

## INDIA

The mere availability of science and technology does not guarantee that economic development will automatically occur. They must be harnessed to productive processes if the desired development is to be brought about. People must be trained to apply science and technology appropriately and effectively on a broad front. Special talents need to be developed. Education and skills must be capable of supporting growth in the economy and giving proper direction to overall development.

Educational planners in India have, therefore, held uppermost in their minds the question of how to equip people with the skills needed to fulfil the needs of different sectors of the economy of a nation. These skills may be in the form of technological services or in construction, design and products requiring appropriate techniques. In India, all-out efforts have been directed, through the various Five Year Plans, to achieving these important objectives by means of technical and vocational education.

All developing nations have time as their greatest enemy. They are required to accomplish in a few decades what the advanced countries of the world have taken centuries to do. Under the conditions that prevail in India it is even more important that technical and vocational education is made relevant to the needs of the various sectors of the economy and the different levels of responsibility. Also, the industrial development should take place in such a fashion that the economy reaches the take-off stage as soon as possible.

During the last quarter of a century the technical education system in India has been developed to take care of these very objectives. At appropriate intervals, care has also been taken to review the whole structure of technical education and to infuse such modifications in the total system as are needed to match scientific, technological and industrial development inside and outside the country. Even so, the lack of proper industrial development and the cycle of natural calamities have created problems which have caused people to ask whether education and training have been sufficiently relevant and adequately reinforced.

A résumé of the facilities for training craftsmen, middle-level technicians and graduates in engineering and technology is given hereunder. Craftsman training is dealt with only summarily as it lies outside the ambit of my survey.

Craftsman training is being looked after by two advisory councils - the National Council for Training in Vocational Trades, and the Central Apprenticeship Council. The former awards National Trade Certificates to those who successfully complete the institutional training and also to apprentices. It is one of the two advisory bodies set up by the Government to ensure that the training imparted in various skills is purposeful and oriented towards the requirements of industries and allied fields. The other advisory body, the Central Apprenticeship Council, advises the Government on all policy matters, standards of training to be attained, course content for theoretical and practical instruction, standardization of tools and equipment required for instruction in the various trades, and details of training to be imparted to the craft instructors.

There are about 355 industrial training institutes spread over the various states and union territories. They provide facilities for the training of more than 155,000 trade trainees. Instruction is imparted in 32 engineering trades and 22 non-engineering trades. The period of training in some of the engineering trades is two years, and one year for the remaining engineering trades and all non-engineering trades. The standard of admission to most of the trades is eight years of school education, while for the remaining trades it is matriculation or one class below. As a general policy, admission is given on the basis of aptitude tests which are conducted in respect of 15 out of 54 trades covering a maximum of 74,000 boys.

Instruction has been simplified, and efforts have been made to maintain good standards. For this purpose, instruction manuals have been prepared for the guidance of instructors, and extensive arrangements have been made for their training and re-training.

Apprenticeship training is arranged according to the provisions of the Apprenticeship Act of 1961. It is obligatory on the part of all employers in specified industries to provide facilities for practical training to the products of the industrial training institutes. The apprenticeship training consists of basic training followed by shop-floor on-the-job training. On the basis of surveys conducted throughout the country, 83,000 training places have been located as against the 45,390 apprentice places in which trainees are actually undergoing training in 4,113 establishments. New trades have also been designated for the purpose of the apprenticeship programme to make a total of 56 designated trades. The new establishments are in the field of printing, catering and chemicals. The period of apprenticeship training varies between six months and four years depending upon the requirements and scope of training in the particular trades. During apprenticeship training, stipends are provided to trainees.

The Government has set up central training institutes at Bombay, Hyderabad, Kanpur, Calcutta, Madras and Ludhiana for the training of 1,098 instructors required annually in the industrial training institutes for 21 trades. Another central training institute has been started in New Delhi for the training of women instructors for cutting, tailoring and embroidery. The duration of training is one year, covering modern methods of instruction. An advanced training institute at Madras has also been started to take care of specific programmes for a higher order of technical and supervisory skills. With a seating capacity of 162, this institute provides facilities for training highly skilled craftsmen. It is also intended to serve as a model for other centres to be established later, and to evolve improved techniques of training which can be followed by institutes engaged in similar activities.

A Centre for Foremanship Training has been started in Bangalore with a view to offering systematic training in foremanship. It imparts technical and managerial skills to foremanship trainees sponsored by industry and other training organizations, and it prepares highly skilled craftsmen. Constant efforts have been made to develop the techniques of trade training to improve technical skills, and also to promote research. For this purpose a Central Staff Training and Research Institute has started functioning at Calcutta. This Institute conducts special training courses and seminars for the guidance and training of principals of industrial training institutes, training officers of the industries, and officers of the Directorate-General of Employment and Training. It also imparts training to enable them to plan, develop and control vocational training programmes to meet the skill requirements of the jobs.

These facilities have enabled the country to build up over the years a force of highly skilled craftsmen, training officers and foremen to organize first-rate shop-floor practice, and highly trained instructors equipped with modern techniques and skills in various engineering and non-engineering fields.

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In India there are 284 polytechnics offering a variety of courses for the preparation of middle-level technicians and operatives required for various duties in industry, construction work, design and overall development. The sanctioned annual admission capacity of these polytechnics is about 49,000, but this was reduced to 28,000 in 1968 due to economic recession and the high rate of unemployment of trained engineering graduates and diploma holders. The duration of courses ranges from two to four years, depending on the scope of the profession concerned. The functions expected of a technician in a changing environment make it imperative for educational planners to cross-fertilize the theoretical instruction given in the institutions with practical training in industry and other engineering professions and vocations. To this end, specific job-oriented courses have come into being in a number of polytechnics. A keen observer would find high quality and utility in the output of this new system which ensures the availability of broad-based theoretical knowledge in addition to practical training in all relevant fields. In effect this means that none of the theory in the diploma courses of the old pattern is lost for the sake of the envisaged practical training. The aim of the technician education is, therefore, to relate theory with practice, to relate teaching to industrial experience and to highlight the need of co-ordination between the technical institutions and industry. It is strongly felt that industry should not be required to invest huge funds on re-training new entrants so as to fit them for specific jobs, or to divert funds and energy away from the normal development process of which the research and design aspect is the most important.

The technical education system of any country is not an inflexible academic formulation. Rather, it grows out of the social, economic and environmental situation of that country. It must take into account the continually developing occupational needs of the people, and their aspirations for a better standard of living. Time and again it has been impressed upon the people of India that the country's economic emancipation depends on proper industrial development which, again, must be commensurate with the vast natural resources yet awaiting exploitation. In any case, departure from the broad-based instruction and practical work in the general diploma courses could prove harmful.

All the 284 polytechnics run conventional diploma courses in civil, mechanical, and electrical engineering and other allied fields of engineering and technology. These allied fields include metallurgy, mining engineering, chemical engineering, electronics, textile technology, refrigeration and air-conditioning, automobile engineering, leather technology, agricultural engineering, instrumentation, architecture, printing technology, production engineering, chemical operation and structural engineering. The distribution of polytechnics by states and by annual intake capacity is given in Appendix 1 on pages 42-44.

### SANDWICH PROGRAMME

To ensure proper technician education and co-ordinate theory with practical training in industry and allied fields, a sandwich programme has been introduced in 44 of the 284 polytechnics. There is no doubt about the effectiveness of this programme in equipping technicians with the general technician functions expected of them by industry and with the specific and particular functions required by those industries that collaborate with the polytechnic running the sandwich programme.

