industrialised nations having a sound base of industries alongside a highly developed agriculture sector. As we march towards the 21st century and, with our policies of economic liberalisation, it is imperative that our development efforts are supported by the relevant science and technology inputs on one hand and relevant human resources on the other. Technical education and research have thus to play a very significant role in the changed economic scenario. For this, they need proper reorientation.

1.2. DEFINITION OF TECHNICAL EDUCATION:

Technical education is one of the most significant component of human resource development spectrum with great potential for contributing to the national economy and for improving the quality of life of the people.

The Dictionary meaning of technical is: - Technical: means of or pertaining to the useful or mechanic arts, on any science, business, profession, sport or the like especially appropriate to any art, science, business or the like; as technical training problem, skills, words. Technician. One skilled in a particular craft or art or trade and skill Education: The word 'education' has Latin derivation. In Latin the word "Educare" means to draw out, to bring up, to foster. If this implication is accepted then education becomes the process of drawing out the dormant qualities from within rather than imposition of some quality from outside.
According to the Dictionary of Education, technical education means education in vocational or technical subjects provided in a secondary school or further educational institution.

Technical education is that type of education in which the trainee has to acquire some specific techniques on the basis of which he may convert raw materials into finished products. Through technical education one acquires a capacity to earn his living. By having this capacity, he starts production of some kind.

In 1962, UNESCO said the term "Technician" applies to persons working in occupations requiring a knowledge of technology and related sciences between that of a skilled worker and that of an engineer or technologist; occupations at technicians level may call for inspection and maintenance, detailed development plans, supervision of production work, detail construction. Collaboration with the engineer is an essential part of the work of the technician". The Huddersfield Conference on the Education and Training of Technicians held in 1966 identified technicians as being those people employed in the broad spectrum of occupations lying between the craftsman on the one hand and the professional (or technologist) on the other.

1.3. IMPORTANCE OF TECHNICAL EDUCATION IN INDIA:

Good development of any nation depends upon natural resources, physical energies and skilled manpower. If there is lack of any of these three fundamental necessities, no nation can progress well. For all these three fundamentals, technical education is necessary. Evidently, its importance cannot be overemphasised.

Some countries in the world lacking in many natural resources are able to organise good manpower on the basis of technical education. This skilled manpower converts the raw materials brought from other countries into finished products and has thus made its country very prosperous. Needless to say that good technical education may be very helpful in making a country prosperous even when it lacks in natural resources.

India does not lack in natural resources. However, it lacks in facilities for technical education. We have a huge manpower which is not in a position to contribute adequately to the growth of national prosperity in absence of good and comprehensive technical education. It is true that we have made some provision for technical
education in our country after the achievement of Independence, but better facilities are still necessary.

The country now stands on the threshold of the 21st century. The last half of this 20th century has transferred our environment, perhaps drastically and brought some distinct changes in our lives and thinking than in any corresponding period in history. These are the consequences of discoveries and inventions in Science and Technology and their applications. The concept of absolute knowledge for the sake of storing knowledge is perhaps no more relevant today. Our efforts in reconciling the traditional concepts and approaches with the demands of the technology age, cannot provide simple solutions for our difficult and complex problems, based only on storing knowledge. Frontiers of knowledge are expanding rapidly and with more modern tools making it possible to acquire the same at a much faster rate and thereby enabling us to devise more efficient methods for solving the problems of the society. The jet age, nuclear energy, inert navigation, manned space missions, genetic engineering, robotics and automation etc, to name only a few, have all made the universe smaller. Along with this, we are facing the catastrophe of shortage of non-renewable energy resources which threaten the very existence of civilization in the entire universe.

Under these conditions, education should not only aim on storing information and mastering skill, but proliferate into areas of innovation and creativity hitherto unheard of. This obviously leads us to a closer introspection of our educational system to make drastic changes and make it relevant and competent to face the future.

Technical education may be regarded as a tool for ushering such changes in an orderly manner. It is an effective instrument to meet the challenges for building a dynamic, vibrant and cohesive nation, sensitive to the needs of the people and to create a better, fuller and more purposeful life. The role of technical education in the development of a nation is a crucial one and hence development of this field is a critical factor in the nation building process.

1.4. **PURPOSE AND AIMS OF TECHNICAL EDUCATION OF INDIA** :

The purpose and aims of technical education in India are the following:

The purpose and aim of technical education, for that matter, all education, is
to develop an integrated personality in every person so that he can lead a happy life in an environment of material comfort. In particular, technical education should aim at training well educated and cultured citizens equipped with a knowledge of modern science and technology, capable of skilled work, physically fit and healthy, and imbued with a spirit of patriotism. They should be devoted to their fellow citizens and ready to contribute through their work and their way of life both to the prosperity of the nation and to the cause of peace and amity among the nations. In addition, they should have the capacity to appreciate and have regard for moral values in life. Their minds should be capable of attuning themselves permanently to a state of happiness, no matter what depressing or elevating situations they may have to face in life.

Technical education should aim at training the student for rational thinking and for training the senses and muscles for acquiring skill in work. The skill a student acquires should be such as to give him joy in the hours of his leisure earned through expertise in producing useful products. Mental and physical work should be complementary to each other.

Broadly speaking, technical education at all levels should apart from ensuring training in general citizenship concentrate on the fulfillment of the following objectives:

a) To train the mind in a rational way of thinking on any given problem and deducing conclusions in a scientific way.

b) To teach the art of planning in the use of natural resources for economic, industrial and housing purposes, use of earth for burning bricks and so on.

c) To develop powers of observation in understanding how nature works and how machines work.

d) To develop manual skill in fabricating the process of production.

e) To develop qualities of discipline to subordinate one's own inclinations to promote the general good of a community, group or the school, or the
country itself, to develop qualities of leadership, initiative, capacity to obey and such other characteristics which will promote social well being of the individual, the community, the country and the world.

f) To use his leisure hours in the development and pursuits which give him happiness and establish harmony and peace in his environment.

Apart from these general aims, technical education should be purposeful. Each stage of technical education, craftsman, diploma and other stage, should be an end in itself, so that students breaking off at any stage will be able to make a living from the technical skill they acquired. They should promote technical development of the country instead of joining the army of the unemployed as the white-collared science and arts educated boys and girls do specially at the end of the middle school and high school stage.

Although self-sufficiency is the aim at each stage of education, preference should invariable be given to those who have covered one stage to get admission to go to the next stage, i.e. vertical movement may be made possible. Curricular for studies should be drawn up with this end in view. This measure will result in giving new dimensions of respectability to craft and other technical education, where there is none now. When once it is known that preference is given in admission to those who have already acquired a skill, almost all boys and girls will then be attracted towards technical education so that the best among them can always be selected from the previous stage to the next higher stage. Those not selected for admission can earn their livelihood by the skill of the craft they have already acquired.

The utter despair and frustration which the boys and girls now feel when denied admission to technical courses, and the anti-social traits they develop towards the community in general and the Government in particular will not then be there to the extent it is now prevailing.

1.5. DEVELOPMENT OF TECHNICAL EDUCATION IN INDIA BEFORE INDEPENDENCE:

The issue of technical education has not come before us all of a sudden. It has already been there, since ancient days. With the changes in time, ideas, circumstances and needs of life, its shape has been changing.
The development of technical education in India before Independence can be divided into two periods: Ancient Period and Modern Period.

**Ancient Period**: In India from the Vedic times, if not earlier, technical training was imparted from father to son. It was also restricted in scope to certain castes. Each caste or community specialised generally in a particular craft. We find reference to technical education in the Rig Veda and Atharva Veda. In the Rig Veda we find vivid description of construction of canals, bridges, vehicles incorporating fast speed and beautifully planned palaces.

During the Epic (The Ramayana and The Mahabharata) period, the technical education as prevalent in the Vedic age continued. In the Ramayana we find frequently reference of Rama’s journey by Pushpak Viman (i.e., Aeroplane) and construction of bridge for going across the sea to Sri Lanka (Ceylon) for conquering Ravana. In the Mahabharata we find mention of houses made of wax. The ruins of Mohenjodaro and Harappa reminds us of the technical skill of that period. Of this period we find description of means of fast transport for going from one place to another and also of weapons and fire-arms used in wars.

During the Buddhist period also, technical education was not neglected.

During the Muslim period, the art of woodwork, architecture, and drawing developed remarkably. Technical education during this period was not however organised. The trainees used to learn the art under the strict personal control and supervision of the artisans concerned.

**Modern Period (British Period)**: After the establishment of the British rule in India, the Britishers engaged themselves in consolidating it. For this purpose, they needed various types of workers. Amongst these, they felt the need of technicians in various areas. It was very costly to borrow these expert workers from abroad, so they decided to open some technical schools and also colleges in India. This led to the establishment of industrial schools attached to factories and other engineering establishments. While it is stated that such schools existed in Calcutta and Bombay (Mumbai) as early as 1825, the first authentic account we have is that of the Industrial School established at Guindy, Madras (Chennai) in 1842, attached to the Gun Carriage Factory there.
The Indian Education Commission (1882) recommended that there should be two types of high schools, one leading to the entrance examination of the University and the other of a more practical character intended to fit the youths for commercial, vocational or nonliterary pursuits. But these recommendation were ignored.

The first Engineering College was established in 1847 at Roorkee by Mr Thompson the then Lt. General of North Western Provinces for training of Civil Engineers. A College of Science was established at Poona (Bombay Presidency) in 1854 as Poona Civil Engineering College for the purpose of training subordinates for its Government departments. The Madras Civil Engineering College was established in 1862 in the Madras Presidency. The Victoria Jubilee Technical Institute (VJTI) was started in Bombay (Mumbai) in 1887. Probably the Bengal Engineering College as it is called now, at Sibpur was established around the same time or may be earlier than the Imperial College established in London.

The next important phase in the development of technical education in India was the appointment of the Indian Universities Commission by Lord Curzon in 1902 under the Chairmanship of Dr. T. Raleigh. The Indian Education Policy Resolution was issued by the Governor General on March 11, 1904. It advocated a new approach to the development of technical education in India. This was followed by another policy statement by the Governor General in 1913 a decade later, stressing the importance of technical education. An Indian Institute of Science, designed on an elaborate model, was established at Bangalore in 1911.

The credit of first starting courses at degree level in mechanical, electrical and chemical engineering should go to the leaders of the Swadeshi Movement in Bengal who in 1907 started a National Council of Education, the offspring of which is the present College of Engineering and Technology at Jadavpur. In 1951 the Indian Institute of Science, Bangalore, opened course in electrical engineering leading to the grant of certificates and associateships. Thanks to the indefatigable efforts of the great patriot Pandit Madan Mohan Malaviya, degree courses in mechanical, electrical and chemical engineering as well as courses in mining and metallurgy was started in 1917 in the Beneras Hindu University.

