

UNESCO  
REGIONAL SEMINAR  
ON  
TECHNICAL AND VOCATIONAL EDUCATION

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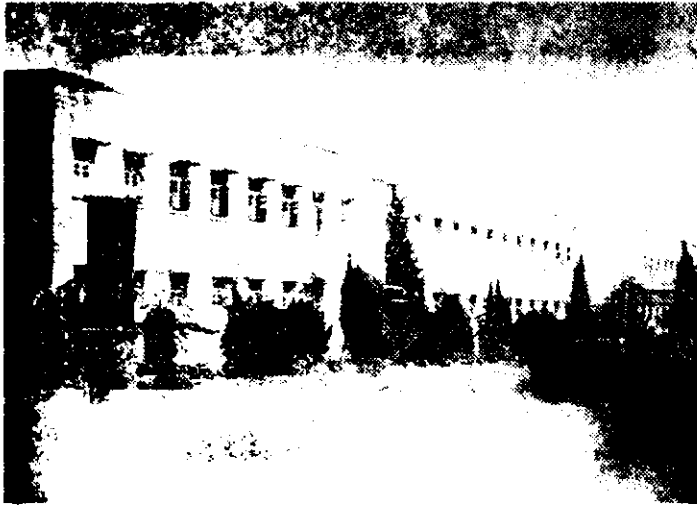
COUNTRY REPORT  
INDIA

MINISTRY OF EDUCATION AND CULTURE  
GOVERNMENT OF INDIA  
NEW DELHI

1979



*Government Polytechnic for Women, Madras*



*Shri Vaishnav Polytechnic, Indore*



*Institute of Printing Technology, Madras*

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# PART ONE

## PROFILE OF TECHNICIAN AND VOCATIONAL EDUCATION

### 1.0.0 Introduction

Education in India was generally identified with liberal education and it was in 1854 that perhaps for the first time the need for introduction of occupational education for a sizeable segment of student population was highlighted by what came to be known as the Wood's Despatch. Since then, various Committees and Commissions which were appointed from time to time to examine the problems of education in India have all emphasised the vital role of technical and vocational education in the country's economic and social development. However, it was only after 1947, when India became independent, that a comprehensive programme for the development of technical education and vocational training was undertaken. Today, India has a big network of technical and vocational institutions offering a wide variety of education and training programmes in various areas of engineering and technology. *The scope of this report is limited : it deals only with aspects of education and training of middle level technical manpower and skilled and semi-skilled personnel.*

### 1.1.0 Types of Institutions

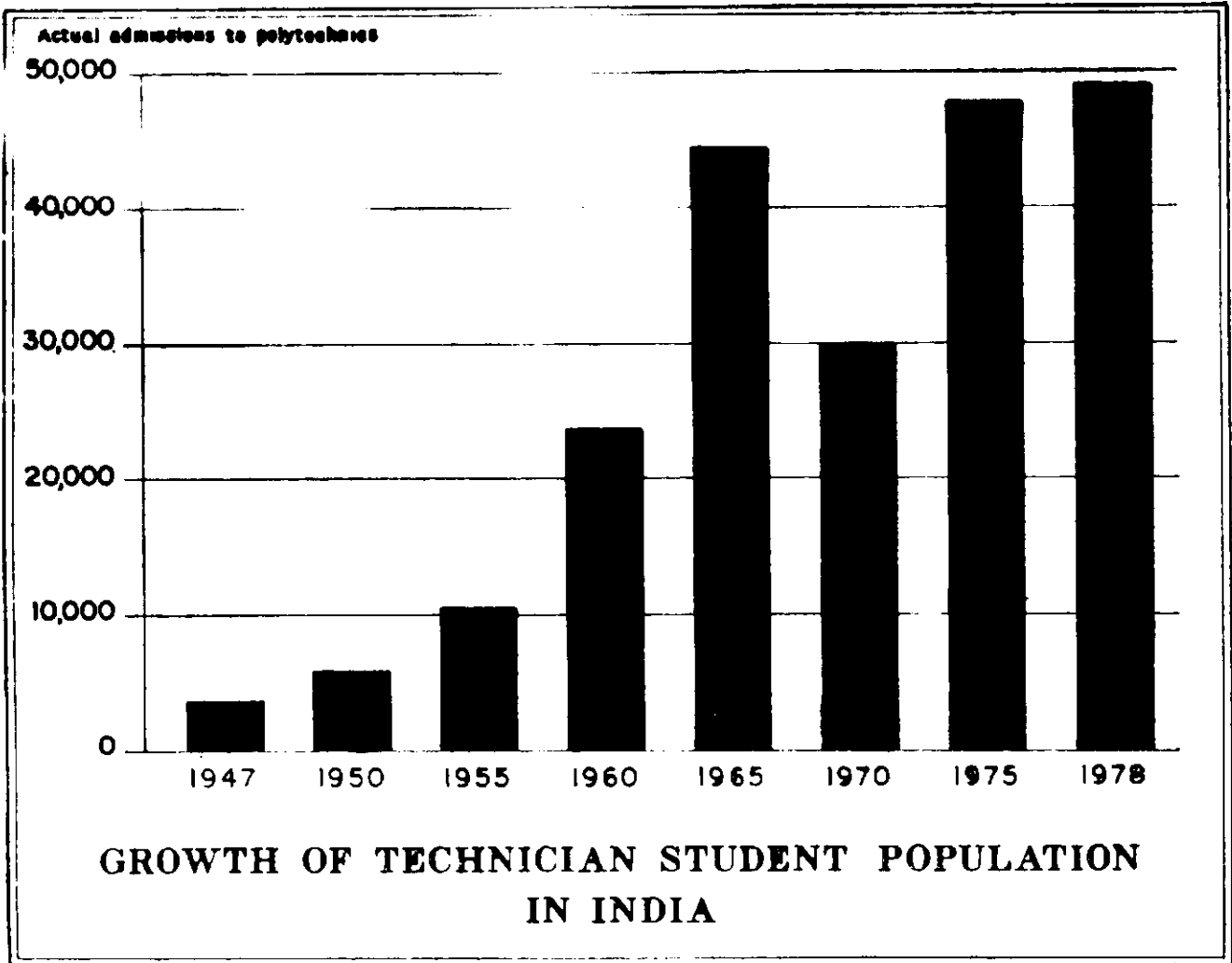
At the end of 1973, there were 4225 institutions imparting technical and vocational education and training in various parts of India. A statement showing the distribution of these institutions, their types, sanctioned intake, enrolment and out-turn is placed at Annexure I. It will be seen that 3455 of these institutions were located in urban areas and the remaining 770 in rural areas. The total enrolment in these institutions was 504442. While 380669 students were enrolled in technical courses offered by the polytechnics, industrial training institutes and junior technical schools, only 123773 students were enrolled in other vocational courses. The break-up of this enrolment among boys and girls was 379460 and 124982 respectively. During the year 1972-73, the students who graduated from these institutions numbered 197066. These institutions offered a variety of courses having different durations and admission qualifications. The total recurring expenditure during the academic year 1972-73 was about Rs. 560 million and the per student expenditure was Rs. 1048.

### 1.1.1 Technician Institutions (Polytechnics)

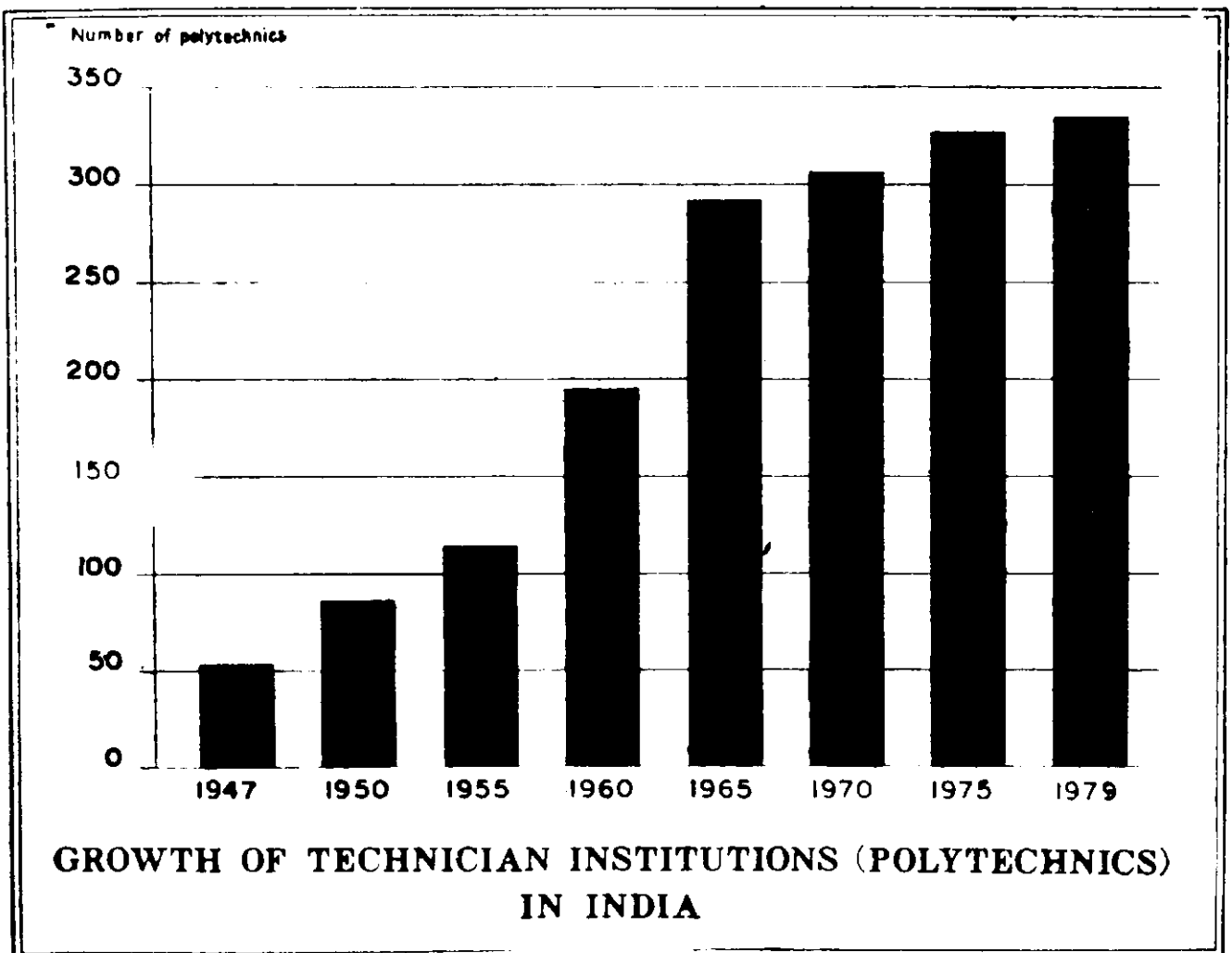
In 1962, UNESCO said that "the term 'Technician' applies to persons working in occupations requiring a knowledge of technology and related sciences between that of a skilled worker and that of an engineer or technologist; occupations at technician's level may call for inspection and maintenance, detailed 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.

In India technicians are educated and trained in polytechnics. At the time of independence in 1947, India had 53 polytechnics with an annual intake capacity of 3500 students and an annual out-turn of about 1500 technicians. Today India has about 335 polytechnics with an annual intake capacity of about 50,000 of which roughly about 50 per cent come out as qualified technicians.

The technician diploma courses range in duration from 2 years to 4 years, 3 years being the most common. The entry qualification is either 10 years or 11 years of schooling. About 64 polytechnics offer sandwich type diploma courses and the remaining are offering fulltime



*In 1968 the annual student intake was reduced by about 30% due to recession etc. This restriction was gradually lifted in early Seventies.*





*Trainees in workshop*

institute-based diploma courses. Some diploma courses are run on the semester pattern, while the others are on the annual pattern. The list of subject areas in which diploma courses are offered is at Annexure II.

About 24 polytechnics are exclusively for women and they offer courses which are of special interest to women. They cater to the needs of the socially/economically inhibited classes who might be reluctant to take advantage of the facilities generally available in regular polytechnics. The list of courses available in these women's polytechnics is at Annexure III.