The programme is sound in that it ensures cross-fertilization of theory with practical training in appropriate industrial undertakings, the creation of appropriate relations between teaching and industry, and the promotion of understanding between the technical institutions and the industries of their complementary functions. There is also a fair possibility of an exchange of experts between the industry and the technical institution which, through the sandwich programme, have come close to each other. Beyond doubt it provides for an integrated educational programme as a joint enterprise of the institution and the industry.

That the system is effective is fully borne out by the number of polytechnics running sandwich programmes in collaboration with industry and engineering undertakings, though there are some polytechnics with no industries in the neighbourhood with which useful collaborative arrangements can be made, and some places where industrial development exists but no polytechnic.

Not only is no part of theory sacrificed in the sandwich programme, but also the vacations are fully utilized for purposes of practical training totalling twelve months in duration. The actual duration of a diploma course thus lasts for  $3\frac{1}{2}$  to four years instead of the three-year period of a conventional diploma. For this purpose the practical training is distributed into two periods of three months each in the first and second year and a period of six months after the final year examination. The training is supervised both by the experts and training officers of the industry and the teachers of the technical institutions concerned. The cost of the diploma-level sandwich programme works out to 150 rupees a month per student. Out of this, the student is paid a stipend of 100 rupees and the remainder is utilized for training charges at the industry, travelling allowances for the supervisory staff of the institution, and miscellaneous expenditure on running the programme.

A regular assessment of training is made and due credit given to the students for purposes of final examination leading to the award of Diploma in Engineering.

In the State of Maharashtra all the diploma courses are being run as sandwich programmes. In-plant training for a period of twelve months is an integral part of the course. The entire course is divided into eight semesters. The sixth semester is the first in which the student is deputed for industrial training. It is resumed in the seventh and eighth. This exercise improves the students' employability.

It is interesting to note that out of the 44 polytechnics conducting sandwich programmes in India, 25 are situated in the Western Region (comprising Maharashtra, Gujarat, Madhya Pradesh, Goa, Daman and Diu). Out of the remaining 19, only three are situated in the Northern Region (comprising U.P., Punjab, Rajasthan, Haryana, and Jammu and Kashmir) which is the most important industrial belt and most densely populated area of the country. A list of polytechnics running sandwich courses is given at Appendix 2 on page 45.

#### DIVERSIFICATION OF DIPLOMA COURSES

No technical education system worth its name can be developed in isolation from industry and the overall economy of a nation. We are living in a highly dynamic world which has given birth to a number of new technological functions. As a result, industry is required to have the services of technicians trained for their special needs. Also specialized industries have come up which have created demands for specialist technicians. All this has created the need for regular review and updating of the curriculum of conventional courses so as to prepare technicians for specialist functions and narrow specialities. The diversification that has taken place has not necessarily meant any appreciable sacrifice of the basic principles of engineering enshrined in the conventional engineering diploma course.

In a number of States in India diversified diploma courses have been started in suitable polytechnics. The courses and their curriculum have been planned so as to keep in view the needs of industry. Industry has been consulted for this purpose. Had this not been done, no meaningful courses could have been formulated or run for the benefit of the community at large.

At present, diversified courses are being run (or are proposed to be run during the Fifth Plan period) in about 125 polytechnics throughout the country. A list of special fields of diversification of diploma courses is given in Appendix 3 on pages 46-50.

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This survey would not be complete if the special efforts being directed towards diversification and re-organization of diploma courses were not mentioned. Under the Indo-Soviet Credit Agreement, the Government of India initiated measures to identify specialized fields of technician training. This approach was part of massive efforts directed towards a meaningful diversification of diploma courses. High-level teams of Indian and Soviet authorities visited a number of polytechnics and held discussions with major industrial projects in the country. They identified the following main areas of specialization for which technician programmes should be developed: machine building; metallurgy of ferrous metals; oil and gas processing equipment; and electrical machine building. For further specialization and emerging technologies they listed: technology of machine building; mechanical working; welding techniques; metallurgy of ferrous metals; production of castings; production forgings and stampings; oil and gas field equipment; oil and gas processing industry; electrical machine building.

Important technologies have been identified with special reference to the industries and institutions having the requirements. Model technician diploma courses were, therefore, started as shown in this table.

| TYPE OF INDUSTRY   | TRAINING INSTITUTION                          | CO-OPERATING INDUSTRIES   |
|--|---|---|
| Mechanical Metallurgy<br>Ferrous metals<br>Mechanical Metallurgy<br>Non-ferrous metals<br>Process Metallurgy<br>Ferrous metals<br>Process Metallurgy<br>Non-ferrous metals | Government Poly,<br>Durg,<br>Madhya Pradesh   | Bhilai Steel Plant,<br>Bhilai<br>Bharat Aluminium Co,<br>Korba  |
| Technology of<br>Mechanical<br>Engineering, Machine<br>Building  | Government Poly,<br>Ranchi,<br>Bihar          | Heavy Engineering<br>Corporation, Ranchi<br>National Institute of<br>Forge & Foundry, Ranchi                                    |
| Machine Building<br>Technology<br>Machine Building<br>Design & Drafting  | Government Poly,<br>Bhopal,<br>Madhya Pradesh | Bharat Heavy Electricals<br>(I) Ltd, Bhopal   |
| Radio Electronics  | Government Poly,<br>Hyderabad                 | Hindustan Aeronautics,<br>Hyderabad<br>Bharat Heavy Electricals,<br>Hyderabad<br>Electronics Corporation<br>of India, Hyderabad |
| Technicians for Oil<br>& Gas Industry  | Baroda University<br>Polytechnic              | Gujarat Refining<br>Oil & Natural Gas<br>Commission Workshop<br>Gujarat Fertilizer<br>Corporation                               |

The programme of Model Technician Diploma courses envisages practical training in important industry in each of the regions in which these courses are being run. The duration of the course is therefore 3½ to four years. During the practical training of students in industry, they are paid a stipend of 150 rupees a month. The number of hours of training during the three-year institutional training is 3,456. Out of this, 1,190 hours, roughly 35% of the total work load, are for theoretical training, and the remaining 65% (2,266 hours) are for practical training. The scheme has been found useful, and it is proposed to extend its scope so as to include in it a number of emerging technologies. A technical assistance agreement exists between the Government of India and the U.S.S.R.

## GIRLS' POLYTECHNICS

There are at present 24 polytechnics for women and girls in India, their chief aim being the promotion of proper technician education. The courses include: Electronics; Medical Lab. Technology; Secretarial Practice and Stenography; Architecture; Architectural Draughtsmanship; Library Science; Pharmacy; Commercial Arts; Costume Design and Dress-Making; Radio Servicing and Operation; Civil Engineering; Interior Decoration and Display; Tele-communications; Electrical Communication Engineering; Catering and Food Technology. Their duration varies between two and three years. Intake capacity of all the women's polytechnics is 2,370. Students who have completed their secondary education are eligible for admission.

In the fifth Five-Year Plan (Draft) it is proposed to run separate wings for women instead of opening independent women's polytechnics. It is estimated that about 25 to 30 such wings for women will be started during the Fifth Plan in the existing polytechnics. This proposal will not only ensure additional educational opportunity for women but will also economize in the cost of instructional facilities required for a polytechnic for women.

Appendix 5 on pages 53-54 lists the existing women's polytechnics by location in different states, intake capacity and duration of courses.