Altogether the number of technical and industrial schools had risen by then to 218 in different States (then called Provinces) and the number of pupils attending them, to 10535. No attempt had, however, been made to regulate and control
standards of technical education. All these institutions were managed by the State Governments and the user agencies, viz. Railway etc.

In 1921, Lord Lyton appointed an Education Committee for considering the problems of technical education. According to the recommendations of the Committee, technical institutes were opened at New Delhi, Kanpur, Dhanbad, Bangalore and Madras (Chennai). Abbott - Wood Committee in 1937 also recommended for technical education but the outbreak of the World War-II in 1939 put a stop to the scheme. In 1941, the Delhi Polytechnic was established.

The report of the Technical Education Committee of the Central Advisory Board of Education, 1943 and the Sargent Report, 1944, however, stressed the need for the development of technical institutions as an integral part of the national system. In 1945 it was decided to open atleast four technical colleges in four regions- East, West, South and North - of the Country.

It was in response to the challenges of the post-war period that the All India Council for Technical Education was set up by the Government of India in November 1945, on the recommendations made by the Central Advisory Board of Education. The Government recognised the need for a planned and balanced development of technical education and considered that, as a preliminary to such a development, a survey by a competent body, of the existing facilities and probable post-war requirements was necessary and decided that the All India Council for Technical Education itself may be assigned the task of this survey and advice.

Prior to the setting up of the All India Council for Technical Education in 1945, technical institutions were run on private and/or provincial basis to meet the requirements of a particular industry or province. The salary scales and the status of the teachers in these institutions varied from state to state and even from institution to institution in the same state but were generally related to salary scales of the PWD's which managed these institutions.

Since the establishment of the All India Council for Technical Education the development of technical education at all levels both in its diversity and numbers has been rapid and more so after the advent of Independence in 1947.
1.6. DEVELOPMENT OF TECHNICAL EDUCATION IN INDIA AFTER INDEPENDENCE:

In 1947 when India became free, there were in the country 38 institutions with a total admission capacity of 2,940 students per year for the degree course. There were also 53 Polytechnics with a total admission capacity of 3,670 students per year for the diploma courses. After Independence our leaders began to pay more attention to the need of technical education in the country. In 1947 the Government of India established the Scientific Manpower Committee for estimating the training needs in the various technical spheres.

Positive steps were taken by the establishment of AICTE in 1945 and a Scientific Manpower Committee in 1947. AICTE approved a committee under the Chairmanship of N.R. Sarkar to advice the Government of India on the facilities and schemes for development of technical education. The Sarkar Committee recommended establishment of four higher technological institutes with a total capacity of 2000 under graduate and 1000 graduate students. I.I.T. at Kharagpur was established in 1951, followed by Bombay, Kanpur and Madras in 1957, 1959 and 1960 respectively.

In 1948-49 the University Education Commission made some suggestions for the promotion of technical education in our country. The Engineering students should be given practical training at the concerned industrial centres. Provision for higher education and research should be made in the field of engineering. Necessary changes should be introduced in the technical and engineering courses according to the needs of the country.

The Report of the Secondary Education Commission (1952-53) also suggested that for the improvement of technical education a close relationship should be established between the industries and technical schools. Various types of technical and vocational courses should be taught.

Highest priority of technical education was given during the First and Second Five Year plans and College of Engineering and Technology was established in New Delhi which was later designated as I.I.T. Fifteen Regional Engineering Colleges were proposed of which 14 were established between 1959-1964 and the 15th in 1977.
The First Five Year Plan of Technical Education envisaged on the one hand the optimum development of facilities for technical education at least up to the University first degree level in all regions of the country, and on the other the development of facilities for training in certain branches of engineering and technology for which no facilities exist in India. The Second Five Year Plan provided an outlay of Rs. 487 million on the development of technical education as against approximately Rs. 230 million on the First Plan. In the Third Plan the total provision for education was Rs. 560 crores and out of this Rs. 142 crores was for technical education which is about 25 percentage. The Fourth Plan outlay (1960-74) for technical education was Rs. 123-17 crores.

With the policy to encourage establishment of Engineering colleges and Polytechnics with financial support from private agencies, nine Engineering colleges and 23 Polytechnics were established during the Second Plan. In 1948-49 there were 38 Engineering colleges and 53 Polytechnics with an admission capacity of 2940 and 3670 respectively. By the end of the First Plan (1951-56) the intake capacity doubled in degree colleges and tripled in diploma colleges. By the end of the Second Plan (1960-61) the numbers of degree colleges increased to 102 and Polytechnics to 195, with admission capacity of 13820 and 25800 respectively. The out-turn of graduates and diploma holders increased from 1270 in 1947 to 5700 in 1960-61 for diploma holders. By the end of 1963-64 the numbers of degree colleges increased to 120 and Polytechnics to 269 increasing the admission capacity to 20780 and 40000 at the two levels.

The Engineering Personnel Committee appointed by the Planning Commission in 1955, estimated that 26500 students in degree and 50500 in diploma would be needed in 1960-61. This target was revised twice during the Second Plan and new targets for admission facilities set at 19500. No serious shortage was anticipated but for the Fourth Plan, the admission facilities were proposed to be revised to 20000 and 40000 by the end of 1965-66. In fact, the facilities created in 1963-64 was considered adequate to meet the target.

The Indian Education Commission (1964-66) also known as the Kothari Commission took some positive measures in the direction of technical education in our country. The Kothari Commission Report remarked that our Country needs more of technicians than engineers. Hence more technical schools (IITs) and Polytechnics
needs to be opened. Polytechnics should be located only in industrial areas, while those already functioning in rural areas should develop courses allied to agriculture and agro-industries. Polytechnics should increasingly adopt sandwich type of courses in co-operation with industry. Courses of special interest to girls should be offered in all Polytechnics at both the certificate and diploma levels and girls completing the lower secondary course should be encouraged to take them up. Technical education should be production-oriented. The technical students should get workshop experiences. Refresher courses, in-service training, summer courses and comprehensive colleges should be organised for reforms in teacher education in the technical institutes.

Due to industrial recession, the intake of Engineering Colleges and Polytechnics was proposed to be reduced by 30% in 1968. But in 1974, the AICTE suggested that the earlier cut back in admission may be restored. By 1977-78, the admission figures were brought back to 25000 and 50000 on an All India basis.

During subsequent years demand for admission, particularly at the degree colleges, increased considerably because of many factors, one of them being the large increase in the number of the eligible high school learners preparing for a career in engineering. The popular demand of students whose employment was not restricted to the jurisdiction of the state or even the whole country induced some state governments and private enterprises to expand existing institutions or set up new institutions with or without approval of the AICTE or the Government of India. In 1980-81 the admission capacity increased to 38200 for degree and 60000 for diploma in 174 degree colleges and 354 Polytechnics.

The National Policy on Education 1986 (as modified in 1992) underlined the need for reorganising the technical and management education system to effectively deal with the changes in the economy, social environment, production and management processes and rapid expansion of knowledge and advances in science and technology.

It laid specific guidelines for the qualitative and quantitative development of the technical and management education sectors; establishment of linkages amongst the concerned agencies, manpower assessment and technical education forecasting, increasing effectiveness of technical education management system, proper delivery systems, measures to achieve greater cost effectiveness and generation of resources through suitable means. It further states that technician education has to play an
important role in developing highly skilled middle level technician manpower for the organised as well as the unorganised sectors and necessary steps will be taken to make technician education flexible, modular and credit based with provisions for multi-point entry to achieve this goal. Programme of Action (POA) - 1992 spells out the steps for implementation of the National Policy on Education.

The Programme of Action for implementation of NPE (POA) lays stress on women's equality with regard to education and employability and entails for increased access of women to vocational, technical and professional education in existing and emergent technologies.

Today, there are 372 technical institutions at the degree level and 958 technical institutions at the diploma level with an annual intake of 88,930 and 1,52,554 students respectively, these include regular Engineering Colleges, Polytechnics, Indian Institutes of Technology Regional Engineering Colleges and other institutions. There are about 100 centres offering post graduate programmes in Engineering and Technology with an annual intake of over 9000 students. The Government has set up about 450 major S & T research laboratories under its various departments and ministries. There are also about 1360 recognised in-house R & D laboratories in public and private sector undertakings. More than 200 consultancy firms are engaged in engineering, design, analysis and research. There are four Technical Teachers Training Institutes (TTTI's) one each in Madras, Chandigarh, Calcutta and Bhopal.

However, in spite of this significant development in the field of technical education, a lot more have to be accomplished in respect of increasing its coverage and enhancing its accessibility to various categories of people and improving its productivity. In addition, the changing scenario by turn of the century in socio-economic, industrial and technological areas needs to be considered to enable the system to play its role with greater relevance and objectivity.

1.7. EXISTING EDUCATIONAL INSTITUTIONS FOR TECHNICAL EDUCATION IN INDIA:

Both Engineering Colleges and Polytechnics are included in technical education.
Engineering Colleges:

Pattern of organisation of Engineering Institutes in India (offering courses leading to first degree) in respect of the administrative structure, and managerial and financial control is not uniform. It, in fact, differs from one institution to the other. Broadly, engineering institutions can be classified into the following five homogeneous groups - homogeneous in respect of administrative and financial arrangements.

1) Indian Institutes of Technology.
2) Regional Engineering College.
3) Engineering Departments/Colleges maintained by Universities.
4) Colleges of Engineering/Technology administered by the State Governments.
5) Private Colleges of Engineering and Technology.

Indian Institutes of Technology: These institutes were established under an Act of the Parliament as centres of advanced learning imparting training to both undergraduates and post graduate students. In addition these institutes were set up with the objective of improving the quality of technical education within the country, by undertaking to develop the faculty of other engineering and technology institutions. The Act declared the Institutes of Technology as "Institutions of National Importance" and rendered them autonomous with freedom to formulate their own academic programmes and confer degrees, diplomas and other academic awards of their own. Though autonomous, each Institute of Technology function under the overall guidance and directions of a Board of Governors in all respects academic, administrative and financial. These are wholly financed by the Central Government.

Regional Engineering Colleges: These colleges endeavour to develop engineering education within the regions covered by them. They are conceived as large-sized engineering colleges and located on All India basis at selected centres in the country. Further, they function as joint co-operative ventures of the Central Government and the State Governments (in the region). They are autonomous and formulate their own academic programmes. However, these colleges are not empowered to give their own degrees, but are affiliated to universities in the region. In respect of administrative, managerial and financial matters they are controlled by
Boards of Governors. They are party residential in character with hostel facilities and residential accommodation for the staff of the college, though stay within the campus is not compulsory on the part of either students or staff.

**Engineering Colleges/Departments Maintained by Universities** : These are administered in a manner similar to the management of any other department in the university concerned. Finances, form part and parcel of the finances of the University. Admission policies, academic standards, etc, are all laid down by the University concerned.