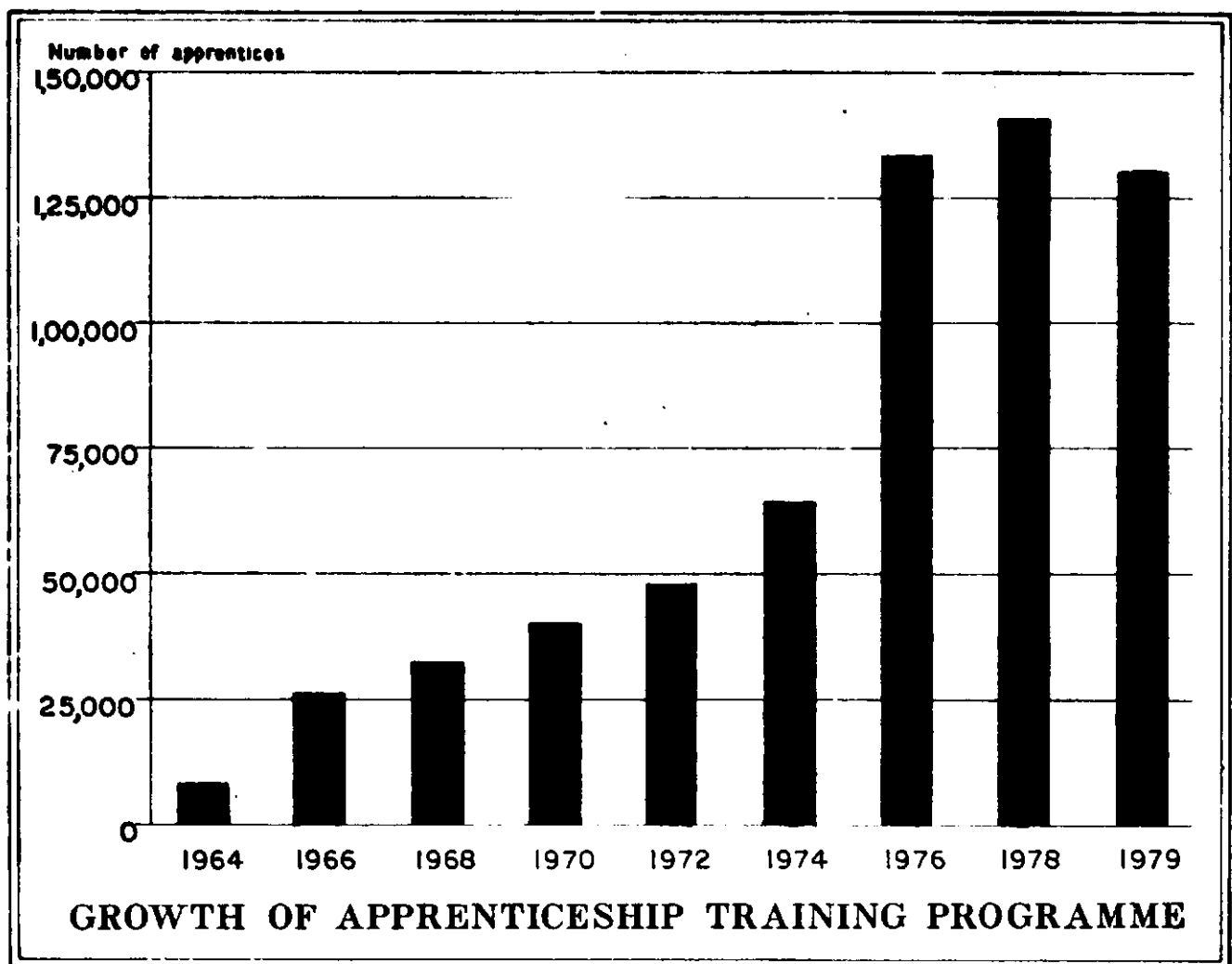
### **1.1.2 Industrial Training Institutes (ITIs)**

The Industrial Training Institutes (ITIs) train craftsmen/skilled workers. Today there are 356 Government ITIs spread all over India. They are permanently affiliated to the National Council for Training in Vocational Trades (NCTVT) and have an annual intake capacity of over 1,58,000. They train skilled workers in 32 engineering and 21 non-engineering trades (listed in Annexure IV) approved by the NCTVT. In recent years 65 more Government ITIs have been given provisional affiliation to the NCTVT. In addition, there are 244 private ITIs most of which are provisionally affiliated to the NCTVT.

The non-engineering trades are usually of one year duration. Certain engineering trades are of 2 years duration and some of them are of one year duration. The educational qualification for admission to these trade courses varies from two classes below matriculation (10 years school education) to a pass in matriculation or equivalent.

### **1.1.3 Apprenticeship Training Scheme**

Under the Apprentices Act, 1961, it is obligatory on all employers in the specified industries to engage apprentices as per the prescribed ratio in the designated trades. The 131 trades



(listed in Annexure V) designated under the Act follow the Indian National Classification of Occupations and cover 217 industries. Ratio of apprentices to workers (other than skilled workers) has been fixed for each trade. The apprenticeship duration ranges from 6 months to 4 years, 3 years being the most common. The entry qualification ranges from 5 years to 11 years schooling, depending on the trade. The industry is responsible for planning and executing the training programme for the apprentices. The training consists of basic training followed by on-the-job or shop-floor training with related instructions throughout the period of training. At present about 127000 trade apprentices are undergoing training in 17270 industrial establishments. In 1973, the Apprentices Act was amended to cover also graduate engineers and technician diploma holders. So far about 57 subject fields (listed in Annexure VI) in engineering/technology have been designated and at present about 14000 graduate/technician apprentices are undergoing training.

#### **1.1.4 Advanced Vocational Training System (AVTS)**

This project which was introduced in 1977 in 16 selected ITIs and 6 CTIs (explained in 1.3.2 below) envisages the training of highly skilled workers and technicians in a variety of advanced and sophisticated skills such as process control instrumentation, metrology and inspection, tool design, heat treatment etc. not available under the craftsmen and apprenticeship training programmes. This is a step further towards the completion of a comprehensive and integrated pattern of training for industry. The list of institutes and trades covered under this system is at Annexure VII.

#### **1.1.5 Vocational Training Programmes for Women**

Although the programmes for training in ITIs and in industrial establishments are for men and women, the latter are generally not fully utilising these opportunities for various reasons. With a view to providing special facilities to girls for vocational training, a chain of training institutes exclusively for women has been set up recently at national, regional and state levels. These Institutes train girls in dress making, needle work, hosiery, secretarial practice etc.

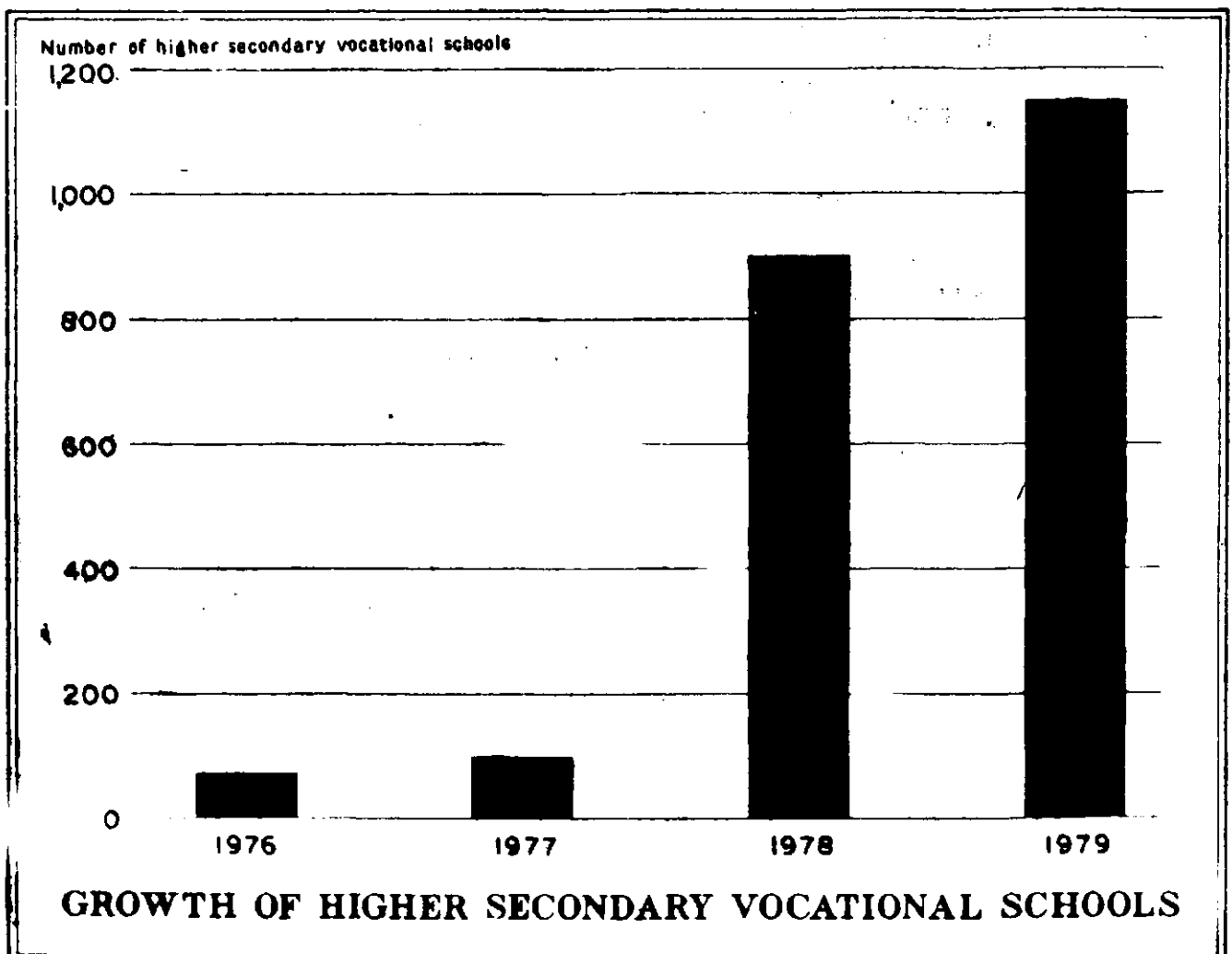
### 1.1.6 Vocational Training for the Handicapped

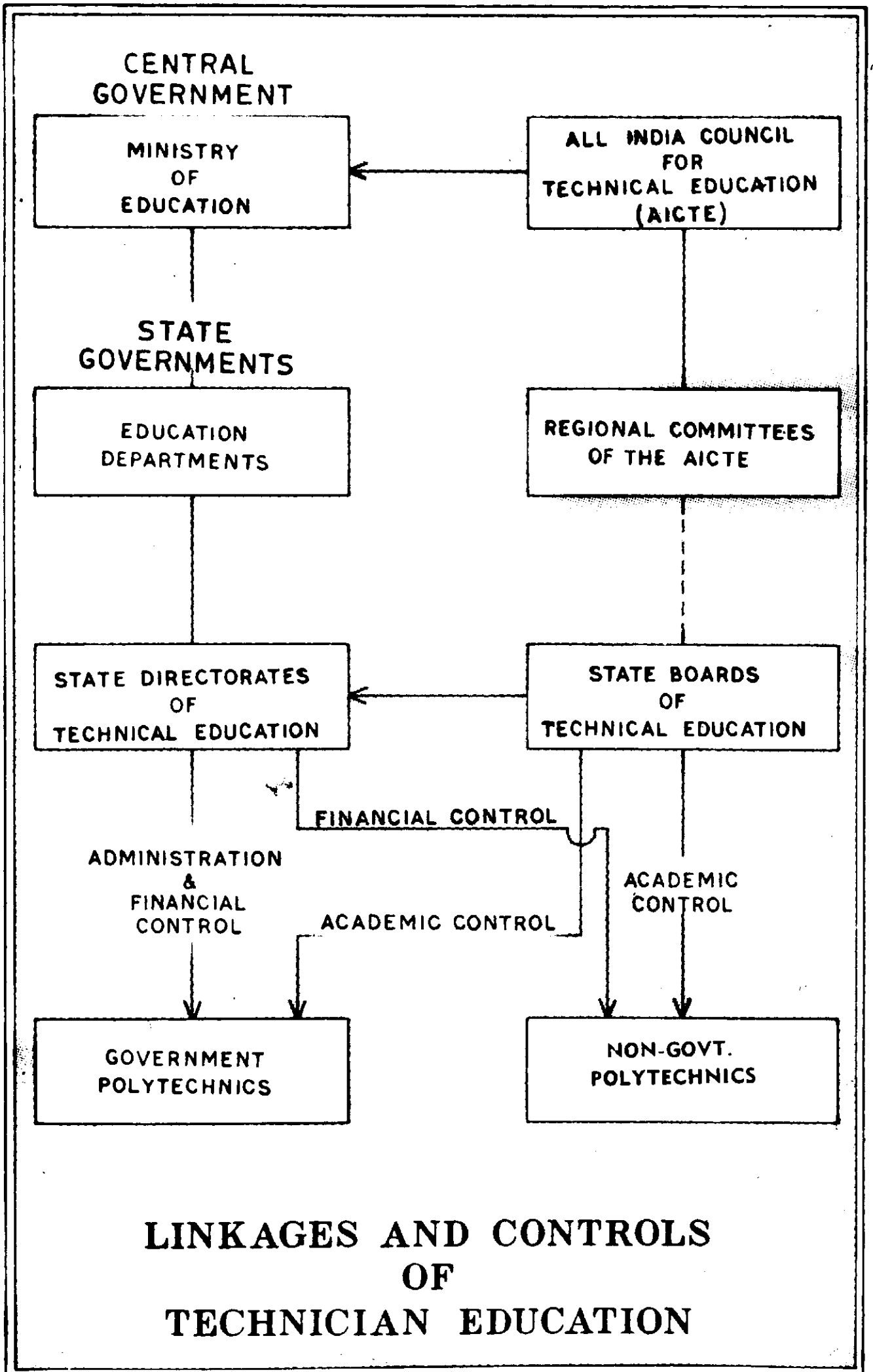
Training programmes for the handicapped and mentally retarded persons are administered by a large number of Government agencies, private charitable societies and trusts. The Government of India in the Ministry of Labour is running 10 Vocational Rehabilitation Centres. These Centres evaluate the deaf and the dumb, the blind and the orthopaedically handicapped persons to assess their fitness and residual abilities. Adjustment training is then provided. Efforts are made to help them in getting on-the-job training or for self-employment. The Ministry of Defence has established a number of rehabilitation units and training centres for the disabled persons from the Armed Forces. The Departments of Social Welfare at the Centre and in the States have a number of special institutes to rehabilitate the physically and mentally handicapped children.

