Report
of
The Review Committee
for the
Technical Teachers' Training Institutes

Ministry of Education and Social Welfare

New Delhi

1976

Printed at : CHAIN PRINTERS, Cantt., Tiruchirapalli – 620 001.

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APPENDICES

REVIEW COMMITTEE FOR THE TECHNICAL TEACHERS' TRAINING INSTITUTES

The Government of India established during the mid-1960's four Technical Teachers' Training Institutes at Bhopal, Calcutta, Chandigarh and Madras in order to train technical teachers for the polytechnics. These institutions have been functioning for nearly a decade now. The Union Education Minister appointed a Committee with the following constitution to review their performance and suggest their future development (vide Ministry of Education & Social Welfare, Government of India, communication No. F. 22-14/74-T. 1 dated October 1, 1974) :—

1	Dr. P. K. Kelkar, Ex-Director, Indian Institute of Technology, Bombay	Chairman
2	Prof. K. M. Bahauddin, Principal, Regional Engineering College, Calicut	Member
3	Prof. D. Banerjee, Principal, Bengal Engineering College, Sibpur, Howrah	Member
4	Dr. C. S. Jha, Head of the Department, Electrical Engineering, Indian Institute of Technology, Delhi (presently Director, Indian Institute of Technology, Kharagpur)	Member
5	Shri R. N. Kapoor, Director of Technical Education, Government of Uttar Pradesh, Kanpur	Member

6 Dr. P. J. Madan,
Vice-Chancellor,
M. S. University,
Baroda — Member

7 Shri M. S. Padmanabhan,
General Manager,
Bharat Heavy Electricals Ltd.,
Bhopal
(presently at New Delhi) — Member

8 Shri A. K. Mandal,
Director,
Planning Commission,
Government of India,
New Delhi

9 Shri R. N. P. Sinha,
Dy. Financial Adviser,
Ministry of Finance,
Government of India,
New Delhi — Member
(Shri S. Biswas was the nominee of the
Ministry of Finance till April, 1975)

10 Shri M. S. Srinivasan,
Dy. Educational Adviser (Technical),
Ministry of Education & S. W.,
Government of India,
New Delhi — Member - Secretary

The terms of reference of the Committee were :—

(i) to evaluate to what extent the aims and objectives of the setting up of the Technical Teachers' Training Institutes have been fulfilled by each of the Institutes,

(ii) to suggest future role of the Technical Teachers' Training Institutes in the scheme of technical education in general and for purposes of teacher training in particular,

(iii) to suggest such measures as may be required for this revised role of the Technical Teachers' Training Institutes and to this end recommend future administrative, organisational and financial set up for the Institutes and

(iv) to evaluate the training programme of the trainees and suggest the interaction between the Technical Teachers' Training Institutes and the Industry.

The Committee met at the Technical Teachers' Training Institutes as noted below :—

Madras	15th	and	16th November,	1974
Chandigarh	10th	and	11th January,	1975
Calcutta	3rd	and	4th March,	1975
Bhopal	26th	and	27th November,	1975

The Committee also met at New Delhi on 9th January, 1975 and 3rd January, 1976 and at Madras on 7th and 8th April, 1976.

When the Committee visited the Technical Teachers' Training Institutes, they went round the institutions, their laboratories and workshops and had discussions with the Principals and the faculty, the Directors of Technical Education and representatives of past and present trainees. In addition, the Committee had occasion to meet the Principals of some of the polytechnics. The Committee had also detailed discussions with Dr. L. S. Chandrakant and Shri H. S. Shahani (the past and the present Chairman of the Board of Governors of these Technical Teachers' Training Institutes), Prof. G. R. Damodaran, Chairman of the Special Committee for reorganisation of polytechnic education in India, and Shri D. P. Nayyar, Adviser, Planning Commission.

The work of the Committee was greatly assisted and facilitated by the series of notes prepared by the Principals of the Institutes. These notes and write-ups provided a helpful background for the task of the Committee. The Committee wish to express their gratitude to the Principals for their cooperation extended to the Committee during the visits.

The Committee also wish to thank all others who responded and assisted the Committee in their task.

Sd/-.	Sd/-.	Sd/-.
K. M. Bahauddin.	D. Banerjee	P. K. Kelkar.

Sd/-.	Sd/-.	Sd/-.
C. S. Jha.	R. N. Kapoor.	P. J. Madan.
Sd/-.	Sd/-.	Sd/-.
M. S. Padmanabhan.	R. N. P. Sinha.	A. K. Mandal.

Sd/-.
M. S. Srinivasan.

1. INTRODUCTION

1.1. Technicians have been defined, in a document of the UNESCO "as 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, detailed construction. Collaboration with the engineer is an essential part of the work of the technician".

1.2. The Damodaran Committee on "Reorganisation and Development of Polytechnic Education" detailed out the functions of the technician as follows :—

(i) Erecting and commissioning of engineering structures, equipment, etc ;

(ii) Engineering drawing and detailing ;

(iii) Maintenance and repair of engineering plant and machinery ;

(iv) Assisting engineers in design and development ;

(v) Assisting engineers and scientists in research and development activity ;

(vi) Inspection and testing ;

(vii) Estimating ;

(viii) Sales and after-sales service ;

(ix) Servicing ;

(x) Contracting ;

(xi) Production and control ;

(xii) Work Study.

1.3. Technicians are essentially products of polytechnics. These institutions have grown phenomenally during the last quarter of a century. From 53 polytechnic

institutions turning out 3700 technicians at the time of Independence, the number has grown to 317 institutions turning out 47,000 technicians today. More than Rs. 100 crores have been invested in creating facilities like buildings, laboratories, workshops, hostels, etc. For the last 3 or 4 years, approximately Rs. 10 crores per year are being spent in running these institutions. Facilities have been created for an annual enrolment of about 50,000 students in these polytechnics. Today the number of technicians trained at these polytechnics who are working in diverse fields contributing to the national economy is more than two lakhs. During the same period, the " polytechnic teacher population " has increased almost ten times - from about 1,000 to about 10,000 today. Teachers - properly qualified, trained and devoted - are essential for the success of any educational system. For educating these technicians, the requirements of the technical teachers are mainly three : the subject knowledge, practical or field experience, and pedagogy. An assessment made in 1966, revealed that there was a shortage of teachers of about 35% of the then total requirements. The existing teachers were also in need of qualitative improvement. To remove these deficiencies and train better teachers for the polytechnics, the Central Government decided to set up four Technical Teachers' Training Institutes at Bhopal, Calcutta, Chandigarh and Madras in Western, Eastern, Northern and Southern Regions respectively.

1.4. Each of the Technical Teachers' Training Institutes was set up as an autonomous body registered under the Society's Act, with a Board of Governors consisting of representatives from the Central Government, State Government and industries and with the following broad objectives :—

(i) to provide professional training for teaching engineering and technological subjects ;

(ii) to provide for instruction and research in such branches of engineering and technology as the Society may think fit and to provide for the advancement of learning and dissemination of knowledge in such branches ;

(iii) to arrange for practical training in industries on a co-operative education plan.

1.5. Each of the Institutes offered a full-time 18-months course for teachers with a degree in engineering and a 24-months course for teachers with a diploma in engineering. In course of time, the duration of these courses was reduced by six months, providing a programme of 12 months and 18 months respectively.

1.6. The Institutes are fully financed by the Central Government. The project estimates for setting up the four Technical Teachers' Training Institues are given in Appendix I A.

1.7. A statement giving the facilities available at these Institutes is given in Appendix I B.

1.8. The Committee also received from the Institutes proposals for their development, a summary of which is given in Appendix I C.

2. TECHNICAL TEACHERS' TRAINING INSTITUTE, MADRAS

2.1. The activities of Technical Teachers' Training Institute, Madras, in general, are concerned with the teachers of polytechnics in the States of Tamil Nadu, Andhra Pradesh, Karnataka and Kerala and the Union Territory of Pondicherry. The Institute started functioning in the year 1966. The number of polytechnics in this area is 103 and the number of teachers involved is about 2850. Of these teachers having engineering qualifications, about 25% are graduates and the rest are diploma holders.

2.2. The Institute is located at Adyar in Madras in an area of about 10·84 hectares. The position regarding physical facilities is given below :—

	Area in Sq. metres.	Cost Rs. lakhs.
Institutional buildings	5,850	33·41
Equipment		11·25
Library		3·44
Furniture		2·47
Residences - Quarters for 17 members of staff		8·71
Hostel - For 110 students		6·21

2.3. In addition, this institute has received assistance from the United Kingdom under the Technical Assistance Programme to the tune of Rs. 6·87 lakhs. This consists mainly of equipment, books for the library and teaching-aids like wall-charts, audio-visual material, etc.

2.4. The Institute has a library with about 12,400 books and 700 bound volumes of journals. In addition, the Institute is subscribing to about 100 technical periodicals in a year. Annual addition of books is about 600 volumes. It may be mentioned that the Institute incurred an expenditure of Rs. 29,800 in 1972-73, Rs. 21,700 in 1973-74 and Rs. 18,900 in 1974-75, on books and journals for the library.

2.5. The Institute on its campus has also got the facilities of a guest house, a post office, a dispensary, social centre and playgrounds.

2.6. The staff position at the Institute is indicated below :—

	Sanctioned.	In position.
Regular Programmes		
Faculty		
Professors	6	6
Assistant Professors	9	8
Lecturers	11	9
Non-Faculty		
Technical	26	26
Non-Technical	47	47
Quality Improvement Programmes		
Faculty		
Professors	2	2
Assistant Professors	4	4
Research Assistant	2	2
Non-Faculty		
Non-Technical	2	2

2.7. Among the faculty members, 2 hold doctorate degrees, 16 other post-graduate degrees and 3 are degree holders in engineering. Of these, 2 have registered with the University of Madras for doctoral work at this Institute.

2.8. Under the Technical Assistance Programme of the United Kingdom, experts have been sponsored for various activities from time to time. The Institute has had the benefit of 13 experts from the United Kingdom, of whom 6 have stayed for 2 years, 3 have stayed for 4-6 years and the rest for 1-3 months. Under the same programme, the Institute has sponsored 15 staff members to the United Kingdom for periods varying from 3-4 months.

2.9. The instructional courses available at this Institute are :—

Diploma in Technical Teaching for 12-18 months ;

Diploma in Science Teaching for 9 months ; and

Degree course of 12 months leading to the award of Bachelor of Technical Education (B.Tech. Ed.).

Of these, the last one, namely, B. Tech. Ed. programme exists in this Institute only and the admission is open to teachers with engineering degree qualifications. The Institute is affiliated to the University of Madras for this award.

2.10. The above courses are regular and full time and under these schemes 582 teachers have been trained today, of whom 118 are degree holders in engineering, 435 diploma holders in engineering and the rest are Science teachers.

2.11. In addition to these regular courses, the Institute has offered short-term courses under the Quality Improvement and Summer School programmes varying from 2 to 4 weeks duration ; 1306 teachers of the polytechnics have attended these courses.

2.12. The Institute has also run a number of special courses at the specific request of various agencies organisations and 212 persons have benefitted under the scheme. The programmes are normally of short duration varying from 1 to 2 weeks. A few have been of a longer duration.

2.13. Mention can also be made about the training of 9 foreign nationals by the Institute under its programmes.

2.14. The Institute has also started an Extension Centre in Kerala.

2.15. Besides teaching and training of teachers of polytechnics, the Institute has engaged itself in other purposeful activities in the educational field. It has brought out instructional materials and laboratory manuals for improved teaching. Appendix II gives the details of academic activities of this Institute.

2.16. To impart effectively practical training to the various teacher trainees, the Institute has developed liaison with a number of industries both in the private and public sector. The Institute has listed 154 industrial organisations where the teacher trainees have been sent for practical training.

2.17. The contacts established by the Institute with some of these industries are also being made use of for various other academic activities such as guest-speakers, job-analysis, curriculum-development, etc.

2.18. The Institute's annual recurring expenditure for the last three years is as under (in lakhs of rupees).

	1972-73	1973-74	1974-75
Regular in-service programme.			
Teaching staff salary	3.78	3.72	4.48
Non-teaching staff salary	2.17	2.57	3.85
Departmental expenditure	0.39	0.50	0.51
Stipend to trainees	2.07	1.89	1.32
Other charges	2.89	3.21	3.08
	11.30	11.89	13.24
Quality improvement programmes and other short-term courses.			
Teaching staff salary	0.56	0.59	1.00
Non-teaching staff salary	0.12	0.12	0.16
Other expenditure	1.28	1.89	0.90
	1.96	2.60	2.06
Total	13.26	14.50	15.30

2.19. This Institute completed the project programme quite early and successfully. Many of the programmes launched by the Institute have been over-subscribed and the intake at the Institute for the long term programmes also had to be increased specially to cater to the enthusiastic sponsorship by the States. The Institute has been able to attract adequate attention in that many organisations have been requesting the Institute to offer various special programmes. Educational-aid material such as the booklets on programmed learning on various topics and Engineering Drawing developed at the Institute have been widely welcomed.

3. TECHNICAL TEACHERS' TRAINING INSTITUTE, CHANDIGARH

3.1. The activities of the Technical Teachers' Training Institute, Chandigarh, in general, are concerned with the teachers of polytechnics in the States of Jammu & Kashmir, Haryana, Punjab, Himachal Pradesh, Uttar Pradesh, Rajasthan and the Union Territories of Delhi and Chandigarh. The Institute started functioning in the year 1967. The number of polytechnics in this area is 77, and the number of teachers involved is about 1400. Of these teachers having engineering qualifications, about 33% are graduates and the rest are diploma holders.

3.2. The Institute is located in Sector 26 in Chandigarh in an area of about 8 hectares. The position regarding physical facilities is given below :—

	Area Sq. metres	**Cost Rs. lakhs**
Institutional Buildings	4,965	17.62
Equipment		8.69
Library		1.69
Furniture		3.01
Residence - Quarters for 16 members of staff (teaching)		6.00
Hostel - for 110 students		5.00

3.3. In addition, this Institute has received assistance from Netherlands under the Technical Assistance Programme to the tune of 5·65 lacs guilders (Rs. 12·51 lakhs.) This consists mainly of equipment, books for the library and teaching-aids like wall-charts, audio-visual aids, etc.

3.4 The Institute has got a library with about 8700 books and 160 bound volumes of journals and subscribes for 150 journals annually.

The library's annual recurring expenditure is of the order of Rs. 23,000 for books and journals.

3.5. The Institute on its campus has the facilities of a social centre and play-grounds.

3.6. The staff position at the Institute is as follows:-

	Sanctioned	In position
Regular in-service programmes		
Faculty		
Professors	6	5
Assistant Professors	8	8
Lecturers	10	9
Non-faculty		
Technical	29	23
Non-technical	67	60
Quality Improvement Programmes		
Faculty		
Professors	1	1
Assistant Professors	4	2
Research Assistants	2	2
Non-faculty		
Non-technical	7	6

3.7. Among the faculty members, 20 have post-graduate degrees and the rest are degree holders in engineering.

3.8. Under the Technical Assistance Programme of Netherlands, experts have been sponsored for various courses from time to time. The Institute has had the benefit of six experts for periods 30 to 78 months. Under the same programme, the Institute has sponsored 10 staff members to Netherlands for 8-9 months and 4 persons for one month.

3.9. The instructional courses available at this Institute are :-

Diploma in Technical Teaching for 12-18 months.

Diploma in Science Teaching for 12 months.

3.10. The above courses are regular and full time and under these 319 teachers have trained to-date, out of which 37 are degree holders, 275 diploma holders and 7 Science teachers.

3.11. In addition to these regular courses, the Institute has offered short - term courses of one to three weeks' duration, in content development, methodology of teaching and educational administration for 1294 teachers of the polytechnics; besides 714 polytechnic teachers have participated in various curriculum development work-shops and other developmental activities like text book writing etc.

3.12. Besides teaching and training of teachers of polytechnics, the Institute has engaged itself in other purposeful activities in the educational field. It has brought out instructional materials, teacher manuals/guides, and laboratory manuals. The Institute was able to publish a number of text books by well-known publishers. Appendix III gives the details of academic activities of the Institute.

3.13. To impart effectively practical training to the various teacher-trainees, the Institute has developed liaison with a number of industries both in the private and public sector. The Institute has listed 110 organisations where the teacher trainees have been sent for practical training.

3.14. The contacts established by the Institute with some of these industries are also being made use of for various other academic activities such as guest speakers, job analysis and curriculum development.