**Colleges of Engineering and Technology Administered by the State Government** : In addition to the Indian Institutes of Technology, Regional Engineering Colleges and University Colleges/Departments of Engineering, there are other Government Colleges which are the sole responsibility of the State Government concerned. These Engineering Colleges are referred to as "State Government Institutions". Administration and management of such colleges is under the direct charge of the Director of Technical Education of the State concerned. In respect of academic matters they are affiliated to a University in the State and receive guidance from the University concerned in the formulation of academic programmes.

**Private Colleges of Engineering and Technology** : These are referred to as "Private institutions" and are established by private agencies. It is also possible that part of the nonrecurring and recurring expenditure is borne by the Government-State as well as Central. For the purpose of administration and management, these colleges are governed by a Managing Committee. On academic matters they are governed by the University to which they are affiliated.

**Polytechnics** : Polytechnic Education caters to the middle level technician education. The Polytechnics provide facilities for study in diploma and certificate courses in Engineering and Technology after H.S.L.C. (10 +). The main objective of the Polytechnic course of studies is to produce technicians at supervisory level to meet the demand of technical manpower in various fields of development. In the past, the complaint was that the Polytechnic courses were mostly theoretical with very little practical bias and they were a poor imitation of the degree courses and therefore, they did not really serve the middle level technical personnel requirements. Further, the complaint was that no attempt had been made towards specialisation, that is, no attempts were made to produce specialised technicians. Perhaps the situation...
has not changed much due to the proliferation of substandard institutions. The Central Government has launched a massive project with the assistance of the World Bank to enable the State Governments to upgrade their Polytechnics in capacity, quality and efficiency, which is quite laudable. Modernization of the existing Polytechnic system with the assistance of the World Bank is aimed at.

The brain storming session held in the Planning Commission on Polytechnic Education discussed in depth as how to reorient Polytechnic education and the discussions resulted in bringing out a document titled "Towards Excellence in Polytechnic Education Perspective for the year 2000 and Beyond". This document among other things, discusses a new concept of Polytechnic education, which envisages new goals and missions for the Polytechnic education system and its operation.

### 1.8. THE ALL INDIA COUNCIL FOR TECHNICAL EDUCATION (AICTE):

It is the most important body, advising the Central and State Governments on matters relating to the organisation and development of technical education in the country beyond the school stage. It was set up in November, 1945. It consists of representatives from all interests concerned such as Parliament, Central Ministries, State Governments, private industry and commerce, Labour, Professional bodies, Inter University Board and so on. As it has representatives of so many interests, it is rather a large body of 60 members. For the day-to-day work of the Council, there is a small coordination committee as the representative of all the interests in the Council. In fact this committee is the executive body of the Council.

On the recommendations of the Council, four regional committees-Northern, Southern, Eastern and Western have been established in different regions for supervising technical institutions and for coordinating the provision of technical facilities in their respective regions. The headquarters of these committees are at Kanpur, Madras, Calcutta and Bombay respectively. The Council has also set up seven Boards of Technical Studies, and with the assistance of these boards have prepared National Diploma and Certificate Courses in the basic branches of civil, electrical and mechanical engineering, chemical engineering and technology, commerce and applied arts. Part-time courses for the benefit of employees in industry
and technical departments of the Government have been designed. The Council also appointed expert committees to make recommendations on the curricular and syllabi for technical high schools.

The Council also recognised that the provision of facilities at the post graduate level had been sadly neglected and they were, therefore, extremely limited both in the range of subjects covered and the number of institutions. It, therefore endorsed the recommendations of the Sarkar Committee that four higher technological institutions should be established, one in each region, to meet the needs of high grade technical personnel required for the implementation of various economic development schemes. Further, that each one of these institutions should make provision for post-graduate courses and advanced work and research in a variety of subjects for a large number of students. The Council also appoints a committee for preparing post-graduate courses in the various branches of engineering. The Council normally meets a year to discuss broad policies, problems and programmes, whereas the regional committees and co-ordinating committees meet more often.


The All India Council for Technical Education Act. 1987 : (52 of 1987)
As passed by the House of Parliament. It became effective from March 28, 1988. Its objective was to provide for the establishment of an All India Council for Technical Education with a view to the proper planning and co-ordinated development of the technical education system through-out the country, the promotion of qualitative improvement of such education in relation to planned qualitative growth and the regulation and proper maintenance of norms and standards in technical education system and for matters connected therewith.

For partial fulfilment of the provisions of the Act. AICTE has, besides other activities, taken up the programme of international co-operation with specific objectives of strengthening of friendly relations, technology base, and promoting co-operation by exchange of technical educational resources with developed and developing countries.
1.9. WORLD BANK ASSISTED TECHNICIAN EDUCATION PROJECT

Technician Engineering Education is considered by the Government of India as an important sector of education for industrial growth and development and for the production of quality output. Technician engineering form a vital link between the people who are engaged in design, development and planning, and the operators who use their physical and technical skills in construction and production in the field and in the industry.

Over the post four decades since the establishment of Polytechnics for the training of technician engineers, these institutions have rendered great service by providing trained technical manpower which made a significant contribution towards the rapid growth of construction, manufacturing and service sector industry in the country. While this is a fact, it is also true that over a period of time the industry is increasingly complaining of a mis-match between their needs and the performance of the Polytechnic product, Prior to 1990 the Government of India commissioned a number of studies which established the need to strengthen the Polytechnic education system in order to improve its quality and efficiency. This called for a very large investment in this sector of education. As a result, a massive project for strengthening technician engineering education with the assistance of World Bank was undertaken in two phases. The first phase covering 9 states for a period of 7 years will conclude in December 1998.

The World Bank Assisted Project for Strengthening Technician Education has three major components :-

1) Capacity Expansion: By expanding and diversifying programmes in the Polytechnics, setting up of new Polytechnics (co-educational and residential women) and continuing education centres and departments; strengthening community Polytechnics; and establishing Polytechnics for the physically handicapped.

2) Quality Improvement: Through modernising equipment and facilities of Polytechnics; intensifying teacher training and updating curricula, strengthening and developing libraries and Learning Resource Utilization and Development Centres.
3) **Efficiency Improvement:** Strengthening structures like State Boards of Technical Education and Directorates of Technical Education in the State; undertaking industry-institute interaction programmes; encouraging internal resource generation in Polytechnics; and establishing facilities for maintenance of equipment and buildings.

The most important aspect of the project is the quality component. Some important steps to improve the quality of training incorporated in the World Bank Assisted Project are:

(a) Faculty development through continuous training and retraining of teachers to keep them updated; (b) introducing courses in new and emerging areas of engineering and technology and periodic evaluation and revision of existing curricular to render manpower training responsive to changing technological requirements of industry; (c) modernisation of workshops and laboratories; and (d) close interaction between institution and industry to ensure relevance of training imparted at Polytechnics.

**NATIONAL PROJECT IMPLEMENTATION UNIT (NPIU):**

The NPIU is a Government of India Unit for World Bank Assisted Project for Technician Education. The NPIU provides guidelines for monitoring and implementation of the project, providing technical advice and undertaking many other activities for the review, evaluation and implementation of each sub-components of the project. In this process NPIU regularly interacts with the State Project Implementation Units in Directorates of Technical Education, T.T.T.Is, and the project Polytechnics. Recently NPIU has started monthly monitoring of the project. This greatly helps in sharing of information on project implementation and keeping the project on course. Interaction between the States and the NPIU for regular exchange of information and for sharing of experiences is necessary and vital for successful project implementation.

1.10. **NEED OF TECHNICAL EDUCATION FOR GIRLS IN INDIA:**

In the modern world of today the role of women is experiencing a whole range of innovations, changes and a great variety of propositions for modifying the institutional fabric of the society. The role of women, outside the home has become
an important feature of the social and economic life of the country and, in the years to come, this will become still more significant. The whole purpose of education has changed as a result of technological development. It is no longer confined to the transmission of knowledge or a heritage of learning. The world of tomorrow which would usher in an information rich and technology intensive society calls for new approaches to learning. Rapid and profound changes are taking place as a result of the development of science and technology. Social and cultural values, which were once accepted as a part of one's life, are now assailed as outmoded, and irrelevant to modern conditions. Since women are regarded as having special responsibility in safeguarding the value system of the society, their education should not only insist on the pursuit of academic excellence, but also help individuals to adjust themselves to these changes which are overtaking society.

The need to bring women into the mainstream of development has been a national concern since Independence. Article 15 of the Constitution prohibits any discrimination on grounds of religion, race, caste, sex, etc. In fact Article 15(3) clarifies that States can make special provisions for women and children. The seventies brought women to the forefront of development with the publication of the Report of the Committee on Status of Women in India.

Development of technical education for women has been a deliberate policy of the Government of India since Independence. Against the background of 50 percent of the population being women in our country, the percentage of girls joining the technical institutions is very low. A large gap exists between the utilisation of provisions by men and women in the field of technical education. "The National Committee on Women's Education" had thereby urged the Government to initiate actions to close the gap that exists between men and women in technical education in the shortest possible time.

The Report of the Committee on the Status of Women in India (1974) made the first assessment of the status of the Indian women and the Report has highlighted the women as individuals with rights of their own. The Technology Policy Statement in 1983 in its preamble states that the technology policy "aims at ensuring that our available natural endowments especially human resource is optimally utilized for a continuing increase in the wellbeing of all sectors of our people".
It hardly needs any further emphasis that the access of women to technical education needs to be improved to optimise their participation in the main stream of the technical work force and to contribute to the industrial economy of the nation. In order to make a meaningful impact the National Policy on Education (1986) stressed the need to provide more and more opportunities to women for access to technical education.

The Programme of Action, revised in 1992 spells out strategies for implementing the National Policy. Women's enrolment in diversified courses in new and emerging technologies is to be enhanced.

The Programme of Action for implementation of NPE (POA) lays stress on women's equality with regard to education and employability and entails for increased women's access to vocational, technical and professional education in existing and emergent technologies.

The World Bank Assisted Project on Strengthening Technician Education further reinforced the need to reduce the imbalances in the enrolment of men and women in technician education. The Technical Teachers Training Institutes, (T.T.T.I's) along with National Project Implementation Unit (N.P.I.U.), New Delhi conducted a national seminar on Jan. 1994 for devising strategies for enhancing participation of women in technical education.

Girls as well as women should receive not as good, varied and comprehensive a general education as boys and men but also suitable professional and technical education such as would fully equip them for their duties both in the home as well as outside. The destiny of a nation is moulded and fashioned through its educational process and in this the technical education of women has a strategic importance. Therefore, to improve the enrolment of girls in technical education, efforts must be made to attract more and more girl candidates to join the technical institutes.

1.11. PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION IN INDIA:

In India women constitute nearly 50% of the population. The literacy rate according to the 1991 census is 52.11%. While 63.86% of men are literate, women
literacy stands at only 39.43%. A large gap exists between the utilisation of provisions for education of males and females in general and technical education in particular.