### 1.1.7 Vocational Schools

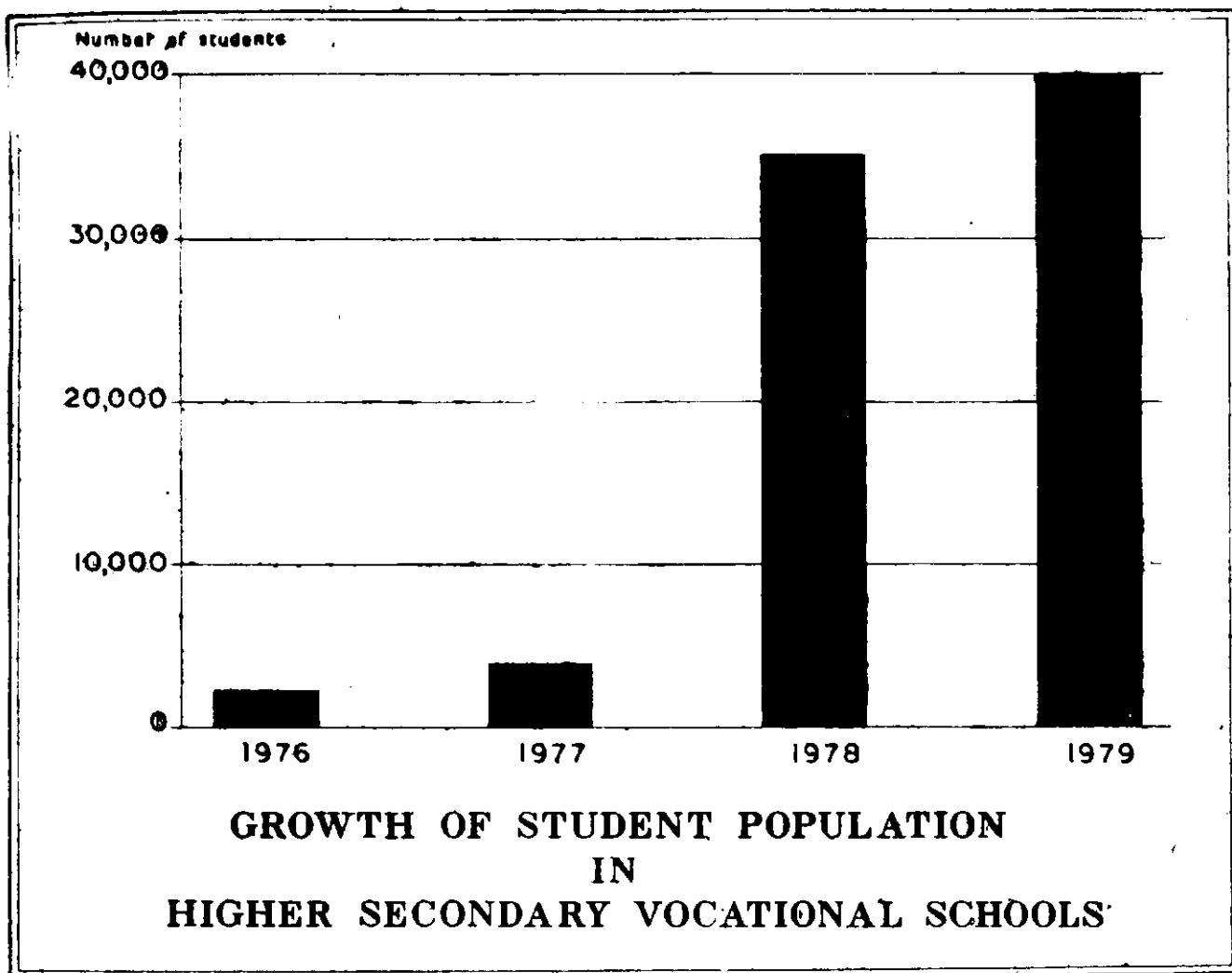
India has recently introduced some major structural and functional changes in the pattern of school education in order to make it an effective instrument of national development and social change. Under the present '10 plus 2' national pattern of school education, the first 10 years are devoted to general education with a good dose of socially useful productive work incorporated in the curricula. Socially useful productive work is described as meaningful manual work resulting in either goods or services which are useful to the community. Under this scheme, it is envisaged to provide useful opportunities for children to participate in social and economic activities inside and outside the class-rooms to enable them to understand scientific principles and processes involved in different types of work and in the setting in which they are found.

The main purpose is to develop proper attitudes towards work, to inculcate dignity of labour, banish status and class distinction and to stress the principle of productivity. The scheme enables the children to take care of simple functions such as repair and maintenance of domestic appliances and vehicles, care of garments, raising vegetables, rendering social services etc. These are not









only productive but in a sense also inspire self-confidence and self-dependence among the children. They may also gain some special proficiency in a particular skill.

At the 'plus 2' higher secondary stage of school education, two distinct streams of courses are offered: one is the academic stream to prepare students for higher education in universities etc. and the other is the vocational stream to prepare them for a variety of occupations through vocational studies and training. By this arrangement, it is proposed to divert about 50 per cent of the student population to vocational courses. Vocationalisation of school education at the 'plus 2' higher secondary stage was launched in 1977. To begin with, the vocational courses have been restricted to areas of commerce, agriculture, home science, health etc. and they are listed in Annexure VIII. The main objective of vocationalisation is to prepare vocationally qualified manpower for a variety of occupations for which training facilities are hardly available in other systems of training. All these courses are full-time institutional courses and are now offered mostly in the same institutions where general education streams run. There are today about 1150 vocational higher secondary schools with an annual intake capacity of about 40,000.

### **1.3.0. Bodies Responsible for Overall Planning and Development of Technical/Vocational Education**

India is a Union of States and education is primarily the responsibility of the State Governments. But the Central Government is invested with certain specific responsibilities. It has powers to coordinate the educational policies of the various States. Higher education, scientific and technical training and research are the special responsibilities of the Central Government.

At the national level, the All India Council for Technical Education (AICTE) plays an important role in the coordination and promotion of education of technicians, engineers and technologists. The All India Board of Technician Education under the aegis of the AICTE promotes and coordinates technician education at the national level. At the State level, the State Boards of Technical Education lay down curricula and conduct examinations for various

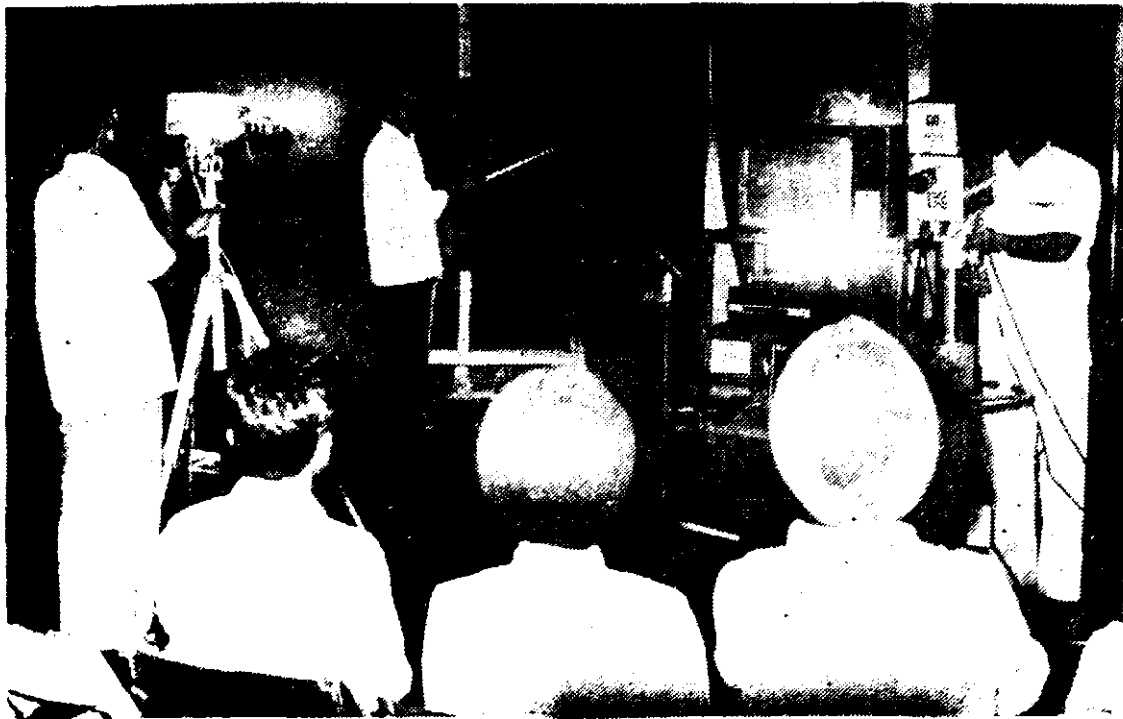
technician courses. Technician education in the State is usually administered by the Directorates of Technical Education. The Directorate General of Employment and Training (DGET) in the Ministry of Labour (Government of India) is responsible for the development and administration of vocational training programmes at the national level, particularly for laying down common standards, policies, training of instructors and supervisors, trade tests and award of certificates. The day-to-day administration of Industrial Training Institutes remains the responsibility of State Governments.

The role of the Government of India in the scheme of vocationalisation of higher secondary education is mainly to ensure countrywide acceptance of this new concept and to assist the State Governments in implementing it. It is a Centrally-sponsored scheme. The National Council of Educational Research and Training (NCERT) is responsible for drawing up the plans and guidelines. The State Departments of Education/School Boards are responsible for the day-to-day administration of the scheme. The Government of India is proposing to set up an All India Board of Vocational Education under the aegis of the AICTE to plan, monitor and coordinate the whole programme of vocationalisation.

### **1.3.0 Supply and Preparation of Teachers/Instructors**

#### **1.3.1 Teachers for Technician Courses**

Development of subject matter competence, teaching ability and industrial orientation are the basic needs of a majority of technician teachers in India. Development of competence in curriculum development, management of industrial and human resources, development of abilities in establishing industry-institution cooperation are the basic needs of senior faculty and administrators. With a view to training teachers and staff of polytechnics, the Government of India has established 4 Technical Teachers' Training Institutes (TTTIs), one each at Calcutta, Chandigarh, Bhopal and Madras. They offer long-term and short-term courses. A common feature of long-term courses is the interweaving of subject matter with pedagogy and industrial orientation.



*A micro-teaching session in progress*

Teacher trainees practise these aspects in real life teaching situations. Short-term courses are mainly meant for updating and refreshing the knowledge in various disciplines.