3.15. The Institute's annual recurring expenditure for the last three years is as under (in lakhs of rupees) :-

	1972-73	1973-74	1974-75
Regular in-service programmes			
Teaching staff salary	2.25	2.64	3.61
Non-teaching staff salary	1.97	2.35	3.80
Departmental expenditure	0.34	0.32	0.34
Stipend to trainees	1.59	1.38	1.02
Other expenses	2.25	1.92	2.58
	8.40	8.61	11.35

Quality Improvement and other short-term courses			
Teaching staff salary	0.38	0.63	0.82
Non-teaching staff salary	0.16	0.24	0.30
Other expenses	1.62	1.88	1.18
	2.16	2.75	2.30
Total	10.56	11.36	13.65

3.16. The construction programme of the Institute was completed with unusual speed and economy while maintaining at the same time good standards and appropriate architectural features.

One of the striking features of this Institute is the meaningful use it has made of industrial experience both in the learning process as well as curriculum development. The link between industry and the faculty at this Institute seems to be very lively.

The Institute has also the advantage of being fully utilised by all the States in the region in that a sizable number of candidates is sponsored by them for its various programmes.

4. TECHNICAL TEACHERS' TRAINING INSTITUTE, CALCUTTA

4.1. The activities of the Technical Teachers' Training Institute, Calcutta, in general, are concerned with the teachers of polytechnics in the States of West Bengal, Assam, Bihar, Orissa, and the Union Territories of Tripura, Manipur, Meghalaya, Nagaland and Arunachal Pradesh. The Institute started functioning in the year 1966. The number of polytechnics in this area is 59 and the number of teachers involved is about 1500. Of these teachers having engineering qualifications, more than 75% are graduates and the rest are diploma holders.

4.2. The Institute is at present functioning in the " guest premises" of J. C. Ghosh Polytechnic at Calcutta. Land of an area of about 4 hectares has been acquired in Salt Lake City, Calcutta, and the construction is expected to start shortly. The position regarding other physical facilities is given below :-

	Cost (Rs. lakhs)
Equipment	7.36
Library	2.87
Furniture	2.55

4.3. The Institute has got a library with about 8000 books and 145 bound volumes of journals. In addition, the Institute is subscribing to about 120 technical journals every year. During the last last three years, the institution has spent Rs. 46,000/-, Rs. 38,000/- and Rs. 34,000/- respectively for the purchase of books and journals for the library.

4.4. The staff position at the Institute is given below :-

	Sanctioned	In position
Regular in-service programmes		
Faculty		
Professors	6	5
Assistant Professors	6	5
Lecturers	5	4
Non-faculty		
Technical	16	8
Non-technical	70	66
Quality Improvement Programmes		
Faculty		
Professors	1	1
Assistant Professors	2	2
Non-faculty		
Technical	4	4
Non-technical	2	2

4.5. Among the faculty members, 11 hold post-graduate degrees and the rest are degree holders.

4.6. The instructional courses available at this Institute are:-

Diploma in Technical for 12-18 months.

Diploma in Science Teaching for 12 months.

4.7. The above courses are regular and full time and under these 315 teachers have been trained todate, out of which 163 are degree holders, 122 diploma holders and the rest are Science teachers.

4.8. In addition to the regular courses, the Institute has offered short-term courses for teachers of polytechnics of varying duration and 105 teachers from these polytechnics in the region have participated in these courses.

4.9. Besides teaching and training of teachers of polytechnics, the Institute has engaged itself in other purposeful activities in the educational field. It has brought out instructional materials and laboratory manuals. Appendix IV gives the details of all academic activities of this Institute.

4.10. To impart effectively practical training to the various teacher trainees, the Institute has developed liaison with a number of industries both in the private and public sector. The Institute has listed 120 industrial organisations where the teacher trainees have been sent for practical training.

4.11. The contacts established by the Institute with some of these industries and organisations are also being made use of for various academic activities such as guest speakers, job analysis, curriculum development, etc.

4.12. The Institute's annual recurring expenditure for the last three years is as under (in lakhs of rupees):-

	1972-73	**1973-74**	**1974-75**
Regular in service programmes			
Teaching staff salary	3.29	3.07	3.02
Non-teaching staff salary	2.56	2.80	4.29
Departmental expenditure	0.29	0.46	0.43
Stipend to trainees	1.21	0.86	0.82
Other charges	2.12	1.93	1.81
	9.47	9.12	10.37

Quality improvement and other short term courses			
Teaching staff salary	0.36	0.47	0.56
Non-teaching staff salary	0.13	0.32	0.59
Other expenditure	0.27	0.79	1.15
	0.76	1.58	2.30
Total	10.23	10.70	12.67

4.13. The Technical Teachers' Training Institute, Calcutta is the only Institute which still has not been able to have a building of its own. For more than 9 years, it has been functioning in hired buildings in different parts of the city. It is very necessary that the programme of construction of the permanent buildings of the Institute is taken on hand and completed at an early date so that the Institute cannot only stabilise itself but also contribute adequately to the development of teacher training in the region for which it has got the required potential. The Committee feels that the lack of buildings has hampered the development programme of the Institute and there should be no further delay in making up this deficiency. When the Institute has its own premises, perhaps it will be easier for the other State Governments in the region also to fully utilise the Institute.

4.14. Nevertheless, it has made progress in some directions. Meaningful and lively laboratory experiments out of material which is easily available have been designed. It has developed a manual for the teaching of English in technical institutions which has many special features.

5. TECHNICAL TEACHERS' TRAINING INSTITUTE, BHOPAL

5.1. The activities of the Technical Teachers' Training Institute, Bhopal, in general, are concerned with the teachers of polytechnics in the States of Madhya Pradesh, Maharashtra, Gujarat and the Union Territory of Goa. The Institute started functioning in the year 1965 in "guest premises". The number of polytechnics in this area is 78 and the number of teachers involved is about 2,500. Of these teachers having engineering qualifications, about 70% are graduates and the rest are diploma holders.

5.2. The Institute is located at Shyamla Hills in Bhopal in an area of about 14.55 hectares. The position regarding other physical facilities is given below :-

	Area (sq. metres)	**Cost (Rs. lakhs)**
Institutional buildings	4645	30.00 (Approx).
Equipment		7.59
Library		2.54
Furniture		2.45

The Institute has just been able to complete its programme of construction of buildings and has moved in recently. The staff quarters and the hostels for the students are now being constructed.

5.3. In addition, this Institute has received assistance under the Technical Assistance Programme of the United Kingdom to the tune of Rs. 7.56 lakhs. This consists mainly of teacher training equipment, educational systems, books for the library and teaching aids.

5.4. The Institute has got a library with about 13,550 books and 160 bound volumes of journals. In addition, the Institute is subscribing to about 80 technical journals every year. The expenditure incurred on the library during the last 3 years is Rs. 57,000/-, Rs. 65,000/- and Rs. 43,000/- respectively.

5.5. The staff position at the Institute is given below :-

	Sanctioned	**In position on 1-12-'75**
Regular in-service programmes		
Faculty		
Professors	6	6
Assistant Professors	7	7
Lecturers	5	5
Non-faculty		
Technical	24	15
Non-technical	62	60

Quality Improvement Programmes

Faculty		
Professors	7	7
Assistant Professors	2	1
Non-faculty		
Technical	3	3
Non-technical	11	10

5.6. Among the faculty members, 11 hold post-graduate degrees and 8 are degree holders in engineering.

5.7. Under the Technical Assistance Programme of the United Kingdom, experts have been sponsored for various courses from time to time. The Institute had the benefit of 13 experts from the United Kingdom for 29 man-months so far. Under the same programme, the Institute has sponsored 10 staff members for periods varying from four to six months for training in the United Kingdom.

5.8. The instructional course available at this Institute is only the Diploma course in Technical Teaching for 12-18 months.

5.9. The above course is regular and full time and under this scheme, 217 teachers have been trained to-date, of whom 81 are graduates and the rest diploma holders.

5.10. In addition to this regular course, the Institute has offered short term courses of 3 days to six weeks duration for about 2,000 teachers of the polytechnics.

5.11. The Institute has also run a number of short-term courses at the request of various agencies and organisations and 200 persons have benefitted under this scheme.

5.12. Mention can also be made about the training of two foreign nationals by the Institute under its programmes.

5.13. The Institute has also started an extension centre in Gujarat.

5.14. Besides teaching and training of teachers of the polytechnics, the Institute has engaged itself in other purposeful activities in the educational field. It has brought out instructional material for improving teaching, and item - and question - banks for improved evaluation. Appendix V gives the details of all academic activities of the Institute.

5.15. To impart effectively practical training to the various teacher trainees, the Institute has developed liaison with a number of industries both in the private and public sector. The Institute has listed 188 industrial organisations where the teacher trainees have been sent for practical training.

5.16. The contacts established by the Institute with some of these industries are also being made use of for various other academic activities such as guest speakers, job analysis, curriculum development, etc.

5.17. The Institute's annual recurring expenditure for the last three years is as under (in lakhs of rupees) :-

	1972-73	1973-74	1974-75
Regular in-service programmes			
Teaching staff salary	2.36	2.68	3.67
Non-teaching staff salary	1.47	2.03	3.50
Departmental expenses	0.27	0.19	0.61
Stipend to trainees	0.70	0.68	0.66
Other charges	0.68	0.96	1.29
	5.48	6.54	9.73
Quality Improvement programmes and other short term courses.			
Staff salary and allowances	0.93	1.38	1.60
Non-teaching staff salary	0.20	0.38	0.46
Other charges	2.17	1.86	2.28
	3.30	3.62	4.34
Total	8.78	10.16	14.07

5.18. The Institute has attempted a special study of educational administration. Curricular material including laboratory manuals for improved teaching and learning packages have been developed by the Institute and considerable efforts in the analysis of evaluation techniques and development of question-and item-banks have also been attempted.

6. REVIEW OF IMPACT

OF TECHNICAL TEACHERS' TRAINING INSTITUTES

6.1. In mid 1960's, four of these Institutes were started in different regions of this country primarily for 'pre-service' training for those who entered polytechnics as teachers in engineering and technology. There was, then, a great shortage of teachers and it was envisaged that this would ease the position. In course of time, the situation changed. A large number of young persons with degree or diploma qualifications in engineering and technology became available in the employment market and polytechnics recruited them as teachers to fill up the then existing vacancies. But they were not adequately trained for the teaching profession. This brought out a shift in the emphasis of Technical Teachers' Training Institutes from the concept of " pre-service training to that of "in-service" training of teachers.

6.2. It is estimated that there are about 8500 teachers today in the polytechnics all over the country. Out of these, hardly 1500 or so, representing about 15% of the total teacher-population have been exposed, in a worthwhile manner, to the training by these Institutes. To have any appreciable and effective impact on polytechnic education, a much larger number, say, at least 75% should be covered by such training. This large coverage has to be brought about within a reasonable period of 3 to 5 years. This means that on average 2000 teachers per year are to be trained in the consecutive years as against the present out-turn of about 350 a year even for the first time coverage in the longer-term training programmes. Facilities have to be increased or alternative systems have to be evolved to tackle this 'Operation-teacher training'.

6.3. In this context mention may also be made of the observations of the Public Accounts Committee of the Parliament in their Ninth Report to the Fifth Lok Sabha (1971-72) which noted "that the Technical Teachers' Training Institutes had not been attracting adequate number of engineers and, therefore, remedial measures have to be taken, in consultation with the engineering institutions and the State Governments, to attract promising teachers". The Central Government had at that time clarified to the Committee the reasons for the Institutes not attracting teachers to the extent envisaged and the measures taken to improve the situation, and had enumerated the other tasks which these Institutes were performing.

It may, however, be observed that now the situation has considerably changed and the number of teachers sponsored for the various courses at the Institutes had also increased in a large measure.

6.4. While the number of teachers trained is an important indicator, the content of the training programme is also equally important. The training content has three elements, viz: (i) pedagogy, (ii) field training and (iii) subject-updating. While a trainee with a diploma background now takes all the three elements at these Institutes, the teacher with the degree background takes only the first two elements. In the earlier years of their establishment, the Institutes offered a 24 months programme for diploma holders and a 18 months programme for the degree holders. Later, this period has been reduced by six months, and presently, the normal longer-term courses are of 18 months and 12 months duration for the diploma and degree holder teachers respectively.

6.5. The training in pedagogy or in educational methods has brought about a great appreciative awareness of its usefulness among all concerned; Directors of Technical Education, Principals of the Polytechnics, and the teachers themselves. The main impediments for the rapid spread of this newer/improved technique of teaching are in getting the aids, the devices, etc., easily and in adequate numbers and in having trained personnel who can use them.

6.6. The field of industrial training also has earned almost equal appreciation about its effectiveness. However, a general feeling is that these trainees are not guided or supervised but are left to themselves in the factory or in the field. It has also been observed that in a number of cases the training has no relevance to the area of teaching. Bigger and reputed industries/organisations which realise the importance of training have separate "Training Divisions" organised for a better system of supervising these trainees, while the same is not true in the smaller establishments and these latter are larger in number. Moreover, even in the bigger establishments it is not always that the authorities concerned involve themselves in training these teachers to enable the full benefit of the programmes to be obtained. It has, however, to be mentioned that the Technical Teachers' Training Institutes have put in great efforts to establish contacts with a large number of industries and organisations and also succeeded in persuading them to take interest in the placement of the teachers. This has resulted in close contact between the industries and the Institutes and has led to incidental benefits such as in job-analysis, curriculum development, etc. and also making the teacher trainees aware of what is expected of the technicians in the field or industry.

6.7. The third element of the training programme in the Institutes, i. e. subject-updating, has been comparatively much less effective. There are many factors which are responsible for the lack of adequate effectiveness of this element of the training programme. Firstly, the emphasis for subject-updating for a teacher varies from one State to another depending upon whether the polytechnic teaching staff has a majority of

graduates or diploma-holders. Even in the case of diploma holders, it is not very clear whether subject-updating may have some definite meaning, since it is doubtful if it is worthwhile to update one or two topics in any discipline at the Technical Teachers' Training Institutes while the teacher in actual practice has to handle a wider number of topics in his chosen discipline itself. Within the time available during their stay at these Institutes, it is not possible for any teacher to cover all the subject topics of his need/ interest. It may not also be possible for the faculty in a particular Technical Teachers' Training Institute to meet the needs of individual teachers in a given group, to train them adequately to deal with all subject topics. Thus the result is a very marginal impact on the effectiveness of the subject-updating in a very narrow area of a specific discipline.

6.8. It may be mentioned that an area where the impact of Technical Teachers' Training Institutes has already been felt considerably and in fact the demand has increased is that of educational services. The educational services have a broad spectrum and cover a wide field; development of teaching aids, instructional materials for library and workshop in the polytechnics, preparation of text books, development of curriculum, development of techniques for the evaluation of technicians by the teachers, building up of the resources in the libraries and ensuring better utilisation. Similar efforts are to be devised in laboratories and workshops by utilising existing equipment/instruments for developing now concepts and ideas to elucidate the principles and innovative ideas.

6.9. These services were not specifically contemplated when the Institutes were started. The necessity for them was realised as more experience in polytechnic education was gathered. It should be mentioned that the Institutes took up these new challenges readily and in an admirable manner. They initiated a number of activities to deal with the developing situation. However, there is need for more painstaking and co-operative work with motivated and dedicated efforts to cater to the ever-increasing demand for expertise.

6.10. The Technical Teachers' Training Institutes are public agencies and certain programmes (such as training of teachers for "work experience" and Vocationalisation of secondary education in the new system) have been taken up by them as specifically desired by the Government and other agencies. This has been helpful in two ways; the facilities, competence and expertise available in these Institutes have been utitised by the community at large for their benefit and in reverse the image of these Institutes has also been built up. Sufficient impact has been exerted by the Institutes through such activities.

7 REVISED STRATEGY

FOR THE TECHNICIAN TEACHER TRAINING PROGRAMMES

7.1. The major problem facing the Technical Teachers' Training Institutes, as has been pointed out, is to expose a large number of teachers of polytechnics to worthwhile training in a reasonably short time. This large coverage is essential, not only because a large number of them will be better 'tuned' as teachers, but also because this will help to bring about an 'attitute change' and thereby create a more congenial atmosphere in the polytechnics towards trained teachers and their newer approaches. To achieve this, the present method of teacher training programmes needs a drastic revision both with regard to the structure and the method of implementation of the programmes.