Technical education helps in harnessing the abundantly available natural resources of the country, which may indirectly contribute to the national wealth and material progress and add to our country's international prestige. It is in this context that the Government of India has given the utmost importance on the development of technical education in the country. Although technical education has developed and diversified significantly in the last two decades, the participation of women in technical education is still low. Compared to the vocational/professional courses it is found that 60% of the females opt for traditional graduation in arts and commerce. The rest 40% comprise of science, medicine and technical graduates. Thus our development and economy is being deprived of the support of about 50% of the population of females.

For the last two decades the development of technical training facilities for girls in new and emerging areas have considerably expanded. Inspite of the expansion of range of jobs open to women in public and private sectors, the participation of women technicians is still not encouraging. Their participation in the workforce in organised sectors though slightly increased during the last few years is not enough. For instance in 1970-71 there were 90034 total engineers and technicians in the country of which women engineers and technicians were only 910 bearing 1.0 percent of it. The participation of women in organised sector was 11.5% in 1971, which became 12.3% in 1981. The enrolment of girls in engineering courses increased 17 times from 1960 to 1983, but its absolute magnitude continued to remain about 5% of the male enrolment.

Women in technical education restrict their participation to limited number of jobs. Social barriers, certain prejudices and attitudinal constraints come in the way of education and employment for the women.

Women's technician training programmes are being offered in specific traditional disciplines. However, only a small number of women, about 11% enrolment, participate in technician education, largely because of absence of residential accommodation and their reluctance to enrol in co-educational institutions. The National Policy on Education (1986) recommended that a larger proportion
## ENROLMENT OF FEMALE STUDENTS FOR VARIOUS TECHNICIAN LEVEL PROGRAMMES IN SOME STATES OF INDIA

<table>
<thead>
<tr>
<th>States</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>TN- Tamil Nadu</td>
<td>39</td>
</tr>
<tr>
<td>KE- Kerala</td>
<td>33</td>
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<tr>
<td>PO- Pondichery</td>
<td>29</td>
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<tr>
<td>RA- Rajasthan</td>
<td>27</td>
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<tr>
<td>KA- Karnataka</td>
<td>26</td>
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<tr>
<td>AP- Andhra Pradesh</td>
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<td>DE- Delhi</td>
<td>25</td>
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<td>GU- Gujrat</td>
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<tr>
<td>UP- Uttar Pradesh</td>
<td>16</td>
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<tr>
<td>HA- Haryana</td>
<td>15.8</td>
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<td>MH- Maharastra</td>
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<td>MP- Madhya Pradesh</td>
<td>14</td>
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<td>AS - Assam</td>
<td>11</td>
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<td>BI- Bihar</td>
<td>9</td>
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Current National Average 22% (1994)
National Average 11% Pre-Project Status (1991)
of technical education and training be given to women at all levels and that the focus should be on modern technologies for industrial employment.

Although some States have shown remarkable progress in enhancing the enrolment of girls students, the picture in most other States is still gloomy, (as shown in Figure-1). Well directed efforts by all the concerned agencies are needed to improve the situation. Fortunately women's technician education forms an important sub-component of World Bank Assisted Project for Strengthening Technician Education in the country.

The percentage of women students enrolled for various technician level programmes ranges from 9% in Bihar to 39% in Tamil Nadu. It is encouraging that some of the State Governments have come out with comprehensive policies for women. Maharastra deserves a special mention in this regard. Most SPIUs are also devising strategies for enhancing women's enrolment by devising new programmes, opening of new women's Polytechnics, hostels for women, adding women's wing in existing Polytechnics etc. These steps are surely a step in the right direction, but much more needs to be done by all key players i.e., NPIU, DTE's, SPIUs, TTTIs and the Polytechnics.

1.12. PROBLEMS OF TECHNICAL EDUCATION IN INDIA:

Before Independence, very little attention was given to technical education and India's industrial development was controlled by dominant needs of British industries. It is no wonder, therefore, that after two hundred years of British rule, India was not able to produce a locomotive engine or even a needle. Higher production was never encouraged, heavy industries were neglected and there was nothing but retail trade in foreign manufactured articles.

All these has been changing since India become free. Today, the Government and the people recognize the vital role which technical education can play in stepping up production and uplifting our standard of living. The Fifth Five Year Plan laid sufficient stress on basic and heavy industries. Tremendous activity is also going on in the sphere of technical education and industrial research in the country. This is not only a landmark in the history of industrial development, but represents the first systematic and planned efforts to apply science and technology to the development of our national industries.
Despite all these, grave inadequacies, past and present, still exist and can be ascribed to many factors. These factors are described below:

**Inefficient Administration**: It is indeed true that AICTE (All India Council for Technical Education) has done very valuable work in the field of technical education. But it is unwieldy in size. Its co-ordinating committee meets very frequently but obviously the decisions thus taken tend to be more administrative than academic and practical.

There is lack of co-ordination in the field of education at the State level, due to the creation of a separate Directorate of Technical Education. It is found that various departments and agencies are involved in programmes of technical training at the school, Polytechnic and college levels. The Department of Labour, General Education and Technical Education often do not agree. Each tries to adopt its own programme and pursue it in isolation. Rivalry at times results in negative results. The consequences are fatal, and the students are the worst sufferers.

Very high positions in public sector undertakings are held by I.A.S. officers and at various ministries and government levels. Technical ignorance of these highly placed persons (administrators and engineers as well) account for the collaboration and aid packages from the USSR, U.S.A. and other foreign countries. While acceptance of financial aids from these countries is not to be deprecated it is of vital concern to the nation to know how it is affecting the industrial and economic development of the country. Such a policy has led the country's development plans from one failure to another.

**Lack of Technical Man-power**: The problem of training technical manpower involves the mobilization of resources to ensure, firstly, that the requirements for national development are adequately met at all levels and in all sections of industry; secondly; that over the whole country technical education is raised to, and maintained at, the highest possible standard; and thirdly, that such education is qualitatively and quantitatively in balance with technological education. In the context of rapid industrialization, the first requirement tends to dominate others, but it is well to remember that it is almost impossible to make short-cuts in education and that quality can be sacrificed only at great peril.
It is indeed true that much has been done in the last thirty years to increase the facilities for technical education and to estimate the needs of technical personnel. But Government has woefully failed so far to match demand with supply. The paradox of acute technical man-power shortage in certain industries together with alarming surplus technical staff in others continues to stare the country in the face. At the same time, if the economy does not expand at the expected rate, the problem of unemployed technicians will become even more acute than it is today.

**Lack of Accreditation and Co-ordination** : There is a general deterioration in the standard of technical institutions. It is partly due to political pressure on the universities and the Government, lack of qualified staff, poor equipment etc. There is no incentive in terms of pay and prospect for teachers as the AICTE pay scale is yet to be implemented fully resulting in resentment and disinterest looming large amongst the experienced senior teachers.

**Lack of Technicians at Lower and Middle Levels** : There is a fair rate of progress in the training of technicians at lower and middle levels, but these fields need greater attention since trained workers are needed in industrial concerns in the interest of increased efficiency. It is not too much to hope, therefore, that in the years to come factories will start training schools for their workers and that such schools will indeed become as common a feature as they are in other industrially advanced countries. The growth of small scale industries has also increased the demand for technically qualified persons at the lower and middle levels. Unfortunately, this aspect of technical education has not been given the attention it deserves.

**Inadequate Programmes and Courses of Study** : Our training is also not upto the mark. As things stand today, our engineering colleges turn out graduates who do routine jobs only. For the major undertakings we have to look to outside to solve our problems. There are also frequent complaints from industry that they do not like what the college teachers are doing with technical education. Those in the educational institutions have been watching with interest the progress of their outgoing graduates and their impression is that these young men feel that they are being taught too many of unnecessary things and too little of what is required. The young engineer's knowledge is most inadequate in respect of the tools and fixtures to be used on the shop floor or in choosing lightening arrestors or in setting the relays while working on an electricity system, on fixing the dimension of a pen-stock or in calculating the cost of a workshop building. While some of these can be taught in colleges...
and schools, the industry must also carry out its responsibility of training and educating the engineers.

**Problem of Medium of Instruction** : The mother-tongue has been accepted as the medium of instruction in the country up to the secondary stage. After passing this stage, when the student takes admission in some technical institution, he is given the training through English, because good books are not available on the subject in his mother-tongue. This creates a great difficulty for the trainee. Consequently, many capable students are left behind. He has to devote much time to the study of English at the neglect of the technical subjects.

**Paucity of Teachers** : During recent years, there is a grave concern over the shortage of teachers. This is mainly due to a large demand for technical personnel in the country. In addition, there is shyness for the technical scholars to move on to the teaching profession. This is the result of many socio-economic factors. Apart from the fact that for technical scholars, industries throw open ample lucrative openings with better service conditions than the educational institutions, teaching is considered in India as a job of second importance, socially, economically and culturally.

The notion that an engineer in a factory is more productive and important than a lecturer in an engineering institution, however baseless it may be, still prevails in India. Such being the case, competent scholar-technicians shudder to enter into teaching profession; with the result that it is the fresh graduates and post graduates, generally not good at teaching who creep into the educational institutions. Teaching is not a mechanical process, it requires man of character, dynamic talent and imagination.

**Lack of Proper Workshop Practice** : Technical education in India is also suffering for want of a proper workshop practice along with academic study in schools and colleges. While other branches of learning can be closed within the four walls of an educational institution, technical instruction can never be restricted to a classroom. The institution with its workshop and laboratory is, no doubt, the main centre of instruction, but real practical experience can be given in outside workshops, factories and farms only.

**The Problem of Post-Technical Education and Training** : This problem has not yet been attended to in our country. After getting the training, if the trainee remains
unemployed for some time, he forgets all that he has learned in the technical field concerned. And those who are lucky enough to get some employment continue working for years according to the old method that they learnt several years ago. They hardly get any chance for acquainting themselves with the latest devices and techniques. Needless to add that they forget also the theoretical aspect of the training that they obtained.

_Lack of Proper After-school Education_: There is another aspect of the problem, as our workers are to be trained to make a worthy use of their leisure. A worker can do better, provided he recoups his energies at regular intervals. Education for leisure thus plays an important part in improving the general efficiency of labourers. It develops the whole personality of a man as a producer. But unfortunately even our best industrial concerns have neglected this important feature of modern education. A few sporadic attempts have, no doubt, been made; some factories have organized classes for giving their workers a rudimentary knowledge of the three R's but these attempts are more or less haphazard. Strikes of labourers for increasing their wages are quite common in this country, but even our labour leaders have not paid the slightest attention to improving the living standard of workers. Most of the labourers seek relief in wine-shops, as soon as their day's work is over. Better wages have not improved their mode of living to the slightest extent, and nothing has been done practically to increase their efficiency as workers and citizens. The conception of modern Polytechnics with their halls, reading-rooms, swimming pools, theatres, games and dramatics appears to be a distant dream in this country.