## PART-TIME DIPLOMA COURSES

The Government has taken keen interest in providing facilities for technician training for workers in industry, engineering undertakings and government departments. The aim of this project is to increase productivity and ensure quality in production on the one hand, and, on the other, to enable workers to improve their qualifications and better their prospects. In order to achieve this aim, part-time diploma facilities have been provided in 33 polytechnics. At least 24 of these polytechnics were started under a centrally-sponsored scheme which envisaged 100% financial assistance from the central government for the part-time courses for a period of five years from the date of their establishment. Instruction is provided in the conventional branches of Civil, Mechanical and Electrical Engineering. Each of the 33 polytechnics is designed for an annual admission capacity of 120 candidates. The duration of the course is four years. Minimum requirements for admission are the same as for full-time diploma course but include two years' experience of active technical service.

In addition to the above polytechnics, facilities have been provided for part-time diploma course in printing technology in four regional schools of printing technology.

Distribution of polytechnics running part-time diploma courses by location may be seen in Appendix 4 on pages 51-52.

## FACULTY DEVELOPMENT AND QUALITY IMPROVEMENT PROGRAMMES

To train polytechnic teachers, four regional technical teachers' training institutes have been started, one each in Madras (Southern Region), Bhopal (Western Region), Chandigarh (Northern Region) and Calcutta (Eastern Region). All four run a full-time regular course leading to a Diploma in Technical Teaching. In addition, they organize short-term training programmes, refresher courses, summer school and winter school programmes, and special workshop projects for the preparation of instructional material, teaching aids and work-books on important topics for serving teachers. Some of these institutes are also engaged in programmes of examination reform and evolving evaluation techniques in co-operation with the appropriate State Boards of Technical Education.

A programme of industrial training forms an integral part of the Diploma in Technical Teaching in the technical teachers' training institutes. It lasts from twelve to 15 weeks depending upon the speciality or topic of study concerned. Here again, the idea is to familiarize the teacher trainee with the actual work situations and the live problems which an industry faces in the various processes of production, design, development and maintenance. Through the industrial training there is an effective cross-fertilization of academic study with the industrial environment. Studies have shown that this programme not only considerably increases the teaching effectiveness of the trainees but that it also changes their outlook.

Science and technology are advancing rapidly, and each day opens new vistas of knowledge. These developments have an essential bearing on engineers, technicians and operatives in all walks of life. Under such circumstances, it has not only become imperative to continually revise, remodel and review the curriculum of technician courses but also to ensure that it takes full care of the changing pattern of jobs on the one hand and their application in engineering practices on the other.

The technical teachers' training institutes have therefore been entrusted with the work of curriculum planning, and special curriculum cells have been instituted in each of these institutes for this purpose. The curriculum development cells in the technical teachers' training institutes and the Allahabad Polytechnic, Allahabad (U.P.), have now taken upon themselves the responsibility of conducting surveys of industries and engineering departments and organizations so as to identify and analyse technician functions, find out special functions and operations, and identify the course structures for the different specialities. After this exercise the curriculum development cells engage themselves in the development of appropriate teaching aids and instructional materials. Serving teachers in polytechnics are trained in the use of these instructional materials and teaching aids and are apprised of modern methods of teaching and course planning.

In curriculum planning and the follow-up programmes, full co-operation is extended to the institutes by the Department of Technical Education and the State Boards of Technical Education. This hastens the adoption of the new curricula for purposes of teaching and final examination. The faculties of the technical teachers' training institutes are fully assisted by the faculties of the polytechnics. The whole programme is so designed as to ensure harmonious relations and secure those benefits that are not generally available to programmes run in isolation.

Present diploma-level education is defective in that the course curriculum is inflexible and the instruction is not oriented appropriately towards practice in industry and other fields where the services of technically trained personnel are needed. One of the reasons for this is that the country is not sufficiently developed industrially; another is that there has been an absence of apprenticeship in industry. Also, the outlook of teachers in polytechnics is not sufficiently practice-oriented, with the result that instruction is overloaded with theory unsupported by practical experience. Steps have now been taken to remove these limitations.

Under the Quality Improvement Programme launched during the Fourth Plan period the following programmes have been undertaken with the chief aim of improving the quality and nature of teaching in the polytechnics :

(a) Short-term In-service Courses for Teachers in Polytechnics

Under this programme short courses on important topics relating to pedagogy, teaching methods and appropriate subjects of course curricula are organized in appropriate institutions. The entire expenditure on this programme is borne by the Government of India.

(b) Summer School/Winter School Programmes

Under the aegis of the Indian Society for Technical Education, courses extending up to twelve weeks are organized to provide instruction for serving teachers on different topics. Subjects for these programmes are carefully chosen so as to cover a wide range of requirements.

(c) Short-term Industrial Training Programme

Under this programme, teachers in engineering colleges and polytechnics are deputed for industrial training for a period of three months. For this programme the summer vacations are utilized. Industries and engineering undertakings are selected keeping in view the broad requirements of polytechnic education. The teachers deputed are expected to acquaint themselves with the actual process of production, design and construction work, and to utilize this knowledge in the classroom. During the training period the teacher is paid a monthly stipend of 300 rupees a month in addition to a travel grant of 100 rupees.

It is worth mentioning here that the technical teachers' training institutes at Bhopal, Madras and Chandigarh have benefited from a massive programme of British collaboration. This collaboration has brought new concepts, new teaching practices and new ideology to the field of technical education as a whole. The exchange of experts and teaching personnel between the two countries has also been very effective. British contributions of teaching materials, library books, and equipment needed for education technology laboratories, reprographic centres and other centres and laboratories have also been massive. One of the important ideas introduced in the technical education system through the British collaboration has been programmed learning. Now successfully implemented in almost all the technical institutions, it has received wide acclaim both from teachers and students.

## APPRENTICESHIP TRAINING

As there has so far been no first-rate apprenticeship programme, it has been difficult to provide facilities for practical training for all the students during their course. Arrangements have, however, been made on a limited basis for post-qualification training in industry, under the practical training stipend programme. In this programme, the Government provides stipends to the value of 150 rupees a month for a diploma holder and 250 rupees a month for a degree holder for a period of 12 months. The scope of this scheme is limited because there are not enough training places in industry for the diploma/degree holders.

This programme facilitates proper practical training in appropriate industries. The apprentice meets actual work situations of production, manufacture, design and construction work and gets accustomed to the industrial environment.

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The scope of the Apprenticeship Act of 1961 was extended by an amendment in 1973. As a result, the training of degree/diploma holders in engineering and technology has been brought within its purview. Classified industries are now required to make provision for a specified number of paid apprenticeship places. They share the cost of stipends with the Boards of Apprenticeship Training up to a value of 150 rupees for diploma holders and 250 rupees for those with degrees. In this connection it may be stated that the Government of India has established Boards of Apprenticeship Training in each of the four regions. The Western Region, consisting of Maharashtra, Gujarat, Madhya Pradesh, Goa, Daman and Diu, is serviced by the Board of Apprenticeship Training, Western Region, Bombay; and the Southern Region, comprising Andhra Pradesh, Tamilnadu, Kerala and Karnataka, by the Board of Apprenticeship Training, Southern Region, Madras. The Northern Region, with Uttar Pradesh, Punjab, Rajasthan, Haryana, Delhi Pradesh, Chandigarh, Jammu and Kashmir, is looked after by the Board of Apprenticeship Training, Northern Region, Kanpur; and the Eastern Region, comprising West Bengal, Orissa, Bihar, Assam and the Union territories of the region, is taken care by the Board of Apprenticeship Training at Calcutta. These statutory organizations are administered by a duly constituted Board of Governors with a director to manage the affairs of the Board of Apprenticeship Training.

Efforts have thus been successfully directed towards creating first-rate apprenticeship training in engineering and technology. It is an effort towards post-qualification training which conditions and re-orientates raw graduates and diploma holders to suit the actual needs of industry. Without doubt it increases the employability of trainees and the effectiveness of their executive powers.