7.2. Duration of the course : Modular Concept.

The programme is to be essentially of a short-term duration to ensure coverage of a larger number of teachers. The Committee realises that the short-term course may have a drawback in not being able to bring about as good an attitude change as a long-term programme. But despite this, a course has to be organised in such a manner that the wide coverage is achieved without losing the essential effects in terms of quality. In view of this, both aspects of the training programme which have made an appreciative impact, namely, pedagogy and industrial training will have to be preferred. However, a different approach for subject-updating will have to be initiated at the same time as a part of the total programme, so that all the components necessary are covered. In order to be aware of the effectiveness of the programme under such changed circumstances, it is absolutely necessary to devise ways of monitoring, at various stages, the progress of the programmes and thus obtain the essential feed back to keep the quality at the required level. In what follows, each of these elements is being elaborated.

7.3. As mentioned earlier, of all the three elements, the pedagogic training has been found to be most effective. It is felt that this training could be effectively concentrated within a period of 12 weeks. The element of industrial training also can be of a duration of 12 weeks. The period of 12 weeks for the programmes as also the concept of the training module for each of these two elements has been suggested keeping in view the convenience of the teachers to be spared in larger numbers by the authorities concerned without much dislocation to the mormal academic work in their respective institutions. The two modules need not necessarily be in sequence. However, to ensure that the industrial training component is effective and will have relevance to the

subsequent teaching activities of the teacher trainees, it is suggested that the training schedule should be systematic and is decided about well in advance of the teacher trainee taking up this programme.

7.4. Subject-updating : Correspondence Courses.

The effectiveness of the subject-updating programme at the Technical Teachers' Training Institutes is very much limited mainly because of two reasons : in the first place, the period of stay of the teacher trainee at the Institute is not adequate for sufficient coverage in depth of the subjects concerned in all the relevant areas of the particular discipline ; secondly, locating expertise of the desired level at the Technical Teachers' Training Institutes in all the areas and keeping them continuously updated will involve considerable investment which, the Committee feels, is not necessary, since such expertise and facilities are already available in the country outside the system of Technical Teachers' Training Institutes.

The Committee is, however, conscious of the need for subject-updating of teachers, whether they are degree holders or diploma holders. A feasible way of implementing the programme of subject-updating is, therefore, to make use of the good, though limited, expertise already developed at the Technical Teachers' Training Institutes at the same time and to making use of the much larger resources available in the country, in educational institutions, industry and elsewhere. To this end, the Committee suggests the organisation of a subject-updating unit in each Technical Teachers' Training Institute with the present resources they have with them as the nucleus. Because subject-uptating is a continuous process, a flexible approach is necessary. The unit suggested above should enlist the resources available all over. Appropriate programme, modular and/or correspondence courses may also be formulated and implemented. Experience indicates that correspondence courses, if properly organised in a systematic manner and with competent personnel, in a variety of disciplines, can be very effective. Adequate funds should be made available from time to time as the programme develops, for this purpose. Even limited subject-updating activity going on at present at the Institutes can, therefore, be strengthened by the adoption of this non-formal approach of organisation of the correspondence course in all the relevant areas in addition to the present institutional programme.

7.5. Programme for Science Teachers.

The Committee observed that science teachers of the polytechnics are also being trained in three of the Institutes. The courses were not identical-in two Institutes, it was of one year's duration and in the other, of nine months' duration. Taking an overall

view, it seems it is as much necessary for science teachers to become much better suited for polytechnic programmes than they are at present. For this purpose, it is very necessary all the Technical Teachers' Training Institutes should organise regular programmes for the science teachers. These programmes should not only include the subject-updating component but also care should be taken to bring about relevance between engineering subjects and science. It appears that this could be done in the Institutes with one semester module of six months duration. Necessary non-formal correspondence course support such as in the case of the engineering/technology teachers can also be arranged.

7.6. Extension Centres.

In addition to the above mentioned modular concept, to ensure adequate coverage of worthwhile training, the concept of extension centres also has to be vigorously followed. It is suggested that in each State of the region, there should be at least one extension centre for supplementing the activities of the particular Technical Teachers' Training Institute, functioning in co-operation with the concerned State Government. In fact a start has already been made in the States of Kerala and Gujarat.

The Extension Centre will organise programmes for the teachers sponsored by the State Government and the planning of the programmes will be done by the extension centre concerned and the concerned Technical Teachers' Training Institute together. Each extension centre should be located in a polytechnic in the State and will have a Professor and an Assistant Professor and two technicians seconded by the concerned Technical Teachers' Training Institute with the necessary contingent support from the State Government concerned both as regards space, supporting staff and other material necessary for the running of this centre. The modular programmes referred to above each of 12 weeks duration, can be offered both at the Technical Teachers' Training Institutes and the extension centres in the States as per mutually agreed arrangements. The number of extension centres in each State will be decided upon, taking into consideration the overall facilities that can be made available by the Technical Teachers' Training Institute concerned and the State Government and also the teacher training requirement of each State. The content of training in the extension centres need not be uniform but flexible depending upon the needs of the area and the expertise available.

The extension centre will have an Advisory Council with the Director of Technical Education of the concerned State as the Chairman and the Principal of the concerned Technical Teachers' Training Institute, Principal of the polytechnic where the centre is located as Members of the Board and the Professor in charge of the extension centre as the Member-Secretary.

7.7. One of the State Governments has started an Institute on its own for training teachers for technicians. Number of State Governments has taken up on their own one element of the training programme, namely, curriculum development. It is highly desirable that Technical Teachers' Training Institutes cultivate close inter-action with these activities of the State Governments.

7.8. Special appreciation courses.

Short term appreciation courses for senior personnel connected with technical education, such as the Principals of polytechnics, Controllers of Examinations concerned with polytechnic examinations, technical education administrators, etc., can also go a long way in achieving the objective of " attitude change ".

7.9. Educational Research and Resources Activities.

The Technical Teachers' Training Institutes have been discharging an important function as Resource Centres in the area of technician education. They have done pioneering work in educational services. More efforts in a well-thought out, planned manner with specific short-term and long-term objectives, have to be organised in this field. This is one growth area of Technical Teachers' Training Institutes where coordination and inter-action between them will fetch high dividends. Coordination is required in the following spheres :-

(a) The task of curriculum development, design of experiments and lesson work in the laboratory and workshops has been taken up by each Institute separately. The same subjects have been tackled in more than one Institute in the area. In view of the fact that there are still a large number of subjects/subject topics yet to be covered, a planned and mutually agreed distribution of work, depending upon the expertise available at each of the Institutes, will produce better results. It is suggested that the Technical Teachers' Training Institutes should organise among themselves to give first priority for all the core subjects. Other subjects, subject topics, may be taken up subsequently. Marginal adjustments, depending upon the needs of the curricula of the courses in the respective States can be worked out thereafter when required by the respective Technical Teachers' Training Institutes.

(b) Concepts and principles for teaching aids have been developed at these Institutes. Here as well, the exchange of ideas among them would be fruitful.

The Technical Teachers' Training Institutes should also assist the polytechnics in preparing/fabricating various aids/devices (like film strips, wall-charts, etc.) and in evolving new concepts and innovations in teacher training. Trying out of new techniques

and new training material and curriculum, item-bank/case-bank concepts, evaluation system, etc. in the polytechnics will help the development of the faculty of the polytechnics, as also the standard of the technician courses.

(c) Preparation of text-books and other instructional material, etc. can be taken up by the Institutes in a coordinated manner to avoid duplication of efforts and to ensure better utilisation of available resources.

(d) The Institutes can develop a system of getting feed back information from the field to improve teaching process and experimental set up in the laboratories. This can be done by building up case-banks out of actual field experience to give practical relevance to teaching. Similarly, item-banks can be built up by the Institutes for the purpose of evaluation and they can test them for their efficacy. Experience/resources in these areas of item-banks/case-banks can be shared by the Institutes.

(e) Institutes can devise a common programme of a periodical survey of the existing resources in the polytechnics like laboratory, workshop and library facilities. This will help in identifyiny obsolete items and in modifying them to suit present demands. This will also enable them to guide the polytechnics with better developed substitutes.

In advocating this coordinated approach among the Technical Teachers' Training Institutes, it is not envisaged to centralise or bring in a hand uniformity. As a matter of fact, the Committee has in mind the need for adequate and appropriate flexibility for each Institute to develop and grow to its fullest extent. Initiatives of each Institute in taking project works of interest to the region and working on the common concepts of curricula to suit the regional requirements have to continue.

7.10. Staff Development Programmes.

The Technical Teachers' Training Institutes also need to give attention for building up and maintaining good faculty with them. While the present incumbents at these Institutes are, by and large, well and qualified and have acquitted themselves creditably, advance in technology and improved techniques that are repidly opening up make it imperative that the faculty at the Institutes is given a periodical, well-planned, refresher course. A deliberately planned and well organised staff development programme with provision for periodical short-term deputation of the faculity members to institutions in India and abroad will go a long way in keeping the faculty alert and abreast of the latest developments. This obviously means an adequate training reserve in each Technical Teachers' Training Institute.

To provide an appropriate motivation, attrative salaries on a par with engineering colleges and other service benefits should be extended to the faculty of the Technical Teachers' Training Institutes keeping in view their special attainments and contribution.

The Technical Teachers' Training Institute faculty may also have regular programme by organising special development courses for this purpose with the Institutes, with the help of industries and other educational agencies for updating of knowledge. A programme of exchange of faculty between the Institutes and the industry and other engineering institutions for short periods should also be evolved. Services of specialists, both from within the country and abroad through UNDP, UNESCO and other such agencies may be availed of periodically, particularly in the area of pedagogy and educational research and resources. All these measures will keep the Technical Teachers' Training Institute faculty in trim continually to attend to the onerous task of technical teacher training entrusted to them.

7.11. Text-book production.

Specific mention might be made of the importance of the task of text-book production for technician programmes. Standard text-books at the polytechnic level are not available, particularly for the revised curricula. It is the responsibility of the Technical Teachers' Training Institutes to attend to this task on a priority basis and make available at least one text book for each special topic of the polytechnic curriculum. This would be possible within a reasonable period of time if the four Technical Teachers' Training Institutes were to pool their resources together and allocate among themselves the responsibility of the work of production of the various subject-topics to be covered. Periodical updating of such text books produced for use in the polytechnics will be the responsibility of the Technical Teachers' Training Institutes.

7.12. Boards of Governors of Technical Teachers' Training Institutes and Coordinating Council.

The Boards of Technical Teachers' Training Institutes as constituted at present have been able to serve the interests of the Institutes fairly satisfactorily till now. Nevertheless, it is necessary that there is sufficient scope and flexibility for each Institute to develop its own genius and methodology and develop its own separate identity commensurate with the objectives of establishment, keeping at the same time in view the need for general coordination in the area of technician teacher training in certain specific core sectors indicated earlier. The Committee recommends that instead of having a

common Chairman for all the four Technical Teachers' Training Institutes, each autonomous Board should have a separate Chairman, a person of standing in the region interested in technical education to be appointed by the Central Government. This will allow for sufficient emphasis to be laid by the respective Institutes for identification of the special problems of the region.

However, in view of the contemplated enlarged activities of the Institutes and to cater to the specific needs of the polytechnic teacher community in the whole country in general, there is also substantial need among the four regional institutes for coordination both to tackle immediate pressing problems and for their integrated future development in the total area of technician teacher training. Therefore, it is suggested that a Coordinating Council with the following composition be set up for this purpose :-

Chairman	:	Head of the Technical Education Division in the Ministry.
Members	:	Chairmen of the Boards of the four Institutes.
Members	:	Principals (Member-Secretaries of the Boards) of the four Institutes.
Member	:	A representative of the Ministry of Finance
Member	:	A non-official representative of the All India Council for Technical Education.
Members	:	Two representatives of the Technician Board of the AICTE, and
Member-Secretary	:	An Officer of the Technical Education Division of of the Ministry.

8. OTHER PROPOSALS OF THE INSTITUTES

8.1. The Technical Teachers' Training Institutes have put forward many proposals for future development. In the earlier chapters, the Committee's views have already been expressed on most of the major proposals brought before the Committee, such as re-structuring the teacher training programmes, special courses for Science and English teachers and workshop and laboratory staff, extension centres, development of Educational Research and Resources Centre including preparation of students' study material, teaching-aids, etc. Here, some of the other proposals which have not been specifically dealt with earlier are considered.

8.2. Specialist technician teacher training

The Institutes, in general, would like to venture into new areas of technician programmes, apart from the conventional Civil, Mechanical and Electrical Engineering. The Committee would support those proposals since primarily it is the responsibility of these Institutes to cater to the needs of the teachers in all technician areas. Obviously, the demand for training any particular group of teachers has to be considered at the appropriate time by the concerned Institute. It may be, however, suggested that any such extension of the activities to cater to the specialist teacher training should not involve large additional inputs by way of faculty and hard-ware. The Committee is of the view that for the present activities of the Institutes, specifically the training programmes, the faculty position at the Institutes is quite satisfactory provided the tenure staff approved for Quality Improvement programmes and other short-term courses now sanctioned for these Institutes are approved on a permanent basis, since these short-term courses contribute in a large measure to their academic growth and activities. An appropriate addition of staff for the new programmes suggested such as for the resource building activities, extension centres, etc. will also be necessary. For facilitating the staff development programme, as already observed, an adequate training reserve is required.

The Committee would also suggest an adequate block grant of Rs. 30 lakhs for each Institute for the next 3-5 years as capital grant for strengthening of the existing departments and other increased activity. Of this block grant, Rs. 5 lakhs will be for the purpose of building up the library resources at the Institutes and the extension centres.

8.3. Special programmes

It has been proposed by two of the Institutes that they should be permitted to train engineering college teachers also. On the other hand, there have been proposals from the Institutes, as also from some of the State Governments when they deposed before the Committee, that the resources and facilities of the Institutes should be utilised for training of teachers for vocational education and work experience at the secondary school level, particularly in the context of the revised pattern of secondary education. There have also been proposals for conduct of special programmes utilising the facilities at the Technical Teachers' Training Institutes for other purposes such as training of the staff of training departments of the industry and for mounting courses for special programmes. The special programmes may have some bearing on technical education even though not necessarily on technician education, and in some cases these programmes have no relevance to technical education at all, but are basically making use of the expertise developed at these

Institutes for the benefit of the community. No hard and fast rule can be suggested with regard to the conduct of these programmes not meant for technician teacher training and the concerned managements have to take a decision regarding these specific issues. The Committee would, however, like to emphasise that within the limited resources available at the Institutes and the very marginal inputs that are possible to be ploughed into the Institutes in the years to come, while extending these services of the Technical Teachers' Training Institutes, it is necessary to keep in view that the main purpose for which these Institutes have been set up is for technician teacher training in which area much leeway is still to be made up. Therefore, the first charge on the facilities/expertise/time of these Institutes is on technician teacher training. Any other activity, if taken up, should be with the specific understanding that extension of such services does not in any way impair the main activity of technician teacher training programmes.

8.4. B.Tech. Ed., M. Tech. Ed. programmes and degree awarding status

Proposals have been made regarding the charter to be given to the Technical Teachers' Training Institute for awarding degrees as also for conduct of degree and post-graduate courses (B. Tech. Ed., and M. Tech. Ed.). The Committee is firmly of the view that activities such as envisaged for a charter for awarding degrees will impair the primary objective of setting up of these Institutes. As regards the conduct of B. Tech. Ed., and M. Tech. Ed. courses, the Committee is not convinced of the need for embarking on such an activity.

8.5. Computer Centre

The establishment of a Computer Centre has also been suggested. Looking into the other pressing demands for the various activities of the Technical Teachers' Training Institutes, and the marginal involvement for computer work in the present set up, the Committee do not recommend any major effort and expenditure for the establishment of Computer Centres in these Institutes at the present juncture.

8.6. Regional Film Libraries

Suggestions for establishment of regional film libraries have been made. The need for film libraries has been conceded and the All India Council for Technical Education has quite sometime ago suggested that the film libraries should be housed in the Technical Teachers' Training Institutes. The Committee's earlier recommendation regarding the strengthening of the Resources Centre at the Institutes includes the establishment and maintenance of adequate film libraries of interest to technician institutions.