_Inadequate Research_: There is an urgent need for concentrating attention on industrial research work, which is still in its infancy in this country. Most of the advanced nations attach great importance to such a type of work, which has contributed to their national development. The U.S. Government currently spends somewhat more than 2.8 percent of the Gross National Product on research and development and testing of defence equipment. China spent in 1960 on industrial and scientific research and technical development about 1.54 percent of the total national budget. As against these figures, the current level of research and development expenditure in our country is about 0.26 percent of the Gross National Product. This worked out to Rs. 50 to 60 crores a year during the Third Plan.

India has presently established a network of national laboratories and institutes in various parts of the country. But the field of technical and
industrial research is so vast and the problems awaiting investigation are too many that the present rate of progress in technological research must be considered tardy.

The absence of adequate research in Indian industries is telling on the cost of industrial products which are being priced out of the international markets. It is also reflected in unsold stocks. If proper research into diversification of products to suit the changing market conditions in the country had been attempted probably the industry would not have been saddled with these stocks.

The main reason for the failure of industrial research to deliver the goods is that industrial research in our country tends to be academic instead of being dovetailed to the requirements of industry. It has few points of contact with the industrial world which is the chief consumer of research results.

Lack of Co-ordination between Industry and Technical Education:

While an ordinary school can stand independently on its own legs, a technical school is a product of its own environment; the economic needs of a locality lead to the establishment of the school and the institution in return tries to satisfy local demands through proper supply of an adequately trained personnel. But the aims and volume of instruction to be provided for any particular branch of industry should be carefully defined. At the same time, technical education is not a matter for educational institution alone, as the entire cooperation of industrial organisations with technical institutes is necessary, if the instruction provided in technical school and college is to be adequate and appropriate. Thus industry and technical education can no longer be considered to be two separate entities. A common alignment between both of them is very necessary.

1.13. SUGGESTIONS TO SOLVE THE PROBLEMS IN TECHNICAL EDUCATION:

1) Administration and Control: The Education Ministry of the Government of India should take up the responsibility of technical education in the same way as it looks after general education as a whole. A Council of Technical Education may be organised for looking after the various implied issues. Suitable persons from various relevant departments may be requested to serve on this Council. The setting up of such a Council should be done both at the Central and State levels. This will bring in uniformity in administration and control of technical education.
A Statutory Board of Education in every State, coordinating the activities of various agencies of education towards a common goal is needed. Top executives of public and private sectors should be drawn from the engineering and technical professions. Even the posting of an engineering officer involves considerable technical consideration with regard to the requirements of the job, qualifications, special training and type of experience of the man proposed to be posted.

2) **The Need for Technical Man-Power**: It should be realized that technical education should not be extremely specialized in character, except in its advanced stages, but should aim at imparting a sound knowledge of fundamental principles which are applicable to different tasks, and at as high a degree as possible of skill.

The expansion of technical education in India should, however be done with caution and full regard to the development of organized industries. Technical education should be both quantitative and qualitative. The problem of training technical manpower involves the mobilization of resources to ensure that the requirements for national development are adequately met at all levels and in all section of industry.

3) **Accreditation and Co-ordination**: It is high time that a system of accreditation on a national level is introduced. Accreditation of technical institutions must, doubt, be in the hands of the All India Council for Technical Education and the Central Government must be responsible for the general policies and other matters. Unless the political influence of the State Governments (where the institutions are located) is reduced, the quality of our technical education cannot be improved. One of the suggestions to avoid political influence is to have an All India cadre for Engineering Colleges as it is in vogue for other services. Reforms in the system of examination can be implemented only if the institutions are given autonomy in their internal administration and to award their own degrees. AICTE may consult professional bodies like the Institutions of Engineering and the Indian Society for Technical Education (ISTE) before launching such a programme.

4) **Training of Technicians at Lower and Middle Levels**: Training of technicians at lower and middle levels need greater attention since trained worker are needed in industrial concerns in the interest of increased efficiency. It is all the more necessary to start technical and trade schools to train the young boys who came out our elementary schools than to start engineering colleges and technological institutions. High school drop-outs may be trained as lower level technicians.
On a close estimate, it is found that after the completion of their elementary education about 20 percent students would join working life. It will be very desirable to provide adequate facilities for suitable forms of vocational education, either on a part-time or on a full-time basis, for these students. Vocationalization is also necessary at the higher secondary stage. The Education Commission has stressed on the need for expanding the vocational courses to cover about half of the total enrolment at this stage. These courses are to be of various types from one to three years and would prepare young persons for employment.

It is also necessary to reduce the wastage in the training of Junior Technical Schools. The trainees of these institutions are at a disadvantage in comparison with those coming out of the I.T.I's, since, on the ground of insufficient workshop practice, they are not given equivalent exemption for entry into further training under the Apprenticeship Act. Thus it is very necessary to give a new turn to the programme of these institutions. These may be renamed 'Technical High Schools' (the word Junior serving no purpose) and along with the existing technical high schools be unmistakably designed as schools for the training of skilled workers and as such made attractive to students and employers and not be regarded as a poor alternative to general secondary education or as a more costly preparation for entry to Polytechnics. The courses offered should be clearly terminal and adjusted through the greater use of available time to meet the requirements of the Apprenticeship Act (the regulation of which should be amended to accept those qualifying from these schools) and enable the trainees to get trade certificates. The training in the I.T.I's, and technical higher schools must be production oriented. Training cum Production Centres will generate own resources.

5) Need for Better Programmes: We must have a pattern of engineering education which should produce all the high class engineers and scientists we need to man our design organizations and consulting services. A new image of technical education has, therefore, to be created. New ideas and concepts has to be experimented and a new "personality" of technical education has to be built up.

With the advancement of science and technology it is now being gradually recognized that it is not enough to adhere to the traditional courses of study. On the other hand, new courses of study aimed at specialization and diversification will have to be planned at the post-graduate and graduate levels, e.g. traffic engineering, industrial engineering, management, corrosion science and engineering, computer
technology, television technology, urban and regional planning, mechanised system, dynamics, nuclear engineering, chemical process designing and engineering, environmental engineering, and man-made fibre technology, alternative energy resource etc. For the Polytechnics also a number of new course like electronics, production technology, power plant engineering, electrical instrumentation and control, tool engineering, petroleum refinery, public health engineering, food technology, rubber technology, leather technology, paper technology, plastic technology and aeronautical engineering will have to be devised. The courses should not be a dilute form of degree course. The Polytechnics should have a separate identity not inferior in any way to degree colleges. These courses will not only widen the scope of technical education, link it with modern advances in technology but also greatly enhance the chances of absorption of persons trained in these disciplines.

To enable an engineer (or a technician) to discharge his duties efficiently, apart from professional competency he must have a clear understanding of himself and of the social, economic and cultural values of the society in which he is a member. The technical students in India should be taught in social sciences and humanities. Such a study prepares an engineer to make a critical analysis of any technical problem, involving socio-economic consequences, in a broader vision and thereby add to his professional competency. Under the circumstances, technical education should not only be accompanied by but also be even based on the structure of general education.

At the same time, the adjustment to changing techniques of industrial productivity demands not only progressively high standards of technical knowledge, but also a new outlook which gives one an insight into the social purpose of work and an understanding of human relationships and human personality. The technical courses should, therefore, be widened to cover a wide field of liberal studies, viz. General Education.

It is also necessary to evaluate the various courses of different levels to meet the changing needs. These should be carried out in co-operation with industry, and should aim at job analysis and specification in terms of levels and duties of skills and responsibilities of technicians.

There is also an urgent need for increasing the efficiency of labourers, as modern industries need workers with intelligence and sufficient knowledge to understand their increasing complexities of manufacturing problems. With a bias
towards work oriented education in the Fifth Five Year Plan, this long-felt need of the country will be removed. After all, labourers with a broad outlook on life are the greatest asset to a nation in the present world of scientific production.

6) **Medium of Instruction**: In the technical institutions the regional languages should be accepted as the medium of instruction. The trainee should not be compelled to acquire proficiency in English, unless he himself insists for the same. For making regional languages as the medium of instruction, it is necessary to produce standard books in regional languages in the various areas of technical education. The teachers for technical institutions should be so trained that they may be able to impart the training through the medium of the regional languages concerned. But English should continue as a compulsory language in the curricular of both technical school and universities, and attempts should be made to provide adequate literature in technical subjects in Indian languages. The teething trouble will not doubt be there but a concerted effort will surely bear fruit in the long run.

7) **New Glossaries**: During recent years, there have been serious attempts for evolving glossary of technical terms. Still the pace of compiling glossaries has to be quickened. Hundreds of new terms are regularly coming into use. It is best for us to adopt them, as they are accepted internationally instead of inventing tortured local equivalents. The goal must be for a number of information clearing houses which facilitate a quick transit of ideas.

8) **Improving the Status and Salary of Teachers**: The whole superstructure of technical education will collapse due to shortage of competent scholarly teachers. The salary and service conditions of teachers should be improved and the importance of the role of a teacher in the nation-building should be socially recognised. It will also be desirable to set up an All-India cadre for engineering colleges, as it is in vogue in other services. The notion that an engineer in a factory is more productive and more important than a lecturer in an engineering institution is far from the truth and should be removed. These steps will ensure the mobility of academically qualified and professionally experienced staff to the teaching profession.

9) **Proper Workshop Practice**: The technical institution with its workshop and laboratory is, no doubt, the main centre of instruction, but real practice and experience can be given in outside workshops, factories and farms only. Efficiency in technical training largely depends on a proper co-ordination of these two scenes of action. As
such practical training and apprentice schemes should be properly organized and coordinated with education at workshops, schools, and technical colleges. The Central and State Governments can spare some of their productive units for such purposes, and should see that technical institutions get adequate facilities for such a type of work.

Active co-operation of the private sector should also be sought for providing workshop practice. Without incurring much expenditure, the industrial concerns (both private and public) could open practical training departments in their industrial plants and conduct technical training programmes like "Blitz Training of Scandinavian Models". The cost so incurred by the individual units for training their workers will be automatically compensated by the increase in the efficiency attained by the workers through such training in the long run. Tax incentives may also be considered for conducting such training by industries.

Further, by introducing economy measures in the administration, it will be possible to eliminate waste, to make a maximum use of outlays and bring down the cost of technical education without sacrificing the quality. For example, if an institution can be made to work for long hours and train large number of students in a system of shift arrangements, wastage due to idleness of tools, equipments and machinery in the laboratory and workshop, which are otherwise there, could be avoided to a considerable extent.

To circumvent the difficulty in the way of getting foreign exchange allocation for the import of laboratory and workshop equipments, it may be worth while to make these equipments and tools as far as possible indigenously and thereby saving foreign exchange.