### DEGREE COURSES

In India 138 engineering colleges are being run for the professional training of engineers and technologists. These colleges offer courses leading to a bachelors degree in engineering and technology. These engineering colleges are inclusive of the Indian Institutes of Technology at Bombay, Kanpur, Madras, Delhi and Kharagpur, the Institute of Science, Bangalore, the Institute of Sugar Technology, the Institute of Paper Technology, 16 Regional Engineering Colleges and some other national centres of specialized technology. The Indian Institutes of Technology are the apex institutes which also offer postgraduate courses in engineering and technology and first-rate facilities for research work leading to doctoral and post-doctoral degrees.

The regional engineering colleges were set up during the Second and Third Plan periods. They have been developed into centres of excellence and as pace-setters for the engineering colleges run by the state governments and private agencies. Quite a few of these colleges also run postgraduate courses leading to M.E./M.Tech. degrees. Also, they offer excellent facilities for research in science, engineering and technology. Each regional engineering college is run by a registered Society and administered by a duly constituted Board of Governors.

Roorkee University is considered to be the pioneering engineering/technological university having residential status. It is an excellent research centre offering facilities in a variety of subjects. Another technological university, known as the Jawahar Lal Nehru Technological University, has come into being in Hyderabad during the Fourth Plan. This university has three constituent engineering colleges.

The engineering colleges run a B.E. course of five years' duration after higher secondary education and four years' duration after an intermediate or predegree course. Facilities are available in a variety of subjects besides the conventional courses in civil, mechanical and electrical engineering. The sanctioned intake capacity of all the engineering colleges is more than 21,000 (reduced by 33% in 1968 due to economic recession and growing unemployment amongst technically trained graduates and diploma holders).

The Indian Institutes of Technology, the Indian Institute of Science, Bangalore, the Banaras Hindu University and Roorkee University have excellent facilities for teaching, research and educational innovation. These centres are, therefore, being used specially for teacher training programmes and programmes of higher studies leading to M.E./M.Tech., doctoral degree and post-doctoral degree studies for teachers in engineering colleges under the Quality Improvement Programme. All these centres run curriculum development cells to update the curriculum of courses leading to first degrees in engineering and beyond. Also, under the Quality Improvement Programme, these institutes run short-term in-service courses and short-term refresher courses in a variety of specialized topics of interest for the benefit of teachers of engineering colleges. They also run summer school programmes and winter school programmes in collaboration with professional bodies like the Indian Society for Technical Education. Some of these institutes - notably the Institute of Science, Bangalore, and the Indian Institutes of Technology, Bombay and Kanpur - have developed excellent research facilities in such important fields as space research, industrial design and aircraft technology. It is worth mentioning here the unique contribution made by the All-India Institute in Planning and Architecture and the Indian School of Mines, Dhanbad. They run courses in narrow specialities of national importance.

Facilities for part-time courses are offered by twelve engineering colleges for the benefit of industrial workers. Admission capacity of these part-time education centres is 790. These four-year courses are run for diploma holders in engineering. The duration of the course is four years. The facilities of part-time degree courses are available mainly in civil, mechanical and electrical engineering. Minimum qualifications for admission are a diploma in engineering, and minimum experience of two years of active technical service. There is provision to expand facilities of part-time education during the fifth Five-Year Plan. This shows how the Government is anxious to improve the lot of the industrial workers and the labour force.

#### TEACHER TRAINING PROGRAMME

Faculty development programmes have been initiated by the Indian Government with a view to improving the methodology of teaching and the quality of the teachers. Initially, the Government sponsored a technical teacher training programme to which a large number of teachers were deputed both in India and abroad. These were aimed at improving both the teaching and quality of instruction. During the Fourth Plan a massive programme of teacher training has been mounted. Training of teachers has now been recognized as a continuing programme. Under the Quality Improvement Programme, which is fully financed by the Government, teachers of engineering colleges are deputed for studies leading to M.E./M.Tech. degrees, for post-doctoral research, and for three months' industrial training. Under these schemes it is proposed to cover the entire teaching force of engineering colleges. The academic courses referred to are specially tailored to suit teachers in engineering colleges. Each trainee of a M.E./M.Tech. programme is paid a stipend of 300 rupees a month in addition to a grant of 1,000 rupees for industrial tours and project work. Each trainee in doctoral research is paid a stipend of 400 rupees a month plus an industrial grant of 1,000 rupees. The first of these programmes lasts for two years and the second for three years. For the short-term industrial training programme of three months' duration, the teacher trainee is paid 300 rupees a month plus a travel grant of 100 rupees. In addition, teachers are deputed for short-term in-service training and short-term courses in specialized topics and modern technologies and engineering practices.

#### ROLE OF GOVERNMENT DEPARTMENTS AND THE PRIVATE SECTOR

Government departments - such as the Ministry of Railways, the Ministry of Food and Agriculture, the Ministry of Defence and public sector undertakings like the

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Hindustan Steel Ltd, the Bharat Heavy Electricals (India) Ltd, and the Heavy Engineering Corporation - have their own training departments. They recruit raw engineering graduates, diploma holders and craftsmen and train them for specific requirements. The training schools run by these organizations have their own training arrangements. They are self-sufficient in the matter of training capacity. Private organizations and industries have their own training arrangements. They willingly undertake programmes for training teachers and students of technical institutions, but for their own functions and engineering operations they run their own training programmes which bear relevance to their specialized needs.

Of late, the technical education system is being organized to suit the requirements of industries, not only in the general area of their functions but also in specialized fields. Past experience has shown that harmonious relations between technical institutions and industry are essential for the meaningful development of the economy. Day by day, industry and engineering undertakings are becoming more and more closely involved in the education system.

## EXAMINATIONS AND AWARDS

Standards of instructional facilities are prescribed and supervised by the universities in the case of courses at degree level and above, and by the State Boards of Technical Education in the case of diploma/technician and certificate courses. Examinations are conducted by these academic bodies, and awards are made on the successful completion of the final-year classes. Over and above these bodies there is the All-India Council of Technical Education which bears constitutional responsibility for the organization and development of technical education throughout the country. This is the apex body in respect of all matters pertaining to technical education and its development up to the desired level. The Council takes stock of long-range needs including the development envisaged in the Five-Year Plans. It also acts as the highest co-ordinating authority in the matter of course-planning and standards.

Practical training is not an essential ingredient for the award of a degree, diploma or certificate except for the degree and diploma courses run on a sandwich pattern. In the sandwich programme, practical training for a period of twelve months is essential, being an integral part of the syllabus. The main reason why practical training is not compulsory for the award of a degree or diploma is that there are not enough training places for all the students attending institutions (49,000 for diploma courses and 21,000 for degree courses). Only in Maharashtra State is practical training an integral part of the technician course, and due credit is given when diplomas are being awarded.

## MANPOWER PLANNING

Unless manpower requirements are forecast ten to 15 years in advance, no meaningful effort can be made to organize technical education. In India, first at the national level and then at regional level, identification of manpower requirements for specialized and general engineering needs, and also for emerging technologies, is attempted on the basis of perspective planning. In this process a study of the institutions which provide the manpower resources is also made.

At the national level, the Institution of Applied Manpower Research (3 Ring Road, Indraprastha Estate, New Delhi) is carrying out manpower planning in a modern scientific manner. At the regional level the State Departments of Technical Education are being encouraged to set up proper manpower cells with a view to giving the planning process a meaningful approach.