8.7. Educational film production

A proposal has been made for the starting of educational film production centre. The Committee is aware that film production is an expensive affair, even though very useful as an educational aid and therefore, would recommend that this activity of production of educational film should be taken up after careful and detailed planning. This should be a joint responsibility of the four Technical Teachers' Training Institutes so that they can decide in what areas their production work could be concentrated. There are some technician level institutions where film technology is being offered as a course. These institutions as also the Film Institute at Poona and the concerned regional Technical Teachers' Training Institute should be involved in the production of films. The Coordinating Council of the Institutes will be in a position to decide about the administrative responsibility of the film production activities and which Technical Teachers' Training Institute will shoulder this.

8.8. Language Laboratory

A proposal has also been made for the establishment of a language laboratory in the Technical Teachers' Training Institutes. While the Committee can understand the intention behind this proposal of improving the communicative ability of the spoken language, the Committee is anxious that large inputs should not result in very limited returns or infructuous expenditure in a field where a particular technique may only give restricted ability in a particular language.

8.9. Courses on Educational Administration

Starting of special courses in Educational Management has been suggested. While the Committee favours in general the idea of short-term courses/occasional seminars, dealing with various aspects of educational administration and finance that may be relevant to the technician teacher, the courses to be offered at these Institutes, be they of long term or short term, should have the primary objective of making the teacher better and effective in his profession. Courses in the areas of only peripheral concern and occasional advantage to a minority of teachers, therefore, have to be avoided.

8.10. Staff College Concept

The Committee's attitude towards the proposal for the concept of Staff College for the Technical Teachers' Training Institutes is also similar. Basic teacher training programme at least for the next 3-5 years is of paramount concern ; any other effort tends to divert and deviate the concerted attention of the Technical Teachers' Training Institutes that is very necessary for this programme. Once the majority, if not

all, teachers have been exposed to effective and worthwhile teacher training programme as indicated earlier, efforts might be thought of at these Institutes for specialised programmes of shorter duration and in the nature of seminars and meetings of all concerned in the development of technician education including industry and other employers, administrators, etc., which would correspond to the Staff College concept. Till that stage is reached, the Committee is anxious that the present efforts should be solely for the objective of teacher training at the grass root level, rather than in a diffused manner.

8.11. Increase in the value of stipends

The Committee has also given thought to the matter of adequate financial support and other facilities to be created at the Technical Teachers' Training Institutes for the welfare of the teacher community who come for these courses. With all round increase in the cost of living and the need for the teachers sponsored for these courses to incur considerable amounts of expenditure in the place of their training in addition to their regular places of posting where their families would stay normally, the Committee would suggest that a minimum of Rs. 300/- per month for a teacher trainee is necessary. The Committee is also guided in this instance by the amount of stipend being paid to the graduate and diploma holder teachers in engineering colleges and polytechnics who go for practical training to industry under the Quality Improvement programme.

9. FINANCIAL IMPLICATIONS OF THE RECOMMENDATIONS

9.1. The Institutes have completed more than a decade of their activities and have made a mark for themselves in the field of technician teacher education in the country. As has been indicated in the earlier chapters, this development has taken place in these Institutes more or less on the lines of the details worked out in the project report and a few changes necessitated because of the various programmes subsequently required to be incorporated in the activities of the Institutes. An amount of Rs. 110.95 lakhs have been spent on buildings and Rs. 72.37 lakhs on equipment and library facilities at these Institutes.

At this stage of development of these Institutes, the task of the Review Committee has been to give direction for their future development and to suggest facilities required for that purpose. In the last two chapters of this report, the Committee's recommendations regarding the various activities of the Institutes have been indicated. What follows is the translation into financial terms the suggested recommendations of the Committee.

9.2. Staff strength at the Institutes

The teaching staff salaries of the four Institutes during the financial year 1974-75 have amounted to Rs. 14.78 lakhs for their regular in-service programmes. For the Quality Improvement and other short term courses approved for these Institutes from time to time, an annual expenditure of Rs. 11 lakhs is being incurred (actuals during the year 1974-75). As has been indicated elsewhere, it is necessary to sustain all these activities of the Institutes on a permanent basis and hence the staff approved on tenure basis for the Quality Improvement Programmes and the other short term courses need to be sanctioned permanently. Further, for the staff development programmes recommended, it has been suggested by the Committee that adequate " training reserve " (to the extent of 20% of the present sanctioned staff strength) should be provided. The annual additional expenditure towards such " training reserve " staff in the four Institutes put together will be of the order of Rs. 5 lakhs.

9.3. Extension Centres

It has been suggested that one Professor, one Assistant Professor and two trained technicians should be seconded to each extension centre. At the present salary scales and allowances attached to these posts, it is estimated that an amount of Rs. 75,000 will be required towards staff emoluments for each extension centre per year. The extension centres are required to take on various activities of teacher training, depending upon the needs of the area and as agreed to by the concerned State Governments and the Technical Teachers' Training Institutes in the region. For these activities for various contingency items of expenditure, etc., the Committee feels that an amount of Rs. 25,000 has to be provided for each extension centre. Thus the total annual requirement for each extension centre will be of the order of Rs. 1 lakh.

The Committee has suggested the starting of an extension centre in each State. Wherever necessary, starting of upto 3 centres has been recommended. At present, there are only two centres, one in Gujarat and the other in Kerala. Establishment of the extension centres on the large scale suggested by the Committee can, therefore, be only gradual. Keeping this in view and taking into account the starting of an estimated ten centres in the first year all over the country, 20 in the next year, 30, 40 and 45 in the subsequent years, the total expenditure involved for the 5 year period for all the institutions together would be of the order of Rs. 1.45 crores.

9.4. Block grant : strengthening the departments and the library resources ; special projects grant

The Committee has suggested a block grant of Rs. 30 lakhs, spread over the total period of implementation of the recommendations, for strengthening of the existing departments and providing additional minimum facilities for the new activities, including the resource centre and subject-updating units. The total expenditure on this account for the four Institutes will be of the order of Rs. 1.2 crores.

It has also been suggested by the Committee that an amount of Rs. 50 lakhs should be available as a special projects grant, to be sanctioned at the discretion of the suggested Coordinating Council from time to time, to the four Institutes for their specifically approved special activities outlined in the report. Thus the total "development grant" suggested for the four Institutes would be of the order of Rs. 1.7 crores.

9.5. Increase in the volume of stipends to the teacher trainees

It has been suggested by the Committee that the value of stipends payable to the teacher trainees (taking into account the rise in cost of living, their out-of pocket expenses and the fact that they are away from their normal place of posting) should be increased from the present Rs. 150/- per month to Rs. 300/- per month. For about 8500 teacher trainees expected to be covered under the "crash programme" of these teacher training Institutes, the total amount required would be of the order of Rs. 1 crore. This has taken into account the fact that each teacher trainee will have to be given the stipend for a minimum period of three months as per the suggested module system.

9.6. These institutions have to be provided with certain essential amenities both for the staff and for the teacher trainees. This is so particularly in view of the fact that these are special types of institutions and those coming to these Institutes for training are of sufficient maturity and of higher age groups than in other technical institutions. Certain minimum comforts and amenities for their stay on the campus during the period of training is very essential so that the maximum impact of the programme could be ensured. As such an amount of Rs. 40 lakhs for the provision of various amenities as will be decided upon by the Coordinating Council/Boards of the Institutes is provided for all the four Institutes together.

9.7. Development of the Calcutta Institute

The Committee has referred to the need for early completion of the construction of buildings for the Technical Teachers' Training Institute, Calcutta to enable the institutional activities to become more effective. It is estimated that an additional amount of Rs. 65 lakhs might be required for the completion of the buildings of the Institute.

9.8. Conclusion

Thus the total financial support required for implementation of the recommendations of the Committee over a period of 5 years will be as follows :—

		Rs. lakhs
(a)	Staff salaries	55.00
(b)	Training reserve	25.00
(c)	Extension Centres	145.00
(d)	Block grant including special project grants	170.00
(e)	Amenities	40.00
(f)	Development of the Calcutta Institute	65.00
(g)	Stipends	100.00
	Total	600.00

Summary of Recommendations

The Institutes have made a mark for themselves in the field of technician teacher education in the country.	9.1.
Training in pedagogy has been very effective and brought about a great appreciative awareness. Industrial training also has earned almost equal appreciation. However, training in these two elements can be in modular form of 12 weeks duration, each to be taken up as a unit, not necessarily in sequence.	6.5; 6.6; 7.3.
Effectiveness of subject-updating programme has been very limited. Along with facilities available at the Institutes, flexible non-formal programmes of subject-updating should also be tried because this is of importance not only to the diploma holder but also to the degree holder teachers.	7.4.
Specially designed 6 months programmes for Science teachers of polytechnics should be arranged.	7.5.

In addition to the modular approach to ensure adequate coverage to a larger number in a prescribed period, it is necessary that activities of the Institutes are extended to the States. There should be extension centres in each State. 7.6.

To bring about an attitude change, special appreciation courses should be conducted for senior personnel connected with technician education in areas of activity. 7.8.

The impact of the Institutes has already been felt considerably in the area of educational services, even though these services were not specifically contemplated when the Institutes were started. More efforts in a well thoughtout planned manner in this pioneering area, with specific short term and long term objectives have to be organised in the four Institutes. 6.8; 6.9; 7.9.

Special programmes are sometimes being conducted at the Institutes which might have some bearing on technical/technician education and sometimes of relevance only regarding the utilisation of the expertise developed at the Institutes. Within the limited resources available at the Institutes, technician teacher training programmes have a priority. Other activities which allow utilisation of the expertise and competence available at the Institutes by the community at large may be undertaken provided the main activity is not hampered. 6.10; 8.3.

Special facilities such as the Computer Centre, Film Libraries, Film Production, Language Libraries, etc. should be on a " pooled basis " with well planned coordination among the four Institutes. 8.5; 8.6; 8.7; 8.8.

It is necessary that there is sufficient scope and flexibility for each Institute to develop its own methodology and genius commensurate with the objectives of establishment. Hence instead of a common Chairman for all the four Institutes, each autonomous Board should have a separate Chairman, a person of standing in the region, interested in technical education, to be appointed by the Central Government. However, in view of the contemplated enlarged activities and the substantial need for coordination also, a Coordinating Council of the four Institutes should be set up. 7.12.

APPENDICES

Appendix I.

ORIGINAL PROJECT ESTIMATES FOR THE TECHNICAL TEACHERS' TRAINING INSTITUTES

The Governments of the States in which these Institutes are located are expected to provide land free of cost to the Institutes. The cost to develop the land is, however, to be borne by the Institute. Well developed polytechnics in the cities where the Institutes are located are to be used as practice polytechnics and for each institute. The Principal of the practice polytechnic should be paid Rs. 150/- per month as allowance for active participation in the Scheme and ensuring that all facilities are made available to the training Institute by the Polytechnic.

The instructional facilities such as buildings, equipment and staff required for each of the Institutes are :-

Buildings:

Administration and class rooms.

1	Class rooms and Tutorial rooms (seven)		3,400	sq. ft.
2	Drawing Halls (three)	...	1,800	,,
3	Audio Visual room	...	1,800	,,
4	Seminar Hall	...	1,500	,,
5	Auditorium	...	6,000	,,
6	Library and Reading room	...	3,000	,,
7	Model room	...	2,000	,,
8	Stores	...	1,000	,,
9	Office	...	2,000	,,
10	Principal's room	...	400	,,
11	Staff room and Staff common room	...	2,000	,,
12	Students' common room	...	1,000	,,
			25,900	,,
	For walls, etc. 42%	...	10,920	,,
			36,820	,,

Say 37,000 sq.ft.

Cost @ Rs. 25.00 per sq.ft. Rs. 9,25,000.

Laboratories

1	Science	...	1,200	sq. ft.
2	Electronics & Instruments	...	1,200	,,
3	Hydraulics	...	1,200	,,
4	Refrigeration & Air conditioning	...	1,200	,,
5	Automobile Engineering	...	1,200	,,
6	Highway Engineering	...	600	,,
7	Applied Mechanics	...	600	,,
8	Public Health Engineering	...	600	,,
9	Structures	...	600	,,
10	Soil Mechanics	...	600	,,
			9,000	,,
	Add 25% for walls, etc.	...	2,850	,,
			11,250	,,

Cost @ Rs. 18/- per sq. ft. ... Rs. 2,02,500.

Total cost of Instruction Buildings ... Rs. 11,27,500

Say ... Rs. 11.28 lakhs.

(The cost includes Civil Work, Sanitary and Electrical fittings).

The cost of construction varies from Rs. 20 to Rs. 25 per sq.ft. for R. C. C. construction and Rs. 16/- to Rs. 18/- per sq. ft. for Workshop type buildings in these centres. C.P.W.D. scheduled rates at these centres are given below :-

R. C. C. W/s type construction.

Bhopal, Chandigarh — Rs. 20/- Rs. 16/-.

Madras, Calcutta — Rs. 25/- Rs. 18/-.

For the purpose of these estimates for all the four centres scheduled rates at Madras & Calcutta were taken.

Equipment.

1.	Equipment for the Laboratories listed above and audio visual equipment. (The item-wise details of equipment requirements will be prepared by the Principals of the training Centres).	Rs. 6,00,000.
2.	Library.	Rs. 1,00,000.
3.	Furniture.	Rs. 1,50,000.
4.	Motor Vehicle (Station Wagon or a Bus).	Rs. 50,000.
		Rs. 9,00,000.

Staff :—

(a)	**Teaching : Designation.**	**No. of posts.**	**Scale of Pay.**
1.	Principal.	1	Rs. 1300-60-1600-100-1800.
2.	Professors (Civil, Mech., Education, Sciences).	5	Rs. 1100-50-1300-60-1600.
3.	Training and Placement Officer.	1	Rs. 1100-50-1300-60-1600.
4.	Asstt. Professors (Civil, Mech., Elec., & Sciences).	5	Rs. 700-40-1100-50/2-1250.
5.	Lecturers (Civil, Mech. Elec. Psy. Sciences).	5	Rs. 400-400-450-30-600-35-670-EB-35-950.

Qualifications and experience of Teaching Staff.

1. **PROFESSOR.**

Essential.

(1) A good degree in the appropriate branch of Engineering of any Indian or foreign University.

(2) Professional experience in the corresponding field for at least a period of not less than 10 years of which 5 years should be in teaching in a responsible position in a college or a polytechnic.

Desirable.

Should have undergone a technical teacher-training course in India or abroad.

2. **TRAINING AND PLACEMENT OFFICER.**

Essential.

(1) A good degree in Engineering.

(2) Professional experience for a period of not less than 10 years.

Desirable.

Experience in training organisation of a large industrial concern.

3. **ASSISTANT PROFESSOR.**

Essential.

(1) A good degree in the appropriate branch of Engineering of any Indian or foreign University.

(2) Professional experience in the corresponding field for a period of not less then 7 years of which at least 4 years should be in teaching in a college or a polytechnic.

4. **LECTURER.**

Essential.

(1) A good degree in Engineering in the appropriate branch of Engineering.

Desirable :

Experience in Teaching/Industry.

(b) **Non-teaching (Technical) :**

	Designation.	No. of Posts.	Scale of Pay.
(i)	Librarian	1	Rs. 210-10-290-15-320-EB-15-425.
(ii)	Draftsman	1	Rs. 150-5-175-6-205-EB-7-240.
(iii)	Mechanics	4	Rs. 180-180-205-7-240-8-280.
(iv)	Artist	1	Rs. 200-15-320.

	Designation.	No. of posts	Scale of Pay
(c)	**Administrative :**		
(i)	Office Supdt.	1	Rs. 350-25-575.
(ii)	Accountant.	1	Rs. 270-15-435-EB-20-575.
(iii)	U. D. C.	3	Rs. 130-5-160-200-EB-8-256-EB-8-284-10-300.
(iv)	L. D. C.	4	Rs. 110-3-131-4-155-EB-4-175-5-180
(v)	Store Keeper.	1	Rs. 130-5-160-8-200-EB-8-256-EB-8-280-10-300.
(vi)	Stenographer.	1	Rs. 130-5-160-8-200-EB-8-256-EB-8-280-10-300.
(vii)	Steno-Typist.	2	Rs. 110-3-131-4-155-EB-175-5-180 + Rs. 20/- S. P.
(viii)	Driver.	1	Rs. 110-3-131-4-139.
(ix)	Duplicator Operator.	1	Rs. 75-1-85-2-95.
(x)	Watchman.	3	Rs. 70-1-80-EB-1-85.
(xi)	Mali.	2	do
(xii)	Sweepers.	2	do
(xiii)	Daftry.	1	Rs. 75-1-85-EB-2-95.
(xiv)	Peons.	10	Rs. 70-1-80-EB-1-85.
(d)	**Health.**		
(i)	Medical Officer (Part-time).	1	Rs. 200/- p. m.
(ii)	Compounder	1	Rs. 130-5-175-EB-6-205-7-212-EB-7-240 (For fully qualified pharmacists only).
(e)	**Hostel.**		
(i)	Block servants	4	Rs. 70-1-80-EB-1-85.
(ii)	Sweepers	2	
(iii)	Watchmen	3	

Recurring expenditure.