### **1.3.2 Instructors for Industrial Training Institutes and Apprenticeship Training Establishments**

Six Central Training Institutes (CTIs) have been established for training instructors of Industrial Training Institutes and Apprenticeship Training Establishments. Their total intake capacity is about 1084. The duration of instructor training programme is one year. Training is imparted in pedagogy and upgrading of skills. These CTIs also offer a large number of refresher and retraining programmes. A Model Training Institute (MTI) of the same organisational structure as an Industrial Training Institute is attached to every Central Training Institute, wherein instructor trainees teach the craftsmen students.

In 1977, the Central Training Institute for Women Instructors in New Delhi was upgraded into a National Vocational Training Institute for Women with a view to increasing facilities for training of women. This institute provides special training facilities in dress making, needle work, hosiery, electronics, secretarial practice etc. and works in collaboration with the two Regional Vocational Training Institutes for Women at Bombay and Bangalore.

The following 4 special Central Institutes/Units provide supplementary training to the faculty and officers from industry, ITIs, CTIs and Government departments:—

1. Central Staff Training & Research Institute (CSTRI), Calcutta
2. Audio-Visual & Printing Unit (AVPU), Kanpur
3. Foremen Training Institute (FTI), Bangalore
4. Advanced Training Institute for Electronics & Process Instrumentation (ATIEPI), Hyderabad.

Apart from providing training, these Institutes/Units also conduct original research in trade training, develop teaching and demonstration materials and also render advisory services to industry on various matters of industrial training, with which they are concerned.

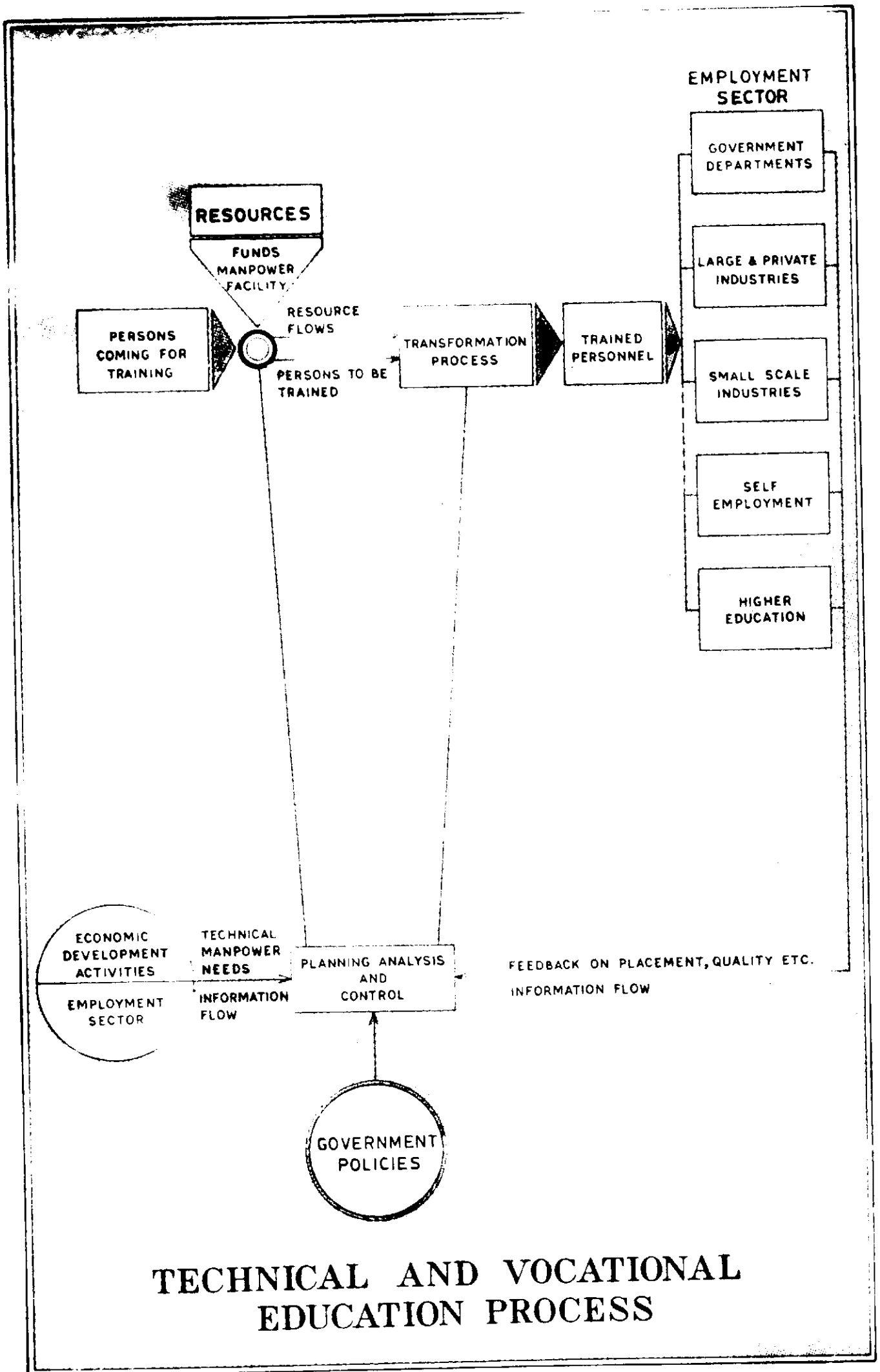
### **1.3.3 Teachers for Vocational Education in Schools**

Vocationalisation at higher secondary school stage was introduced only in 1977. Lack of teachers with adequate academic preparations and professional training is a major constraint on the implementation of the vocational education programme. Till now 84 new vocational courses have been started in various parts of India. Since all these courses are new, suitable teachers are difficult to get. The problem is dealt with by drafting professionals from various fields on part-time basis and also by appointing retired professionals. In a number of schools, there are certain technically qualified teachers whose skills and knowledge are required to be updated. This is being done by giving them short-term training courses of durations ranging from 3—6 weeks at a time. It is proposed to involve the TTTIs, CTIs etc. in a big way in the training of teachers for vocational courses in schools.

### **1.4.0 Articulation of Technical and Vocational Education with Manpower Planning**

There has been considerable expansion in technical and vocational education. While on the one hand skilled workers are needed for manning the development schemes, a large number of skilled craftsmen and technicians are facing unemployment. Lack of a national manpower information system, imbalances in the estimated demand and supply of technical manpower, poor quality of craftsmen and technicians, fluctuations of growth rates in industries and investments are some of the major reasons for this situation. Efforts are now being made to study these problems seriously.

The Government of India has recently decided to diversify and consolidate the existing courses and introduce new courses based on well-established and well-defined manpower needs. A reliable national manpower information system for storage, updating, retrieval and analysis of manpower information to assist technical and vocational education planning is proposed to be



# TECHNICAL AND VOCATIONAL EDUCATION PROCESS

set up with the Institute of Applied Manpower Research in New Delhi as the lead centre. Community surveys are being organised for introducing need-based vocational courses in higher secondary education.

### 1.5.0 Continuing Education Programmes in Technical and Vocational Education

Some efforts have been made to provide for vertical advancement of personnel from one level of technical education/training to the next higher one. Thus, a skilled worker with a national trade/apprenticeship certificate can take a diploma course and similarly facilities for those who have proven ability for academic achievement might go for specially designed degree courses. Availability of part-time and evening courses in some centres also provides for this vertical mobility. These facilities are, however, offered at present only in a limited scale and within the structure of diploma/degree courses. There is need to enlarge the facilities for continuing education.

The pattern of various courses in India has so far been on rigid entry and exit points and, therefore, did not encourage horizontal and vertical mobility. It has now been decided to introduce credit system with provision for multi-point entry to part-time and full-time programmes. This is expected to bring in a lot of flexibility thereby providing ample opportunities for continuing further education to technicians and skilled workers at various levels.

Several polytechnics are offering part-time evening post-diploma courses for working technicians. A few engineering colleges in the country are offering admission to technician diploma holders for degree programmes. A proposal to start advanced technician programmes in selected polytechnics is now under the active consideration of the Government of India. The Technical Teachers' Training Institutes, Central Training Institutes and many other specialised agencies are already offering several short-term refresher and retraining courses in various areas depending upon requirements.



*One of the numerous 'Summer Schools' for technician teachers*

The vocationalisation of education at the 'plus 2' higher secondary school stage has been so structured as to make it both terminal and continuing. While most of the students of the vocational courses will enter into the world of work either through self-employment or by taking a job, for those who wish to continue and improve their qualifications, various possibilities are available.

#### **1.6.0 Vocational Guidance and Employment Counselling**

About 261 Employment Exchanges under the control of the Ministry of Labour (Government of India) have Vocational Guidance and Employment Counselling Units. In addition, University Employment Information and Guidance Bureaux function in 66 universities. These units and bureaux help applicants and youth in planning their careers and also give career counselling. They collect and compile occupational information and disseminate the same to students, teachers, parents and job-seekers both individually and in groups through career talks, group discussions, career exhibitions, film shows etc. Assistance is also rendered to applicants and students in securing training/apprenticeship opportunities and in providing part-time/vacation employment etc.

#### **1.7.0 General Problems and Constraints**

Even though India has made significant achievements in providing facilities for technical and vocational education, numerous problems and constraints have presented themselves in its development and improvement. The figures of student intake and out-turn at technician level show that the wastage in the system is as high as 52 per cent i.e. if 100 students are taken in for a technician course only 48 of them ultimately qualify as technicians. Similarly wastages in the craftsman training and vocational education systems are of the order of 20 to 35 per cent. Some of the reasons for this wastage are: lack of necessary aptitude among the students, inadequacies of instructional facilities, ineffective teaching, non-selective admission of students, changing mix of urban and non-urban background of students, inadequate utilisation of existing instructional facilities, lack of adequate financial resources for departmental operating and training costs, inadequate employment opportunities etc.

Intensive study of the problems of wastage is very necessary. This is needed on both academic and planning considerations. Any effort for improvement of existing courses, introduction of new courses, diversification of programmes etc. would be helped a great deal by such feedback information as would be available from such studies. From the planning point of view, any effort to reduce wastage would contribute to the efficiency of the system as such and thus provide for out-turn of additional manpower that may be required without further inputs.

## PART TWO

### CURRICULA OF TECHNICIAN AND VOCATIONAL EDUCATION

#### 2.1.0 Technician Diploma Courses

The general objectives of technician education are to provide for (i) basic knowledge in related sciences to be able to understand and appreciate technological processes and operations, (ii) understanding and application of basic principles of design, construction and production, and acquisition of related practical skills in the chosen fields of engineering/technology, (iii) understanding of management principles, (iv) development of language and communication skills, and (v) development of individual personality.