There is at present a flow of technology from the industrially advanced country to a less developed country like ours. Such a type of technology might not be suitable to our requirements. Problems of India cannot be solved merely by duplication, transplantation or even adaptation of foreign technology. The scientific and technological centres in the country should devise techniques in various fields, appropriate to the pattern of the country's resources and actual need.

Arrangements are also necessary for giving non-stipendiary students some working experience in part-time paid jobs in industrial concerns.
10) **Provision of Post Technical Education and Training**: There must be provision of post technical education and training in our country through correspondence courses, part-time training, sandwich courses, short-time courses, refresher courses, close contact with the technical institutions and industries.

The correspondence courses may be organised for those workers who need enough orientation in latest theoretical principles. For in-service workers, this is a good device. The part-time courses develop the theoretical knowledge and skill of the in-service workers. But the part-time courses may be possible only at some technical institutions. Morning or evening classes may be arranged for this purpose.

In short-time courses the in-service workers are invited to attend certain courses for two or three weeks at some technical institution. This programme may be conveniently arranged during the holidays of some relevant industries. Through refresher courses also the in-service workers may be trained in latest techniques and devices. Obsolete techniques shall be replaced this way.

After-school education for workers must be an essential programme in our country. Professional organizations must provide the necessary facilities for the continuing education of the practising engineers. They should hold frequent discussions on technical problems faced in day-to-day work as they not only be useful to enlighten the young engineer with an approach to practical problems. It will also be desirable if our post-graduate education programmes, in addition to a regular two-year course, include short-term courses to enable practising engineers to learn the latest techniques.

11) **Need for Research**: There is an urgent need for concentrating attention on industrial research work, which is still in its infancy in this country. In a country like India, which has to withstand an ever-growing competition from foreign markets, it is high time we rationalized our industry and followed scientific methods of production in the interest of country's economy. For the modern machinery to be installed in industry, we have to depend to-day entirely upon foreign machinery which cost us much more than what we had manufactured. Transport and packaging charges further enhance the cost. The time factor in getting them to our premises is another unhappy matter. It is, therefore, essential that our scientists, technologists and engineers do co-operate and put in their best efforts to enhance production, to control quality, to reduce the cost, and thus to do away with foreign machinery.
What is required is a formula for making the best use of creative and inventive talents to meet the requirements of industry and a changes in the qualitative atmosphere. It is of utmost importance that engineers and scientists combine their talents and experience with the knowledge available in the manufacturing units with actual users, the university professors and visiting foreign experts. Such an approach alone could secure rapid economic growth.

What is needed is a co-operation between technical institutions and industrial units in research leading to inventions and innovations. We can also entrust the universities with a number of research projects.

12) Co-operation of State, Industry and Technical Education: Co-operation of industrial organisations with technical institutes is necessary, if the instruction provided in technical schools and colleges is to be adequate and appropriate. Thus industry and technical education can no longer be considered to be two separate entities. A common alignment between both of them is very necessary.

In the planning of technical courses and their contents, the industry must, therefore co-operate actively with the institution. This co-operation may be in the form of releasing staff for short periods to take up teaching assignments in colleges. Recruitment of engineers who have actually done practical design and development work as part-time professors may help to get a proper feedback from industry.

Professional institutions must also provide the necessary facilities for the continuing education of the practising engineers. These institutions must hold frequent discussion on technical problems encountered in day-to-day work as they will not only be useful but enlighten the young engineer with an approach to practical problems.

As a link between the industry and the educational institution, these institutions must take part in framing the details of the engineering courses and their organization. A panel of persons in industry interested in technical education may be maintained by these institutions so that they are available to spare some time regularly to acquaint themselves with the real problems. The professional institutions must hold seminars on developments in engineering specially to make practising engineers aware of the day-to-day advances in technology. While it is accepted that post-graduate study may not be possible for all, engineers definitely need a knowledge of transistors, computers.
silicones, etc. The institution can undertake to impart the knowledge through convenient short-time courses and discussions.

Expansion of technical education should be begun with caution and with full regard to the development of organized industries. The Central and State Governments should make a full survey of educational needs of industries and commerce and then determine the stages to which each type should be carried out and especially the number of recruits that can be annually absorbed. Thus the State, industry and technical education are faced with a common problem today, and therefore co-operation among themselves is absolutely necessary for upgrading India's production scenario to the maximum or to that of advanced countries like the U.S.A., England, Russia, Germany and many others.

1.14. TECHNICAL EDUCATION IN ASSAM:

Technical education is not a new concept in Assam. The issue of technical education has already been there, since the pre-independence period. Our State has abundant natural resources. It is rich in flora and fauna. For the development of her vast natural resources it is urgent to provided the greatest facilities for training up an army of technicians.

In this age of science and technology, the prosperity of a State depends solely on different industries it endeavours to set up. As such, the importance of expansion of technical education has become imperative, in order to be self-sufficient and independent in all spheres.

We should develop industrially as well as technically, Assam being backward in this respect. When other States are advancing much ahead it is all the more urgent that this type of education should expand rapidly both for men and women. But there is dearth of technical personnel in emerging fields. It has, therefore, become a great concern for the State Government to establish more and more technical institutions in Assam. The State Government as well as educationists are trying to organize technical education on a sound basis. Plans are being elaborated and reforms are being proposed with a view to adapting technical education to the present and future needs of the country.
1.14.1. **TECHNICAL EDUCATION IN ASSAM BEFORE INDEPENDENCE**:

Technical education before Independence was in its infancy in Assam. The first two industrial schools in our State were established in 1907 by the Missionaries one each at Kohima (Nagaland) and Shillong (Meghalay). But there were no such institutions at the colleges level. However, a few seats used to be reserved for students from our State in the Sibpur Engineering College, Calcutta. There were no facilities to meet the personnel requirements of the State. Therefore, at that time, women receiving technical education were out of question.

Modern technical education had its beginning towards the later part of the nineteenth century with the establishment of the Williamson Artisan School at Jorhat and the Williamson survey classes attached to Sibsagar High School. With the efforts of the then Director of Industries, Rai Bahadur Kanak Lal Barua, and the then Weaving Superintendent, Rai Sahab N.M. Sundaram, the Government Weaving Institute at Guwahati was established in the year 1920.

In September 1927, the Industries Department of the Government of Assam started the technical school at Jorhat. It had a branch at Nagaon also. Late Bholanath Baruah, a timber merchant and one of the richest man of Assam donated a generous sum of rupees one lakh for its establishment and growth. As means of security in case of any untoward failure of the institution he exercised a Will in the name of His Royal Highness Prince of Wales who visited India in the year 1921. This institution was formally opened by the Governor of Assam on 16th January 1928 and named it as "The Prince of Wales Technical School", in honour of the British Crown Prince. The institution was subsequently taken over by the Technical Education Department and its name was slightly changed to H.R.H. (His Royal Highness), the Prince of Wales Institute of Engineering and Technology.

1.14.2. **TECHNICAL EDUCATION IN ASSAM AFTER INDEPENDENCE**

After Independence the development and progress in the field of technical education has been remarkable. It has received a new shape and is being reorganised more scientifically. The Assam Engineering Institute was started in January 1948, at Chandmari, Guwahati. The establishment of the Assam Engineering College at
Guwahati in 1955, subsequently shifted to its present site at Jalukbari, was a
land-mark in the history of technical education in Assam. Thus by the end of the First
Five Year Plan, the State had one Engineering College. Considerable expansion of
technical education was made at all levels in the Second Five Year Plan. At the degree
level, the Assam Engineering College was made a composite unit by providing
courses in Mechanical and Electrical Engineering. In addition, another Engineering
College was started at Jorhat in 1960. Thus we had two Engineering Colleges at degree
level - one at Guwahati established in the year 1955-56, and the other at Jorhat
established in 1960-61. These two college offered a five year integrated courses of
study in the main fields of technology, namely, Civil Mechanical and Electrical
Engineering, with a total annual intake capacity of 330 students. In addition, Chemical
Engineering degree course was offered at the Assam Engineering College, where a
post graduate course in Civil Engineering has also been started. With the introduction
of two year Pre-University course from 1972, the five year integrated course has been
reduced to four-year. There is a Regional Engineering College at Silchar, which was
established in 1967. The Silchar Regional Engineering College has an annual intake
capacity of 250 students, in the conventional branches of engineering studies.

There was only one Polytechnic in the State at Guwahati by 1950-51. The
creation of a separate Department of Technical Education in 1958 contributed much
to the growth of technical education in Assam. In the later part of the Second Five
Year Plan two more Polytechnics were established, one at Silchar and the other at
Nagaon. These two institutions had been raised to full-fledged composite units for
training in all the three basic engineering branches. Again, in the last year of the Third
Five Year Plan, two more Polytechnics were established, one each at Shillong (now
Meghalaya) and Dibrugarh, in Civil Engineering course only. But by 1970-71, there
were six Polytechnics functioning in the State including the Girls' Polytechnic at
Guwahati. All these Polytechnics offer three-year diploma courses in Civil, Mechanical
and Electrical Engineering, except the Girls' Polytechnic which provides
two-years courses in Civil Engineering, Draftsmanship, Secretarial Practice and
Stenography, while the Assam Engineering Institute, Guwahati started Chemical
Operator's course (renamed Diploma in Chemical Engineering).

The Girls' Polytechnic at Guwahati started functioning from January 1965.
This institution had an annual intake capacity of 30 students. At first, there was no
proper hostel facilities for girls. As such, a few of the private houses were taken on
GROWTH OF ENGINEERING COLLEGES AND POLYTECHNICS IN ASSAM (1957 -1997)
rent for the purpose. There were only 7 girls residing in these rented houses. But by 1970-71, the number of girls residing in the hostel increased to 37 that is, 14 in the first year and 23 in the second year. It could manage to have a proper hostel only when the institution was shifted to its own site at Bamunimaidan in 1975. The teaching staff of this institution consisted of 4 Lecturers and 4 Instructors with 2 males and 2 females in each.

The examination of these institutions is conducted by the State Council of Technical Education, Assam. Moreover, Diploma courses which form a very important part of the technical education of the State are designed to train up technician to fill up the supervisory positions in industry and other technical organisations.

The growth of Engineering Colleges and Polytechnics in Assam from 1957 to 1997 is shown in Figure - 2.

At present, there are 3 Engineering Colleges in the State.


There are 9 Polytechnics in Assam.

1) Assam Engineering Institute - Guwahati, Estd. - 1948.
2) Girls' Polytechnic - Guwahati, Estd - 1964.
5) H.R.H. the Prince of Wales Institute of Engineering and Technology - Jorhat, Estd. - 1927.