Staff salaries.	...	Rs. 3.2 lakhs p. a.
Stipends.	...	Rs. 4.5 lakhs p. a.
Maintenance and Miscellaneous expenditure.	...	Rs. 0.6 lakh p. a.
		Rs. 8.3 lakhs per annum.

Hostels :

It is expected that there will be about 110 students at a time in the campus. Single-room hostel accommodation should be provided for all teacher trainees. The total cost of construction of hostels will be Rs. 5.00 lakhs.

Staff Quarters.

It is necessary that the entire teaching staff should be provided with staff quarters. The cost of the staff quarters will be Rs. 6.00 lakhs.

It is estimated that the development of land at each of these four centres would cost Rs. 1.00 lakh.

SUMMARY OF FINANCIAL ESTIMATES:

Development of land.	Rs.	1.00	lakh.
Buildings.	Rs.	11.28	lakhs.
Equipment.	Rs.	9.00	lakhs.
Hostel.	Rs.	5.00	lakhs.
Staff Quarters.	Rs.	6.00	lakhs.
Recurring (Ultimate)	Rs.	8.30	lakhs per annum.

Appendix I B.

(a) INSTITUTIONAL INFORMATION

	'Technical Teachers' Training Institute.				Total.
	Bhopal	Calcutta	Chandigarh	Madras	
1. Date of establishment of the Institute	1965	1966	1967	1966	
2. Long term courses being conducted at the Institute.	Diploma in Technical Teaching 12-18 months.	Diploma in Technical Teaching 12-18 months. Diploma in Science Teaching 12 months.	Diploma in Technical Teaching 12-18 months. Diploma in Science Teaching 12 months.	Diploma in Technical Teaching 12-18 months. Diploma in Science Teaching 9 months. B. Tech. Ed. 12 months.	
3. No. of Polytechnics in the jurisdiction of the Institute.	78	59	77	103	317
4. Approx. No. of teachers in these Polytechnics	2500	1500	1400	2850	8250

Appendix I B. *(Contd.)*

(a) INSTITUTIONAL INFORMATION

	'Technical Teachers' Training Institute.				Total.
	Bhopal	Calcutta	Chandigarh	Madras	
5. Approx. percentage of graduates among the total polytechnic teacher population	70	75	33	25	50 (average)
6. No. of teachers who participated in the long term programmes (figures in brackets indicate graduate teachers who took part	217 (81)	315 (163)	319 (37)	582 (118)	1433 (399)
7. No. of teachers who took part in the short-term programmes.	2000	1005	714	1306	5025

Appendix I B. *(Contd.)*

(b) INSTRUCTIONAL FACILITIES

		Technical Teachers' Training Institute			
		Bhopal	Calcutta	Chandigarh	Madras
1	Year of establishment	1965	1966	1967	1966
2	**Instructional buildings**				
	(a) Area in sq. metres	4645	Construction	4965	5850
	(b) Cost	30.00	yet to start	17.62	32.41
3	Cost of equipment	7.59+ 7.56*	7.36	8.69+ 12.51**	11.25+ 6.87*
4	**Library**				
	(a) Cost	2.54	2.87	1.69	3.44
	(b) **Number**				
	(i) Books	13550	8000	8700	12400
	(ii) Bound volumes of journals	160	150	170	700
	(iii) Journals subscribed to annually	80	120	150	100
5	Furniture - Cost	2.45	2.55	3.01	2.47
6	Staff Quarters - Cost	under construction	—	6.00 (16 members)	8.71 (17 members)
7	Hostel - Cost	-do-	—	5.00 (110 students)	6.21 (110 students)
8	**Faculty Position**				
	(a) **Normal Programme.**				
	Teaching :-				
	Professors	6	5	5	6
	Asst. Professors	7	5	8	8
	Lecturers	5	4	9	9

Appendix I B. *(Contd.)*

(b) INSTRUCTIONAL FACILITIES

	Technical Teachers' Training Institute			
	Bhopal	Calcutta	Chandigarh	Madras
Non-teaching :-				
Technical	15	8	23	26
Non-technical	60	66	60	47
Quality Improvement Programmes.				
Teaching :-				
Professors	7	1	1	2
Asst. Professors	1	2	2	4
Lecturer	—	—	2	2
Non-teaching :-				
Technical	3	4	—	2
Non-technical	10	2	6	2

(All expenditure is indicated in Rs. lakhs)

* from U. K.

* * from Netherlands.

(c) INSTITUTIONAL INFORMATION

Annual Expenditure

Technical Teachers' Training Institute

	Bhopal			Calcutta			Chandigarh			Madras		
	72-73	73-74	74-75	72-73	73-74	74-75	72-73	73-74	74-75	72-73	73-74	74-75
Normal Programmes.												
Teaching.	2.36	2.68	3.67	3.29	3.07	3.02	2.25	2.64	3.61	3.78	3.72	4.48
Non-teaching.	1.47	2.03	3.50	2.56	2.80	4.29	1.97	2.35	3.80	2.17	2.57	3.85
Departmental.	0.27	0.19	0.61	0.29	0.46	0.43	0.34	0.32	0.34	0.39	0.50	0.51
Stipend to trainees.	0.70	0.68	0.66	1.21	0.86	0.82	1.59	1.38	1.02	2.07	1.89	1.32
Other expenses.	0.68	0.96	1.29	2.12	1.93	1.81	2.25	1.92	2.58	2.89	3.21	3.08
	5.48	6.54	9.73	9.47	9.12	10.37	8.40	8.61	11.35	11.30	11.89	13.24
Q. I. P. and Other Short-term programmes.	3.30	3.62	4.34	0.76	1.58	2.30	2.16	2.75	2.30	1.96	2.60	2.06
Total.	8.78	10.16	14.07	10.23	10.70	12.67	10.56	11.36	13.65	13.26	14.49	15.30

Appendix I C.

PROPOSALS MADE TO THE REVIEW COMMITTEE BY THE TECHNICAL TEACHERS' TRAINING INSTITUTES FOR THEIR FUTURE DEVELOPMENT.

T. T. T. I., Bhopal.

(1) Restructuring all teacher training programmes in a modular form competency based approach ;

(2) Special courses for Science and English teachers and workshop and laboratory staff;

(3) Training of staff for Training Departments in Industry ;

(4) Diploma Course in Educational Management ;

(5) Extending training courses for Engineering College faculty ;

(6) Charter to the Institute for grant of degrees ;

(7) Teaching Aid Centre ;

(8) Three Extension Centres ;

(9) Computer Centre ;

(10) Educational Research Cell ;

(11) Establishment of Case Bank and test item bank ;

(12) Regional Film Library ;

(13) National Testing Service for Technician Education ;

(14) Educational Film Production Centre ;

(15) Preparation of Students' self study material.

T. T. T. I., Calcutta.

(1) Teacher Training in specialised areas ;

(2) Educational Research Programme ;

(3) Expansion of the language laboratory ;

(4) Establishment of film library.

T. T. T. I., Chandigarh.

(1) Extension Centres in each State ;

(2) Starting of B. Tech. Ed. and M.Ed. courses affiliated to Punjab University.

(3) Teachers' Training Programme for specialised fields ;

(4) Research Development Programme ;

(5) Staff Development Programme ;

(6) Further expansion of existing departments ;

(7) Establishment of Film Laboratory ;

(8) Resource Centre.

T. T. T. I., Madras.

(1) The Establishment of an Extension Centre in each State of the region ;

(2) Starting of Diploma / Degree in Technical Teaching Courses in specialised subjects such as Commercial Practice, Printing Technology, Leather Technology, Chemical Technology, Textiles and for equipment ;

(3) Strengthening of the Curriculum Development Unit ;

(4) Setting up of an Educational Research Unit and

(5) Starting of Training Programme for Engineering College Teachers.

Appendix II.

TECHNICAL TEACHERS' TRAINING INSTITUTE, MADRAS

ACADEMIC ACTIVITIES

I. **Full Time Programmes :-**

(1) **Diploma in Technical Teaching (Dip. T. T.) :**

For in-service polytechnic teachers having a Diploma in Engineering, the Course is of 18 months duration and is planned such that the entire training programme integrates the three essential elements, viz : (i) Subject Content Development, (ii) Pedagogy and (iii) Related Industrial experience.

(2) **Diploma in Science Teaching :**

For in-service polytechnic teachers having a degree in Physics, Chemistry or Mathematics, the course is of 9 months duration and is an integrated programme of Education, Teaching and Industrial Studies.

(3) **Bachelor of Tech. Edn. (B. Tech. Ed) of University of Madras :**

For in-service Engineering teachers having a degree in Engineering, the course is of one academic year's duration, and is designed to enable the participants to improve their effectiveness in teaching by an integrated application of Pedagogy, Industrial Practices, Modern Evaluation Techniques, Modern Teaching Methods and Aids and Curriculum Process.

II. **Short-term Courses (Quality Improvement Programmes and Summer Schools) Short-term Programmes.**

Several short courses of varying duration are offered in the following areas, under the Quality Improvement Programme of the Ministry of Education & Social Welfare, Government of India and Summer School programme of Indian Society for Technical Education :-

Institute based.

(1) Methods of effective teaching for teachers of polytechnics.

(2) Subject matter updating for teachers of polytechnics.

(3) Curriculum Development Workshops.

Extension Programmes.

(4) Extension Courses in Methods of effective teaching in selected polytechnics.

(5) Extension Courses in Laboratory oriented teaching in selected polytechnics.

The Courses were :-

(1) (Orientation Courses) for Principals of Polytechnics in the Southern Region.

(2) " Modern Educational Practices ", for Heads of Departments.

(3) (Study Conference) for Officers in-charge of Training in Industry and Technical Institutions.

(4) For participants from Rajasthan Atomic Power Project on " Educational Technology ".

(5) " Crash " Training Programme on Engineering Drawing-I.

(6) " Bridge Course " in English.

(7) Use of projected aids for teaching Engineering subjects in Polytechnics.

(8) Laboratory Centred Instruction in Production Technology.

(9) 'Advanced Structural Engineering'.

(10) 'Effective Instruction in Commercial Practice'.

(11) 'Methods of Testing and Evaluation for Technician Subjects'.

(12) (Extension course) in Education at Tuticorin.

(13) Validation of Demonstration Models.

(14) Teaching English for Communication.

(15) On Mathematics for Technicians.

(16) On Modern Educational Practices for University Teachers.

(17) Laboratory Centred Short course in Public Health Engineering.

(18) Special course for Science (Physics) Teachers of Karnataka Polytechnics to evolve a new Curriculum at S.J. Polytechnic, Bangalore.

(19) Laboratory Centred Instruction in Structural Engineering at College of Engineering, Trivandrum.

(20) Laboratory Centred Instruction in Heat Power Engineering at Government Polytechnic, Kottayam.

(21) Modern Educational Practices for Heads of Departments at Government Polytechnic, Hyderabad.

(22) Physics Curriculum.

(23) Day Release Programme in Applied Science and Maths.

(24) Teaching Elec. Machines.

(25) Orientation course in Industrial Electronics Lab. Curriculum.

(26) Entrepreneurship Programme for Principals of Polytechnics.

(27) Laboratory Centred Instruction in Automobile Technology (conducted at Andhra Polytechnic, Kakinada, A. P.)

(28) Preparation of Test items / Questions in Hydraulics (conducted at Govt. Polytechnic, Coimbatore).

(29) Modern Educational Practices for Non-Engineering Teachers.

(30) Course on 'Special Needs of Adolescent Girls & Suitable Methods of Teaching them'.

(31) 'Development of Demonstration Models for Teaching Basic Electrical Engineering'.

Workshops.

(1) On Production Techniques in Closed Circuit Television.

(2) Effective Teaching-sponsored by Indian Society for Technical Education at NITIE, Bombay.

(3) On Construction and Servicing of Industrial Electronic Units.

(4) On Project Method of Teaching.

(5) On Laboratory Techniques in Physics.

(6) Curriculum Development in Physics.

(7) On Educational Technology.

(8) Book Writing in Science.

(9) Curriculum Development in Electrical Machines.

(10) Orientation Workshop for Curriculum Developers.

(11) Curriculum Development in Applied Mechanics.

(12) On Audio-Visual Aids.

(13) Curriculum Development in Hydraulics.

(14) Curriculum Development in Production Technology.

(15) Preparation of Teaching Aids (held at Government Polytechnic, Hyderabad).

(16) Curriculum Development for Printing Tech. Teachers.

(17) Curriculum Development in A. C. circuit and machines conducted at Government Polytechnic, Vijayawada, A.P.

(18) Production of Non-projected Aids (conducted at Trivandum, Kerala).

(19) Curriculum Development in Hydraulics (conducted at Nellore, A.P.)

(20) Laboratory Centred Instruction in Production / Workshop Technology at Mysore;

Seminars.

(1) 'Development of Library Facilities and Services in Polytechnics'.

(2) 'Present Day Practice in Pre-stressed Concrete'.

(3) Staff Development Programme (for Principals of Polytechnics).

III. **Other Short term Courses (Special Courses).**

(1) "Work Experience" Courses for Kendriya Vidyalaya.

(2) Audio-Visual Course for Rajasthan Atomic Energy Project.

(3) Audio-Visual Course for Southern Petro Chemical Industries Corporation.

(4) UNDP / ILO Programmes.

(5) Laboratory Technician's Course (AC College of Technology, University of Madras).

(6) Evaluation Course for School Education (Tamil Nadu).

(7) Orientation Course for teachers engaged in teaching school drop-outs (Madras).

(8) Special Course for Central Footwear Training Institute, Madras.

(9) Item Bank Project for the University Staff.

(10) T. V. Maintenance Course.

(11) Course on Instructional Procedures for Naval Officers deputed by the Indian Navy.

PUBLICATIONS, PROJECTS, ETC.

The details of publications, projects etc., undertaken are given below :—

1. Teachers' support material in Engineering Drawing I (17 Units).
2. Students' support material in Engineering Drawing I (17 Units).

   Nearly 10,000 sets of these materials in cyclostyled form (for First 11 Units) were supplied for the use of students in Polytechnics for the first 3 years. These materials are now printed by the Principal, Nachimuthu Polytechnic, Pollachi, Tamil Nadu.
3. Teachers' support material in Engineering Drawing II (10 Units).
4. Students' support material in Engineering Drawing II (10 Units).
5. Science for Technicians (Printed and published by the Director of Technical Education, Karnataka).
6. Teachers' support material in Mathematics - Vol. I. (10 Units).
7. Students' support material in Mathematics - Vol. I. (10 Units).
8. Students' support material in English communication - Vol. I. (9 Units).
9. Teachers' support material in Engineering Mechanics - (14 Units).
10. Students' support material in Engineering Mechanics. (14 Units).
11. Industrial Electronics Lab Manuals - Module I.
12. Industrial Electronics Lab Manuals - Module II.
13. Industrial Electronics Lab Manuals - Data Manual.

14. Design and fabrication of 30 lab. kits in industrial electronics.
(Three of these equipments are being commercially manufactured by a private firm in Madras under licence from NRDC, New Delhi).

15. A Manual of Civil Engineering Models.

16. A Hand-book of classroom Demonstrations in Basic Electrical Engineering.

17. Objective type test item in Applied Mechanics.

18. Objective type test items in Surveying.

19. Objective type test items in Production Technology.

20. Test Items in Hydraulics.

21. Programmed Instruction Booklets in Electrical Engineering. (set of 14 booklets).

22. P. I. Booklets in Maths. (set of 4 booklets).

23. P. I. Booklets in Electronics Test Instruments (set of 5 Booklets).

24. Curriculum for Diploma Course in TV Engineering (With an emphasis on Servicing and Maintenance).

25. Curriculum for Post Diploma Course in Television Engg. (with an emphasis on Servicing and Maintenance).

26. Curriculum for TV Servicing Course.

27. Course outline for post-graduate programme for Bachelor of Communication Arts Degree.

28. Item Bank Project — Test items are being compiled for various subjects of diploma courses.

29. Television Maintenance and Servicing Lab. Manual.

30. Demonstration trolleys for Classroom use.
(5 Demonstration trolleys - to facilitate the domonstration of concepts and principles in classroom in the disciplines of Civil, Electrical, Mechanical, Science and Educational technology were designed, fabricated and presented each to a polytechnic in the four States of Southern Region).