The Institute of Applied Manpower Research has recently undertaken an extensive survey of educational and training facilities by functions, vocations and professions on an all-India basis. The results of the survey are being examined and analysed. This survey is expected to give, in precise terms, a picture of those educational facilities that are available, those that are required and those that are utilized. While this study is being processed, an in-depth study of specialized fields has also been undertaken by the Institute of Applied Manpower Research. On the basis of these projections, it has been decided that expansion of technical education, at the degree level or the diploma level, is not required during the Fifth Plan. More and more attention is therefore being paid to the consolidation of the existing facilities and to the improvement of the quality of technical education.

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APPENDIX 1: DISTRIBUTION OF POLYTECHNICS BY STATE  
AND SUBJECTS AND THEIR ADMISSION CAPACITY

|   | Capacity |
|---|----------|
| NORTHERN REGION   |          |
| <u>Delhi</u> (3 polytechnics)   |          |
| Civil 150, mechanical 270, electrical 210, electronics 30, auto. 30, architecture and draftsmanship 30, refrigeration and air-conditioning 30   | 750      |
| <u>Himachal Pradesh</u> (2 polytechnics)  |          |
| Civil 90, mechanical 60, electrical 105, auto. 15   | 270      |
| <u>Jammu &amp; Kashmir</u> (1 polytechnic)  |          |
| Civil 30, mechanical 45, electrical 45, auto. (post dipl.) 15   | 135      |
| <u>Punjab</u> (10 polytechnics)   |          |
| Civil 420, mechanical 525, electrical 525, textile technology 30, leather technology 25, mechanical engineering (sandwich) 30, auto. (post dipl.) 30  | 1585     |
| <u>Chandigarh</u> (1 polytechnic)   |          |
| Civil 75, mechanical 90, electrical 45  | 210      |
| <u>Haryana</u> (7 polytechnics)   |          |
| Civil 390, mechanical 465, electrical 345, auto. 30, machine tool 30, oper. weld & steel met. tech. 15, ref. and air-cond. 15, elec. mech. and app. 30, elec. & cont. 15, radio and television 15   | 1305     |
| <u>Rajasthan</u> (6 polytechnics)   |          |
| Civil 300, mechanical 450, electrical 450, mining nil, ind. electronics nil, auto. nil, inst. nil   | 1200     |
| <u>Uttar Pradesh</u> (36 polytechnics)  |          |
| Civil 1580, mechanical 2290, electrical 2260, auto. 150, text. chem./tech. 30, electronics 90, arch. asstship 28, ref. air-conditioning 10, leather technology 60, prtg. technology 80, paper and pulp tech. 90, industrial elec. (post dipl.) 15, chemical 10, auto. (post dipl.) 40, inst. 10 | 6743     |
| EASTERN REGION  |          |
| <u>Assam</u>  |          |
| Civil 360, mechanical 150, electrical 120, chemical operator 30   | 660      |
| <u>Bihar</u>  |          |
| Civil 670, mechanical 375, electrical 270, mining 40, text tech. 30, ceram. tech. 15, production technology 30, drawing and design  | 1445     |

|  | <u>India</u> |
|--|--------------|
|  | Capacity     |
| <u>Orissa</u> (5 polytechnics)   |              |
| Civil 45, mechanical 155, electrical 155, mining 20, metal 15, chem. 15, tele-com./electronics 35, drilling tech. 10, surveying 10, ref. & air-conditioning 15, auto. 15, instrument 15  | 505          |
| <u>Tripura</u> (1 polytechnic)   |              |
| Civil 30, mechanical 15, electrical 15   | 60           |
| <u>Manipur</u> (1 polytechnic)   |              |
| Civil 30, mechanical 15, electrical 15   | 60           |
| <u>Meghalaya</u> (1 polytechnic)   |              |
| Civil 60   | 60           |
| <u>West Bengal</u> (27 polytechnics)   |              |
| Civil 1135, mechanical 1780, electrical 735, mechanical & electrical (combined) 370, electronics 30, radio comm. nil, mining 58, auto. 30, printing 100, textile technology 20   | 4258         |
| WESTERN REGION   |              |
| <u>Goa</u> (1 polytechnic)   |              |
| Civil 40, mechanical 40, electrical 40   | 120          |
| <u>Gujarat</u>   |              |
| Civil 485, mechanical 870, electrical 790, elec. & radio 30, auto. 70, metallurgy 30, text. tech. 150, text. chem. 45, pharm. 200, sound 20, const. & structure 70, ref. & air-conditioning 120, instru. and central 5, machine handling technology 20, agro. ind. engg. 20, tele-comm. 30, television 20, ceramic 20, printing 30, comm. practice 120, production 60, MC tools, mec. & tools engg. 40, oil and gas tech. 30, production of fertilisers 30, synthetic resins & plastics 30 | 3355         |
| <u>Madhya Pradesh</u>  |              |
| Civil 818, mechanical 758, electrical 734, mining 10, meta. 30, auto. 12, pharm. 30, text. tech. 15, printing 20, structural engg. 15, comm. practice 60, fine arts 25   | 2527         |
| <u>Maharashtra</u>   |              |
| Civil 1290, mechanical 1170, electrical 1100, tele-communication 120, mining 15, meta. 50, auto. 15, text. tech. 70, text. chem. 50, sugar tech. 10, paint 20, arch. 136, chem. 40, parm. 220, leather tech. 15, printing 100, sound & television 21, production 50, ind. electronics. 50  | 4542         |

India

Capacity

SOUTHERN REGION

Andhra Pradesh

Civil 860, mechanical 975, electrical 945, elec. comm. 60, mining 20, auto 60, text. tech. 30, ceram. tech. 25, meta. nil, pharm. nil, chem. 90, commercial practice 40 3105

Kerala

Civil 820, mechanical 925, electrical 625, tele-comm. 30, auto 60, text. tech. 60, chem. operator 60, printing 30 2610

Tamil Nadu

Civil 1250, mechanical 1487, electrical 1295, auto 40, text. tech. 100, leather tech. 15, printing 95, chem. operator 60, production engineering nil, fisheries and navigation 30, refrigeration nil, town and country planning nil, meta nil, tool design nil, welding tech. nil, commercial practice nil 4327

Mysore

Civil 1085, mechanical 1005, electrical 975, tele-comm. 70, mining 60, auto 80, text. tech. 40, printing nil, sound nil, ceram. tech. nil, meta. 30, cinematography nil, commercial practice 110 3455

Pondicherry

Civil 60, mechanical 40, electrical 40, comm. practice nil 140

SUMMARY

|                                   |       |
|-----------------------------------|-------|
| Northern Region (66 institutions) | 12243 |
| Eastern Region (54 institutions)  | 7048  |
| Western Region (73 institutions)  | 10544 |
| Southern Region (90 institutions) | 13682 |