The Sixth IIT was established at North Guwahati (Kamrup) in 1994.
1.15. **ADMINISTRATION OF TECHNICAL EDUCATION IN ASSAM**

There is a separate Directorate of Technical Education created in the year 1960 and controls all Government Polytechnics and Engineering Colleges of the State. Incidentally, there is no such institutions at degree and diploma level in the private sector. The State Council for Technical Education (SCTE) is a non-statutory body with Director of Technical Education (DTE) as the ex-officio secretary.

An Examination call is also attached to the Directorate. There is no separate Administrative Department of Government (Secretariat) Ministry for Technical Education but its is common to the entire Education sector of the State.

At present there are 9 nos. of Polytechnics in the State, all being fully under the control of the State Government. All these Polytechnics as well as all the diploma and post-diplom courses conducted were duly approved by the AICTE. The two year post H.S.L.C. (10 +) certificate courses do not come under the purview of the AICTE. The certificate courses conducted in the Polytechnics were approved by the State Government/SCTE.

**Community Polytechnics**: Five out of these nine Polytechnics have taken up the scheme of Community Polytechnic with full funding from the MHRD. These are :-

1) HRH the Prince of Wales Institute of Engineering and Technology at Jorhat, (1979).

2) Nowgong Polytechnic at Nagaon (1986).

3) Silchar Polytechnic at Silchar (1986).


5) Bongaigaon Polytechnic at Bongaigaon (1988).
THE STATE COUNCIL FOR TECHNICAL EDUCATION (SCTE):

The SCTE, was formed not by any Act but was constituted by the Government of Assam, (Dept. of Education). It was originally constituted with 31 members with the minister of Education as Chairman and Director of Technical Education as Secretary and convener. The Council is the highest body at the state level for advising the Government on all policy matters in connection with expansion and development of technical education in the State. Specifically the functions as enumerated at the time of formation of the Council were as stated below :-

1) To advise the Government on the co-ordinated development of technical education in the State at all levels.

2) To work in liaisons with the Regional Committee of the All India Council for Technical Education (AICTE) for technical education in formulation of schemes and to recommend additional facilities to be provided by establishment of new institutions, expansion of existing ones for training in Technical and Industrial Education in the State.

3) To advise the Government in matters of affiliation or recognition of institutions providing Technical and Vocational Education (but not University courses) provided they maintain satisfactory standard and follow the syllabus prescribed by the Council.

4) To advise on proper inspection of institution periodically and to ensure that the standard of the courses and instructional facilities provided are satisfactory.

5) To advise the Government on conducting of examinations and awarding diplomas and certificates conforming to minimum standard prescribed by AICTE.

6) To advise the Government for payment of grant-in-aid to the private institutions and all such other matters as may be referred to them by the Government from time to time.
1.16. **FACTORS WHICH HELP OR HINDER PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION**:

In Assam, the participation of girls in technical education is very low. There are certain factors which help or hinder participation of girls in technical education in the State. The factors which help education of girls in the technical field are - family related factors, social factors, economic factors, information and guidance services and flexibility of the education structure. The hurdles are family related factors, lack of facilities, social factors, economic factors, shyness of girls, lack of information and guidance in schools and rigidity of the education structure.

**FACTORS WHICH HELP PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION IN ASSAM**:

The factors are the following:-

**Family Related Factors**: Parents must be broad-minded and have a sympathy for girls education. They must treat their daughters equally with their sons. They must give education to their daughters so that they can become economically independent. Such an attitude of parents can increase the participation of girls in technical education.

**Social Factors**: Outdated social customs should be done away with. A progressive society with an enlightened outlook towards the education of girls is very necessary. Parents should have the courage to come out of the long practised customs and allow their daughters to join the technical institutions. Society should have a favourable attitude towards technical education of girls. Only then the enrolment of girls in technical education will increase.

**Economic Factors**: The general condition of the people must be improved. Economic factors play an important role in improving the enrolment of girls in technical education. The parental income also determines the attitude of parents towards girls' education.
Information and Guidance Services: A proper network of information and guidance services is essential for increasing the participation of girls in technical education. The importance and the facilities available to girls should be made known to the girls at the school level.

Flexibility of the Education Structure: Facilities for girls such as common-rooms, recreation facilities, hostel facilities, etc., must be made available. This will facilitate education of girls in technical field.

FACTORS WHICH HINDER PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION IN ASSAM:

These factors are the following:

Family Related Factors: Lack of guardian's courage to come out of the long practised social customs and allow their wards to join the technical institutes, guardian's reluctance to send their wards to far away places for fear of security and allied reasons etc. Some parents have apathy for girls' education. Most parents do not treat their daughters equally with their sons. All these creates major hurdles in the participation of girls in technical education.

Social Factors: Unfavourable attitude of the society towards the education of girls in the technical field acts as a hurdle in the way of increasing the enrolment of girls in technical field. The persistence of old ideas in the society, that the girls should take up those non-technical courses only that are based on stereotyped traditional roles to be performed by women also acts as a hurdle.

Economic Factors: Low parental income also is a hindering factor in the participation of girls in technical education. The parental income of students from rural schools is about half of the income of parents of the urban schools, even less. This leads to less rural school students joining technical courses.

Lack of Facilities: Such as hostel accommodation, common-rooms, recreation facilities, etc., prove as a hindrance to the participation of girls in technical education.

Lack of Information and Guidance in Schools: Less number of girls join
technical courses due to lack of proper guidance and counselling. Lack of adequate information and guidance in schools proves as a major hurdle in technical education for girls.

**Rigidity of the Educational Structure** : Lack of flexible course structures and infrastructural delivery systems to suit women students is one hindering factor in increasing the participation of girls in technical education. There is very less involvement of women in policy formulations and decision making in the technical field.

**Shyness of Girls** : Shyness of the girl students, particularly from rural and backward areas to join co-educational courses also hinders the participation of girls in the technical field.

### 1.17. PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION IN ASSAM:

Assam has kept intact its tradition of a higher percentage of literacy than the national level. According to the census of 1991, the literacy rate for Assam State is 53.42%. While 62.34% of males are literate, female literacy stands at 43.70%. Though the literacy rate in Assam is slightly higher than the All India average (1.31% better than All India percentage) it has not been very much satisfactory because Assam ranks 22nd amongst the states in order of literacy. Female literacy in Assam is higher than All India percentage. It is 4.28% better than All India Percentage.

In Assam, the scenario in the field of technical education for women is not at all satisfactory. A large gap exists between males and females in the utilisation of provision of technical education. Most women go for arts and commerce courses, only a few go for technical courses.

Technical education is one of the most significant components of human resource development spectrum with great potential for contributing to the national economy and for improving the quality of life of the people. In recognition of the importance of this sector, successive Five Year Plans laid great emphasis on the development and consolidation of technical education, in terms of both quality and quantity, in the State, due to which some improvement have been achievement, but it cannot be claimed to be substantial enough.
Development of technical education for women has been a deliberate policy of the Government of India, since Independence. The establishment of the Assam Engineering College at Guwahati in 1955, was a landmark in the history of technical education in Assam. Another Engineering College was started at Jorhat in 1960. The two colleges now have an annual intake capacity of 225 and 210 respectively. The enrolment of girl students in these two technical institution in the year 1996-1997, is 215 in the Degree level. The Regional Engineering College was established in 1967 at Silchar.

Consequent to the recommendation of the National Conference on Women Education in 1958 only one Polytechnic for girls was established at Guwahati in the State of Assam in 1964. The establishment of this Girls' Polytechnic at Guwahati and introduction of the two Diploma courses were duly approved by the AICTE. Introduction of certificate courses is however, a State subject and does not come under the preview of the AICTE. The two certificate courses were introduced on approval of the State Government/SCTE. Another Residential Girls' Polytechnic has been set up at Golaghat in 1987. The number of girls present in these two Girls' Polytechnics in the year 1997 in Diploma courses is 140.

There are altogether 9 Polytechnics, all approved by the AICTE, conducting Diploma courses. Although admission to these Polytechnics are open to both boys and girls, the enrolment of girls candidates has been less than 9 percent. However, the seats available in the two Girls' Polytechnics are utilized in full and even than the total percentage of girls enrolled in technician courses is less than 12 percent. Also the courses offered in the girls' institutions are very limited, having no opportunity to take up programme in specialised areas.

**THE INTAKE OF BOYS AND GIRLS IN THE POLYTECHNICS OF ASSAM DURING 1994-95 ARE AS FOLLOWS:**

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>PERCENTAGE OF GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls' Polytechnics</td>
<td>X</td>
<td>114</td>
<td>100%</td>
</tr>
<tr>
<td>Co-educational Polytechnics</td>
<td>2533</td>
<td>211</td>
<td>7.69%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2533</strong></td>
<td><strong>325</strong></td>
<td><strong>11.37</strong></td>
</tr>
</tbody>
</table>
In Assam most of the students appear in the school final examination (10+) conducted by the Board of Secondary Education, Assam. Only a negligible percentage of students appear in the school final examination held by other agencies. The latest available statistics of the school final examination conducted by the Board of Secondary Education of Assam in 1990 is as follows:

<table>
<thead>
<tr>
<th>Passed</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers</td>
<td>55062</td>
<td>25336</td>
<td>80398</td>
</tr>
<tr>
<td>Percentage</td>
<td>68.5</td>
<td>31.5</td>
<td>100</td>
</tr>
</tbody>
</table>

Going by this statistics also it is desirable that the enrolment of girls in technician courses should be about 30 percent. But it will be a herculean task to improve the enrolment of girls in the Polytechnics from the present level of 12 percent to 30 percent. Besides Assam is not an industrially developed State and hence establishment of a new Polytechnic with large number of specialised courses may result in unemployment among girls, which could ultimately be a deterrent factor in the improvement of girls' enrolment in Polytechnics.

The All India Council for Technical Education (AICTE) has emphasised the need to diversify the technical courses and make them more relevant so that the products become more employable. Particular emphasis has been given on technical education for women. World Bank has come forward to assist in the development and quality improvement of technical education in Assam under which the curriculum of technical institutes are being revised to make them more relevant to our needs. A Curriculum Development Cell has started functioning under the Directorate of Technical Education assisted by the World Bank with the formation of State Project Implementation Unit for Assam State. So much has been done, yet the enrolment of women in the technical institutions of Assam is very low.

A lot more resources and efforts are required to improve the system, particularly in respect of introduction of courses in specialized fields, accessibility to the weaker sections of the society such as women, modernisation of laboratories, workshops, libraries, etc., improvement in instructional system, industry - institute interaction, infrastructure development, use of computers for awareness, teaching and administrative support, curriculum development and strengthening and improving the efficiency and effectiveness of managerial functions.
Efforts must be made to attract more and more girl candidates to join the technical institutions. There is no discrimination between boys and girls in the matter of admission as well as employment. The admission is decided on common merit of both boys and girls candidates. Therefore, to improve the enrolment of girls in technical institutions other areas such as wider publicity, free tuition, hostel facilities and other amenities have to be taken care of. The girls must be made aware of the opportunities available to them so that they may come out of the cocoon of frustration and become willing participants in the field, hitherto dominated by men.