31. Educational Research : A full scale Research Study was completed to study the reactions of students and teachers to the use of structured pre-prepared curriculum materials.

32. Vocationalisation Projects in Electronics Pt. I.
    The following curriculum materials are under preparation :
33. Teachers' support Material in Maths. Vol. II.
34. Students' support Material in Maths. Vol. II.
35. Students' support Material in English Communication. Vol. II.
36. Industrial Electronics Lab. Manual, Modules III & IV.
37. Teachers' support Material in Hydraulics.
38. Students' support Material in Hydraulics.
39. Teachers' support Material in Production Technology.
40. Students' support Material in Production Technology.
41. Teachers' support materials in Electrical Machines.
42. Students' support Materials in Electrical Machines.
43. Objective test Items in Mathematics.
44. Objective test Items in Science.
45. Further collection of test Items for Item Bank.

TEACHING AIDS / PROJECTS DEVELOPED AT THE INSTITUTE.

I. CIVIL ENGINEERING DEPARTMENT.

Name of the Model.

1. Water level depth indicator.
2. Trolley for strength of material.
3. Model of Overhead tank.
4. Making model of an Imphofit tank.
5. Fabrication of an arch.
6. Railway bridge model.
7. Model of trickling filter.
8. Model of metacent.
9. Septic tank model.
10. Built up column.
11. Aqueduct model.

12. Model of a jet.
13. Model of a 3 hinged arch.
14. Preparation of a Rivetted joint.
15. Irrigation map of Southern Region.
16. Fabrication of Grill work for the combined footing.
17. Water treatment plant.
18. Model of a current meter.
19. Verification of a pressure equipment.
20. Fabrication of R. C. C. (O. H. P.) Model.
21. Flow meter model.

II. MECHANICAL ENGINEERING DEPARTMENT.

22. Spring winding machine.
23. Auto delivery drinker.
24. Biscuit packing machine.
25. Fuel pump element.
26. Drill Dynamometer.
27. Demonstration kit on Autowiring.
28. Apparatus on measuring coefficient of friction.
29. Cooling tower.
30. Belt tension apparatus.
31. Bell crank lever.
32. Quick Return Mechanism.
33. Model of 'D' slide valve.
34. Exhaust gas calorimeter for Fist Engine.
35. A porter governor.
36. Ackerman steering mechanism.
37. Fabrication of wheel puller.
38. Model of centreless grinder.
39. Pipe bending machine.
40. Deflection measuring device under buckling load.

41. Valve Mechanism.
42. Broach Model.
43. Wheel alignment model.
44. Principle of clutch.
45. Model of a Mechanical governor.
46. Model of a carburetor.
47. Model of a 2-stroke engine.
48. Model of an Electrolux.
49. Snap gauge, plug gauge.
50. Making of multi-cylinder mechanism.

III. ELECTRICAL ENGINEERING DEPARTMENT.

Name of the Model.

51. Transistor static model.
52. Model of a shielded grid Thyratron.
53. Electrical Thermometer.
54. Design and construction of choke.
55. Making M. I. Inst. Demonstration type.
56. Concept of AC wave generation model.
57. Kit of moving coil instrument.
58. Model of Eddy current damper.
59. Making 4 pole ration of the synchroniser.
60. Making one chicken indicator.
61. Air friction damping.
62. Demonstration model on 3 phase rotating field.
63. Model of a two-polo motor.
64. Demonstration principles of communication.
65. Fabrication of an Induction heating box.
66. Power grid on southern Region - Thermocole model.
67. Making gear mechanism for synchro - transformers.

IV. **C. C. T. V. DEPARTMENT.**

68. Magnetic board for floor plan.
69. Television Demonstrator.
70. T. V. circuit experiment boards.
71. Test equipment trolleys.

V. **SCIENCE DEPARTMENT.**

72. Atmospherical model Railway.
73. Working model of a permitit tower.

VI. **MATHEMATICS DEPARTMENT.**

74. Pythagoras theorem providing model.
75. Binary adder.
76. Number Tree model.
77. Hexo stat model.
78. Circular slide rule.
79. A model of solid of Revolution.
80. Hollow cylindrical model with cone edge.
81. Model to show the nature of the roots of a quadratic equation.

VII. **EDUCATIONAL TECHNOLOGY LABORATORY.**

82. An eccentric ram model.
83. Stop-cylinder Machine Bed motion model.
84. Cathode ray rube model.
85. Quick return Mechanism of shaping machine.

VIII. **WORKSHOP**

86. Strip heater.
87. Bingly tutor boxes.
88. Rolenson's cup air monometer.
89. Thermocole cutting benches.

Appendix III.

TECHNICAL TEACHERS' TRAINING INSTITUTE, CHANDIGARH.

ACADEMIC ACTIVITIES.

I. **Full Time Programmes :-**

(1) Diploma in Technical Teaching for 12 - 18 months.

(2) Diploma in Science Teaching for 12 months.

II. **Short-Term Courses** - Curriculum Development Workshops.

	Curricula Designed.	**States which participated.**
1	Three years generalised diploma in Civil, Electrical and Mechanical Engineering	U. P., Rajasthan, Delhi, H. P., Chandigarh, Punjab, Haryana and J & K.
2	Three years specialised course in Electronics and Communication Engineering	Punjab, Chandigarh, Delhi, Rajasthan, U. P. & Haryana.
3	Three years specialised course in Automobile Engineering	Punjab, Delhi, H. P., Haryana & Chandigarh.
4	2 years diploma course in Library Science	Punjab, U. P., Rajasthan, J. & K.
5	1 year post diploma course in Building Technology & Valuation	Rajasthan, Chandigarh & Punjab
6	1 year post diploma course in Refrigeration & Airconditioning	U. P., Punjab, Chandigarh & Rajasthan
7	1 year post diploma course in Ground Water Engineering	Rajasthan & Chandigarh
8	1 year post diploma course in Production Engineering	Delhi, U. P., Punjab, Rajasthan & Chandigarh
9	1 year post diploma course in Electronics	U. P., Rajasthan & Delhi
10	Three years specialised course in Architectural Assistantship	Delhi and Chandigarh
11	Four years part-time diploma course in Civil, Electrical and Mechanical Engineering	Chandigarh

Short-Term Courses - Symposium on :

1. Polytechnic Education
2. Soil Mechanics
3. Concrete technology
4. Electronic Circuits.
5. Laboratory Techniques in Heat Engines.
6. Applied Thermodynamics.
7. Soil Mechanics
8. Electronic Circuits.
9. Principals Conference (I, II & III).
10. Audio - visual course I.
11. Electrical Control Circuits.
12. Highway Engineering.
13. Audio - visual course II.
14. Machine tools.
15. Field and Lab. testing of Engineering materials.
16. Electrical Machines.
17. Building Drawing.
18. Materials and Heat Treatment.
19. Industrial Electronics.
20. Physics Teaching.
21. Basic Electronics - Theory and Practice.
22. I. C. Engines.
23. Applied Mathematics.
24. Programme on Management & Administration of Polytechnic Education for Principals of Polytechnics.
25. Seminar on Organisation of Polytechnic Libraries.
26. Short Orientation Course in II Sem. Physics.
27. Audio Visual.
28. Heat Engines.
29. Machine Tools.

30. Civil Engineering Drawing.
31. Public Health.
32. Basic Electronics.
33. Management & Administration of Polytechnic Education.
34. Mechanical Engineering Drawing.
35. Mathematics
36. Contactor Control Circuits.
37. Library Science.
38. Applied Physics.
39. Applied Chemistry.
40. Electronic Circuits.
41. Lab Practice in Electrical Machines and Measurements.
42. Evaluation Techniques for Lecturers in Electrical Engg.
43. Special courses on Teaching Methodology at Jaipur.
44. Hydraulics.
45. Evaluation techniques for Lecturers in Civil Engineering.
46. Solid State Devices and Applications in Collaboration with NPC.
47. Supervisory Development Course.
48. Thermal Engineering.
49. Advanced Electronics.
50. Mechanical Engineering Drawing.
51. Audio Visual Aids.
52. Summer School in Management & Administration of Polytechnic Education.
53. Soil Mechanics.
54. Maintenance of Electrical Equipments.
55. Summer School in Teaching Methods.
56. Applied Chemistry.
57. Materials & Metallurgy.
58. How to teach Electronics II.
59. Refrigeration & Airconditioning.

60. Evaluation Technique in Electrical Engineering.
61. Engineering Measurements and Quality Control.
62. STC for Heads Departments on Evaluation Techniques.
63. Advanced Electronics II.
64. Library Science.
65. Construction Management.
66. Study Conference for Principals on Evaluation techniques.
67. Electrical Design and Drawing Lab. Practices.
68. Building Construction Preparation of Instructional Material.
69. Advanced Refrigeration.
70. New trends in Teaching and Learning II.
71. Soil Mechanics - Theory and Practice of Lab. Testing
72. Industrial Management.
73. Maintenance of Electrical Equipment.
74. Summer School in Applied Physics - Lab. organisation & Practice.
75. Evaluation Techniques.
76. Electronics - Lab. Practice.
77. Design and Maintenance of Electric Installations.
78. Structural Drawing.
79. Electronic Circuits I.
80. Management course for Senior Lecturers & Heads of Deptts.
81. Library Science - Classification and Cataloguing.
82. Industrial Drawing and Estimating.
83. Modern Mathematics.
84. Communication techniques.
85. New Trends in Teaching and Learning.
86. Concrete Technology.
87. Methods of Teaching (Exclusively for Women Teachers).
88. Electronic Circuits.
89. Highway & bridge Engineering.
90. Library Science.

LIST OF PUBLICATIONS.

I. TEXT BOOKS.

1. English Prose selections for Polytechnic Students.
2. Programme Text in Strength of Materials.
3. Electrical Engineering Materials.
4. Applied Mathematics for Electrical Engineering.
5. General Mechanical Engineering.

II. LABORATORY MANUALS

1. Laboratory Manual on Heat Engines.
2. Laboratory Manual on Concrete.
3. Soil Investigation Manual.
4. Laboratory Manual on Electrical Machines.

III. DATA BOOKS.

1. Highway Engineering.
2. Structural Engineering.
3. Civil Drawing.

IV. INSTRUCTIONAL / RESOURCE MATERIAL.

1. Recent Trends in Technical Instructions.
2. Practical Notes for Heat Treaters.
3. Contactor Control Circuits.
4. Teachers' Guide for Ferrous Materials and Heat Treaters.
5. Work guide in Engineering Measurements.
6. Guide book for Library & Extension Lectures Vol. I & II.
7. Task work in Estimating and Costing.
8. Guide book for ISI Conventions and Engineering Drawing.
9. A course in Basic Electronics.
10. A course in Public Health Engineering.
11. A course in Civil Engineering Drawing.
12. Glass for Engineering use.

13. A booklet on organising practicals in Building Construction.
14. A simplified approach towards teaching the principles and characteristics of electric motors.
15. Design and construction of small transformers.
16. Application of Management Techniques to the problems in Technical Education.
17. Instructional objectives and questions for evaluation on Construction Planning.

V. TEACHERS' GUIDES.

I YEAR CIVIL ELECTRICAL AND MECHANICAL ENGINEERING.

1. Teachers' Guide in English.
2. Teachers' Guide in Applied Mathematics.
3. Teachers' Guide in Applied Chemistry.
4. Teachers' Guide in Engineering Drawing.
5. Teachers' Guide in Applied Mechanics.
6. Teachers' Guide in Workshop Practice.
7. Teachers' Guide in Library & Extension Lectures.
8. Teachers' Guide in Applied Physics.
9. Teachers' Guide in Building Construction.
10. Teachers' Guide in Civil Engineering Drawing.
11. Teachers' Guide in Engineering Materials.
12. Teachers' Guide in Structures I.
13. Teachers' Guide in Surveying I.
14. Teachers' Guide in Public Health Engineering.
15. Teachers' Guide in Irrigation.
16. Teachers' Guide in Electrical Engineering.
17. Teachers' Guide in Mechanical Engineering.
18. Teachers' Guide in Hydraulics.

II YEAR ELECTRICAL.

19. Teachers' Guide in General Engineering.
20. Teachers' Guide in Applied Mathematics III.
21. Teachers' Guide in Basic Electricity and Electric Measurements.
22. Teachers' Guide in Electrical Design and Drawing I.
23. Teachers' Guide in Electrical Workshop Practice I Sem.
24. Teachers' Guide in Electrical Engineering Materials.
25. Teachers' Guide in Mechanical Workshop Practice.
26. Teachers' Guide in Electrical Machines I.
27. Teachers' Guide in Electronics I.
28. Teachers' Guide in Fabrication Technique.
29. Teachers' Guide in Library & Extension Lectures (II SEM)
30. Teachers' Guide in Electrical Design & Drawing II.
31. Teachers' Guide in Electrical Workshop Practice (II Sem).

II YEAR MECHANICAL.

32. Teachers' Guide in Strength of Materials.
33. Teachers' Guide in General Mechanical Engineering.
34. Teachers' Guide in Mechanical Engineering Drawing I & II.
35. Teachers' Guide in Workshop Technology I & II.
36. Teachers' Guide in Workshop Practice I & II.
37. Teachers' Guide in Materials and Metallurgy.
38. Teachers' Guide in Hydraulics and Hydraulic Machines.
39. Teachers' Guide in Electrical Technology.
40. Teachers' Guide in Thermal Engineering I.

III YEAR CIVIL.

41. Teachers' Guide in Structural Drawing I & II.
42. Teachers' Guide in Rao; waus Bridges and Tunnels.
43. Teachers' Guide in Soil Engineering.
44. Teachers' Guide in Library & Extension Lectures (III GSM).
45. Teachers' Guide in R. C. C.

46. Teachers' Guide in Concrete Technology.
47. Teachers' Guide in Highway Engineering.
48. Teachers' Guide in Construction Management & Accounts.
49. Teachers' Guide in Survey camp.
50. Teachers' Guide in Surveying II.
51. Teachers' Guide in Estimating and Costing.
52. Teachers' Guide in Structures II.
53. Teachers' Guide in Project.

III YEAR ELECTRICAL.

54. Teachers' Guide in Electrical Machines II.
55. Teachers' Guide in Electronics II.
56. Teachers' Guide in Transmission & Distribution.
57. Teachers' Guide in Electrical Design and Drawing.
58. Teachers' Guide in Electrical Workshop Practice.
59. Teachers' Guide in Generation, Protection, Switchgear and Economics.
60. Teachers' Guide in Utilization of Electrical Energy.
61. Teachers' Guide in Electronics III.
62. Teachers' Guide in Project III M.

III YEAR MECHANICAL.

63. Teachers' Guide in Thermal Engineering II.
64. Teachers' Guide in Theory of Machines.
65. Teachers' Guide in Materials and Metallurgy.
66. Teachers' Guide in Mechanical Design & Drawing.
67. Teachers' Guide in Workshop technology III.
68. Teachers' Guide in Workshop Practice III M.
69. Teachers' Guide in Automobile Engineering.
70. Teachers' Guide in Production Engineering.

71. Teachers' Guide in Refrigeration and Airconditioning.
72. Teachers' Guide in Industrial Management.
73. Teachers' Guide in Project III M.
74. Teachers' Guide in Mechanical Engineering Drawing III M (I & II Sem).
75. Teachers' Guide in Engineering Drawing & Estimating & Costing (Part A & B).

PRODUCTION OF INSTRUCTIONAL MATERIALS.

1.	Teachers' Guides.	...	75 Nos.
2.	Textbooks.	...	5 Nos.
3.	Laboratory Manuals.	...	4 Nos.
4.	Data Books.	...	3 Nos.
5.	Other Instructional / Resource Material.		17 Nos.

Appendix IV.

TECHNICAL TEACHERS' TRAINING INSTITUTE, CALCUTTA
ACADEMIC ACTIVITIES

I. **Full Time Programmes :-**

(1) Diploma in Technical Teaching for 12-18 months.