APPENDIX 2 : POLYTECHNICS CONDUCTING SANDWICH DIPLOMA COURSES

|  |  |
|--|--|
| Ramgarhia Polytechnic, Phagwara                                    | Jharsaguda Engineering School,<br>Jharsaguda                           |
| Allahabad Polytechnic, Allahabad                                   | Orissa School of Engineering,<br>Keonjhar                              |
| Government Polytechnic, Panaji, Goa                                | Assam Engineering Institute,<br>Gauhati                                |
| K.J. Somaiya Polytechnic, Bombay                                   | Birla Institute of Technology,<br>Calcutta                             |
| Polytechnic Institute, Harda                                       | The Calcutta Technical School,<br>Calcutta                             |
| R.C. Technical Institute, Ahmedabad                                | State Technological Institute,<br>Rourkela                             |
| Bhagubai Mafatlal Polytechnic,<br>Bombay                           | M.C.M. Polytechnic, Avadi,<br>Madras                                   |
| S.V. Government Polytechnic,<br>Bhopal                             | A.H. Wadia Institute of Technology,<br>Kalina, Bombay                  |
| Dharamsinh Desai Institute of<br>Technology, Nadiad                | Angel Junior Technical College<br>(Polytechnic), Bombay                |
| Shri Bhavsinhji Polytechnic,<br>Bhavnagar                          | Government Polytechnic,<br>Visakhapatnam                               |
| Government Polytechnic, Ujjain                                     | Y.M.C.A. Institute of<br>Engineering, Faridabad                        |
| Dr. S. & S. Gandhi College of<br>Engineering and Technology, Surat | Tamil Nadu Polytechnic, Madurai  |
| Government Polytechnic, Bulsar                                     | Coimbatore Institute of Technology<br>Sandwich Polytechnic, Coimbatore |
| A.V. Parekh Technical Institute,<br>Rajkot                         | Central Polytechnic, Madras  |
| Vaishnav Polytechnic, Indore                                       | Government Polytechnic, Khandwa  |
| Samrat Ashok Technological<br>Institute, Vidisha                   |  |
| K.V. Polytechnic, Patna  |  |
| Government Girls Polytechnic,<br>Ahmedabad                         |  |
| L.E. College, Morvi  |  |
| Government Polytechnic, Rajkot                                     |  |
| K.J. Polytechnic, Broach   |  |
| Government Girls Polytechnic,<br>Surat                             |  |
| Pt. Jawahar Lal Nehru Polytechnic,<br>Sanawad                      |  |
| Bhailal Bhai & Bhikhabhai<br>Polytechnic, Vallabh Vidyanagar       |  |
| C.T.I. Polytechnic, Gwalior  |  |
| Government Polytechnic, Dhanbad                                    |  |
| Government Polytechnic, Barauni                                    |  |
| Orissa School of Engineering,<br>Cuttack                           |  |
| Behrampur Engineering School,<br>Behrampur                         |  |

India

APPENDIX 3: EXISTING & PLANNED PROGRAMMES OF DIVERSIFICATION

(Location refers to a Government Polytechnic except where stated)

ANDHRA PRADESH

Degree Courses

Electronics and Communication Engineering                      Nagarjunasagar College, Hyderabad

Diploma Courses

Chemical Engineering    Visakhapatnam  
Automobile Engineering    Anantpur  
Commercial Practice    Tirupathi and Vishakhapatnam  
Pharmacy    Tirupathi, Vishakhapatnam and Hyderabad  
Radio Electronics    Hyderabad (under USSR programme)

Part-time Diploma Courses

Electrical Communication Engineering  
Civil Engineering

ASSAM

Diploma Courses

Automobile Engineering  
Agricultural Engineering  
Tele-Communication Engineering

BIHAR

Diploma Courses

Chemical Operators Course    Ranchi  
Commercial practice    Ranchi  
Mettalurgy    Ranchi  
Technology of Mechanical Engineering (under USSR programme)    Ranchi

GOA

Diploma Courses

Commercial Practice    Goa  
Structural Fabrication and Erection    Goa  
Electrical Communications    Goa

GUJARAT

Diploma Courses

Construction and Structural    Ahmedabad, Bhavnagar, Patan & Bulsar  
Technical in Chemical Industry    Bulsar  
Sound and Television Engineering    Rajkot

|   |   |
|---|---|
| Telecommunication Engineering                 | Rajkot  |
| Ceramics Technology                           | L. E. College, Morvi  |
| Printing Technology                           | Ahmedabad   |
| Commercial Practice                           | Patan, Porbander, Broach and Rajkot                                     |
| Technical Sales Representatives & Services    | L. D. College of Engineering, Ahmedabad                                 |
| Technicians for Oil and Gas Industry          | Baroda University Polytechnic (under USSR programme)                    |
| <u>Post-Diploma Courses</u>                   |   |
| Production Engineering                        | S. & S. S. Gandhi College, Surat, and Bhavsinhji Polytechnic, Bhavnagar |
| Instrumentation & Control                     | A. V. Parekh Technical Institute, Rajkot                                |
| Material Handling Technology                  | Ahmedabad   |
| Air conditioning and refrigeration            | L. D. College of Engineering, Ahmedabad                                 |
| Power Plant Engineering                       | L. D. College of Engineering, Ahmedabad                                 |
| <u>Part-time Courses</u>                      |   |
| Machine Tools Technology                      | Ahmedabad   |
| Welding Technology                            | Ahmedabad   |
| Tods Engineering (Jigs, Dies and Fixtures)    | Ahmedabad   |
| <u>Short-term Job-oriented Programmes in</u>  |   |
| Office Management and Business Correspondence |   |
| Accountancy and Taxation                      |   |
| Banking                                       |   |
| Instrumental Analysis                         |   |
| Industrial Engineering and Management         |   |
| Computer Programming                          |   |
| Stenography                                   |   |
| Reception and PBX Operator                    |   |
| Punch Operator                                |   |
| Laundrier                                     |   |
| Public Address system-cum-Project Operator    |   |
| Electroplater                                 |   |
| Farm Mechanic                                 |   |
| Family Planning Assistant                     |   |
| Typewriting and Duplicating Machine Repairer  |   |
| Truck Driver-cum-Repairer                     |   |
| Plumber                                       |   |



|  |   |
|--|---|
| Automobile Engineering                               | L. V. Polytechnic, Hassan; Bellary  |
| Leather Technology and Plastics                      | Chintamani  |
| Public Health Engineering                            | Chintamani  |
| Agriculture Engineering                              | D. A. C. F. Polytechnic, Chickmangalur<br>and Krishnarajapet                            |
| Construction Technology                              | Raichur   |
| Chemical Engineering                                 | Karnataka Polytechnic, Mangalore  |
| <u>Post-Diploma Courses</u>                          |   |
| Refrigeration and Air-Conditioning                   | S. J. Polytechnic, Bangalore  |
| Production Engineering                               | S. J. Polytechnic, Bangalore  |
| Metrology and Quality Control                        | S. J. Polytechnic, Bangalore  |
| Electronics  | S. J. Polytechnic, Bangalore  |
| Machine Tool Technology                              | S. J. Polytechnic, Bangalore and<br>D. R. R. Polytechnic, Davangere                     |
| Welding Technology                                   | Tumkur and Belgaum  |
| Erection and Maintenance Engineering                 | Karnataka Polytechnic, Mangalore  |
| Design Draughtsmanship and<br>Production Development | M. E. I. Polytechnic, Bangalore   |
| Architecture and Town Planning                       | K. H. K. Institute, Dharwar   |
| Foundry Technology and Heat<br>Treatment Technology  | S. J. Polytechnic, Bhadravati   |
| Boring and Drilling and Mine Surveying               | School of Mines, Oorgaum  |
| ORISSA   |   |
| <u>Diploma Courses</u>                               |   |
| Automobile Engineering                               | Orissa School of Engineering, Cuttack   |
| Instrument Technology                                | Orissa School of Engineering, Cuttack   |
| Electrical Communication Engineering                 | Berhampore Engineering School,<br>Berhampore  |
| Mines Surveying and Drilling                         | Orissa School of Mining, Keonjhar   |
| <u>Post-Diploma Courses</u>                          |   |
| Refrigeration and Air-Conditioning                   | Jharsuguda Engineering School   |
| PUNJAB   |   |
| <u>Post-Diploma Course</u>                           |   |
| Air-Conditioning and Refrigeration                   | Amritsar  |
| UTTAR PRADESH  |   |
| <u>Diploma Courses</u>                               |   |
| Electronics  | Allahabad, K. L. Polytechnic, Roorkee;<br>D. N. Polytechnic, Meerut; Lucknow,<br>Kanpur |
| Chemical Engineering                                 | Gorakhpur, Bareilly   |