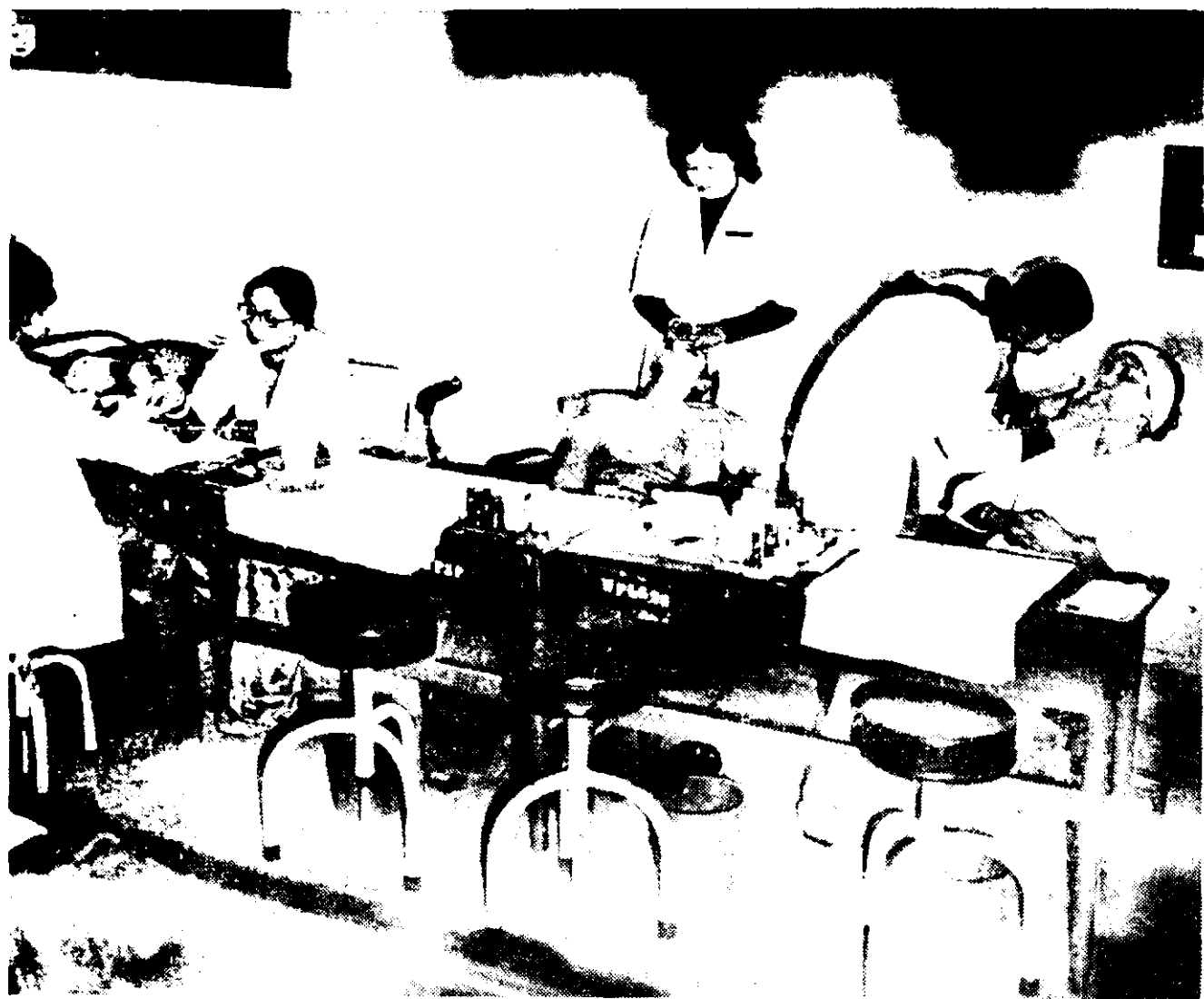
The areas and subjects of the curricula are given in Annexure II. In general, there are 5 categories of courses: (i) generalised diploma courses in civil, electrical and mechanical engineering, (ii) specialised diploma courses in electronics, automobile engineering, etc. (iii) specialised diploma courses in technologies such as leather, printing, fisheries etc. (iv) diploma courses in the services and business sector such as hotel management and catering, beauty culture, secretarial practice, interior decoration etc. (v) diploma courses in medical and life sciences such as medical laboratory technology, pharmacy etc.

Consistent with the objectives of technician education, the curriculum for any technician education programme has roughly the following components:

<i>Curriculum</i>	<i>% of total time</i>
1. Language . . . . .	5
2. Basic sciences . . . . .	10
3. Applied sciences . . . . .	10
4. Technical skills . . . . .	15
5. Specialisation . . . . .	50
6. Humanities and management . . . . .	10

In the case of sandwich courses, the industrial training/experience forms an additional curriculum component.

Language and communication skills play a very important role in the curriculum of technician education. Basic sciences courses are included in order to promote versatility and future technical growth of the technician. Applied sciences are extensions of basic sciences emphasising the areas of particular importance in a chosen field/discipline. These are related to specialisation. Technical skills, which include basic workshop and drawing skills, are essential for developing appreciation for skilled work and for understanding the fundamentals of graphic communication. Specialisation in the chosen field forms the most important part of the curriculum as this is of direct relevance to the job which the student is expected to get after he gets his diploma. The subject matter of specialisation is reviewed and revised at regular intervals. Courses in humanities and management are integrated with the specialisation in the chosen field. These courses are aimed at providing basic understanding of management principles, acquisition of skills in using management techniques and appreciation of the human side of industrial enterprises.



*A 'beauty culture' class in progress*

The relative emphasis on theoretical and practical contents of curriculum depends on the objectives of the programme. The curriculum for a technician course which is intended to train technicians who work closer to the professionals in design, development, testing, management etc. will have more theoretical content than in the case of a technician course which is intended to train a technician who works closer to the craftsmen in production, construction, erection, etc. The latter will have more practical content than the former. The relative weightage assigned to theory and practice in the generalised diploma courses in civil, electrical and mechanical engineering is 50 : 50. The list of subjects covered in these generalised courses is at Annexure IX.

In the curriculum of sandwich diploma courses, industrial training forms an integral part. In-plant training in industry is designed to have some relationship with what is being taught at the polytechnic during the academic term. During industrial training, the students work under the general supervision of the training-in-charge in the industry and are attached to different sections by rotation. The students maintain the record of their work and write periodical reports which are assessed. The duration of industrial training period varies from course to course, but 12-months period is common in an overall duration of 3½ years. The spells of industrial training are usually 3 months, 3 months and 6 months at the end of the first year, second year and third year of the course respectively. There are many other combinations to suit the local conditions.

### **2.2.0 Craftsmen Training Courses**

The objectives of the craftsmen training courses are: (i) to ensure a steady flow of skilled worker in different trades of industry, (ii) to raise the quality and quantity of industrial produc-



tion by systematic training of workers, and (iii) to reduce unemployment among the educated youth by equipping them for suitable industrial employment.

The areas and subjects offered in the training of craftsmen are given in Annexure IV. These have been briefly explained in section 1.1.2 above.

The scope of the curriculum is restricted to the particular trade in which the trainee receives training keeping in view the objectives of the craftsmen training scheme. Acquisition of skills in specific trades is the central theme of the curriculum. Theory, drawing, computation and science in the curriculum are related and integrated with practical skills to be acquired. The curriculum envisages 104 weeks of training for 2-year trades and 52 weeks of training for 1-year trades. The training comprises usually 1 week of induction, 4—15 weeks of basic/allied trade training, the remaining period being devoted to the main trade training. A sample curriculum analysis is given below:—

<i>Curriculum component</i>	<i>% of total time</i>
Practicals . . . . .	54
Theory . . . . .	36
Drawing . . . . .	5
Workshop Calculations and Science . . . . .	5

However, these percentages are variable from trade to trade.

Those who complete the one-year ITI trade courses successfully can undergo training in industry for 2 years, and those who complete 2-year ITI trade courses can have one year in-industry training. During the in-industry training, the trainees have to spend 7 hours a week in the institutes for instructions in related subjects; the remaining 35 hours of the week are spent in industrial training.

Tests are conducted at the end of each year for performance assessment. Those wanting proficiency certificate (National Trade Certificate) should qualify in the All India Trade Tests conducted by the National Council for Training in Vocational Trades.

### 2.3.0 Vocational Courses at Higher Secondary School Stage

The major objectives of vocationalisation of school education at higher secondary stage are (i) to divert a sizeable section of school students to meaningful occupational programmes without sacrificing the educational contents, (ii) to prepare the students for entrepreneurial avocations with sufficient amount of skills required for a particular occupational area, and (iii) to prevent purposeless crowding in the universities.

The occupational areas which have been chosen for vocational courses can be broadly divided into six: agriculture, commerce, industry, home sciences, para-medical and miscellaneous. The details of subjects are at Annexure VIII. The curricula have been designed with a view to developing skills of the levels and quality acceptable to the employing agencies. Broadly, the frame of the curricula is as given below:—

Language . . . . .	10—15% of the total time
Basic subjects relevant to vocations . . . . .	10—15% of the total time
Vocational studies and practice . . . . .	60—80% of the total time

In any case at least 50 per cent of the total instructional time is devoted to vocational practice. The vocational practice may partly be in the schools and partly in the field. The programmes have been so prepared that education and training cannot be fully designed in the schools alone. Vocational practice is given in the local industries, agricultural farms, dairies, fisheries, hospitals, health centres, banks and such other organisations.

#### **2.4.0 Identification of Occupational Areas and Formulation of Curricula**

The method adopted to identify potential areas of occupation is carefully conducted occupational surveys district-wise and/or region-wise. The surveys are conducted through questionnaires and personal interviews. Such surveys assess the employment potential, skills and knowledge necessary for the occupation and types of courses needed to meet these requirements. Such an analysis leads to the formulation of programmes and course objectives. Curriculum areas or components required to achieve the course objectives are derived. The subjects thus derived are further detailed for teaching and evaluation purposes.

#### **2.5.0 Curriculum Development Centres**

India has set up 5 curriculum development centres, one each at the Technical Teachers' Training Institutes at Chandigarh, Bhopal, Madras and Calcutta and the 5th one at the Allahabad Polytechnic. These centres are responsible for designing/redesigning, developing and evaluating curricula for technician education programme in their respective regions/states.

Four stages have been identified in the curriculum process viz. (i) curriculum design, (ii) curriculum development, (iii) curriculum implementation, and (iv) curriculum evaluation. These four stages are the elements of a feedback loop, emphasising the need for continuous improvement of the system.

Curriculum design involves establishing job opportunities, listing the activities performed/likely to be performed by the products of the course in different job positions, analysing knowledge and skills required for performing the activities identified, formulation of course objectives, identification of curriculum areas and course contents depending on activity analysis, entering behaviour and constraints in the system, organisation of the curriculum, evaluation scheme and working out resources required for implementation.

Curriculum development involves designing and developing instructional resources such as teachers' manuals, learning packages, teaching aids, item banks, text books, laboratory manuals etc. It also involves teacher development. All these activities are centred round the objectives and contents identified in the design stage.

In the curriculum implementation stage, teaching/learning is effected in the institutions using the instructional resources developed earlier.



*A 'Curriculum Development Workshop' in progress*

In the curriculum evaluation stage, the curriculum, the instructional resources and the instructional processes are evaluated on the basis of feedback collected from various sources. The evaluation results are fed to the other three elements of the feedback system for improvement.

Curriculum design for a large number of technician education programmes has been very well accomplished. This has created an awareness and a sense of involvement among polytechnic faculty, administrators of technician education and the professionals from industry in the process of technician education and training. Considerable work has also been done in the area of curriculum development. A large number of instructional materials for teachers and students have been prepared. The curriculum has been analysed in terms of subject-wise instructional objectives. Test items/questions, model question papers and their specifications consistent with the instructional objectives have been developed.

In all these activities, the polytechnic faculty and representatives from industry are actively involved.

### **2.6.0 Curriculum Evaluation Methods**

Curriculum evaluation can be defined as the collection and provision of evidence, on the basis of which decisions can be taken about the feasibility, effectiveness and educational value of a curricula. The evaluation process can take place during the implementation of a new curriculum (formative evaluation) or it can occur after a new curriculum has settled down (summative evaluation). Strategies generally adopted during evaluation are either based on tests of achievements and criteria or on informed judgements resulting from observations, interviews and questionnaires. The first strategy tends to be restricted to those outcomes which can be objectively assessed and the second strategy tends to be subjective and unreliable. A hybrid approach involving different techniques become necessary for studying different aspects of a curricula.

Curriculum evaluation as a full-fledged project was undertaken by one of the curriculum development centres in 1975 and was completed in 1977. The evaluation was done under the following broad headings :

- (i) learning strategies used by students,
- (ii) teaching strategies adopted by the teachers,
- (iii) complete examination system,
- (iv) structure, timing, sequencing and presentation of actual curriculum,
- (v) support given by support material,
- (vi) resource needs of the polytechnics, and
- (vii) organisation and communication in the institutions (polytechnics).

The sources of information used in this project were students, student pass-outs, teachers, employees, examiners, educational administrators etc. The methodology adopted consisted of :

- (i) actual observation of teachers in class-rooms and laboratories,
- (ii) structured interviews with students, teachers and employers,
- (iii) assignment and criteria tests of students,
- (iv) filling of questionnaires by students, teachers and examiners, and
- (v) collection of data on examinations from the educational authorities.

This evaluation has formulated a basis of curriculum revision in some States and has further highlighted the need for improving the implementation process. It has brought into focus many deficiencies that existed.

### **2.7.0 Divergencies between Curriculum Planning and Actual Implementation**

Much remains to be done in respect of curriculum implementation. Among the main problems are:

#### **(i) *Lack of precise manpower forecasts***

Lack of precise information on the quality and quantity of manpower required for different categories of jobs is an important constraint.

#### **(ii) *Lack of teacher competence***

Any curriculum design should essentially take into account the competence of the teaching faculty. Any change in content or methodology should be judged in the context of teacher obsolescence as well as pedagogical preparation of teachers. Drastic changes in content in the curriculum cannot be made without a well-planned scheme for faculty development. Faculty competence both in content and pedagogy is a major factor influencing design process.

#### **(iii) *Lack of resources***

Efforts in improving curriculum require a variety of resources, lack of which on many occasions are a definite constraint. The instructional process is affected by technological inputs, software for teaching, equipment in laboratories, financial resources of institutions, competence of technical staff and managerial and planning abilities of administrators and senior teachers.