1.18. **WORLD BANK ASSISTED TECHNICIAN EDUCATION PROJECT AND ASSAM**

The Central Government had launched a massive project with the assistance of the World Bank to enable the State Governments to upgrade their Polytechnics in capacity, quality and efficiency. This project was undertaken in two phases. The first phase covering 9 States including Assam for a period of 7 years will conclude in December 1998.

**PROJECT ACTIVITIES IN THE STATE**

The following activities were proposed to be taken up:

1) **Residential Girls' Polytechnic**: A Residential Girls' Polytechnic at Golaghat by conversion of the existing Girls' Polytechnic will be set up with the following two courses:

   (i) Electronics (30 intake) (ii) Textile Chemistry and Design (30 intake).

2) **Community Polytechnics**: There are five number of Polytechnics (Assam Engg. Institute, Nagaon Polytechnic, Prince of Wales Institute, Dibrugarh Polytechnic, Bongaigaon Polytechnic) where Community Polytechnic scheme were taken up with 100% Direct Central Assistance from Government of India. But the fund was not sufficient and hence with the World Bank Assistance it was proposed to strengthen the various activities in the rural areas like transfer of technology, man-power development, technical services and support services for the benefit of the rural masses. However, it has now been decided to withdraw the funding under the project.
3) **Continuing Education** : The Polytechnics were working almost in isolation. It has been observed that the various categories of employees in industry need to undergo certain training for their horizontal as well as vertical mobility. Through this subcomponent it is proposed to build up necessary infrastructure and conduct various short-term tailor made training programmes for industry personnel. This will also generate additional revenue, which can be utilised for developmental purpose of the Polytechnics. Hopefully, Assam Engineering Institute is taking the lead in this aspect.

4) **Girls' Hostel** : Out of 8 nos. of Polytechnics, 3 Polytechnics (Assam Engineering Institute, Assam Textile Institute, Bongaigaon Polytechnic) do not have Girls' Hostel. Three hostels with a total capacity of 240 boarders will be constructed so that this additional facility may improve the number of girl candidates joining Polytechnics.

5) **Modernising Existing Polytechnics (8 Nos.)** : A number of new courses have been introduced since 1984, but the infrastructure facilities like laboratories and workshops and other amenities could not be developed. Additional building space, new equipments etc., will be provided. Two vehicles for each Polytechnic will also be provided towards better mobility of staff and students aiming at better training through industries. This will take care of the quality aspects of training.

6) **Staff Development** : 100% of all categories of teaching staff will be trained and retrained through short and long term courses on content updating, learning resource development, curriculum development, environmental and pollution, computer applications, management, foreign and local study tour, foreign training, skill development, B.E. and M.Tech courses, etc. This is expected to improve the teaching learning process. To develop an institute into a centre of excellence and to take up training of staff for attitudinal change, through T.T.T.I. Bhopal, are also covered under the scheme. The AICTE requirement of four month's training in four years (average of one month's training per annum) is proposed to be achieved through this scheme.

7) **Curriculum Development (CD)** : A.C.D. Centre will be set up at State level to take up C.D. on a continuous basis to suit the requirement of industries. Multipoint entry and credit system of examination will be introduced in all Polytechnics.
8) **Learning Resource Development (LRD)**: A State level LRD Centre and a L.R. Utilization Centre in each Polytechnic will be set up to supplement/strengthen the teaching-learning process.

9) **Computer Centres**: Computer Applications will be a part of syllabi of all Diploma courses. Further, instructional support, information processing, accounts and administrative matters will be taken up through computers. All Polytechnics will set up one computer centre each.

10) **Industry - Institute Interaction**: Interaction between Polytechnics and industries will be promoted towards producing better quality of students, who can be easily acceptable to the industries.

11) **Maintenance Cell**: A State level Maintenance cell at POWI, Jorhat and a Maintenance cell in each polytechnic will be set up so that the machineries and equipments can be kept in fully working conditions.

12) **Strengthening Directorate**: A State Project Implementation Unit (SPIU) will be set up at the Directorate to look after the implementation of the project. In addition, computer centre will also be set up at the SPIU and the Examination Cell for operation of management information system and to handle the examination.

**STATE PROJECT IMPLEMENTATION UNIT, ASSAM**:

*(A Government of Assam Unit for World Bank Assisted Project for Technician Education)*.

The State Project Implementation Unit (SPIU), Assam is a Government of Assam Unit for World Bank Assisted Project for Technician Education. The objective of the SPIU, Assam is to strengthen and modernise the entire Polytechnic Education system in Assam with World Bank Assistance.

The component and subcomponent of the project are the following:

(A) **Capacity Expansion**:

i) Establishment of Residential Girls' Polytechnic at Golaghat (1 No.).
ii) Strengthening Community Polytechnics (5 Nos.).

iii) Promoting continuing education for industry personnels.

iv) Providing new Girls' Hostel at Assam Engineering Institutes, Assam Textile Institute and Bongaigaon Polytechnic.

(B) Quality Improvement:

i) Modernising Existing Polytechnics.

ii) Staff Development.

iii) Curriculum Development.

iv) Establishment of Learning Resource Development Centre (1 No.) and Learning Resource Utilisation Centre (8 Nos. in Polytechnics).

v) Establishing Computer Centres in Polytechnics.

(C) Efficiency Improvement:

i) Industry - Institute Interaction.

ii) Establishment of Maintenance Cell at State level (1 No.) and in Polytechnics (8 Nos.).

iii) Strengthening State Directorate.

WORLD BANK PROJECT ACTIVITIES FOR GIRLS IN ASSAM

1) One Polytechnic for Girls' Exist.

2) A new Residential Girls' Polytechnic at Golaghat in addition to that mentioned with Diploma courses in (a) Electronics and (b) Textile chemistry and Design is proposed to be set up with World Bank assistance.

3) Girls' hostel have been provided in five Polytechnics out of existing eight nos of Polytechnics to accumulate 100% of girl students including repeaters and future provisions.

4) Three girls' hostels in the remaining three Polytechnics are proposed to be constructed for which State Government have sanctioned, and approval of World Bank and National Project Implementation Unit, New Delhi have been received. Construction has started in case of two hostels.
5) Adhoc arrangement has been made to provide hostel accommodation to girl students of two Polytechnics having no regular girls' hostel.

6) Admission in all co-ed Polytechnics are open to girl candidates. Separate amenities such as lavatories, common-rooms are provided in all Polytechnics and suitably maintained.

7) Number of Merit-scholarship in Girls' Polytechnics is more than these at co-ed Polytechnics.

8) In Girls' Polytechnics no tuition fees is charged. Training materials including drawing sheets, paper, pencils, etc., are provided free to students at Girls' Polytechnic.

9) Training course is being arranged in early 1995 through TTTI, Calcutta for all TPO's, Principals and a few women faculty regarding guidance and counselling and enhancing participation of women in technician education and employment.

10) A proposal for similar facilities for girls in other concerned Polytechnics is to be taken up.

11) Book Bank facilities for Girls' Polytechnic exists. Directorate is actively considering to provide separate Book Bank facilities for girls in all co-ed Polytechnics.

12) The matter of employment of women is being taken up with selected industries who has signed MoU (Memorandum of Understanding) with State Project Implementation Unit.

13) Recently the number of women teachers in Polytechnic have increased, although there is no special provision for employment of women in Government policy.

14) Training of girls students under Apprentice Training Act is given priority.

15) Priority is given to women staff under the Department for undergoing training studies under the World Bank Project.
1.19. **RATIONALE OF THE STUDY**:

The destiny of a nation is moulded and fashioned through its educational process and in this the technical education for women has a strategic importance. Access to technical education needs to be improved to optimise the participation of women in the mainstream of technical workforce and to contribute to the industrial economy of the nation. In Assam a large gap exists between males and females in the utilisation of provisions of technical education. Successive Five Year Plans laid great emphasis on the development and consolidation of technical education, in terms of both quality and quantity, in the State, due to which some improvement have been achieved, but it cannot be claimed to be substantial enough.

The enrolment of women in technical education in the State is very low. It appears necessary that a critical study be made to find out the reasons for the low participation of women in technical education. It will be equally significant to find the problems faced by the girl students in the technical institutions of Assam. The findings will help in understanding the problems of the girl students in the technical institutions of Assam. It is hoped that this study will be of great help to the students and teachers of the technical institutions of Assam. Hence this study has been undertaken.

The rationale for the study having been established, the methodology to be employed for the problem under consideration was planned and executed.

1.20. **STATEMENT OF THE PROBLEM**:

As the investigator belongs to the State of Assam, she therefore, wanted to study the problems of the girls students in the technical institutions of Assam. The main aim of the present investigation is to study and analyze the problems faced by the girls students in the technical institutions of Assam. It also tries to suggest some remedial measures for solving the problems of the girl students. The aim of the present investigation is also to study the attitude of the girl students in the technical institutions of Assam towards technical education.

So the investigator has stated the problem of the study as :- "A Study Of The Girl Students In The Technical Institutions Of Assam With Special Reference To Their Problems".
1.21. **OBJECTIVES OF THE STUDY:**

The investigator has given the following objectives of the study:

1) To study the development of technical education in Assam since Independence with special reference to girls.

2) To identify factors which help or hinder participation of girls in technical education in the State of Assam.

3) To investigate the problems faced by girls in the technical institutions of Assam.

4) To suggest remedial measures for solving the problems of girl students in the technical institutions of Assam.

5) To study the attitude of girls studying in the technical institutions of Assam towards technical education.

1.22. **SCHEME OF CHAPTERISATION:**

The scheme of chapterisation in the present report is presented here:

In the first chapter the meaning of technical education with its historical background, development of technical education in India, participation of girls in technical education in India, problems and suggestions to tackle the problems of technical education in India have been thoroughly discussed. It also describes the development of technical education in Assam from the pre-independence period to its present position, participation of girls in technical education in Assam, impact of the World Bank Project in the State, problems faced by the girl students in the technical institutions, etc.

The second chapter highlights the special features of the present study and attempts has been made to arrange the related literature in a comprehensive manner. It attempts to being to light those related literature and studies which have some implications on the present study.
In the third chapter, the methodology of the study has been discussed under the titles: viz. need of the study, statement of the problem, definition of terms, objectives of study, hypotheses, delimitations of the study, sample, tools, data collection, analysis and interpretation of data and scheme of chapterisation.

The fourth chapter discusses the analysis and interpretation of the data. The Questionnaire for students and Questionnaire for teachers has been analysed and interpreted. The Attitude Scale and the Interview Schedule has also been analysed and interpreted.

The fifth chapter deals with the summary, major findings of the study and conclusion.

The sixth chapter gives suggestions for further research in the field of technical education.

The Bibliography is then provided. In the Appendices, tools of the study have been included.