## India

|  |  |
|--|--|
| Automobile Engineering                 | Bareilly, Meerut, Lucknow, Kanpur, Jhansi, Mirzapur and Gorakhpur  |
| Agriculture Engineering                | Bareilly and Lucknow   |
| Commercial Practice                    | Bareilly and Lucknow   |
| <u>Post Diploma Courses</u>            |  |
| Industrial Electronics                 | Allahabad, Bareilly, Lucknow and Kanpur  |
| Refrigeration and Air-Conditioning     | M. G. Polytechnic, Hathras; Bareilly, Moradabad, Lucknow, Faizabad, Mirzapur, Gorkhpur, D. N. Polytechnic, Meerut; Allahabad |
| Automobile Engineering                 | Lucknow, and P. 'M.' V. Polytechnic, Mathura   |
| Foundry Technology                     | Moradabad  |
| High Altitude Engineering              | Nainital   |
| Instrument Technology                  | Manpur   |
| Design and Drafting                    | Allahabad and Lucknow  |
| TAMIL NADU                             |  |
| <u>Degree Courses</u>                  |  |
| Sugar Technology                       | Institute of Chemical Technology, Madras   |
| Agricultural Technology                | Muthai Polytechnic, Annamalainagar   |
| Production Technology                  | Coimbatore   |
| Design and Drafting Technology         | P. S. G. Polytechnic, Coimbatore   |
| Industrial Engineering                 | Coimbatore   |
| Electronics                            | Tamilnadu Polytechnic, and Women's Polytechnic Madurai   |
| Bio-medical Technology                 | Vellore  |
| Plastics and Petro-Chemical Technology | Institute of Chemical Technology, Madras   |
| Television                             | Institute of Film Technology, Madras   |
| Library Science                        | Women's Polytechnic, Madras  |
| Commercial Practice                    | V. S. V. N. Polytechnic, Virudhunagar, and Women's Polytechnic, Madurai  |
| <u>Post-Diploma Courses</u>            |  |
| Welding Technology                     | Tiruchirapalli   |
| Marine Engineering                     | Central Polytechnic, Madras  |
| Diesel Locomotion and Traction         | Tiruchirapalli   |
| PONDICHERRY                            |  |
| <u>Diploma Course</u>                  |  |
| Commercial Practice                    |  |
| Electronics                            |  |

APPENDIX 4: PART-TIME DIPLOMA COURSESCivil/Mechanical/Electrical Engineering

|  | <u>Admission<br/>Capacity</u> |
|--|-------------------------------|
| <u>Chandigarh</u>                                  |                               |
| Central Polytechnic, Chandigarh                    | 30                            |
| <u>Punjab</u>                                      |                               |
| Guru Nanak Engineering College, Ludhiana           | 60                            |
| Thapar Polytechnic, Patiala                        | 60                            |
| <u>Rajasthan</u>                                   |                               |
| Jodhpur Polytechnic, Jodhpur                       | 30                            |
| Government Polytechnic, Kota                       |                               |
| <u>Uttar Pradesh</u>                               |                               |
| Government Polytechnic, Kanpur                     | 100                           |
| Hewett Polytechnic, Lucknow                        | 120                           |
| <u>West Bengal</u>                                 |                               |
| Acharya Prafulla Chandra Roy Polytechnic, Calcutta | 120                           |
| J. C. Ghosh Polytechnic, Calcutta-23               | 60                            |
| Central Calcutta Polytechnic, Calcutta-14          | 60                            |
| Birla Institute of Technology, Calcutta-50         | 40                            |
| Asansol Polytechnic, Asansol                       | 120                           |
| Calcutta Technical School, Calcutta-13             | 120                           |
| <u>Bihar</u>                                       |                               |
| New Government Polytechnic, Patna-13               | 100                           |
| <u>Gujarat</u>                                     |                               |
| Dr S. S. Gandhi College of Eng. & Tech., Surat     | 45                            |
| Government Polytechnic, Ahmedabad                  | 100                           |
| Government Polytechnic, Dohad                      | 45                            |
| S. B. Polytechnic, Bhavnagar                       | 45                            |
| Government Polytechnic, Bulsar                     | 30                            |
| Government Polytechnic, Porebander                 | 15                            |
| Shri K. L. J. Polytechnic, Broach                  | 30                            |
| M. S. University Polytechnic, Baroda               | 100                           |
| <u>Madhya Pradesh</u>                              |                               |
| S. V. Government Polytechnic, Bhopal               | 120                           |
| Shri Vaishnav Polytechnic, Indore                  | 120                           |
| Government Polytechnic, Jabalpur                   | 120                           |

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|   | <u>Admission<br/>Capacity</u> |
|---|-------------------------------|
| Government Central Technical Institute (Polytechnic), Gwalior         | 120                           |
| <u>Maharashtra</u>  |                               |
| Government Polytechnic, Poona   | 120                           |
| <u>Andhra Pradesh</u>   |                               |
| Government Polytechnic, Hyderabad                                     | 80                            |
| <u>Kerala</u>   |                               |
| Kerala Government Polytechnic, Calcutta-5                             | 60                            |
| Maharaja's Technological Institute, Trichur                           | 60                            |
| Government Polytechnic, Kalamarsery<br>Centre Polytechnic, Trivandrum | 60                            |
| <u>Tamil Nadu</u>   |                               |
| Central Polytechnic, Madras   | 120                           |
| Government Polytechnic, Tiruchirapalli                                |                               |
| <u>Printing Technology</u>  |                               |
| Northern Regional School of Printing Technology, Allahabad (U.P.)     | 20                            |
| School of Printing Technology, Calcutta (West Bengal)                 | 40                            |
| Government Institute of Printing Technology, Bombay (Maharashtra)     | 50                            |
| Regional School of Printing, Madras                                   | 35                            |
| Total   | <u>2485</u>                   |

APPENDIX 5 : GIRLS' POLYTECHNICS

With Dates of Establishment, Fields of Study, and Admission Capacity

Capacity

NORTHERN REGION

Delhi Women's Polytechnic, Kashmere Gate, Delhi 6 (1962)  
 Electronics 25, commerical practice 25, interior decoration 25,  
 library science 25, medical laboratory tech. 28, commerical art 25,  
 architectural assistantship 30 185

Chandigarh Government Polytechnic for Women, Chandigarh (1962)  
 Commercial practice 30, architectural assistantship 25, pharmacy  
 and dress-making course 30, interior decoration and display 30,  
 radio engineering and electronics 30, library science 30 175

Punjab Government Polytechnic for Women, Jullundur  
 Library science 30, commercial practice 30, pharmacy 30 90

Haryana Government Polytechnic for Women, Ambala  
 Library science 30, pharmacy and dress-making 30 60

Uttar Pradesh Government Girls' Polytechnic, Lucknow (1963)  
 Electronics 30, commercial practice 45, architectural assistant-  
 ship 10 95

Women's Polytechnic Aligarh Muslim University, Aligarh (1966)  
 Electronics 30, commerical practice 20, costume design etc. 20 70

EASTERN REGION

West Bengal Women's Polytechnic, 21 Convent Road, Calcutta 14  
 (1963)  
 Electrical communication 30, architectural assistantship 30 60

Orissa S. K. D. A. Polytechnic for Women, Roukela 4 (1968)  
 Tele-communication 15, library science 30, commerical practice 30 75