#### **(iv) *Lack of academic flexibilities***

Technician education in India is academically controlled by the State Boards of Technical Education. These State Boards prescribe a common curriculum with little room for flexibilities. The examination is also controlled by these Boards. Although grant of autonomy to polytechnics has been accepted in principle, the progress so far made is not significant.

Vocational courses especially at the higher secondary school stage are of recent origin and considerable divergencies have been observed between the stated objectives and the actual implementation. These divergencies are generally in the organisational plans, supply of suitable instructional material, availability of competent teachers and the examination system. All these are being closely observed and remedial measures are being proposed.

## PART THREE

### INNOVATIONS AND EXPERIMENTS

#### 3.0.0 Major Reviews

The technician (polytechnic) education in India was rigorously reviewed during 1970-71 by a Committee under the Chairmanship of Prof. G. R. Damodaran. The vocational (craftsmen) training programmes were reviewed in 1978 by a Committee headed by Mr. S. Abdul Quadir. The main impetus to vocationalisation of higher secondary school education was given by the report of the Education Commission (1964—66) headed by Prof. Kothari. Mostly based on the recommendations of these Committees several innovations and experiments have been and are being undertaken. Some of the more important ones are briefly mentioned below:—

#### 3.1.0 Vocationalisation of School Education

The structural and functional changes which India has introduced in the pattern of school education recently is in itself a major innovation. Combining education with saleable skills and offering courses along with general education at the higher secondary stage is an experiment which is tried in the country for the first time. The traditional vocational courses offered in the polytechnics and Industrial Training Institutes have been carefully avoided and only those occupations which the country needs have been chosen. Another innovative aspect is the involvement of the community in the educational endeavour so that the institutional and community resources are fully utilised for preparing the future manpower requirements.

#### 3.2.0 Diversification of Courses

With the growing industrialisation, a need was felt for specialised types of technicians and craftsmen. Courses in several polytechnics have been diversified in order to supply the right type of technicians needed by the country. In such diversified courses several electives are offered in the final year of the 3-year course. The number of specialised courses is being increased to meet the actual needs both at diploma and at post-diploma levels. In respect of craftsmen training, unpopular trades are being abandoned and new trades are being introduced.

#### 3.3.0 Special Projects

Special projects have been undertaken in the following four areas in technician education: (i) establishment of a National Educational Testing Service, (ii) design and development of multi-media learning packages, (iii) educational film production, and (iv) educational research.

#### 3.4.0 Extension Centres of ITIs

Efforts are now being made to plan and organise extension services in polytechnics, where the faculty from Technical Teachers' Training Institutes work in collaboration with polytechnic faculty to improve the teaching and learning process. Several such Extension Centres have already been established in various parts of India.

#### 3.5.0 Rural Development Programmes

With the increasing emphasis on rural development, India has identified 35 polytechnics as 'Community Polytechnics'. These polytechnics will take up the work of transfer of technology to the countryside, will interact with the environment and organise their programmes and activities to meet the needs and requirements of the rural community.

Over 70 per cent of the trainees in the ITIs are from rural areas and naturally these Institutes have been playing a useful role in artisan training of rural youth. Special efforts are now on to coordinate the rural development programmes of numerous agencies all over India.

### 3.6.0 Industry-Institution Cooperation

One of the major problems facing technical, vocational education has been the lack of adequate collaboration and cooperation between industry and educational institutions. However, industries in India have now begun to realise their role in technical and vocational education. In order to effectively plan and supervise industrial training programmes of engineers and technicians, four Regional Boards of Apprenticeship Training have been established. Four Regional Directorates of Apprenticeship Training look after the industrial training of trade apprentices. Another aspect of industry-institute cooperation is the involvement of industries in designing, developing, implementing and evaluating the curricula. Under the Quality Improvement Programme sponsored by the Government of India, technician teachers are being sent for industrial training for three months at a stretch for exposing them to industrial situations. The concept of 'adoption of polytechnics' by industry is gaining ground. Action is being taken to institute in polytechnics 'adjunct professorships' for engineers from industry and 'industrial residency' in industry for teachers from polytechnics. Institutions are also being encouraged to set up Consultancy Centres to promote consultancy services.

### 3.7.0 Entrepreneurship Development Programmes

Entrepreneurship development programmes are now being organised for technicians and craftsmen in order to provide them with the requisite knowledge and skills for starting small scale industrial units. Financial institutions, small scale industries organisations, district industries centres etc. are keen to promote the entrepreneurial efforts of skilled craftsmen and technicians.

### 3.8.0 Learning Resource Centres

The role of resource centres in the instructional process is significant. They can help individualise the instructional process and make it more student-oriented. Remedial instruction to weaker students becomes easier through a variety of instructional alternatives. Such centres offer facilities to the teacher to design his own instructional strategies around material and equipment available. It is proposed to establish Learning Resource Centres in a few selected institutions on an experimental basis.



*Teacher trainees at work in one of the 'Learning Resource Centres'*

### **3.9.0 Staff Appraisal Schemes**

Appraisal of staff is a method of giving staff an opportunity to receive constructive and helpful comments about their performance without fear of punishment and with the prospect of recognition for achievement or the assurance of training if this is felt to be necessary. At present teacher appraisal is done primarily for administrative purposes. Confidential reports hardly represent the profiles and the strength/weakness of the teachers. Staff appraisal schemes based on methodology acceptable to the faculty are proposed to be introduced. These schemes would also enable identification of the needs of staff development.

### **3.10.0 Other Innovative Programmes**

Establishment of Special Vocational Training Institutes for Women (1.1.5 and 1.3.2), introduction of Advanced Vocational Training System (1.1.4), setting up of Vocational Rehabilitation Centres for the physically and mentally handicapped (1.1.6), establishment of specialised Central Institutes/Units to provide expertise and supplementary training in highly sophisticated areas (1.3.2), Continuing Education Programmes (1.5.0), Curriculum Evaluation Schemes (2.6.0) etc. are some of the other innovative programmes introduced in India.

**Distribution of Technical and Vocational Education and Training Institutions and their Sanctioned Intake, Enrolment and Out-turn as on 31-12-1973**  
(Referred to in I.1.0)

Sl. No.	Type of Institution	No. of Institution			Sanctioned in take			Enrolment			Out-turn		
		Urban	Rural	Total	Urb	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
1	Polytechnic	295	32	327	46,460	3,628	50,088	95,008	7,494	1,02,502	15,836	883	16,719
2	Industrial Training Institute	329	36	365	1,44,482	10,569	1,55,051	1,29,606	9,148	1,38,754	59,920	4,436	64,356
3	Junior Technical School	216	50	266	16,418	3,174	19,592	38,024	7,285	45,309	4,950	755	5,705
4	Craft & Handicraft School	293	177	470	11,303	4,030	15,333	13,402	4,273	17,675	6,986	2,884	9,870
5	Industrial and Technical School	1,131	263	1,394	67,640	9,605	77,245	66,410	10,019	76,429	33,568	4,957	38,525
6	Agricultural School	48	57	105	2,560	3,004	5,564	3,092	3,450	6,542	2,158	2,624	4,782
7	Forestry School	17	20	37	1,019	1,160	2,179	1,151	1,049	2,200	1,088	1,181	2,269
8	Veterinary and Animal Husbandry School	17	4	21	988	415	1,403	1,366	450	1,816	1,396	446	1,842
9	Nursing & A.N.M. & Health Visitor's School	504	22	526	21,595	434	22,029	33,465	905	34,370	13,184	370	13,554
10	Pharmacy School	23	1	24	1,210	200	1,410	1,633	378	2,011	444	196	640
11	Other Para-medical School	63	5	68	3,332	245	3,577	3,811	248	4,059	3,132	196	3,328
12	School for Training in Cooperation	68	5	73	8,741	720	9,461	9,274	762	10,036	7,632	419	8,051
13	Commercial Training School	61	2	63	11,859	170	12,029	11,793	128	11,921	4,437	107	4,544
14	School for Village Level Officers	58	39	97	6,780	6,471	13,251	7,262	5,445	12,707	4,777	3,570	8,347
15	Fishery School	25	26	51	1,118	959	2,077	1,729	2,571	4,300	1,286	500	1,786
16	School for Music, Dance, Drama etc.	179	15	194	10,581	1,174	11,755	17,878	1,574	19,452	4,890	450	5,340
17	School for Drawing & Painting	53	9	62	4,231	341	4,572	6,224	157	6,741	2,063	316	2,379
18	Other Schools	75	7	82	4,153	296	4,449	7,239	379	7,618	4,899	130	5,029
	<b>TOTAL</b>	<b>3,455</b>	<b>770</b>	<b>4,225</b>	<b>3,64,470</b>	<b>46,595</b>	<b>4,11,065</b>	<b>4,48,367</b>	<b>56,075</b>	<b>5,04,442</b>	<b>1,72,646</b>	<b>24,420</b>	<b>1,97,066</b>

Source : Third All India Educational Survey — IAMR Report No. 4/1975-All India



**List of technician courses offered in common polytechnics***(Referred to in 1.1.1 and 2.1.0)*

1. Civil engineering
2. Mechanical engineering
3. Electrical engineering
4. Electronics/tele-communication/industrial electronics/radio/T.V./sound equipment
5. Mining engineering
6. Metallurgy
7. Automobile engineering
8. Production engineering/technology
9. Pharmacy
10. Chemical engineering/operators
11. Architecture
12. Textile technology/chemistry/engineering
13. Ceramics technology
14. Instrument technology/instrumentation control
15. Refrigeration and airconditioning
16. Printing technology
17. Leather/footwear technology
18. Paper and pulp technology
19. Commercial practice/secretarial practice & stenography
20. Construction technology
21. Tools technology/tools engineering/tool design
22. Plastics technology
23. Town and country planning
24. Public health engineering
25. Agricultural engineering/agro-industrial engineering/agro-mechanical engineering
26. Electrical machine & appliances
27. Knitting technology
28. Garment technology/making
29. Ground water engineering
30. Mechanical and electrical engineering (combined)
31. Drilling engineering
32. Mines surveying
33. Petro-chemical technology/engineering
34. Material handling technology
35. Power plant engineering
36. Technical sales representation/salesmanship

- 37. Man-made textile chemistry**
- 38. Man-made textile technology/man-made fibres**
- 39. Paint technology**
- 40. Commercial Art**
- 41. Cinematography**
- 42. Fisheries & navigation**
- 43. Applied mechanics & electronics**
- 44. Machine tool operation & maintenance**
- 45. Welding & Sheet metal/welding technology**
- 46. Costume design & dress making**
- 47. Wool technology**
- 48. Materials management**
- 49. Tube-well engineering**
- 50. Home science**
- 51. Structural fabrication and erection engineering**
- 52. Optometry and refraction**
- 53. Sugar technology**
- 54. Industrial engineering**
- 55. Medical equipment**

## ANNEXURE III

### **List of technician courses offered in Women's Polytechnics**

*(Referred to in 1.1.1)*

1. Civil engineering
2. Radio engineering/electronics/tele-communication
3. Interior decoration & display
4. Costume design & dress making
5. Commercial practice/stenography & secretarial practice
6. Commercial art
7. Architectural assistantship
8. Library science
9. Medical laboratory technology
10. Beautician/beauty-culture
11. Pharmacy
12. Home science
13. Social communication media
14. Catering technology
15. Industrial technology
16. Cosmetology
17. Data processing
18. Mechanical (design & drafting).

**List of engineering trades together with period of training and minimum educational qualifications for admission etc.**

( Referred to in 1.1.2 and 2.2.0 )

Sl. No.	Name of the trade	Duration	Qualification for admission
<b>Engineering trades</b>			
1	Blacksmith	1 year	Should have studied upto two standards below matriculation or equivalent or three standards below higher secondary examination or senior cambridge examination.
2	Welder (gas & electric)	1 year	
3	Sheet metal worker	1 year	
4	Moulder	1 year	
5	Carpenter	1 year	
6	Mechanic (motor vehicle)	2 years	
7	Mechanic (tractor)	1 year	
8	Mechanic (diesel)	1 year	
9	Upholstry	1 year	
10	Plumber	1 year	
11	Painter	1 year	
12	Farm mechanic	2 years	
13	Wireman	2 years	
14	Building constructor	2 years	
15	Pattern maker	2 years	
<b>II</b>			
<i>Essential</i>			
16	Fitter	2 years	Should have studied upto two standards below matriculation examination or equivalent or three standards below the higher secondary examination or senior cambridge examination.
17	Turner	2 years	
18	Machinist	2 years	
19	Machinist (grinder)	2 years	
<i>Desirable</i>			
Pass in matriculation or equivalent examination or 10th class which is one class below the higher secondary examination.			
<i>Essential</i>			
20	Electroplater	2 years	Should have passed matriculation or an equivalent examination or passed 10th class which is one class below the higher secondary examination or senior cambridge examination.
<i>Essential</i>			
21	Electrician	2 years	(i) Should have passed matriculation or an equivalent examination or passed 10th class which is one class below the higher secondary examination or senior cambridge examination. (ii) Should have had science as one of the subjects.