(2) Diploma in Science Teaching for 12 months.

II. **Short-term Courses :-**

(1) Orientation Course for Principals of Polytechnics on "Modernising Instructional Supervision in Polytechnics ".

(2) Workshop on Lesson Planning (First Course).

(3) Strategies of Teaching.

(4) Lesson Planning in Mechanical Engineering Drawing.

(5) Polymer.

(6) Inspection & Quality Control.

(7) Refrigeration & Air Conditioning.

(8) Soil Mechanics & Foundation Engineering.

(9) Evaluation-I (Study & Development of Tools).

(10) Energy Conversion : Principles & Practices.

III. **List of Laboratory materials developed.**

(These are prototypes only and not for distribution)

1. (a) Diode Characteristics circuit (Static method).
   (b) Zener diode characteristics.
2. Transistor Characteristic circuit (Static method).
3. Silcon controlled Rectifier Characteristics.
4. Triode (Vacuum Tube) Characteristics.
5. Single Phase Energy Meter.
6. Single Phase Capacitor start motor.
7. Circuit for demonstration of charging and discharging of voltage across a capacitor.
8. Deflectional system of moving Iron instrument.
9. Demonstration model of deflectional system of electric dynamic instrument.
10. Experimental set-up for demonstration of phase shifting of voltage by R-C network.
11. Diode (Vacuum Tube) characteristics.
12. Measurement of peak value of an alternating quantity.
13. Measurement of unknown frequency.
14. Temperature measurement circuit with Thermistor.
15. R. L. C. Bridge.
16. Experiments on addition of voltage phasors.
17. Blocking Oscillator by switching transistor.
18. Full-wave phase shift control by S. C. R. (D. C. load).
19. High Power transistorised inverter.
20. Single stage amplifier.
21. Multistage amplifier.
22. Performance of class B Push-Pull type of Amplifier.
23. Colpitt and Hartley Oscilistors.
24. Demonstration model of Regulated Power Supply.
25. Astable Multivibrator.
26. Bistable Multivibrator.

27. Multi input amplifier.
28. Inverter.
29. Half wave control of Lamp / universal motor by S. C. R.
30. Full wave control of A. C. fan (1 phase) by S. C. R.
31. Full wave control of D. C. load by S. C. R.
32. S. C. R. Timer.
33. Automatic Battery charger.
34. Differential amplifier.
35. Thyratron control.
36. Saw-tooth wave generation by S. C. R.
37. Demonstration models on frequency measurement.
38. Demonstration model of a vacuum tube voltmeter.
39. Demonstration model on rotating magnetic field.
40. Multirange D. C. meters.
41. Part of cathode ray oscilloscope.
42. Latching Relay by S. C. R.
43. Method of Turning off S. C. R.
44. Single phase commutation.
45. S. C. R. Inverter.
46. 3 phase commutation by S. C. R.
47. Transistorised gates (and/or).
48. Magnetic current Balance.

(MECHANICAL ENGINEERING)

1. Dynamic Torsion Testing Machine.
2. Redevelopment of Photo-elastic stress analysis apparatus.
3. Apparatus for the demonstration of different model of buckling of columns having different end fixing.
4. A new simple model of vortest cooling apparatus.
5. Apparatus for the demonstration of life and drag on different section i. e. Aerofoil, Sphere, Cylinder etc.
6. Demonstration of the balancing of a cantilever beam using the principle of stable condition of equilibrium.

7. Model on ' persistence of Vision ' Phenomenon was reconstructed replacing the A. C. Channel frame by a complete wooden structure much more stake in nature.
8. Impulse and moment apparatus.
9. Gyroscope apparatus.
10. Bending moment apparatus.
11. Water jet momentum apparatus.
12. Test Rig Linear variable differential transducer.
13. Model water Tunnel to study to flow pattern.
14. Torsion testing apparatus.
15. Coplanar concerrent and noncerrent system of forces apparatus.
16. Parallel Forces apparatus.
17. Elasticity apparatus.
18. Seebeck effect apparatus.
19. Peltier effect apparatus.
20. Vortest cooling and heating apparatus.
21. Measurement of pressure.
22. Stable, unstable and neutral condition of equilibrium Apparatus.
23. Vapour compression Refrigeration unit.
24. Photoelastic stress analysis apparatus.
25. Buckling apparatus.
26. Demonstration of Cavitation phenomenon.
27. Rubber Torsion apparatus.
28. Demonstration of natural circulation.
29. Conservation of Angular momentum.
30. Inclined tube boiler for the study of convection current.
31. Apparatus for demonstration energy transfer by coupled oscillation.
32. Coriolis force apparatus.
33. Demonstration of Vortex vibration in structure.
34. Ventury Flume.
35. Flow measurement apparatus.
36. Apparatus of verification of gas law.

(CIVIL ENGINEERING)

1. Equilibrium of moments apparatus.
2. Friction apparatus.
3. Modelon determination of Motacentric Height.
4. Modelon Capillarity.
5. Modelon Capillary action through soils.
6. Modelon Capillary action through narrow space.
7. Modelon quicks and phenomenon.
8. To study the action of a groove in stopping the rise in water.
9. Apparatus for determination of Modulus of rigidity of rubber.
10. Apparatus for determination of Modulus of Elasticity by deflection method.
11. Centre of gravity apparatus.
12. Model on Damp-proof-course.
13. Model on Prestressed beam.
14. Spring piston analogy.
15. Timber models on various types of footings.
16. Cardboard model showing bending of columns.
17. Cardboard model showing stability of trusses.
18. Model on automatic flushing cistern.

(Science)

1. The phenomenon of ' Magnetic Screening '.
2. The mechanism of ' transverse have propogation '.
3. Temperature (Physics).
4. U-Tube manometer.
5. Differential manometer.
6. Inclined tube manometer.
7. Mercury Barometer.
8. Pilot-tube for Dynamic pressure.
9. Liquid as bad conductor of electricity demonstration set-up.
10. Steam turbine demonstration model.

11. Lenz's law of electromagnetic Induction-demonstration model.
12. Liquid as good conductor of electricity demonstration set-up.
13. Ohm's law. Demonstration model.
14. Heat transfer in solids (conduction).
15. Heat transfer in liquids (convection).
16. Electrolysis of Acidulated water.

LIST OF PUBLICATIONS.

1. Offering and requirements in Polytechnics Education : Symposium Report.
2. Administration in Technician Education : Symposia Report.
3. Workshop on Sandwich courses in Technical Education : Report.
4. Seminar on Development of Library facilities & services in Polytechnics : Report.
5. Seminar on Micro teaching : Report.
6. Teachers' Manual - Applied Science, Physics.
7. Teachers' Manual - Mathematics I & II.
8. Teachers' Manual - Applied Mechanics I & II.
9. Teaching Aids for Polytechnics - A brochure Vol. I.
10. Towards newer concepts and Methods in Technical Education-Monograph.
11. A teachers' guide to Laboratory Methods in Electrical Technology.
12. A conceptual framework of Engineering Activities - Monograph.
13. Teaching Learning Optimisation - Monograph.
14. Job Analysis - A pilot study : Report.
15. A study of Present Engineering Spectrum in U. S. A. : Report.
16. Text Book and Key book on English for Technical Students.
17. Teachers' Manual on Elements of Civil Engineering.
18. Teachers' Manual on Workshop Practice & Shoptalk.
19. Prajnan : A professional journal with international registration on Technical Education - twice a year.
20. Industrial Training for Technical Teachers - A Guide.

Special tasks / projects / rendered or undertaken.

1. (a) Assisted the State Councils for Technical Education W. B. and Orissa as member on special invitation to their committees to develop their new polytechnic curricula.

   (b) Provided details of structure and content of the new syllabus for W. B. on request from the Government of West Bengal.

   (c) Proparing text books, Teachers' manuals and students workbook for polytechnic teachers & students.

2. Advised as requested, Gujarat State on the structure of the new curriculum proposed by them.

3. Proposed technician course on electronic technology on request from an Institute in Mysore.

4. Participated in Domodaran Committee and provided detailed studies job analysis data on demands from industries, heads of the Institutions and others. Suggested a model structure and some appropriate diversifications.

5. Conducted a frequency analysis of demand in the newly emerging areas of technician specialities during July, August and Sept. 1974 in the Eastern Region. The result was forwarded to the panel formed by the Technician Board who are entrusted to reconmend newer courses, as per request of the Ministry.

6. Job Analysis - A report of Pilot Project on Job Analysis carried out to give direction for approaching CD activities has been published as a handout. This work is being persued in collaboration with ERC of AICTE and Industries. So far a public sector Industry, i.e. HSL Rourkela has been covered.

7. The Institute prepared charts on Silk-Screen process on several topics and these are supplied to Polytechnics against payment. (Details as per list at appendix-5 (D).

8. New method of evaluation has been suggested by the Institute and accepted by the special committee for the reorganisation of the polytechnic education in West Bengal and implemented from July 1974, by the West Bengal Government.

9. Admission test for polytechnic students based on differential abilities in specific technologies are being developed. All initial data have been compiled and sample tests made with tentative formats.

List of Charts, films etc.

Heat Engine. (Pictorial type).

1. Dead Weight safety valve.
2. Lever type safety valve.
3. Low water and high steam safety valve.
4. Ramabottom safety valve.
5. Water level indicator.
6. Pressure gauge.
7. Steam - stop valve.

Machine Tools. (Pictorial type).

1. Marking out.
2. Non cutting.
3. Metal cutting.
4. Micrometer.
5. Centre lathe.
6. Tail Stock.
7. Turning process.
8. Lathe operations.
9. Turning process.
10. Marking.
11. Transversal Turning and Facing.
12. Profile turning.
13. Back gear.
14. Thread cutting.
15. Screw cutting.
16. Screw cutting with tap wrench.
17. Eccentric turning.
18. Job mounting.
19. Job mounting on carriage for boring.
20. Drill.

21. Countersinking and counter boring.
22. Drilling Machine.
23. Drilling.
24. Radial Drilling.

Public Health Engg. (Civil). (Pictorial type).

1. Inspection chamber.
2. Typical water supply scheme.
3. Open Drains.
4. 3-way gully trap.
5. Fittings and specials.
6. Trickling Filter.
7. Drop Man Hole.
8. Rapid Sand Gravity Filter.
9. Incinerator.
10. Anti Syphonage Device.
11. (a) Wash Down Closet Basin.
    (b) Syphonic type Closet Basin.
12. Air Valve.
13. Intercepting trap.
14. Bib-Cock.
15. Reflux valve.
16. Different source of water supply.
17. Sluice valve.
18. Acration 'For activated sludge process'.
19. Fittings and specials.
20. Ferrule.
21. Slow sand fitter.
22. Master Trap.
23. Flushing cistern.
24. Manhole.

A list of A-V Aids developed.

(1) **Blow-up photo chart size 20" x 30" cc.**

A. Trainees Handling equipments in Electrical lab.

B. Experiments in Mechanical lab.

C. Close-up view of a meter.

D. Organisation and production.

E. Exploration of space.

F. Cyroscopic Demonstration Models.

G. Pile Foundation.

H. Behaviour.
(Projective test).

(2) Overlaying Albuma size 10½"x15" in rexine jacket.

A. Fractional Horsepower Motor.

B. Centrifugal pump.

(3) **2" x 2" Black and White Slides (35 mm).**

A. Reinforced concrete basement under construction.

B. Irrigation structures.

C. Oscilloscope readings.

D. Theory of Isometric **projection.**

E. Planning Machine.

F. Energy conversion.

G. Photo Elastic Bench (Experiments) (Colour).

H. Soil Mechanics and foundation.

I. Quality Control (SQC).

J. Industrial Engg.

K. Workshop technology.

L. Science (illustrations).

M. Energy conversion.

N. Line and Functional organisation.

O. A-V. Instruction and Media.

P. Concrete technology.

Q. A-V. Equipments and Medias.

R. Components for communication.

S. Quality control.

T. Soil consolidation.

U. Electrical meters and Governing Laws.

V. Microteaching.

W. Learning, Motivation, Behaviour, etc.

X. Plasma theory, experiments, etc.

Y. Punishment, Reward, Discipline and Extrinsic feedback.

Z. Electrical circuits.

AA. Conversions of National Energy to electrical energy.

BB. Types of compressors.

CC. Simulator in Tech.

DD. Method, time study Industrial Engg.

EE. Simulations of skills in Tech. Education.

FF. Relationship of Technical Education to Development.

GG. A-V Practical.

HH. Tyton pipe joint.

II. Charts Models etc. (colour).

JJ. Demonstration Models in Mech. Engg. (colour).

KK. Electronic Components (colour)

LL. Drainage system (colour).

4) **35 mm Black and White Filmstrip.**

A. Electrical motor.

B. Storm water collection system.

C. Pipe Jacking under Railway track.

D. Cable jointing.

E. Service connection.

(5) **O. H. P. Transparences with cardboard mounts.**
10" x 10" Ea.

Electrical.

Mechanical.

Civil.

Education.

Science.

(6) **Docustat prints (photocopying).**
(Positive).

Civil.

Electrical.

Mechanical.

Science.

Education.

Training and

Placement.

B. E. College.

(7) **Photo taking.**

All Departments Demonstration Models, etc.

(8) T. T. T. I. has also undertaken projects to cover important and vital CMPO, CMDA, Tube Railway, 2nd Hooghly bridge, and similar projects. These are later converted to slides, filmstrips and other A-V Aids.

Softwares developed at T. T. T. I. photo lab.

1. 35 mm Black and white slides.
2. 35 mm Colour slides.
3. 35 mm Macro Photography.
4. 35 mm B/W Filmstrips.
5. Docustat printing.
6. O. H. P. Transparencies.
7. Photo taking.

8. Enlargements.
9. Photo-Blow-up charts.
10. Acetate O. H. P. Transparencies.
11. Overlaying Album.

Appendix V.

TECHNICAL TEACHERS' TRAINING INSTITUTE, BHOPAL
ACADEMIC ACTIVITIES

I. **Full Time Courses : Regular**

Diploma in Technical Teaching of 12-18 months' duration.

II. **Short Courses / Quality Improvement Programmes / Summer Schools.**

(a) **Polytechnic Staff Development - T. T. T. I. based.**

1. Principals' Study Conference (Annual).
2. Workshop on Sandwich Courses.

Short Courses :

3. In Educational Management.
4. In Resources Utilisation.
5. On Innovations in Teaching.
6. On Leadership in Evaluation Techniques.
7. On Educational Research Methodology in Technical Education.
8. On Programmed Instruction.
9. On Subject content.
10. On Curriculum Development.
11. On Orientation to New Curriculum.
12. On Audio-visual Aids.
13. On Evaluation Techniques.

(b) **Polytechnic Staff Development - Institution based.**
Short Courses on :-

(i) Curriculum Development.
(ii) Evaluation Techniques.
(iii) Audio-Visual Aids.

III. **Curriculum Development.**

1. Survey for Job Analysis.
2. Topic level validation Survey.
3. Preparation of detailed Curricula for Technician courses in (M.P. State).
4. Workshops for Curriculum development in Gujarat.
5. Text book preparation.
6. Preparation of work-books.
7. Preparation of Lab. Manual.
8. Preparation of Learning packages
9. Preparation of Educational Aids.
10. (a) Item writing.
    (b) Item Review.
    (c) Paper setting.
11. Survey on Students' reaction to revised Exam. system.

SPECIAL TASKS / PROJECTS / CONSULTANCY / EXTENSION SERVICES UNDERTAKEN.

I. **Special Projects**

1. Investigation into the efficacy and utility of sandwich courses.
2. Feasibility of part-time and correspondence courses.
3. Feasibility study on Agricultural Technician Courses.
4. Library utilisation Survey.
5. Lab. Innovations - Polytechnic based Projects.
6. Preparation of a revised Equipment list for Polytechnics.
7. Investigation on the feasibility of Russian aided Model Technician Courses at selected Polytechnics in the country.

II. **EXTENSION SERVICES.**

1. Conference on Evaluation Techniques at G. S. T. I., Indore.
2. A course on Teaching Technology at Madras.
3. Short course on Evaluation Techniques at T. T. C. (P&T) Jabalpur.

4. Short courses on Programmed Instruction at

   (a) Bhopal.

   (b) Jabalpur.