Assam Girls' Polytechnic, P. O. Silpakhari, Gauhati 3 (1964)  
 Civil engineering/draughtsmanship 15, commerical practice 30 45

WESTERN REGION

Gujarat Government Polytechnic for Girls, Ahmedabad 15 (1964)  
 Costume and dress-making 30, commercial practice 30, electronics  
 radio engineering 30, architectural draughtsmanship and assistant-  
 ship 30 120

Government Girls' Polytechnic, Surat (1965)  
 Commercial practice 30, architectural draughtsmanship and assistant-  
 ship 30, electronics and radio engineering 30, commercial art 30 120

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Capacity

Madhya Pradesh Government Women's Polytechnic, Bhopal

Medical laboratory technology 25, costume design and dress-making 15, architectural draughtsmanship 15, commercial practice 25 80

## SOUTHERN REGION

Andhra Pradesh Kamala Nehru Girls' Polytechnic, Hyderabad (1961)

Civil 30, electrical communication engineering 30, catering and food technology 30, commercial practice 60, pharmacy 100 250

Government Polytechnic for Girls, Kakinada (1961)

Civil Engineering 30, communications engineering 30, pharmacy 30, commercial practice 30 120

Government Polytechnic for Women, Guntur 4 (1968)

Commercial practice 30, communications engineering 30, costume design and dress-making 30 90

Kerala Women's Polytechnic, Trivandrum 18

Costume design and dress-making 30, commercial practice 30 60

Women's Polytechnic, Trichur 7 (1962)

Commercial practice 30, costume design and dress-making 30, electronics 30 90

Women's Polytechnic, Calicut 9 (1963)

Commercial practice 30, costume design and dress-making 30 60

Tamil Nadu Government Polytechnic for Women, Madras 20

Electronics 30, costume design and dress-making 30, commercial practice 30, civil engineering 30 120

Government Polytechnic for Women, Madurai (1963)

Civil engineering 30

Government Polytechnic for Women, Coimbatore

Civil engineering 30, commercial practice 30, electronics 30 90

Karnataka Government Polytechnic for Women, Hubli 21

Commercial practice 30, costume and dress-making 30, tele-communication 30, civil engineering draughtsmanship 30 120

Government Polytechnic for Women, Bangalore

Commercial practice 30, costume design and dress-making 30, civil engineering draughtsmanship 30, library science 30 120

Government Polytechnic for Women, Mangalore (1970)

Commercial practice 30, tele-communication 30, library science 30 90

APPENDIX 6: ENGINEERING COLLEGES

| Courses additional to civil, mechanical, and electrical engineering (which are run in all States)   | Admission capacity | Actual admissions | Out-turn |
|---|--------------------|-------------------|----------|
| <b>NORTHERN REGION</b>  |                    |                   |          |
| <u>Chandigarh</u> (4 institutions)  |                    |                   |          |
| Agro; Meta; Elec Comm; Arch; Chem; Chem; Pharm; Prodn.  | 505                | 350               | 404      |
| <u>Delhi</u> (3 institutions)   |                    |                   |          |
| Chem; Text Tech; Electronics.   | 610                | 538               | 483      |
| <u>Haryana</u> (2 institutions)   |                    |                   |          |
| Text Tech; Electronics.   | 320                | 315               | 219      |
| <u>Jammu &amp; Kashmir</u> (1 institution)  |                    |                   |          |
| Meta; Chem.   | 250                | 65                | 175      |
| <u>Punjab</u> (3 institutions)  |                    |                   |          |
| Agri Engg.  | 435                | 302               | 399      |
| <u>Rajasthan</u> (5 institutions)   |                    |                   |          |
| Meta; Electronics; Mining; Chem; Pharm; Agri Engg.  | 870                | 496               | 730      |
| <u>Uttar Pradesh</u> (14 institutions)  |                    |                   |          |
| Meta; Agro; Chem; Text Tech; Mining; Electronics; Text Chem; Arch; Pharm; Agri Engg; Sugar Tech; Sugar Engg; Alcohol Tech; Bio-Chem; Food Tech; Oil Tech; Paint Tech; Plastics; Ceramics; Fine Art; Com Art; Sculpture. | 2753               | 2149              | 2163     |
| <b>EASTERN REGION</b>   |                    |                   |          |
| <u>Assam</u> (2 institutions)   |                    |                   |          |
| Chem.   | 240                | 233               | 298      |
| <u>Bihar</u>  |                    |                   |          |
| Tele-comm; Mining; Petro-Tech; Meta; Chem; Applied Geology and Applied Geop; Prodn.   | 1039               | 437               | 676      |
| <u>Orissa</u> (2 institutions)  |                    |                   |          |
| Meta; Chem.   | 320                | 334               | 192      |

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| Courses additional to civil, mechanical, and electrical engineering (which are run in all States)  | Admission capacity | Actual admissions | Out-turn |
|--|--------------------|-------------------|----------|
| <u>Tripura</u> (1 institution)   | 60                 | 15                | 19       |
| <u>West Bengal</u> (12 institutions)<br>Tele-Comm; Mining; Meta; Text Tech;<br>Arch; Naval Arch; Pharm; Ceram Tech;<br>Leather Tech; Agri; Food Tech; Instrument;<br>Aero; Chem; Plastic & Rubber Tech.  | 1748               | 1430              | 1719     |
| WESTERN REGION   |                    |                   |          |
| <u>Gujarat</u><br>Electronics; Chem; Text Tech; Text Engg;<br>Arch; Meta; Pharm.   | 1847               | 1895              | 1315     |
| <u>Madhya Pradesh</u> (10 institutions)<br>Tele-Comm; Chem; Meta; Mining; Arch;<br>Pharm.  | 1192               | 1124              | 1306     |
| <u>Maharashtra</u> (14 institutions)<br>Tele-Comm; Meta; Chem; Text Tech; Text<br>Chem; Arch; Aero; Instruments; Town<br>Planning; Pharm; Food Tech; Interm & Dyes;<br>Plastics; Pig Paints and Varnish; Oil, Fats<br>and Waxes; Oil and Chem Tech;<br>Pharmaceuticals and Fine Chem; Petroleum. | 2404               | 2504              | 2448     |
| <u>Goa</u>   | 60                 | 48                | 24       |
| SOUTHERN REGION  |                    |                   |          |
| <u>Andhra Pradesh</u> (11 institutions)<br>Electronics; Chem; Arch; Mining; Pharm;<br>Meta; Marine Mech.   | 1450               | 1145              | 966      |
| <u>Kerala</u> (6 institutions)<br>Chem; Electronics; Arch.   | 1120               | 679               | 815      |
| <u>Tamil Nadu</u> (15 institutions)<br>Electronics; Chem; Automobile; Meta; Text<br>Tech; Pharm; Leather Tech; Aero;<br>Instrument; Technology; Arch.  | 1630               | 2295              | 1887     |
| <u>Mysore</u> (17 institutions)<br>Text Tech; Tele-Comm; Meta; Chem; Arch.   | 1470               | 1843              | 1985     |

Summary

| REGION          | No. of<br>Institutions | Sanctioned<br>strength | Actual<br>admissions | Out-<br>Turn |
|-----------------|------------------------|------------------------|----------------------|--------------|
| NORTHERN REGION | 32                     | 5744                   | 4215                 | 4573         |
| EASTERN REGION  | 24                     | 3407                   | 2449                 | 2904         |
| WESTERN REGION  | 33                     | 5623                   | 5571                 | 5093         |
| SOUTHERN REGION | 49                     | 6670                   | 5962                 | 5653         |
| Total           | 138                    | 21444                  | 18197                | 18223        |