Sl. No.	Name of the trade	Duration	Qualification for admission
22	Instrument mechanic	2 years	<i>Essential</i>
23	Refrigeration mechanic	2 years	(i) Should have passed matriculation or an equivalent examination or passed 10th class which is one class below the higher secondary examination or senior cambridge examination.
24	Millwright maintenance	2 years	
25	Tool & die maker	2 years	(ii) Should have had science and mathematics as elective subjects.
26	Watch & Clock maker	2 years	
27	Draughtsman (mechanical)	2 years	
28	Wireless operator	1 year	
29	Surveyor	2 years	
30	Draughtsman (civil)	2 years	
31	Mechanic (radio and T.V.)	2 years	
32	Electronics	2 years	
<i>Non-engineering trades</i>			
1	Bleaching, dying and calico printing	1 year	Should be two standards below matriculation.
2	Book-binding	1 year	
3	Cane, willow and bamboo work	1 year	
4	Cutting & tailoring	1 year	
5	Embroidery & needle work	1 year	
6	Hand composition and proof reading	1 year	Matriculation with proficiency in English & Regional Language.
7	Weaving of fancy furnishing fabrics	1 year	Should be two classes below matriculation.
8	Hand weaving of nawar, tape, durries and carpet	1 year	
9	Weaving of woollen fabrics	1 year	
10	Manufacture of foot wear	1 year	
11	Knitting with machine	1 year	
12	Manufacture of household utensils	1 year	
13	Manufacture of sports goods (leather)	1 year	
14	Manufacture of sports goods (misc.)	1 year	
15	Manufacture of sports goods (wood)	1 year	
16	Manufacture of suit-cases and other leather goods	1 year	
17	Preservation of fruits and vegetables	1 year	
18	Printing Machine operator	1 year	Matriculation.
19	Stenography (English)	1 year	Matriculation with English/Hindi as one of the subjects.
20	Stenography (Hindi)	1 year	
21	Weaving of silk & woollen fabrics	1 year	Two classes below matriculation.

**List of Trades Designated under the Apprentices Act, 1961 (amended upto  
August 1979)**

*(Referred to in 1.1.3)*

Designated Trades	Ratio of apprentices to workers other than unskilled workers	Period of training	Minimum Educational Qualifications	
			Essential	Desirable
1	2	3	4	5
<i>Group No. 1 Machine shop trades group</i>				
1. Fitter 2. Turner 3. Machinist 4. Machinist (grinder)	1 : 7	3 years	Pass in the 8th class examination or its equivalent	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science as one of the subjects
<i>Group No. 2 Foundry trades group</i>				
5. Pattern maker 6. Moulder	1 : 7	3 years	Pass in the 8th class examination or its equivalent	
<i>Group No. 3 Metal working trades group</i>				
7. Blacksmith 8. Sheet metal worker	1 : 7	3 years	Pass in the 8th class examination or its equivalent	
9. Welder (gas and electric)	1 : 7	2 years		
10. Motor vehicle body builder				
<i>Group No. 4 Electrical trades group</i>				
11. Electrician	1 : 7	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	Should have had Science as one of the subjects
12. Lineman 13. Wireman	1 : 7 1 : 7	3 years 3 years	Pass in the 8th class examination or its equivalent	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science as one of the subjects
14. Auto electrician	1 : 7	2 years	Pass in the 8th class examination or its equivalent with Science	
15. Electrician Aircraft	1 : 10	4 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science	
16. Winder (Armature)	1 : 7	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	@ Pass in matriculation or equivalent examination or the 10th class under the 10+2 system with Science subject
17. Cable jointer @	1 : 2	3 years		
18. Electrician (mines)	1 : 7	3 years		

	1	2	3	4	5
<b>Group No. 5 Building and furniture trades group</b>					
19. Carpenter		1 : 7	3 years	Pass in the 8th class examination or its equivalent	} Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with science as one of the subjects
20. Plumber		1 : 2 2 : 3 9 : 10	} }	Do.	
21. Brick mason/Bldg. constructor		1 : 7	3 years	Pass in the 8th class examination or its equivalent	
22. Brick layer		1 : 7	1 year	Pass in the 5th class examination	
23. Furniture maker and designer		1 : 4	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10 + 2 system	
24. Cabinet maker		1 : 5	3 years	} Pass in the 8th class examination or its equivalent	
25. Sports goods maker (wood)		1 : 5	2 years		
<b>Group No. 6 Maintenance trades group</b>					
26. Millwright Mechanic (Maintenance)		1 : 2	4 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	Should have had science as one of the subjects
27. Mechanic maintenance (Textile machinery)		1 : 7	3 years	Do.	
28. Mechanic maintenance (Chemical plant)		1 : 7	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with science as one of the subjects	
29. Mechanic dairy maintenance		1 : 7	3 years	} Pass in the 8th class examination or its equivalent	
30. Mechanic Sewing Machine		1 : 4	1 year		
31. Mechanic mining machinery		1 : 7	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	
<b>Group No. 7 Precision machining trades group</b>					
32. Tool and die maker		1 : 2	4 years	Pass in matriculation examination or its equivalent or the 10th class under the 10 + 2 system	Should have had science as one of the subjects
<b>Group No. 8 Instrument trades group</b>					
33. Instrument mechanic		1 : 3	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	Should have had science as one of the subjects
34. Mechanic instrument aircraft		1 : 10	4 years	-do- with science as one of the subjects	
35. Watch & clock repairer		1 : 4	3 years	Studied upto matriculation or its equivalent or the 10th class under the 10+2 system with science as one of the subjects	Pass in matriculation or its equivalent or the 10th class under the 10+2 system with science subjects

1	2	3	4	5
<b>Group No. 9 Refrigeration and air-conditioning trades group</b>				
36. Refrigeration and air-conditioning mechanic	1 : 3	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	Should have had Science as one of the subjects
<b>Group No. 10 Heat engine trades group</b>				
37. Mechanic (Motor vehicle)	1 : 4	3 years	Pass in the 8th class examination or its equivalent	Pass in matriculation examination or the equivalent or the 10th class under the 10+2 system with Science as one of the subjects
38. Mechanic (diesel)	1 : 4	3 years		
39. Mechanic (tractor)	1 : 3	3 years		
40. Mechanic (earth moving machinery)	1 : 1	4 years		
41. Mechanic (marine diesel engines)	1 : 5	3 years	Pass in the 8th class examination or its equivalent	Pass in the matriculation examination or its equivalent or the 10th class under the 10+2 system
<b>Group No. 11 Draughtsmen and Surveyors trades group</b>				
42. Draughtsman civil	1 : 10	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science and Mathematics as elective subjects	—
43. Draughtsman mechanical	1 : 10	3 years		
44. Surveyor	1 : 14	3 years		
<b>Group No. 12 Construction trades group</b>				
45. Fitter structural	1 : 5	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science and Drawing as subjects	—
<b>Group No. 13 Power plant trades group</b>				
46. Boiler attendant	1 : 2	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science as one of the subjects	—
47. Steam turbine operator	1 : 4	3 years	Pass in matriculation examination or its equivalent or 10th class under 10+2 system	—
48. Switch boards attendant	1 : 4	3 years		
<b>Group No. 14 Printing trades group</b>				
<b>(i) Typesetting group</b>				
49. Compositor hand	1 : 7	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with proficiency in English and any regional language	—
50. Lino operator		3 years		
51. Mono operator		3 years		
52. Mono caster		2 years		



(ii) *Printing group*

53. Letter press machineman (plate & cylinder) 1 : 7 3 years Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system

(iii) *Photo mechanic group*

54. Process cameraman 1 : 5 3 years  
55. Retoucher lithographic  
56. Engraver Pass in matriculation examination or its equivalent or 10th class under the 10+2 system with Physics and Chemistry

(iv) *Binding group*

57. Book binder 1 : 7 2 years Pass in the 8th class examination or its equivalent

(v) *Litho Offset group*

58. Plate maker (lithographic) 1 : 5 2 years }  
59. Litho offset (machine minder) 1 : 7 3 years } Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with physics and chemistry as subjects

*Group No. 15 Hotel and Catering trades group*

60. Cook (General) 1 : 5 and one more for every ten workers } 3 years }  
61. Cook (Vegetarian) 1 1/2 years }  
62. Steward 2 years }  
63. Baker or Confectioner 2 1/2 years }  
64. House Keeper 2 years }  
65. Hotel Clerk or Receptionist 2 years }  
66. Linen Keeper 1 : 1 1 year }  
67. Canteen Services Supervisor 1 : 1 1 year }  
68. Restaurant Hostess 1 : 1 1 year }  
69. Bill Clerk 1 : 3 1 year }  
70. Pantryman 1 : 2 1 year }  
71. Barman/Bartender 1 : 2 2 years } Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system

*Group No. 16 Textile trades group*

72. Weaver 1 : 50 6 months Pass in the 7th class examination or its equivalent  
73. Doffer-cum piecer 1 : 50 6 months }  
74. Tenter (drawing and speed/fly frames) 1 : 25 6 months }  
75. Winder 1 : 50 6 months }  
76. Knitter (hosiery) 1 : 4 1 1/2 years Pass in the 8th class examination or its equivalent

1	2	3	4	5
<b>77. Printing textiles</b>	1 : 20	6 months	Pass in the 8th class examination under the 10+2 system or two standards below matriculation or equivalent	Pass in matriculation or its equivalent or the 10th class under the 10+2 system or with science & mathematics
<b>78. Warper &amp; sizer</b>	1 : 25	1 year	Studied upto 8th class or its equivalent	Pass in the 8th class or its equivalent
<b>Group No. 17. Mining Trades Group</b>				
<b>79. Sirdar (colliery)</b>	1 : 7	3 years	Pass in matriculation examination or its equivalent or 10th class under the 10+2 system	
<b>80. Short firer/blaster (mines)</b>	1 : 7	2 years		
<b>81. Rigger (engineering and chemical industry)</b>	1 : 7	3 years	Pass in the 8th class examination or its equivalent	
<b>Group No. 18. Chemical trades group</b>				
<b>82. Attendant operator</b>	1 : 10	} 3 years	} Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with physics, chemistry and mathematics	
<b>83. Instrument mechanic (chemical)</b>	1 : 3			
<b>84. Laboratory assistant</b>	1 : 4			
<b>Group No. 19 Commercial trades Group</b>				
<b>85. Book keeping and accountancy</b>	1 : 4	} 1 year	} Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with commerce as special subject	
<b>86. Store keeper (including purchase)</b>	1 : 4			
<b>87. Cashier (general)</b>	1 : 2			
<b>88. Sales assistant (general)</b>	1 : 7	} 1 year	} Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	
<b>89. Clerk (general)</b>	1 : 20			
<b>90. Expert assistant</b>	1 : 2	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	
<b>91. Retail distribution assistant</b>	1 : 2	1 year		
<b>92. Library assistant/clerk</b>	1 : 4	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	
<b>Group No. 20 Cutting &amp; tailoring trades group</b>				
<b>93. Designer and master cutter</b>	1 : 5	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system	
<b>94. Tailor (men)</b>	1 : 4	1½ years	} Pass in the 8th class examination or its equivalent	
<b>95. Tailor (women)</b>	1 : 4	1½ years		
<b>96. Tailor (general)</b>	1 : 5	2 years		

**Group No. 21 Agriculture trades group**

97. Agricultural mechanic	}	1:7	2 years	Pass in the 8th class examination or its equivalent
98. Farm organisation and management				
99. Horticulturist				

*For Sl. Nos. 98 & 99*  
Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system

**Group No. 22 Leather Craft trades**

100. Sports good maker (leather)	1:3	}	2 years	Pass in the 8th class examination or its equivalent
101. Leather goods maker	1:7			
102. Footwear maker	1:1			
103. Finished leather maker	1:3			
104. Maintenance mechanic for leather machinery	1:3		3 years	