5. A course on Teaching effectiveness.

6. Training Programme for Mathematics Teachers.

III. CONSULTANCY SERVICES.

1. Organisational Development. (Polytechnic-based project aimed at improvement of its performance with the T.T.T.I. support as an external change agent in areas of M. B. O., Team Development, Planned Innovations, Preparation for Autonomy, etc.

2. 2 + 2 Experiment (Analytical study of instructional, managerial, evaluative, and innovative processes in four polytechnics 2 in Gujarat and 2 in M. P. with deep involvement of T.T.T.I. faculty.)

3. 'Change Agent' Programme-(Development of an internal change agent within a polytechnic to :

   a. help individual faculy member to plan, implement, and evaluate curriculum development processes.

   b. diagnosed training and development needs and organised programmes for the same.

   c. Improve the effectiveness of curriculum implementation.)

LIST OF TEACHING AIDS.

I. EQUIPMENT FABRICATED:

1. ON/OFF liquid level control.
2. Electric Siren.
3. Pulse type telemetry.
4. Twilight using SCR/LDR.
5. Pulse counter using ICS.
6. Operational amplifier for driving recorder-arm.
7. Toy-motor controller using SCR.
8. D. C. to D. C. converter.
9. Proctor Compaction Apparatus.

10. Permeameter.
11. Sand pouring cylinder.
12. Shrinkage limit apparatus.
13. Thin walled tube samples.
14. Time study practice Apparatus.
15. Expt. for Acceptance Sampling Techniques.
16. Expt. for X and R Chart construction.
17. Expt. to prove the Basis for statistical tolerancing.
18. Expt. for simulation Quality Control by Attributes.
19. Equipment for Cutting of Thermocole.

II. WORKING MODELS:

1. PMMC ammeter
2. Phase-sequence indicator.
3. Slip indication of induction motor rotor.
4. U-tube manometer.
5. Bourdon pressure gauge.
6. Demonstration of law of friction.
7. Demonstration of bending stress.
8. Principle of electro-mechanical conversion.
9. Rack and Pinion arrangement.
10. Cam and Follower mechanism.

III. MODELS.

1. Form work for stair-case.
2. Permanent adjustment of Dumpy Level.
3. Scaffolding.
4. Bar bender's table.
5. Erection of a stell truss.
6. Funicular polygon.
7. Concurrent forces.
8. Hydraulic accumulator.

9. Surface texture terminology.
10. Working Principle of gear pump.
11. Orthographic projection of lines and planes.
12. Sine bar set-ups.
13. Drilling Jig.
14. Quick return mechanism.
15. Tool Geometry.
16. Slip Gauges.

IV. LABORATORY DEMONSTRATIONS / EXPERIMENTS :

(a) Soil Mechanics

1. Vibration rollers for sand compaction with measuring cylinder and wooden rammer.
2. Concept of permeability and comparator.
3. Capillary flow of water through soils (with glass tubes).
4. Concept of sieve size (plywood).
5. C. B. R. apparatus.
6. Demonstration of pore pressure.

(b) Hydraulical

7. Demonstration of pressure difference and flow pattern between throat inlet of venturi.
8. Demonstration of hydraulic jamp and flow over spill way.
9. Force on a bend in pipe flow.
10. Demonstration of liquid pressure.
11. Demonstration of variation of pressure with depth of liquid.
12. Calibration of Bourdon pressure gauge.
13. Determination of eccentricity, alignment, and depth of key way.
14. Measurement of included angle of dovetail.

(e) Electronics.

15. Principle of closed-loop system along with stability considerations.
16. Circuit illustrating Binary scale of two action.

17. Time-delay relay using SCR.
18. Complimentary symmetry amplifiers.
19. Principle of Nixie tube.
20. Displays with LED's.
21. FET amplifier and UJT pulse sawtooth generator.
22. Stepping-motor action (without electronic driving unit).

(d) **Workshop Process/Machine Tools :**

23. Demonstration of basis turning processes on a centre lathe.
24. Methods of cutting screw threads on a centre lathe.
25. Common engineering materials-properties and applications.
26. Investigation of functions of a shaping machine.
27. Checking perpendicularity of cross slide with spindle axis.

(e) **Industrial Engineering** :

28. Use of Decimal minute watch.
29. Performance Rating.
30. Time Study (Snap back method).
31. Time Study (Continuous method).
32. Frequency Distribution.
33. Statistical Basis for Tolerancing.
34. Proof of sampling Techniques.
35. Single sampling.
36. Double sampling.
37. Determination of Percentage utilisation of equipment.

(f) **Maintenance Engineering.**

38. Defects of 'Ball bearing shaft assembly'.
39. Determination of extent of gear on spir gear.
40. Determination of wear of shaft journal.
41. Defects in roller bearing.
42. Determination of wear on guide-ways.
43. Defects of a clutch plate.
44. Defects of Ball bearings and causes.

(g) **Metrology :**

45. Full inspection of taper plug gauge.
46. Use & handling of outside micrometer.
47. Use and handling of vernier Calipers.
48. Finding out internal taper of given job.
49. Calibration of a micrometer.
50. Comparison of accuracy of methods for measurement of angles.
51. Comparison of accuracy methods of linear measurement.

V. SIMULATED AIDS :

1. Verification of Chu's Law.
2. A. C. Transients.
3. A. C. Series Circuit.
4. Two Wattmeter Method.
5. Triode characteristics.

VI. SLIDE-TAPE SEQUENCES :

1. Well Sinking.
2. Loss of head due to friction in pipes.
3. Bus-bar arrangements.
4. Switchyard layout.
5. Circuit Breaker Principles.
6. Motor enclosures and Ventilation.
7. Angular measurement.
8. Testing of drilling machine.
9. Basic Involute gear measurement.
10. Use of precision measuring instrument.
11. Application of Gauges.
12. Dial indicater and its application.
13. Slip gauges and their use.
14. Fire fighting equipment.
15. Replacement of broken gear tooth.

16. Unconventional Machining.
17. Projection of solids.
18. Pressure measurements.
19. Classification of I. C. Engines.
20. Casting.

VII. **SLIDES :**

1. Operation of Earthmoving machines.
2. Construction of underseamed pile foundations.
3. Sequence of caisson foundation.
4. Repairs to a building.
5. Concept of Bonding Moment and Shear Force.
6. Pile foundation.
7. Defects in Castings.
8. Constructional Details of Bench Drill.

VIII. **O. H. P. MODELS :**

1. Oil-blast Circuit Breakers-Are quenching.
2. Constructional details of a. d. c. machine.
3. Fnicular polygon.
4. Concurrent forces.
5. 3-point problem.
6. Components of Tehodolite.
7. Moire's fringes
8. Principle of Tracer type of Profilograph.
9. Angular measurement using Sine-bar and Dial indicator.
10. Quick return motion of a shaper.
11. Diesel Engine.
12. Leading Jig for the study of strains.
13. Dynamic transparency of waveforms of Terminal voltage (with and without commutation.)

IX. MAGNETIC BOARD CUTOUTS:

1. Assembly of spigot and socket joint.
2. Construction of a carburettor.
3. Use of Sine-bar & Dial indicator for measurement of taper.
4. Simple gear train
5. Constructional details of an electric meter.
6. Oil-blast circuit breakers – Are quenching.
7. Orthogonal projects.
8. Layout of furniture in a room.
9. Placing and reinforcement for an R.C.C. slab.
10. Mitring and laying of A.C. sheets for roofing
11. Unconventional Methods of Machining.
12. Petrol Engine.
13. Taper turning by Tail-stock offset Method.
14. Different Types of Rivetted Joints.
15. Gib and Cotter Joint.
16. Bomb Calorimeter.

X. FINAL BOARD CUTOUTS:

1. Double-rivetted double-cover rivet joints.
2. Curve setting.
3. Necessity of widening of road on curves
4. Defects in concrete roads.
5. Components of bridges.
6. Permanent adjustment of Dumpy level.
7. Stages in construction of a building.
8. Concept of levelling.
9. Interpretation of contours.
10. Flow diagram of water treatment.
11. Road signs.
12. Tool Geometry

13. Sine bar
14. Systems
15. Hydraulic mechanism of a shaper
16. Erection & removal of Form-work of beam & slab.
17. Cement Manufacturing Process

XI. FLIP-OVER CHARTS :

1. Fresinet system of pre-stressing
2. Stages of past-tensioning for pre-stressing
3. Sequences of drilling and blasting operation
4. Operation of a scraper.
5. Laying of sheets on a roof
6. Construction of 132-KV pressure cable
7. Pin-type Insulator
8. Construction of Induction Motor
9. Construction of Ellipse.
10. Drawing section of a cone
11. Vapour compression Refrigeration System.
12. Thermodynamic properties.
13. Machining of cast iron bush on centre lathe
14. Vee facing by shaper
15. Section of solids
16. Cam Profile
17. Construction of concrete pedastal Pile Foundation
18. Underpinning of Foundation
19. Grillage Foundation
20. Principle of A. C. Generation.
21. Automatic Three-phase starters.
22. Relative characteristics of Aluminium and copper conductors.
23. Relative characteristics of Aluminium and copper conductors.
24. Filter circuits.
25. Construction of Turbo - Alternator.

SINGLE-SHEET CHARTS:

1. Panelled door.
2. Staking for building.
3. Air ejector.
4. Milling cutters.
5. Thread Cutting.
6. Section of a Cone.
7. Radial Drilling Machine.
8. Septic Tank
9. Cross - section of a stem of Tree.
10. Stopping sight Distance.
11. Flush Door.
12. Forces in current carrying conductor.
13. Construction of a Turbo - Generator.
14. Polyphase Transformer connections.
15. Comparison of single phase motor characteristics.
16. D. C. Shunt Motor Starter.
17. M.H.D. Power Generation.
18. Single phase and polyphase voltage generation.
19. Arc-breaking in ABCB and OCB.
20. Power Transmission Schemes
21. Auto Transformer Starter.
22. Rotating Magnetic fields.
23. Electron Theory of Electricity and Magnetism.
24. Cathode Ray Tube.
25. Cathode Ray Oscilloscope.
26. Progressive cost Analysis of a Thermal Power Station.
27. D. C. Motor Classification.
28. Transformer on Load.
29. Transmission of Electric Power.
30. Phase Relationships in an induction Motor Rotor.

31. Comparative aspects on Power Utilization (8 charts)
32. Over voltage Protection.
33. Servation of Energy.
34. Position of Centroid for common plane areas.
35. The Surface Gauge.
36. Open Belt Drive and Cross Belt Drive.
37. Potential Energy.
38. Saws.
39. Chain Drive.
40. Belt drive for Perpendicular shafts.
41. Position of Centre of Gravity for Common Regular solid bodies.
42. Work.
43. Reduce Labour use machines.
44. Transmission of Power by Direct Friction.
45. Builders' Hardware.
46. Friction.

Note : Some of the minor aids of the list given above are not readily available on account of their loss, damage, etc.

XIII. CHALK-BOARD AIDS :

1. A set of different gears.
2. Templates for drawing proportionate figures such as circles, triangles and other geometrical shapes.
3. Venturimeter.

XIV. PHOTOGRAPHS.

1. A set of 40 Photographs on Metrology / Machine Tools / Materials Technology.

XV. PROGRAMMED LEARNING MODULES :

1. Basic Circuits and Amplifiers.
2. Magnetic Amplifier Principle.
3. D. C. Motor Characteristics.
4. Measurement of Pressure.

5. Snap Gauges.
6. Sine-Bar.
7. Vernier Calipers.
8. Auto Collimator.
9. Hypothetical Otto Cycle.
10. Plug Gauges.
11. Concept of Stress and Strain.
12. Necessity and calculation of overtaking sight distance.
13. Weight and volume relationship in soil.
14. Setting-up of Theodolite and measuring Horizontal Angles.
15. Using Plannimeter.
16. Types of drilling machines.
17. Snap gauger.
18. Principle of moments.
19. Ply gauges.
20. Hypothetical otto cycle.

LIST OF PUBLICATIONS.

A. CURRICULAR.

I. Curriculae for Madhya Pradesh State.

1. * Core Curriculum for 1st Year Diploma.
2. * Second Year Curriculum for Civil Engg.
3. Second Year Curriculum for Mech. Engg.
4. Second Year Curriculum for Elect. Engg.
5. Third Year Curriculum for Civil, one set.

a. Quantity Surveying and Costing II.

b. Project Work.

c. Maintenance Engineering.

d. Irrigation Engineering.

e. Structural Design and Drafting.

f. Communication Engineering.

g. Municipal Engineering.

h. Works Organisation and Accounts.

6. Third Year Curriculam for Mech. Engg. one set.

a. Industrial Engineering.

b. Industrial Management.

c. Costing Estimating and Engineering Economics.

d. Metrology and Instrumentation.

e. Maintenance Engineering.

f. Metal Cutting and Machine Tools.

g. Tool Design.

h. Advance Drafting and Design.

i. Planning, Control of Production & Sales.

j. Fabrication Technology.

k. Power Plant Engineering.

l. Refrigeration and Air Conditioning.

7. Third Year Curriculum for Electrical Engg. one set.

a. Instrumentation.

b. Utilization of Electric Power.

c. Generation Transmission and Distribution.

d. Electrical Installation Fault Location and Maintenance.

e. Electric Traction.

f. Industrial Electronics and Control.

g. Electrical Communications.

h. Power System Operation.

II. **Curriculum for Gujarat State:**

a. **1st Semester.**

1. Physics.

2. Workshop Practice.

3. Engineering Drawing.

4. Chemistry.

5. Communication skill.
6. Mathematics.

b. **2nd Semester.**

1. Engineering Mechanics.
2. Chemistry.

c. **3rd Semester**

1. Mathematics III.
2. Electric Circuits.
3. Mechanical Technology.
4. Electrical Engineering & Electronics.
5. Strength of Material.
6. Mechanical Drafting.
7. Metal Process Engineering.
8. Material Technology.
9. Civil Engineering Drawing.
10. Mechanics of Structures.
11. Surveying and Investigation.

d. **4th Semester.**

1. Elect. & Elect. Drafting.
2. Generation Transmission and Distribution.
3. Electrical Machines.
4. Electrical Engineering and Electronics.
5. Civil Engineering Drawing II.
6. Mathematics IV.
7. Construction Technology.
8. Surveying and Investigation.

B. **Instructional Material.**

I. **1st Year**

1. a. Engineering Mechanics.
   b. Chemistry.
   c. Physics.
   d. Workshop Practice.
2. Workbook in Workshop Practice.
3. Workbook in Engineering Drawing.
4. Set of hundred slides in workshop practice.
5. Teachers' guide in Engineering Drawing.
6. Workbook in Chemistry.
7. Workbook in Mathematics.

II. **2nd Year.**

1. Workbook in Civil Engineering Drawing.
2. Workbook in Surveying and Investigations.
3. Workbook in Construction Technology.
4. Workbook in Applied Circuit Theory.
5. Electrical Engineering Drawing workbook.
6. Learning Package in Metal Process Engg.
7. Mechanical Drafting.
8. A course in General Studies and Advanced Technical English.

III. **3rd Year.**

1. Workbook in Structural Design and Drafting.
2. Instrumentation workbook.
3. Electric Installation, Fault Location and Maintenance.
4. Metrology and Installation.
5. Maintenance Engineering.
6. Industrial Management.
7. Industrial Engineering.
8. Learning Package in Industrial Engg.

C. **Samples Test Items In**

1. Communication Skill.
2. Engineering Drawing.
3. Workshop Practice.
4. Physics.
5. Chemistry.
6. Mathematics.
7. Engineering Mechanics.
8. Electrical Machine.
9. Electrical Engg. Material and Components.
10. General Studies and Advanced Technical English.

D. **Text Books (C/M/E).**

1. A Course in Technical English. Book I.
2. Mathematics for Polytechnics Vol. I.
3. Principles of Physics for Polytechnics.
4. A Course in Technical English Book II.
5. Passages in General Studies.
6. Mathematics for Polytechnics Vol II.

E. **Test Items.**

1. Materials Technology.
2. Technical English.
3. Elect. Engg. Materials and Components.
4. Electrical Machines.

F. **Miscellaneous.**

1. CDC Report.
2. A Survey of Job Analysis.
3. Question and Answer, TTTI.
4. Interaction with Industry, Monograph 5.
5. Examination Reforms, Monograph 4.
6. Curriculum Development Monograph 2.
7. Educational Project.
8. Educational Technology.

Printed at : CHAIN PRINTERS, Cantt., Tiruchirapalli - 620 001.