**Group No. 23 Ship building trades group**

105. Shipwright steel	}	1:7	3 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science	
106. Pipe fitter			3 years		
107. Rigger	}	1:7	2 years	Pass in the 8th class examination or its equivalent	
108. Gas cutter			2 years		
109. Shipwright (wood)			2 years		
110. Painter			2 years		
111. Boat builder		1:7	3 years	Pass in the 8th class examination or its equivalent	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system

**Group No. 24 Electronics trades group**

112. Mechanic radio & radar aircraft	1:10	4 years	}	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with Science
113. Electronics mechanic	1:5	3 years		

**Group No. 25 Photography trades group**

114. Photographer	1:4	1½ years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system
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**Group No. 26 Iron and Steel trades group**

115. Millwright (rolling mills)	}	1:10	4 years	Pass in the 8th class examination or its equivalent	
116. Bricklayer (refractory)			3 years		
117. Furnace operator (steel industry)		1:15	2 years	Pass in higher secondary PUC with Mathematics, Physics & Chemistry or equivalent	Pass in +2 under 10+2 system with Mathematics, Chemistry & Physics

1	2	3	4	5
118. Crane operator (overhead) (steel industry)	1:15	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with physics & mathematics	
<b>Group No. 27 Beautician trades group</b>				
119. Beautician	1:3	2 years	Pass in matriculation examination or its equivalent or the 10th class under the 10+2 system with biology as one of the subjects	Pass in higher secondary or PUC or +2 under 10+2 system with biology.
120. Hair dresser	1:3			
121. Health slimming assistant	1:3			
<b>Group No. 28 Glass &amp; Ceramic trades group</b>				
122. Ceramic moulder	1:4	2 years	Pass in the 8th class examination under 10+2 system or two standards below matriculation or its equivalent.	
123. Ceramic caster	1:4	2 years		
124. Ceramic kiln operator	1:4	2 years		
125. Ceramic press operator	1:4	2 years		
126. Ceramic modeller	1:4	2 years		
127. Ceramic decorator	1:4	2 years		
128. Clay toy maker	1:4	2 years		
129. Moulder (refractory)	1:4	2 years		
130. Glass blower/Blowing machine operator (glass)	1:4	2 years		
131. Enamel glazer	1:4	2 years		

**Subject fields in engineering and technology which have been specified as designated trades for the apprenticeship training of graduate/technician apprentices under the Apprentices Act, 1961.**

*(Referred to in 1.1.3)*

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Sl.No.      Name of Subject field

1. Civil engineering
2. Irrigation engineering
3. Public health engineering
4. Structural engineering
5. Dam engineering
6. Highway engineering
7. Construction technology
8. Mechanical engineering
9. Refrigeration and airconditioning
10. Machine tool technology
11. Production engineering
12. Automobile engineering
13. Electrical engineering
14. Electronics and telecommunication engineering
15. Computer engineering
16. Television engineering
17. Industrial electronics
18. Radio and electronic engineering
19. Nuclear engineering
20. Avionics
21. Metallurgy
22. Textile engineering
23. Agricultural engineering
24. Chemical engineering
25. Sugar technology
26. Marine engineering
27. Nautical engineering
28. Aeronautical engineering
29. Mining
30. Plastic technology
31. Textile chemistry
32. Naval architecture
33. Architecture

- 34. Regional and town planning**
- 35. Textile technology**
- 36. Glass technology**
- 37. Ceramic technology**
- 38. Silicate technology**
- 39. Pharmaceutical science**
- 40. Oil and soap technology**
- 41. Pigment and paint technology**
- 42. Dye stuff technology**
- 43. Printing technology**
- 44. Leather technology**
- 45. Leather goods and footwear manufacture**
- 46. Rubber technology**
- 47. Food technology**
- 48. Bio-chemical engineering**
- 49. Instrumentation technology**
- 50. Petroleum engineering**
- 51. Petroleum technology**
- 52. Applied geology**
- 53. Applied geophysics**
- 54. Jute technology**
- 55. Paper technology**
- 56. Catering technology**
- 57. Plastic engineering**

**List of institutes and trades under Advanced Vocational Training System**

*(Referred to in 1.1.4)*

**A. CENTRAL SECTOR****1. Advanced Training Institute, Madras**

- (i) Industrial chemistry
- (ii) Process control instrumentation
- (iii) Production technology

**2. Central Training Institute for Instructors, Bombay**

- (i) Process control instrumentation
- (ii) Advanced tool and die making
- (iii) Plastic mould making
- (iv) Metrology and inspection
- (v) Tool design
- (vi) Machine tool maintenance
- (vii) Advanced welding

**3. Central Training Institute for Instructors, Calcutta**

- (i) Advanced tool & die making
- (ii) Metrology and inspection
- (iii) Tool design
- (iv) Machine tool maintenance

**4. Central Training Institute for Instructors, Kanpur**

- (i) Advanced tool & die making
- (ii) Metrology and inspection
- (iii) Heat treatment
- (iv) Machine tool maintenance

**5. Central Training Institute for Instructors, Hyderabad**

- (i) Metrology and inspection
- (ii) Machine tool maintenance
- (iii) Advanced welding

**6. Central Training Institute for Instructors, Ludhiana**

- (i) Advanced tool and die making
- (ii) Metrology and inspection
- (iii) Tool design
- (iv) Machine tool maintenance

## B. STATE SECTOR

- 1. Andhra Pradesh I.T.I., Visakhapatnam**
  - (i) Indian standards and blue print reading
  - (ii) Mechanical and electrical maintenance
  - (iii) Marine diesel operation and maintenance
  - (iv) Welding (heavy plates and pressure vessels)
- 2. Assam I.T.I., Gauhati**
  - (i) Indian standards and blue print reading
  - (ii) Mechanical and electrical maintenance
  - (iii) Welding
- 3. Bihar I.T.I., Dhanbad**
  - (i) Indian standards and blue print reading
  - (ii) Mechanical and electrical maintenance
  - (iii) Coal mining equipment maintenance
  - (iv) Welding
- 4. Gujarat I.T.I., Baroda**
  - (i) Process control instrumentation
  - (ii) Tool and die making
  - (iii) Indian standards and blue print reading
  - (iv) Mechanical and electrical maintenance
- 5. Haryana I.T.I., Faridabad**
  - (i) Tool and die making
  - (ii) Indian standards and blue print reading
  - (iii) Mechanical and electrical maintenance
  - (iv) Welding
- 6. Jammu and Kashmir I.T.I., Jammu**
  - (i) Tool and die making
  - (ii) Indian standards and blue print reading
  - (iii) Mechanical and electrical maintenance
- 7. Karnataka I.T.I., Bangalore**
  - (i) Tool and die making
  - (ii) Indian standards and blue print reading
  - (iii) Mechanical and electrical maintenance
- 8. Kerala I.T.I., Kalamassery**
  - (i) Tool and die making
  - (ii) Indian standards and blue print reading
  - (iii) Mechanical and electrical maintenance
  - (iv) Domestic appliances maintenance
  - (v) Marine diesel operation
  - (vi) Welding



**9. Madhya Pradesh I.T.I., Jabalpur**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**10. Maharashtra I.T.I., Pune**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**11. Punjab I.T.I., Patiala**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**12. Rajasthan I.T.I., Jodhpur**

- (i) Indian standards and blue print reading
- (ii) Mechanical and electrical maintenance
- (iii) Welding

**13. Tamil Nadu I.T.I., Ambattur**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance
- (iv) Welding

**14. Uttar Pradesh I.T.I., Meerut**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**15. Uttar Pradesh I.T.I., Rae Bareilly**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**16. West Bengal I.T.I., Durgapur**

- (i) Tool and die making
- (ii) Indian standards and blue print reading
- (iii) Mechanical and electrical maintenance

**Vocational courses which have so far been introduced at higher secondary school stage***(Referred to in 1.1.7 and 2.3.0)***AGRICULTURE**

1. Agriculture chemicals (pesticides, fertilizers, weedicides, plant protection)
2. Agro-based industries
3. Crop production (scientific agriculture, principles of crop production; crop science)
4. Dairying (animal science and dairying)
5. Fisheries (pisciculture; fresh water fish culture)
6. Fish processing technology
7. Floriculture and medicinal plants (horticulture and fruit and vegetable preservation, horticulture and silviculture assistant, vegetables and fruits, spices and plantation crops)
8. Farm mechanics and post-harvest technology (post-harvest technology; farm equipment and maintenance; farm mechanics)
9. Poultry (poultry science; poultry farming)
10. Sericulture and apiculture
11. Soil conservation and rural construction
12. Small farm management
13. Forestry and wood products

**COMMERCE**

1. Accountancy & auditing (accountancy)
2. Stenography
3. Banking (banking assistant)
4. Insurance
5. Import-export procedure (international trade)
6. Stores purchase and stores maintenance (Material management)
7. Salesmanship and advertising and display (marketing and salesmanship)
8. Cost-accounting (accountancy & costing)
9. Taxation law
10. Cooperative organisation and operations (cooperative management cooperation)
11. Office procedure and routine (office secretaryship, office management)
12. Business management for small scale industries (elementary industrial management)
13. Small industries and self-employment

**ENGINEERING AND TECHNICAL**

1. Building construction technology
2. Building maintenance
3. Servicing technology (office equipment)
4. Electrical wiring and servicing of electrical appliances (electrical maintenance and servicing)
5. Domestic electrical appliances—repairs and maintenance
6. Clock and watch repair technology
7. Basic workshop technology
8. Automobile servicing (scooter and motor cycle servicing)
9. Servicing technology (repair, servicing and maintenance) (radio, electronic equipment, projection equipment and domestic electronic appliances).
10. Radio and television—maintenance and repair
11. Oil and soap technology
12. Leather technology

13. Printing and book binding
14. Textiles assistant
15. Sugar technology
16. Mining assistant
17. Wood carving and inlay work
18. Textile technology and wet processing
19. Mechanical servicing and maintenance
20. Fabrication practice
21. Civil engineering and maintenance
22. Water supply and sanitary service
23. General contracting
24. Electrical motor rewinding
25. General machinist
26. Basic electrical technology
27. Electronic technology
28. Air conditioning and refrigeration technology

#### HOME-SCIENCE

1. Cookery
2. Bakery and confectionery
3. Food preservation and nutrition (food preparation)
4. Hotel and hostel management (catering)
5. Applied nutrition and dietetics
6. Tailoring and embroidery
7. Child-care and nutrition
8. Designing, dyeing and printing
9. Dress designing and making
10. Interior decoration
11. Textile and designs

#### PARA-MEDICAL

1. Medical laboratory technician
2. Physio-therapy technician
3. X-ray technician (radiological assistant)
4. Medical record technician
5. Optician and refractionist (ophthalmic technician)
6. Multipurpose basic health workers (male)
7. Psychiatric assistant
8. Pharmaceutics operator
9. Pharmaceutical laboratory assistant
10. Pharmacy
11. Dental hygienists
12. Dental mechanic
13. E.I.E.G.—E.C.G., audiometry technician
14. Hospital house keeping
15. Nursing

#### MISCELLANEOUS

1. Photography
2. Pre-school and primary teacher training
3. Tourist guide
4. Drawing painting and commercial art.

### List of subjects in the generalised technician courses

(Referred to in 2.1.0)

<i>Civil</i>	<i>Electrical</i>	<i>Mechanical</i>
English	English	English
Mathematics	Mathematics	Mathematics
Physics	Physics	Physics
Chemistry	Chemistry	Chemistry
Engineering drawing (basic)	Engineering drawing (basic)	Engineering drawing (basic)
Applied mechanics	Applied mechanics	Applied mechanics
Workshop practice	Workshop practice	Workshop practice
Guided self learning activities	Guided self learning activities	Guided self learning activities
Building construction	General engineering	Strength of materials
Civil engineering drawing	Basic electricity & electrical measurement	General mechanical engineering
Engineering materials Hydraulics	Electrical design & drawing	Mechanical engineering drawing
Elementary electrical & mechanical engineering	Electrical workshop practice	Workshop technology Electrical technology
	Mechanical workshop	Thermal engineering
Surveying Public health engineering	Electrical engineering materials	Hydraulics & hydraulic machine
Soil Engineering	Electrical machine	Theory of machine and design
Irrigation		
Structural theory Irrigation	Electronics	Materials and metallurgy
Structural theory design & drawing (steel & RCC)	Fabrication technique	Automobile engineering
Estimating & Costing	Transmission and distribution	Refrigeration and airconditioning
Railways, bridges & tunnels	Industrial management	Estimating and costing and production engineering
Concrete technology Highway engineering Construction management & accounts	Generation, protection switch-gear & economics Utilization of electrical energy	Industrial management Project work
Project work	Project work	